FINAL

Virgin River Conservation Management Assessment

November 2008

Prepared for:

Clark County, Nevada
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This document was developed through participation from the following agencies:
US Bureau of Land Management, Clark County, US Fish and Wildlife Service, US National Park Service, Nevada Department of Wildlife and the Nevada Division of Forestry.

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ACRONYMS

AGFD	Arizona Game and Fish Department
AGRC	Automated Geographic Reference Center
amsl	above mean sea level
ASLD	Arizona State Land Department
AZ	Arizona
bgs	below ground surface
BLM	Bureau of Land Management
C	Candidate species
CalPIF	California Partners in Flight
CCCP	Clark County Department of Comprehensive Planning
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWA	Clean Water Act
DWMA	Desert Wildlife Management Area
E	Evaluation Species
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ET	evapotranspiration
FEMA	Federal Emergency Management Agency
GAP	Gap Analysis Program
HMMP	Hydrological Monitoring and Mitigation Plan

LANDSAT	Land Use Satellite
LE	Federally endangered
LT	Federally threatened
mg/L	milligrams per liter
Mya	million years ago
NDEP	Nevada Department of Environmental Protection
NDOT	Nevada Department of Transportation
NDOW	Nevada Department of Wildlife
NDWR	Nevada Department of Water Resources
NLCD	National Land Cover Database
NNHP	Nevada Natural Heritage Program
NRA	National Recreation Area
NRCS	Natural Resources Conservation Service
NSBERP	Northern States Bald Eagle Recovery Program
NTU	nephelometric turbidity units
NV	Nevada
PCU	platinum-cobalt units
PRISM	Parameter-elevation Regressions on Independent Slopes Model
SDNHM	San Diego Natural History Museum
SNWA	Southern Nevada Water Authority
SSURGO	Soil Survey Geographic Database
STATSGO	State Soil Geographic Database
SWPARC	Southwest Partners in Amphibian and Reptile Conservation
SWReGAP	Southwestern Regional Gap Analysis Project
TPWD	Texas Parks and Wildlife Department
USBR	U.S. Bureau of Reclamation
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VRCMA	Virgin River Conservation Management Assessment
VRHCRP	Virgin River Habitat and Conservation Recovery Program
WL	Watch List Species
WAPT	Wildlife Action Plan Team
WSC	Wildlife Species of Concern
XC2	Former species of concern

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Introduction

PURPOSE AND NEED

The Virgin River Conservation Management Assessment (VRCMA) is being prepared to assess the resource conservation needs in the Virgin River Basin. The resulting species conservation-based technical effort provides information for use as a cooperation strategic planning tool. The assessment analyzed more than 100 potentially imperiled species in the Virgin River Basin. Information gained from this effort will be incorporated into the Virgin River Habitat Conservation and Recovery Program (VRHCRP) process described below.

For decades, efforts have been underway along the Virgin River to address species conservation and protection concerns for the endangered fish (woundfin and Virgin River chub) and riparian bird species (southwestern willow flycatcher, Yuma clapper rail) utilizing the Lower Virgin River and its floodplain. The Lower Virgin River Recovery Implementation Team and other agencies and organizations have been at work to implement conservation and restoration activities along the Lower Virgin River. In the Upper Virgin River in Utah, the Virgin River Resource Management and Recovery Program, a recovery action program, was established in 1999.

In 2001, the USFWS approved the Clark County MSHCP (CCMSHCP) and associated Section 10 Incidental Take Permit for 78 covered species. The CCMSHCP is a comprehensive, long-term habitat conservation plan for the covered species listed in the Section 10 permit. Many of the 78 species addressed by the CCMSHCP occur within the Virgin River area. As such, permit condition J(2)(b) for the take permit requires the permittees to participate in development of a conservation management plan for the Virgin River riparian habitat. The CCMSHCP currently covers the City of Mesquite for take of species covered by the CCMSHCP, however, there are species that occur along the Virgin River that require incidental take and are not covered by the CCMSHCP. This prompted the City of Mesquite to move forward with the development of a Habitat Conservation Plan (HCP) to cover those species, (Virgin River chub, woundfin, Yuma clapper rail, southwestern willow flycatcher and yellow-billed cuckoo).

Furthermore, in 2004, the Virgin River Habitat Conservation and Recovery Program (VRHCRP) was formed to combine efforts associated with the Lower Virgin River Recovery Implementation Team and the Virgin River HCP being prepared by the City of Mesquite to implement conservation measures and recovery actions within the 100-year floodplain of the Lower Virgin River.

Additionally, on May 15, 2007, Clark County signed a MOA by and between the United States Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), National Park Service (NPS), Nevada Department of Wildlife (NDOW), the City of Mesquite, Virgin Valley Water District (VVWD), and Southern Nevada Water Authority (SNWA) that refined the framework for the development, determination of roles and responsibilities, participation in and implementation of the multi-party VRHCRP. The VRHCRP is being designed to merge the multiple efforts to protect listed species and their habitat, as well as conservation and management efforts for non-listed species and their respective habitat, in and along the Virgin River, into a single collaborative process to maximize the protections afforded the species and habitat by making the most efficient use of the time and resources of the signatories to the MOA.

The MOA also modified the boundary for consideration in the conservation management plan provision J(2)(b) of the Clark County MSHCP take permit which was under contract at the time of the signing of the MOA. The boundary for inclusion in the CMP was changed from the Virgin River riparian habitat to the adjacent or associated upland areas of the Virgin River watershed beyond the 100-year floodplain or riparian area and named the document a VRCMA. Although the VRCMA does not include the potential imperiled aquatic and riparian Virgin River species, species descriptions were prepared for them and are located in Appendix E.

The signatories agreed to cooperate in coordinating the VRCMA with the VRHCRP. The VRCMA has since been designed to provide information to the VRHCRP. The goals of the VRHCRP are to identify, plan, coordinate and/or assist in implementing avoidance, minimization, mitigation or conservation activities to contribute to the long-term recovery and conservation of listed and non-listed species and their habitats in the

Virgin River watershed. This will be accomplished for each species or group of species in the order of priority outlined below.

i. Virgin River listed species, including the woundfin, Virgin River chub, southwestern willow flycatcher, yellow-billed cuckoo, and Yuma clapper rail.

ii. Virgin River riparian-dependent species proposed for coverage under the CCMSHCP.

iii. Other species and resources in the Virgin River watershed identified as appropriate for inclusion in the VRHCRP by the Executive Committee, including Species of Conservation Priority identified by the State of Nevada.

In contrast, the VRCMA is a non-regulatory conservation management plan that provides assessment information useful for the VRHCRP and other management actions for the surrounding upland areas.

VIRGIN RIVER CONSERVATION MANAGEMENT ASSESSMENT PARTICIPANTS

Clark County, Nevada has undertaken the development of this VRCMA. Additionally, state and federal agencies (resource management agencies) have participated in meetings and contributed to the shaping and development of this document and process. These resource management agencies are the USFWS, BLM, NPS, NDOW, and Nevada Division of Forestry (NDF). A description of each of these participants is provided below.

Clark County

Clark County is a political sub-division of the State of Nevada. It encompasses approximately 8,000 square miles of land and is home to over 1.8 million residents. Clark County is governed by a seven member Board of Commissioners, elected from geographic districts on a partisan basis for staggered four-year terms. Commissioners biennially elect a chairperson who serves as the commission's presiding officer. The commission in turn hires a county manager, who is responsible for administrative operations. To assist in the orderly development of Clark County, the Board, along with the Cities of Henderson, Mesquite, Boulder City, Las Vegas and North Las Vegas and the Nevada Department of Transportation developed a MSHCP. This effort led to the procurement of an Incidental Take Permit under the Endangered Species Act (ESA) of 1973. Clark County serves as the Administrator of the Plan and Permit, which covers 78 species and their associated habitats.

U.S. Fish and Wildlife Service

The USFWS is a federal agency within the Department of Interior. This agency has responsibilities and regulatory authorities under ESA of 1973, as amended, the Migratory Bird Treaty Act of 1918, as amended, the Bald Eagle and Golden Eagle Protection Act of 1940, as amended, and the Fish and Wildlife Coordination Act of 1934, as amended. The Virgin River and its watershed harbors many fish, wildlife, and plant species and their habitats to which USFWS is entrusted to conserve, protect, and enhance for the continuing benefit of the American people.

Bureau of Land Management

The BLM is responsible for the stewardship of our public lands. It is committed to manage, protect, and improve these lands in a manner to serve the needs of the American people for all times. Management is based on the principles of multiple use and sustainable yield of our nation’s resources within a framework of environmental responsibility and scientific technology. These resources include recreation, rangelands timber, minerals, watershed, fish and wilderness, air and scenic, and scientific and cultural.

National Park Service

The NPS administers Lake Mead National Recreation Area under the NPS Organic Act of 1916 et seq., and the Lake Mead National Recreation Area Act of 1964 to conserve the Recreation Area’s scenic, natural, cultural, and wildlife resources and to provide for public enjoyment of those resources in such a manner as to leave them unimpaired for the enjoyment of future generations.

Nevada Department of Wildlife

By authority of Nevada Revised Statutes (NRS) 501.105 and 501.331, NDOW is responsible for administering the policies and regulations necessary for the preservation, protection, management and restoration of Nevada's resident wildlife species. NRS 503.351 provides authority for the Director of NDOW to enter into cooperative agreements for the purpose of the management of native wildlife. NRS 503.584-503.589 directs NDOW to cooperate with other states and legal entities to the maximum extent practicable for the conservation, protection, restoration and propagation of species of native fish, wildlife and other fauna that are threatened with extinction. Nevada Administrative Code (NAC) Chapter 503 extends protected wildlife status to numerous native wildlife species including the species proposed for coverage in the VRHCRP.

Nevada Division of Forestry

By authority of NRS 527.010, 527.060-527.110, and 527-260-527.030, NDF is responsible for managing all forestry, nursery, endangered plant species, and watershed resource activities on certain public and private lands. The NDF also provides fire protection of structural and natural resources through fire suppression and prevention programs and other emergency services.

DEVELOPMENT PROCESS AND CHAPTERS OF THIS DOCUMENT

The VRCMA was developed in a stepwise manner by building upon information organized into major components (chapters) of the assessment (Figure 1). An explanation of the contents of each chapter is provided below.

- **Chapter 1: Existing Conditions** – This chapter describes the ecological and human aspects of the area within the VRCMA Boundary. It also identifies the 108 special status species that will be addressed through the remainder of the document.
- **Chapter 2: Existing Information and Data Gaps** – This chapter describes available information and data gaps regarding life history, habitat, distribution, threats, and protection levels of the 108 special status species.
- **Chapter 3: Conservation Objectives** – This chapter identifies the 10 conservation objectives (four general, six specific to human effects) that are used to guide the development of the conservation actions associated with the VRCMA Boundary. An effects analysis by habitat type is included, which was used to determine the conservation objectives.
- **Chapter 4: Conservation Actions** – This chapter identifies the methodology and analysis used to identify and provide a preliminary ranking of conservation actions for the 108 special status species. Initial conservation actions are identified, but they are further refined in Chapter 5: Conservation Management Assessment. In addition, habitat diversity indices were calculated and presented for use in identifying locations within the VRCMA Boundary in most need of protection.
- **Chapter 5: Conservation Management Assessment** – This chapter is the result of input of resource management agencies' ranking of the conservation actions first identified in Chapter 4. The actions presented in this chapter are the final actions. Reporting, monitoring methodology, and measures of success are also identified here.
- **Chapter 6: Implementation Schedule** – This chapter identifies the timeline for implementation and updates of this VRCMA. Adaptive management is also discussed.
- **Appendices** – The following four appendices are attached to this document:
  - **Appendix A:** SWReGAP Land Cover Type Descriptions, associated with Chapter 1: Existing Conditions
  - **Appendix B:** Available GIS Datasets Data Screening Level Assessment Summary,

- Appendix C: Data Screening Level Assessment Summary, associated with Ch 2: Existing Information

- Appendix D: Summary Tables of Effects on the Special Status Species

- Appendix E: Draft Aquatic and Riparian Species Descriptions

ASSOCIATED DATABASES

Two databases have been developed in association with this conservation management assessment: a web-based, GIS geodatabase and a conservation actions database. The purpose of the geodatabase is to allow for the collection and storage of data related to the Virgin River area, including both the area within the VRCMA Boundary and that area addressed by the VRHCRP. The purpose of the conservation actions database is to track the identification, prioritization, and implementation of conservation actions within the VRCMA Boundary.

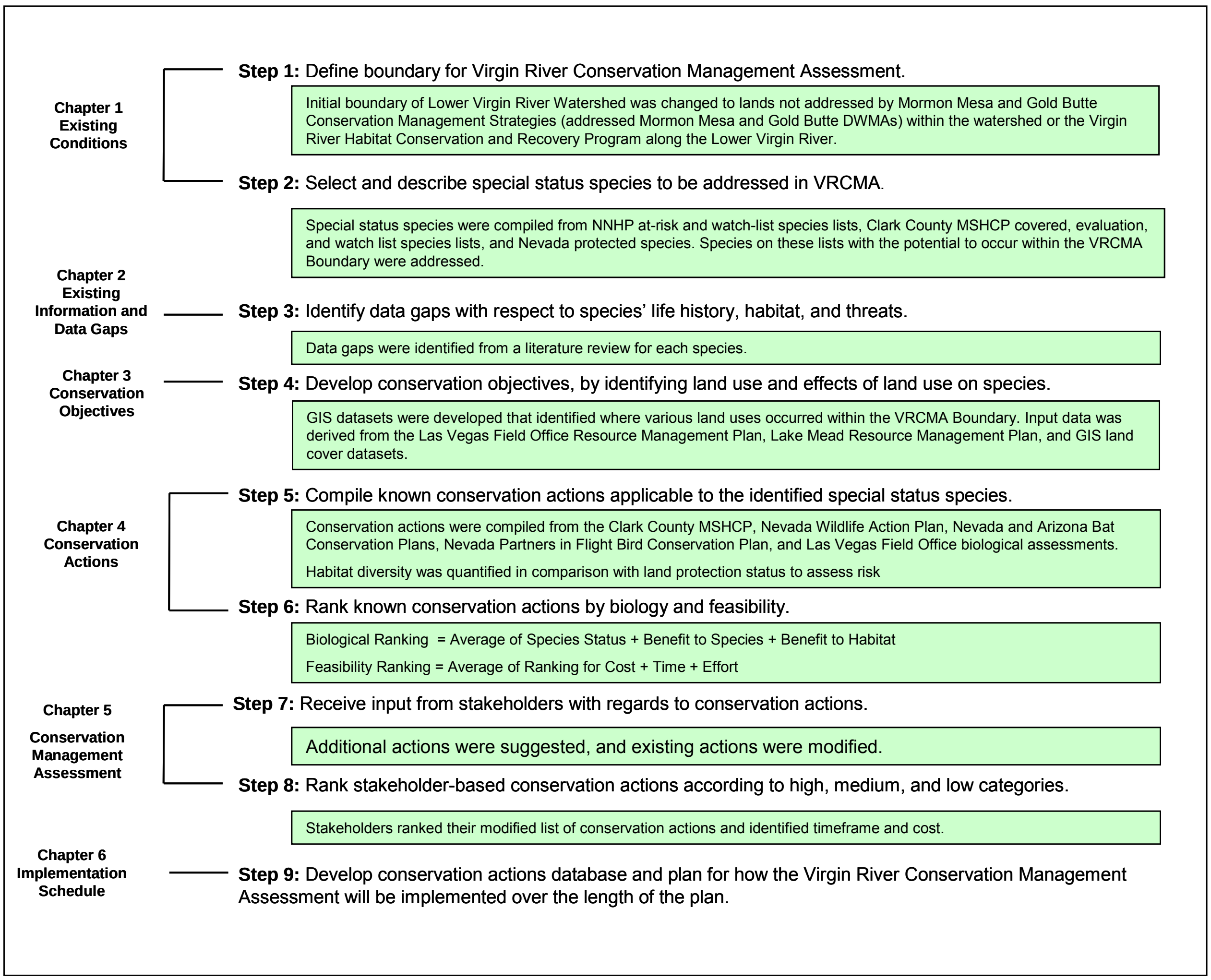


Figure 1 Overview of the primary components (chapters) and associated stepwise process used to develop the Virgin River Basin Conservation Management Assessment (VRCMA).

Chapter 1: Existing Conditions

This chapter describes the existing conditions for the area considered in this document, including information on the natural environment, special status species, and the human environment. The purpose of this chapter is to provide a context for later chapters of this Virgin River Conservation Management Assessment (VRCMA).

1.1 AREA ADDRESSED IN THIS DOCUMENT

The area addressed in this VRCMA is referred to as the VRCMA Boundary in this document and includes the area between the Gold Butte and Mormon Mesa Desert Wildlife Management Areas (DWMAs) and terrestrial habitat adjacent to the Virgin River and outside the 100-year floodplain of the Virgin River. This 51,963-acre area occurs within the Mojave Basin and Range Ecoregion (EPA 2007) and encompasses portions of Clark County in Nevada and Mohave County in Arizona (refer to Figure 1-1). Elevations above mean sea level (amsl) range from 1,214 feet (370 meters) near the Virgin River floodplain to 8,071 feet (2,460 meters) in the Virgin Mountains.

Hydrology, water quality, and other characterizations of the area that refer to water or aquatic environments are addressed in a separate document, the Virgin River Habitat Conservation and Recovery Program (VRHCRP) document. The VRHCRP addresses the 100-year floodplain of the Virgin River and associated water issues and five listed fish (i.e., woundfin and Virgin River chub) and bird species (i.e., southwestern willow flycatcher, Yuma clapper rail, yellow-billed cuckoo).

1.2 NATURAL ENVIRONMENT

1.2.1 Climate

The climate in the VRCMA Boundary is typical of the southern Nevada desert with hot and dry summers and mild winters. The average annual precipitation of approximately four inches (10.1 centimeters) generally occurs because of two types of storm events: (1) longer-duration, low intensity winter events associated with frontal systems or (2) shorter-duration, high intensity summer storms (CCRFCD 2001). Winter storms in the area are regionally associated with broad low-pressure systems that develop over the Pacific Ocean and move easterly. Precipitation from these storms is generally widespread and, on rare occasions, is intense (CCRFCD 2001). However, summer storms occur as localized convective thunderstorms and can often be intense. Maximum precipitation normally falls between November and March, while minimum precipitation occurs in May, June, September, and October. During July and August, thunderstorms are common, contributing between 25 and 30 percent of annual precipitation (BLM 1998). These storms are often of sufficient intensity to produce localized flash flooding (BLM 1998).

Air masses moving across southern Nevada are usually low in moisture. This arid condition is characterized by low precipitation, low humidity, and cloudless skies. Summer climate is marked by hot days and mild nights, with an average daily temperature of nearly 90ºF (32ºC). Winter temperatures drop below freezing about 12 days per year. The average winter daily temperature is 46ºF (8ºC). Spring and autumn are generally moderate and the average daily temperature is 80ºF (27ºC) (RECON 2000).

The distribution of average annual precipitation in the VRCMA Boundary can be observed in Figure 1-2, in which the average precipitation from 1960 to 1990 is presented (PRISM 2006).

1.2.2 Geology

Within the VRCMA Boundary, significant faulting, folding, and natural erosion from the Virgin River and water bodies present in earlier eras (e.g., the Muddy Lake) has left a complex landscape of steep, craggy cliffs; sandstone buttes; and alluvial fans (BLM 1990).

The Virgin Mountains to the south and the Mormon Mountains to the west form the external boundaries of the VRCMA Boundary. These ranges expose rock ranging from Precambrian crystalline basement rocks to

Mesozoic continental sedimentary deposits (Langenheim et al. 2000). Within the center of these mountains and hills is the Mesquite depression, or basin. The Mesquite Basin is a large structural depression that has been extensively deformed since its inception during the Miocene epoch approximately 24 million years ago (Mya). Between approximately 24 and 13 Mya, subsidence occurred within the basin and sediments began accumulating. This period was followed by intense deformation due to large displacement of normal faults that occurred between approximately 13 and ten Mya. Deposition of the Muddy Creek Formation occurred between 11.5 to 5.5 Mya. Approximately 5.5 Mya, the Colorado River and probably the Virgin River were flowing into the Mesquite Basin and formed Muddy Lake, which was an extensive body of water that extended from the base of the Clover Mountains southward into the Las Vegas Basin. At some point, the Mesquite Basin was breached, and Muddy Lake began draining into the Colorado River Basin. The breach of Muddy Lake caused a dramatic shift in deposition and erosion into and out of the basin. The erosion that occurred resulted in the modern day landforms present within the basin (Dixon and Katzer 2002).

The Mesquite Basin is comprised of two structural blocks: 1) the Piedmont Block, which comprises the area south of the Virgin River; and 2) the Central Mesquite Block, which comprises the area north of the Virgin River. The Piedmont Block is dominated by faults that trend northeast to east-northeast. The block is predominately comprised of a Tertiary Piedmont gravel and Quaternary alluvium and colluvium, which overlie the Tertiary Muddy Creek and Horse Springs formations as well as the highly fractured and faulted Paleozoic carbonate rocks that underlie the entire basin. The Central Mesquite Block is characterized by faults striking northeast to northwest. This block consists of a deep tectonic basin, which is predominately comprised of the Tertiary Muddy Creek Formation, Lower Tertiary sediments, Mesozoic sedimentary rock units, and Paleozoic carbonate rocks. The width and length of the ephemeral and perennial washes located in this block are controlled by the northerly-trending fault lines (Dixon and Katzer 2002).

A generalized map of the surficial geology of the Mesquite Basin within the VRCMA Boundary is presented in Figure 1-3. Surficial materials are not soils; instead, they are deeper earth materials between the soil zone and underlying bedrock. Soils typically develop from weathering of the uppermost portion of these earth materials. Surficial geology is useful in modeling species-habitat interactions, because it is the basis for soil creation and partially determines the distribution of habitats.

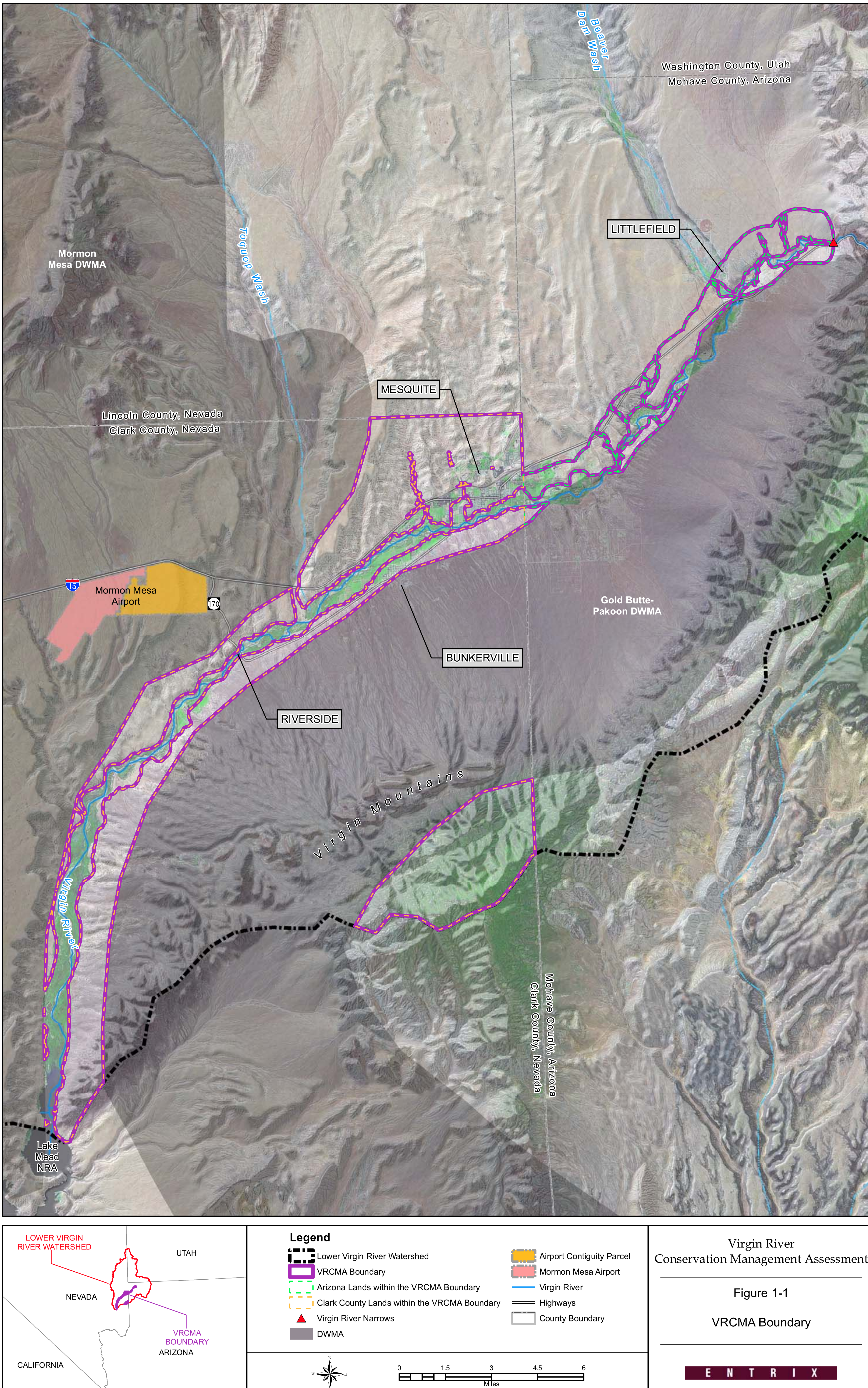
1.2.3 Soils

Soils have been mapped by the Natural Resources Conservation Service (NRCS) within the VRCMA Boundary (NRCS 2004). Soils along the associated tributary washes are the Toquop series, which are comprised of fine sandy loams and fine sands. Toquop soils are on smooth, nearly level broad terraces adjacent to perennial streams and slightly convex, nearly level to gently sloping alluvial fans. These soils formed in very deep sandy alluvium. Upland soils outside of the Lower Virgin River floodplain are generally shallow, loamy-skeletal, mesic to hyperthermic soils interspersed with rock outcroppings. On the eastern edge of the Virgin River Narrows area, which is mainly comprised of rock outcroppings, many of the soil types are clay. Badlands (semiarid regions with sparse vegetation that experience high rates of erosion) occur in the southeastern portion of the watershed, amongst rock outcroppings and coarse silty and/or loamy soils.

A generalized map of the soils of the VRCMA Boundary was developed using STATSGO NRCS data (NRCS 2006) (Figure 1-4).

1.2.4 Wildlife

Wildlife species occurring within VRCMA Boundary include those typically found in and adapted to the arid Mojave Desert Ecosystem. The distribution and abundance of species is influenced by many factors, including plant species diversity, vegetation structure, substrate, predator/prey populations, and availability of cover sites and water. Environmental conditions within the desert are highly variable, and many species are able to quickly take advantage of favorable circumstances (e.g., rainfall) and/or to escape harsh situations through adaptations of physiology (e.g., use of metabolic water) and/or behavior (e.g., hibernation, under ground burrows and migration). Washes and stream courses often serve as corridors for animal movements, providing habitat connectivity across the greater landscape. Generally, wildlife also occurs in greater numbers and diversity with higher structural complexity of the vegetation and plant species diversity.

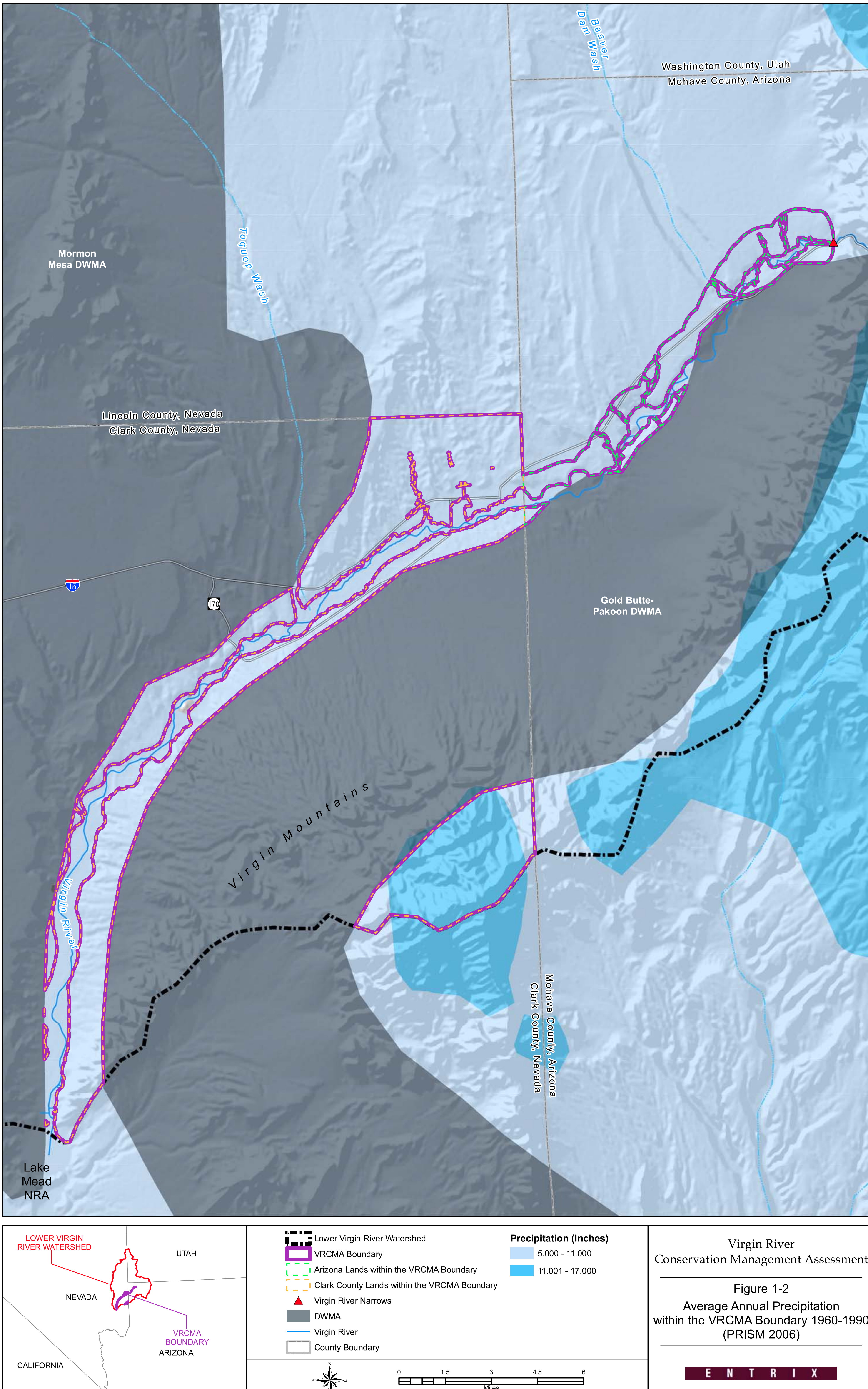


Virgin River
Conservation Management Assessment

Figure 1-1

VRCMA Boundary

E N T R I X



Virgin River
Conservation Management Assessment

Figure 1-2
Average Annual Precipitation
within the VRCMA Boundary 1960-1990
(PRISM 2006)

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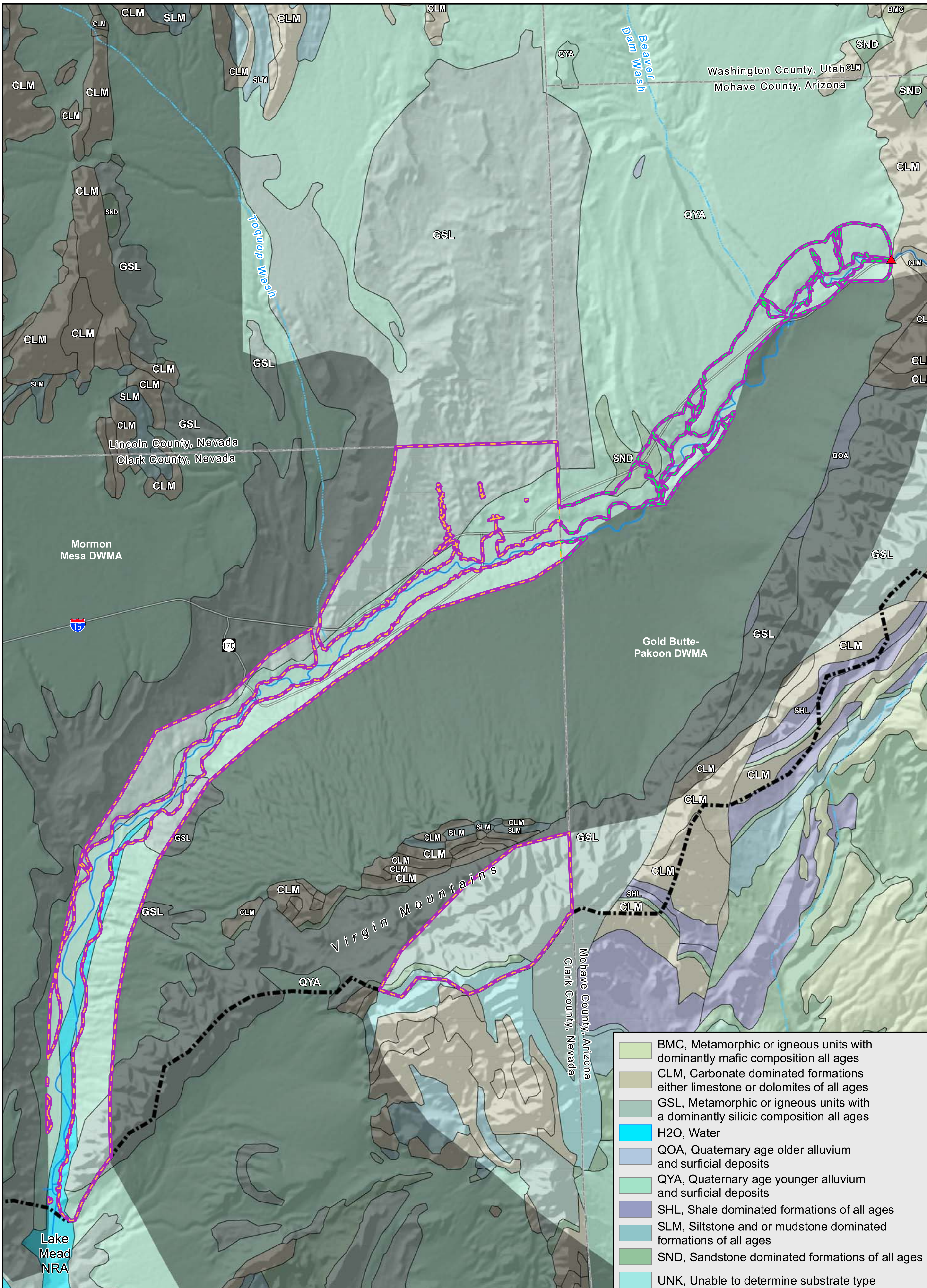
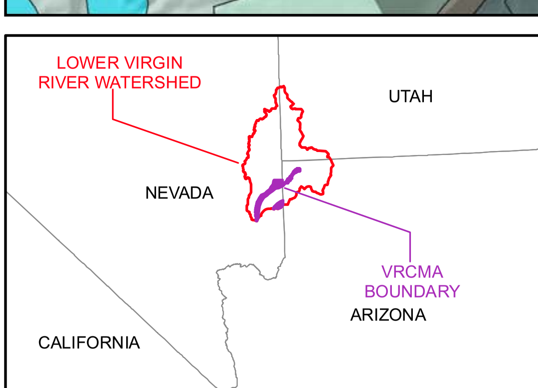




Lower Virgin River Watershed
VRCMA Boundary
Arizona Lands within the VRCMA Boundary
Clark County Lands within the VRCMA Boundary
Virgin River Narrows
DWMA
Virgin River
County Boundary

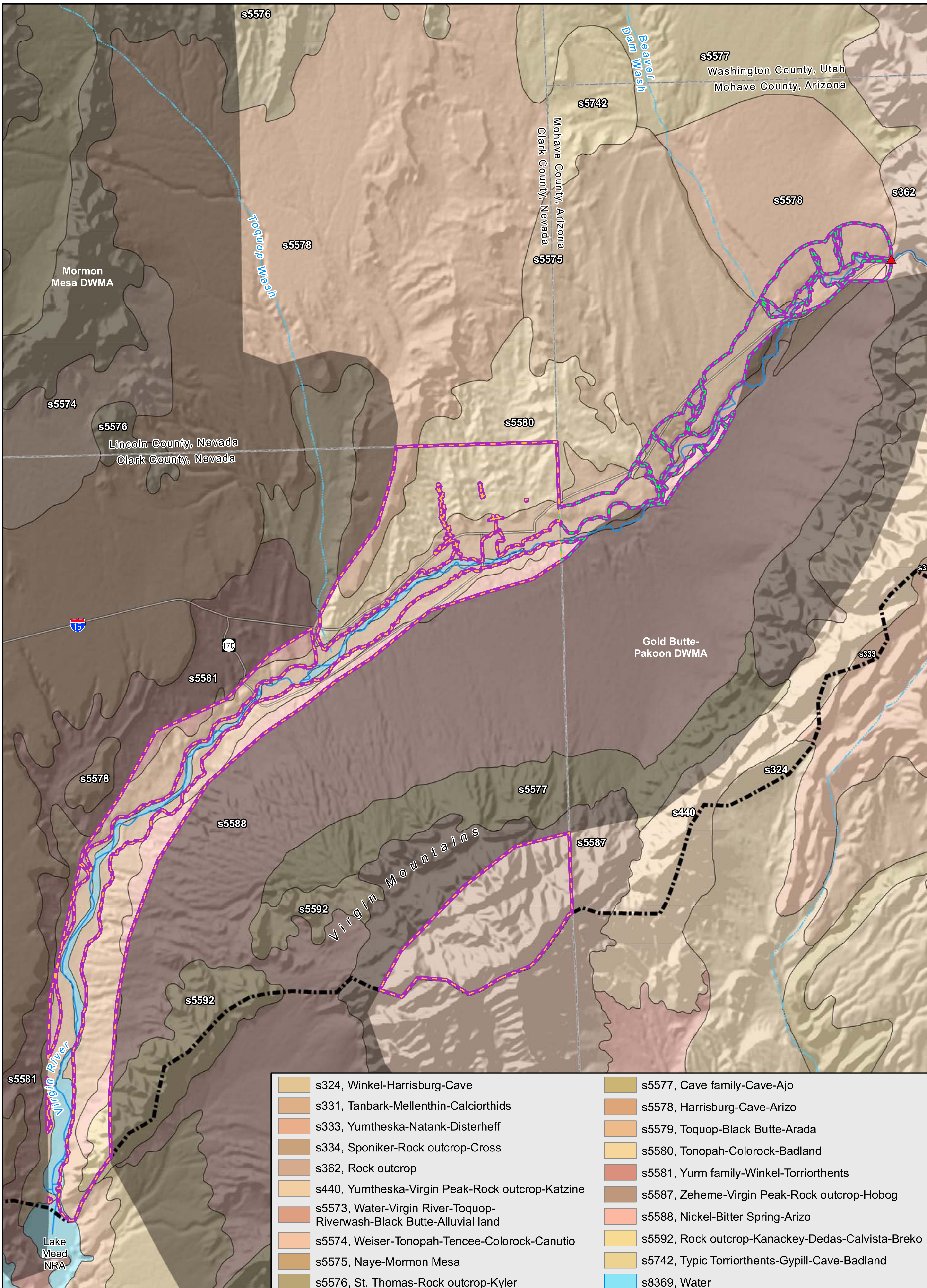
0 1.5 3 4.5 6
Miles

Virgin River
Conservation Management Assessment

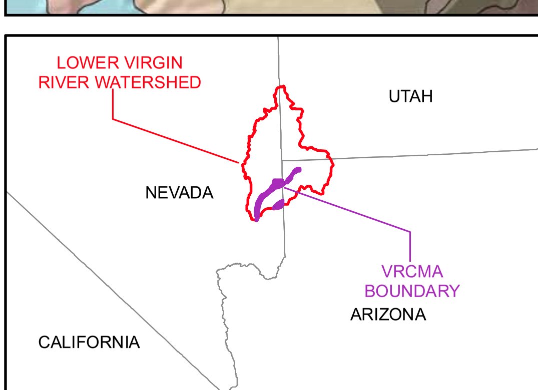
Figure 1-3

Surficial Geology
within the VRCMA Boundary

E N T R I X



s324, Winkel-Harrisburg-Cave
s331, Tanbark-Mellenthin-Calciorthids
s333, Yumtheska-Natank-Disterheff
s334, Sponiker-Rock outcrop-Cross
s362, Rock outcrop
s440, Yumtheska-Virgin Peak-Rock outcrop-Katzine
s5573, Water-Virgin River-Toquop-Riverwash-Black Butte-Alluvial land
s5574, Weiser-Tonopah-Tencee-Colorock-Canutio
s5575, Naye-Mormon Mesa
s5576, St. Thomas-Rock outcrop-Kyler
s5577, Cave family-Cave-Ajo
s5578, Harrisburg-Cave-Arizo
s5579, Toquop-Black Butte-Arada
s5580, Tonopah-Colorock-Badland
s5581, Yurm family-Winkel-Torriorthents
s5587, Zeheme-Virgin Peak-Rock outcrop-Hobog
s5588, Nickel-Bitter Spring-Arizo
s5592, Rock outcrop-Kanackey-Dedas-Calvista-Breko
s5742, Typic Torriorthents-Gypill-Cave-Badland
s8369, Water



Lower Virgin River Watershed
VRCMA Boundary
Arizona Lands within the VRCMA Boundary
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County Boundary

0 1.5 3 4.5 6
Miles

Virgin River
Conservation Management Assessment

Figure 1-4

Soils
within the VRCMA Boundary

E N T R I X

Mammal species typically occurring in the Mojave Desert and other basin and range habitats include coyote (*Canis latrans*), kit fox (*Vulpes macrotis*), black-tailed jackrabbit (*Lepus californicus*), desert cottontail (*Sylvilagus audubonii*), rock squirrel (*Spermophilus variegatus*), antelope ground squirrel (*Ammospermophilus leucurus*), desert wood rat (*Neotoma lepida*), and Merriam's kangaroo rat (*Dipodomys merriamii*). Big game species such as desert bighorn sheep (*Ovis canadensis*) and mule deer (*Odocoileus hemionus*) may also occur.

The Mojave Desert Scrub ecosystem and other basin and range habitats provide breeding and wintering habitat for many species of birds, most of which forage and nest on the ground or among low shrubs. Typical species present include red-tailed hawk (*Buteo jamaicensis*), common raven (*Corvus corax*), greater roadrunner (*Geococcyx californianus*), mourning dove (*Zenaidura macroura*), Gambel's quail (*Callipepla gambelii*), cactus wren (*Campylorhynchus brunneicapillum*), Say's phoebe (*Sayornis saya*), western kingbird (*Tyrannus verticalis*), house finch (*Carpodacus mexicanus*), and, in areas of human presence, the non-native house sparrow (*Passer domesticus*).

Reptile species are the most diverse animal taxon in the Mojave Desert ecosystem, as well as other basin and range habitats. The distribution and abundance of these reptile species are strongly influenced by microhabitat features such as substrate and/or cover sites. Reptile species present include desert tortoise (*Gopherus agassizii*), chuckwalla (*Sauromalus obesus*), collared lizard (*Crotaphytus bicinctores*), western banded gecko (*Coleonyx variegatus*), zebra-tailed lizard (*Callisaurus draconoides*), western whiptail (*Cnemidophorous tigris*), desert iguana (*Dipsosaurus dorsalis*), and northern desert horned lizard (*Phrynosoma platyrhinos platyrhinos*). Snake species include western patch-nosed snake (*Salvadora hexalepis*), coachwhip snake (*Masticophous flagellus*), glossy snake (*Arizona elegans*), California (common) kingsnake (*Lampropeltis getulus californiae*), and sidewinder (*Crotalus cerastes*). Amphibians present in the area include the red-spotted toad (*Bufo punctatus*).

Higher elevation areas in the VRCMA Boundary, such as those where pinyon-juniper woodlands and mixed conifer forests are present, contain a slightly different composition of wildlife species. Characteristic species of pinyon-juniper habitat include pinyon mouse (*Peromyscus truei*), bushy-tailed woodrat (*Neotoma cinerea*), pinyon jay (*Gymnorhinus cyanocephalus*), juniper titmouse (*Baelophus ridgwayi*), and bushtit (*Psaltriparus minimus*). Both pinyon nuts and juniper berries are important food sources and many wildlife species serve as dispersal agents for these plants (Frischknecht 1975, as cited in Laudenslayer and Boggs 1988).

Higher elevation conifer forests are likely to contain forest birds such as woodpeckers, mountain chickadee (*Poecile gambeli*), and Cooper's hawk (*Accipiter cooperii*), as well as large game mammals such as mule deer (*Odocoileus hemionus*). Reptile species are reduced in types of species present, as compared to the lower, hotter basin habitats.

1.2.5 Land Cover, Including Vegetation

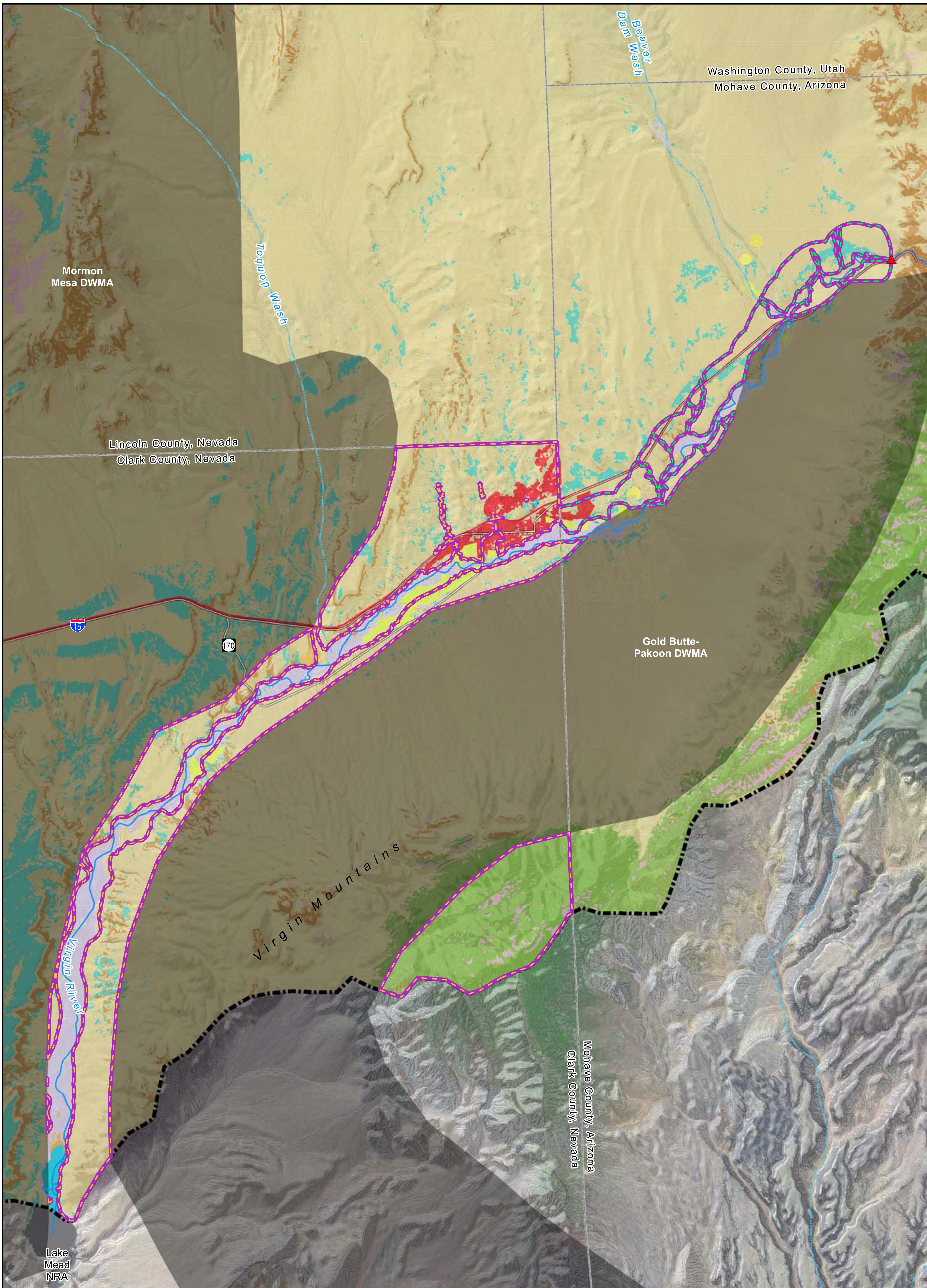
The VRCMA Boundary occurs within the Mojave Basin and Range Ecoregion (EPA 2007). Predominant vegetation types are the creosote bush-white bursage desert scrub at lower elevations, mixed desert scrub at moderate elevations, and pinyon-juniper woodland at higher elevations within the watershed. The Southwestern Regional Gap Analysis Project (SWReGAP) has mapped land cover for all of Nevada, Utah, Arizona, Colorado, and New Mexico according to ecological systems (USGS GAP 2004). Ecological systems are "groups of plant community types that tend to co-occur within landscapes with similar ecological processes, substrates, and/or environmental gradients" (Comer et al. 2003, as cited in Lowry et al. 2005). This concept primarily groups areas by dominant existing vegetation types, but its system approach also includes physical components of the landscape, such as landform, aspect, substrate, hydrology, and climate (Lowry et al. 2005). The minimal mapping unit of this land cover dataset is approximately one acre. This means that the SWReGAP land cover dataset will not identify or record unique areas less than one acre in size. Instead, they will be lumped with the adjacent land cover type. Altered and disturbed land cover types are not distinguished by these ecological systems; instead, National Land Cover Database legend types have been used (Lowry et al. 2005).

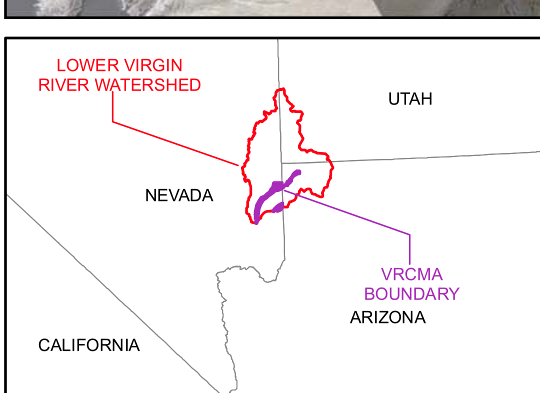
The acreage of each SWReGAP land cover type within the VRCMA Boundary was quantified (Table 1-1). A simplified distribution of land cover types within the VRCMA Boundary was developed (Figure 1-5). Appendix A provides a description of each of these ecological system types.

Table 1-1 Acres of Each Ecological System Occurring within the VRCMA Boundary (USGS GAP 2004)

SWReGAP Land Cover Type	**Nevada Portion**	**Arizona Portion**	**All Lands in VRCMA Boundary**
Agriculture	814.6	181.3	995.9
Colorado Plateau Blackbrush-Mormon-tea Shrubland	19.9	0.0	19.9
Colorado Plateau Mixed Bedrock Canyon and Tableland	27.6	0.0	27.6
Developed, Medium - High Intensity	381.8	292.9	674.8
Developed, Open Space - Low Intensity	2,062.2	234.7	2,296.9
Great Basin Pinyon-Juniper Woodland	8,151.4	0.0	8,166.0
Inter-Mountain Basins Big Sagebrush Shrubland	7.0	0.0	7.0
Invasive Southwest Riparian Woodland and Shrubland	429.0	145.0	574
Mogollon Chaparral	579.2	0.0	580.1
Mojave Mid-Elevation Mixed Desert Scrub	4.3	0.0	4.3
North American Arid West Emergent Marsh[a]	23.9	0.0	23.9
North American Warm Desert Badland	498	42.3	540.3
North American Warm Desert Bedrock Cliff and Outcrop	1,940.8	103.8	2,044.5
North American Warm Desert Pavement	659.8	5.6	665.4
North American Warm Desert Playa	4.9	0.0	4.9
North American Warm Desert Riparian Mesquite Bosque[a]	217.3	0.0	217.3
North American Warm Desert Riparian Woodland and Shrubland[a]	15.3	0.0	15.3
North American Warm Desert Wash	1,070.1	832.0	1,902.1
Open Water[a]	97.9	2.3	100.3
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	210.8	0.0	210.8
Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	1.4	0.0	1.4
Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	10.0	0.0	10.0
Rocky Mountain Ponderosa Pine Woodland	853.7	0.0	853.7
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	24,995.0	6,953.1	31,948.1
Sonora-Mojave Mixed Salt Desert Scrub	26.9	67.5	94.3
Grand Total	43,102.3	8,860.6	51,978.4

[a] Aquatic and riparian habitats are included in this table, but are not analyzed in this VRCMA





Lower Virgin River Watershed
VRCMA Boundary
Arizona Lands within the VRCMA Boundary
Clark County Lands within the VRCMA Boundary
Virgin River Narrows
DWMA
Virgin River
County Boundary

Generalized SWReGAP Vegetation

- Agriculture
- Cliff and Canyon
- Developed
- Forest/Woodland
- Invasive Riparian
- Low Vegetation Desert
- Open Water
- Riparian
- Scrub
- Shrubland

0 1.5 3 4.5 6
Miles

Virgin River
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Figure 1-5
Simplified Version of SWReGAP Land Cover Types within the VRCMA Boundary (SWReGAP 2004)

E N T R I X

1.3 HUMAN ENVIRONMENT

1.3.1 Land Ownership

The VRCMA Boundary is predominantly managed by the BLM. Private lands are grouped along the length of the Lower Virgin River. Other federal landowners and state agencies have land holdings primarily along the Lower Virgin River, or interspersed among BLM lands in areas further from the Lower Virgin River. The Southwest Regional Gap Analysis Program (SWReGAP) has developed a landownership dataset that covers all of Arizona, Utah, Nevada, and New Mexico (USGS GAP 2005). Total acreage by landowner (Table 1-2) and distribution of land ownership in the VRCMA Boundary (Figure 1-6) are provided.

Table 1-2 Acres of Land Ownership within the VRCMA Boundary (USGS GAP 2005)

Ownership	Nevada Portion	Arizona Portion	All Lands in VRCMA
BLM	35,154.6	6,560.3	41,714.8
NRA (NPS land)	1,660.8	0.0	1,660.8
Private	5,055.4	1,683.2	6,738.6
State	1,057.9	615.0	1,672.9
Open Water[a]	202.0	0.0	202
Grand Total	43,130.7	8,858.4	51,989.1

[a] Aquatic and riparian habitats are included in this table, but are not analyzed in this VRCMA

1.3.2 Land Use Designations

Within the VRCMA Boundary, several city and county governments have developed land use zoning prescriptions.

Clark County Department of Comprehensive Planning, has developed land use zoning for the entire county. Within the VRCMA Boundary, the majority of these lands are under the management of BLM and are zoned as open lands. Other lands in the communities of Bunkerville are zoned for rural and low density residential, industrial, and commercial uses (CCCP 2006b).

The City of Mesquite in Clark County, Nevada, has recently expanded its City boundary. The Mesquite Lands Act (MLA) of 1986 (Public Law 99-548), as amended in 1996 (Public Law 104-208) and in 1999 (Public Law 106-113), encompasses approximately 10,620 acres plus 2,560 acres for a potential airport development project which is currently undergoing separate NEPA consultation. These two parcels are referred to as the 1996 Amendment Parcel (P.L. 99-548, amended as P.L. 104-208) and the Contiguity Parcel (P.L. 99-458, amended as P.L. 106-113) (Figure 1-1). The lands located to the west of the Contiguity Parcel are slated for direct sale to the City for a planned airport development as stipulated in the MLA legislation (P.L. 99-548, amended as P.L. 106-113). The sale of the Contiguity Parcel to the City is contingent upon the successful completion of the federal and state permitting requirements to allow for the airport development; otherwise, this land will not be available for purchase by the City. The City proposes to use these lands to promote future urban development in this area of Nevada. To date, the City has sold and/or leased designated parcels to prequalified developers for use in establishing master-planned residential and mixed-use commercial developments that are consistent with the City's updated master plan goals (Land Use Component updated in August 2007). Additionally, there is a congressional bill pending that would allow the City to acquire 4,900 acres of public land around the special Gold Butte region south of Mesquite and for the the City to implement a conservation easement (i.e., National Conservation Area).

SNWA is currently attempting to purchase or lease up to 21,578 afy of pre-1930 Virgin River water rights. As a part of the VRHCRP, SNWA is requesting an incidental take permit (ITP) for potential retirement of agriculture and conveyance of pre-1930 Virgin River water rights in Nevada to Lake Mead up to 21,578 afy. This includes development of SNWA's pre-1930 Virgin River water rights and conveyance of water rights owned or controlled by SNWA through the channel of the Virgin River and/or existing diversion and conveyance structures of the Mesquite and Bunkerville Irrigation Companies to Lake Mead. As part of the

VRHCRP, VVWD is applying for an ITP for the extraction of groundwater water rights in the amount of 12,200 acre-feet.

Four communities within Mohave County, Arizona, which include Littlefield in the VRCMA Boundary, have developed a land use plan, which includes zoning for residential, commercial, light industrial, public facilities, recreation, and open space for those communities (Mohave County Board of Supervisors 1998). Outside of these communities, there is no zoning in the northwestern portion of Mohave County.

State and federal lands are not subject to these city and county zoning guidelines.

1.3.2.1 Residential Patterns in the VRCMA Boundary

Residential patterns within the VRCMA Boundary are primarily small towns located along the Lower Virgin River. Very limited private land exists away from the Virgin River Valley. Figure 1-1 shows the locations of populated areas (i.e., cities, towns and/or communities) within the VRCMA Boundary.

Mesquite

As of the 2000 federal census, the City of Mesquite had a population of 9,389, with a 2005 census estimate of 13,523 (U.S. Census Bureau 2000). Furthermore, Clark County Comprehensive Planning department estimates a population of 18,012 as of July 1, 2006 (CCCP 2006a).

At various times, the City of Mesquite has boomed as a casino and resort vacation and retirement community. The City of Mesquite has been experiencing rapid growth in recent years from gaming, retirement living, and light industrial businesses. Currently, its predominant industries are the arts, entertainment, recreation, accommodation, and food service sectors at 50.3 percent and retail trade at 10 percent (U.S. Census Bureau 2000). The primary transportation artery serving the City of Mesquite is I-15, which connects major population centers in Nevada and Utah.

Bunkerville

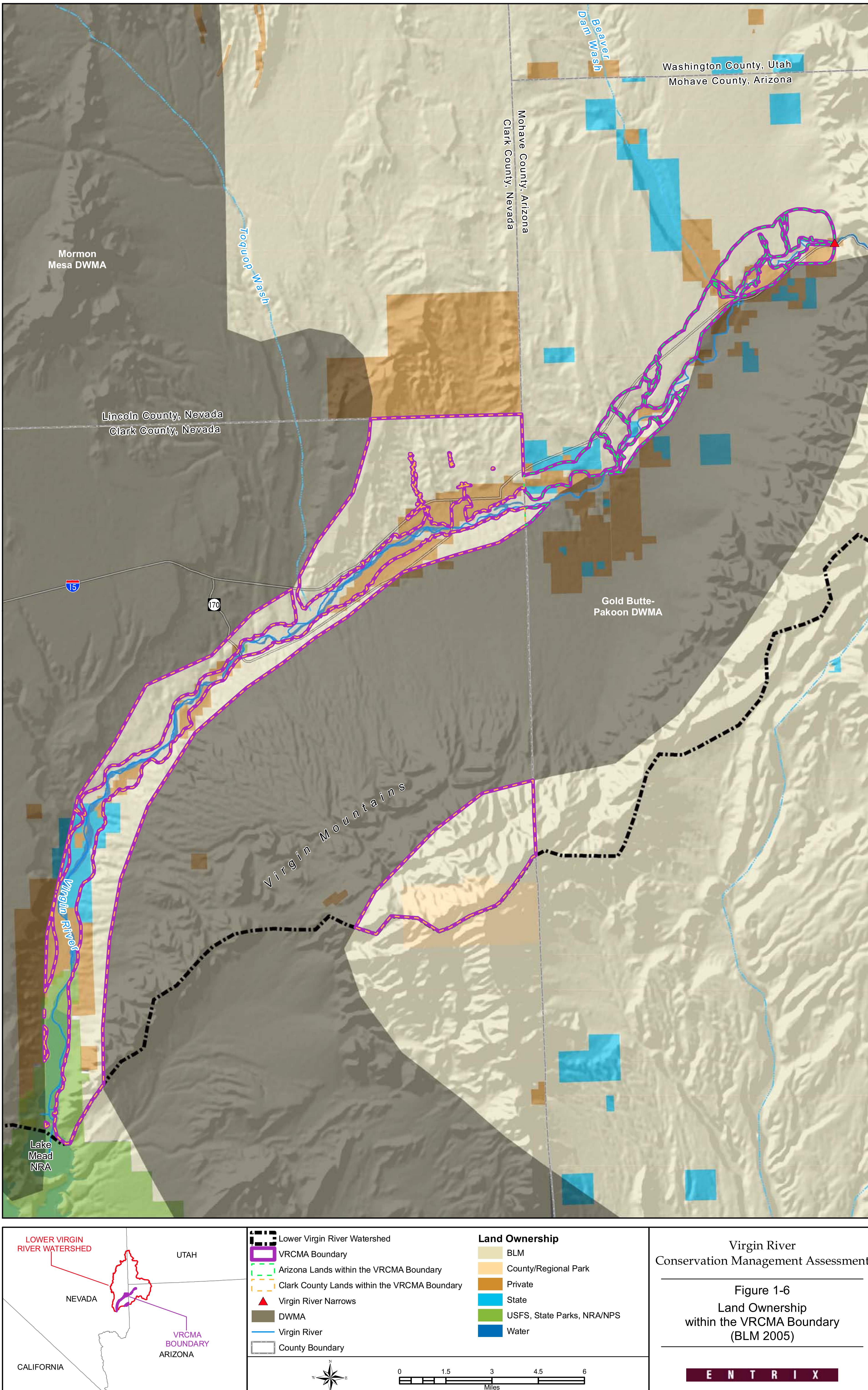
In 2000, the population of Bunkerville was 1,014 and was estimated to be 1,202 in 2006 (U.S. Census Bureau 2000 and CCCP 2006a). The largest employment sector is the services industry at 40.8 percent; the second largest sector is educational, health, and social services at 10.2 percent (U.S. Census Bureau 2000). Agriculture also plays an important part in this community along the Lower Virgin River. The area includes several large dairy farms and crop operations (CCCP 1994).

Riverside

Riverside is a community or populated place (Class Code U6) located in Clark County. The community was named for its location near the Virgin River. Besides Mesquite and Bunkerville Irrigation companies, other pre-1930 surface water rights on the Virgin River exist in the vicinity of the Riverside Diversion. These water rights are held by private individuals and are not part of the Virgin River decree. The water rights are pre-1922. SNWA currently owns approximately 600 afy of these water rights.

Littlefield

Littlefield is a small community in northwestern Mohave County, Arizona, located in the 86432 zip code, which had a combined population of 1,053 with three other communities as of the 2000 census (U.S. Census Bureau 2000). Littlefield and three other communities are the only communities in Arizona off of I-15. As a result, most residents work and shop in Mesquite, Nevada, or St. George, Utah (Mohave County Board of Supervisors 1998).



Virgin River
Conservation Management Assessment

Figure 1-6
Land Ownership
within the VRCMA Boundary
(BLM 2005)

E N T R I X

Changes in Residential Patterns

The City of Mesquite, in Clark County, Nevada, has recently expanded its boundaries to the north and west and is rapidly growing in population and extent. The Mesquite Lands Act of 1986 (Public Law 99-548) and 1988, and subsequent amendments (Public Law 104-208, Public Law 106-113), have enabled the City of Mesquite to exclusively acquire land in excess of 10,000 acres (4.047 hectares) from the BLM, which manages the surrounding public lands. The purposes of these acts were to increase the size of the city limits and to allow for increased economic development and growth. The City of Mesquite and Clark County have been pursuing the ability to accommodate additional residential growth within their boundaries for several years, as it will enable the community to encourage economic growth. Continuing demands to provide land and public services for the growing population has the potential to create resource use conflicts in the area. The majority of community growth occurs along the northern side of the Virgin River.

To the west of the VRCMA Boundary lies Las Vegas, Nevada. This city has experienced rapid growth in recent years, which has fueled the expansion of the City of Mesquite and is likely to place additional development pressure on the VRCMA Boundary in the future, either directly or indirectly, through the need for water sources.

1.3.3 Existing Land and Resource Management

1.3.3.1 Grazing

Livestock grazing of cattle and horses occurs on grazing allotments on BLM lands within the VRCMA Boundary, as well as on some private lands. Some grazing allotments have been closed or reduced to seasonal availability in recent years for the protection of desert tortoise (BLM 1998). Grazing allotments within the ACECs managed by the Las Vegas Field Office have been closed (BLM 1998); although, trespass grazing remains a problem in these managed areas. Grazing allotments managed by the Arizona Strip Field Office in the Arizona portion of the VRCMA Boundary have seasonal restrictions (BLM 2007a). Grazing also occurs on some state trust lands in Arizona (ASLD 2007). There are no state trust lands within Nevada.

1.3.3.2 Mining

Mining for fluid, leasable, and locatable minerals on BLM lands within the VRCMA Boundary occurs in accordance with the resource management plans of the Las Vegas and Arizona Strip field offices.

Active lode and placer claims exist in the Mormon Mesa area of Clark County, Nevada. No geothermal or solid mineral active claims occur within the VRCMA Boundary (BLM 2007b). No mining activities are allowed within wilderness, wilderness study areas, or ACECs unless preexisting claims exist (BLM 1998). Existing claims can be mined if a mining plan of operations is approved (Ronning, pers. comm.).

1.3.3.3 Recreation

On public lands, Special Recreation Management Areas (SRMAs) are well-defined land units that support a combination of natural features that make them attractive and manageable for interrelated recreation opportunities on a sustained basis. Investment and levels of management are typically higher than what is required across most of the Extensive Recreation Management Areas (BLM 1998). No SRMAs have been designated within the VRCMA Boundary by the Las Vegas or Arizona Strip field offices. Public lands not designated as special recreation management areas, or other special designations, are managed as extensive recreation management areas (BLM 1998).

OHV use in the two BLM districts within the VRCMA Boundary is prohibited in wilderness areas and river segments with tentative classification as eligible for Wild and Scenic River status and only allowed in designated areas for ACECs (BLM 1998, BLM 2007a). Within other BLM lands in Nevada in the VRCMA Boundary, OHV use is allowed on existing roads, trails, and dry washes (BLM 1998).

1.3.4 Protection Status

The land status dataset (USGS 2005) also identifies the protection status of lands within the VRCMA Boundary (Table 1-3, Figure 1-7). The five biodiversity management status categories can generally be defined as follows:

- **Status 0**: Open water areas within the VRCMA Boundary.
- **Status 1:** An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events (of natural type, frequency, intensity, and legacy) are allowed to proceed without interference or are mimicked through management." No Status 1 lands are present within the VRCMA Boundary.
- **Status 2:** An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but which may receive uses or management practices that degrade the quality of existing natural communities, including suppression of natural disturbance.
- **Status 3:** An area having permanent protection from conversion of natural land cover for the majority of the area, but subject to extractive uses of either a broad, low-intensity type (e.g., logging) or localized intense type (e.g., mining). It also confers protection to federally listed endangered and threatened species throughout the area.
- **Status 4:** There are no known public or private institutional mandates or legally recognized easements or deed restrictions held by the managing entity to prevent conversion of natural habitat types to anthropogenic habitat types. The area generally allows conversion to unnatural land cover throughout (USGS GAP 2005)."

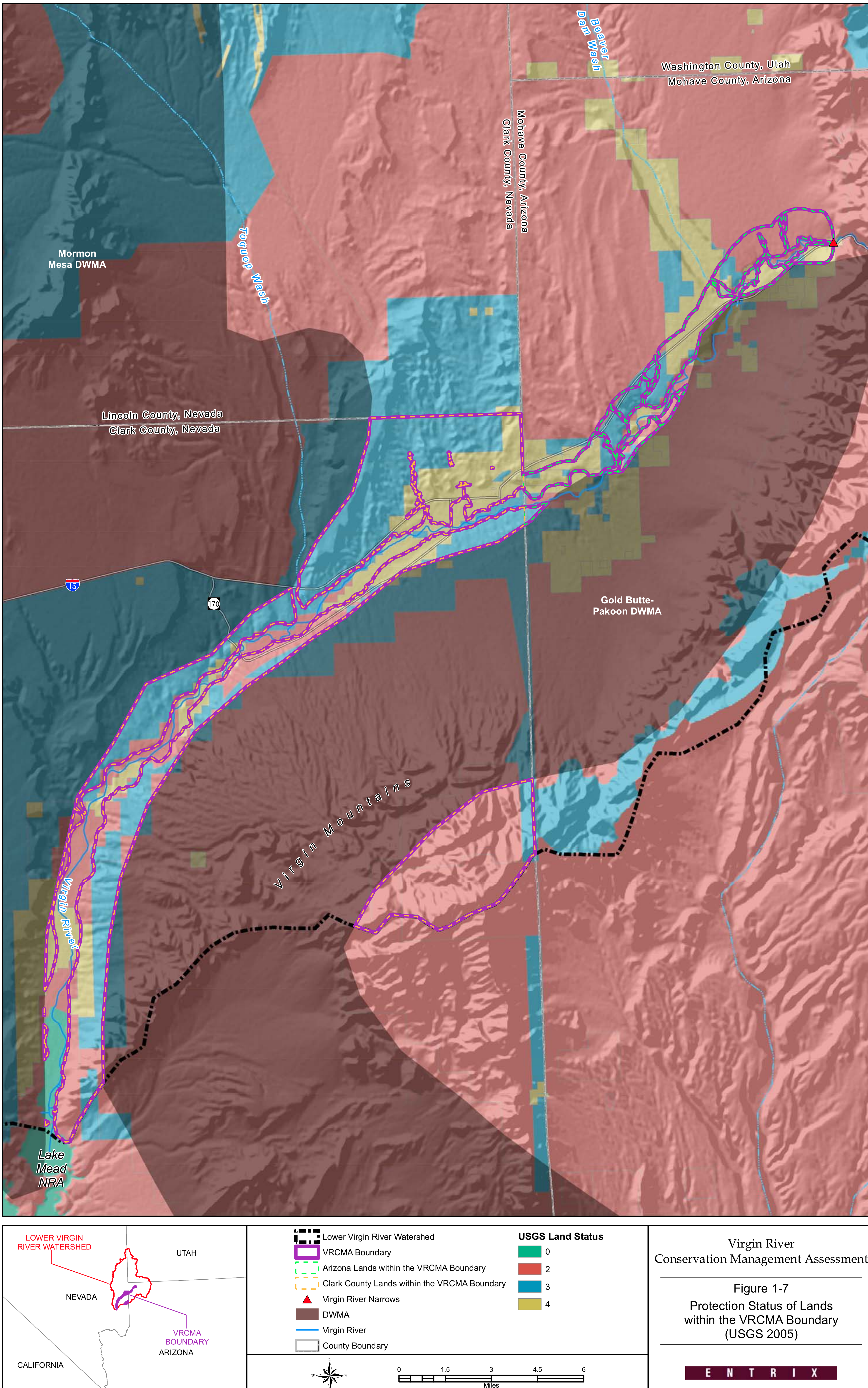
Table 1-3 Acres of Protection Status of Lands and Water within the VRCMA Boundary (USGS 2005)

Status	Nevada Portion (Acres)	Arizona Portion (Acres)	All Lands in VRCMA (Acres)
0	71.9	0.0	71.9
1	-	-	-
2	14,909.7	2,927.5	17,837.2
3	20,511.3	2,432	22,944.2
4	7,609.6	3,500.1	11,109.8
Grand Total	43,102.5	8,860.6	51,963.1

In the VRCMA Boundary, the majority of land in status level 2 is land within the Lake Mead National Recreation Area (NRA)/National Park Service (NPS) land, ACECs, DWMAs, wilderness, wilderness study areas, or state wildlife management areas. Status level 3 lands are primarily those that allow grazing, mining, or other commodity uses on lands, albeit with restrictions and a management plan. Status level 4 lands are private, city, county, or state lands and Native American reservations with no restrictions from converting these lands for human uses.

Within the VRCMA Boundary, over 6,010 acres (2,432 hectares) of ACECs occur on BLM lands for the protection of the desert tortoise. Approximately 5,069 acres (2,051 hectares) of ACECs (Virgin River Corridor, Beaver Dam Slope, Virgin River) have been designated that occur within the VRCMA Boundary, along the Lower Virgin River (BLM 1998, 2007a). These ACECs were established for the purposes of protecting habitat for threatened and endangered fish, riparian birds, and the Las Vegas bearpoppy and extend well beyond the VRCMA Boundary.

Three DWMAs have been established on BLM lands near the VRCMA Boundary (Beaver Dam Slope, Gold Butte-Pakoon, and Mormon Mesa). Conservation management strategies have already been developed for the Mormon Mesa and Gold Butte-Pakoon DWMAs in Clark County, Nevada.



Virgin River
Conservation Management Assessment

Figure 1-7
Protection Status of Lands within the VRCMA Boundary (USGS 2005)

ENTRIX

1.4 OVERVIEW OF SPECIAL STATUS SPECIES IN THE VRCMA BOUNDARY

This section presents information on the distribution, habitat, life history, and threats of special status species in the VRCMA Boundary. It includes a species-habitat relationship matrix (refer to Table 1-5) and species descriptions for each of the species selected for this Virgin River Conservation Management Assessment.

Of the 108 species addressed in this Virgin River Conservation Management Assessment:

- 0 are federally endangered, 0 with critical habitat,
- 1 is federally threatened, one with critical habitat,
- 0 are candidate species,
- 13 are previous category 2 candidate species,
- 30 are protected by the state of Nevada (24 animals, 5 plant species),
- 5 are protected by the state of Arizona (3 animals, 2 plant species),
- 50 are BLM sensitive species in Nevada (BLM 2003a) and ten are also BLM sensitive species in Arizona (BLM 2005),
- 25 are covered species for the Clark County MSHCP,
- 21 are evaluation species for the Clark County MSHCP,
- 21 are watch list species for the Clark County MSHCP,
- 37 are at risk species as designated by NNHP, and
- 35 are watch list species as designated by NNHP.

1.4.1 Identification of Species Included in the Virgin River Conservation Management Assessment

A list of special status species (Table 1-4) occurring in the VRCMA Boundary for inclusion in this conservation management assessment was derived using established lists developed by the Clark County Multiple Species Habitat Conservation Plan (Covered [C], Evaluation [E], and Watch List [WL] taxa), Nevada Natural Heritage Program (At-Risk and Watch List taxa for Clark County, Nevada), and Nevada Administrative Code (NAC) protected species. If the range of the species on these lists was included the VRCMA Boundary and potential habitat for the species occurred within the VRCMA Boundary, then the species was added to the special status species list for this conservation management assessment. In total, 108 species are addressed in this document, including 74 wildlife species and 35 plants.

In Table 1-4, species' federal and state status is identified. For federally-listed species, critical habitat may or may not be identified. Critical habitat is defined as "(1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation (NMFS 2007)." State and global conservation rankings are defined according to NatureServe (NatureServe 2007a).

Table 1-4 Special Status Species Addressed in the Virgin River Conservation Management Assessment

Taxon	Common Name	Scientific Name	Species Status and Protection Levels: Clark County MSHCP[a]	Federal ESA[b]	Critical Habitat	State of Nevada	State of Arizona[d]	BLM Sensitive Species	Global and State Ranking[e]
amphibian	Pacific tree frog	*Hyla regilla*	WL						G5/S2 (AZ), S5 (NV)
bird	American peregrine falcon	*Falco peregrinus anatum*	C			Yes	WSC	Yes	G4T4/S4(AZ), S2 (NV)
bird	bald eagle	*Haliaeetus leucocephalus*	WL			Yes			G5/S2S3, S4N (AZ), S1B, S3N (NV)
bird	Bendire's thrasher	*Toxostoma bendirei*	E					Yes	G4/S4 (AZ), S1 (AZ)
bird	black-chinned sparrow	*Spizella atrogularis*				Yes			G5/S5 (AZ), S3B (NV)
bird	blue grosbeak	*Guiraca caerulea*	C						G5/S5 (AZ), S3B (NV)
bird	Brewer's sparrow	*Spizella breweri*				Yes			G5/S5 (AZ), S4B (NV)
bird	cactus wren	*Campylorhynchus brunneicapillus*	WL						G5/S5 (AZ), S4 (NV)
bird	crissal thrasher	*Toxostoma crissale*	E			Yes		Yes	G5/S5 (AZ), S3 (NV)
bird	ferruginous hawk	*Buteo regalis*	WL			Yes		Yes	G4/S3 (NV)
bird	flammulated owl	*Otus flammeolus*	WL			Yes		Yes	G4/S4?B (NV)
bird	golden eagle	*Aquila chrysaetos*	WL			Yes		Yes	G5/S4 (AZ), S4 (NV)
bird	gray vireo	*Vireo vicinior*	E			Yes		Yes	G4/S4 (AZ), S3B (NV)
bird	Le Conte's thrasher	*Toxostoma lecontei*	E			Yes		Yes	G3/S3 (AZ), S2 (NV)
bird	loggerhead shrike	*Lanius ludovicianus*	E			Yes		Yes	G4/S4 (AZ), S4 (NV)
bird	long-eared owl	*Asio otus*				Yes		Yes	G4/S2B, S3S4N (AZ), S4 (NV)
bird	Lucy's warbler	*Vermivora luciae*				Yes		Yes	G5/S5 (AZ), S2S3B (NV)
bird	northern goshawk	*Accipiter gentilis*	WL						G5/ S3 (AZ), S2 (NV)
bird	northern saw-whet owl	*Aegolius acadicus*	WL						G5/ S4 (AZ), S4 (NV)
bird	phainopepla	*Phainopepla nitens*	C			Yes		Yes	G5/S2B (NV)
bird	pinyon jay	*Gymnorhinus cyanocephalus*				Yes		Yes	G5/S5 (AZ), S3S4 (NV)
bird	prairie falcon	*Falco mexicanus*				Yes		Yes	G5/S4 (AZ), S4 (NV)
bird	Scott's oriole	*Icterus parisorum*	WL						G5/S5 (AZ), S4B (NV)
bird	summer tanager	*Piranga rubra*	C						G5/S4 (AZ), S2B (NV)
bird	vesper sparrow	*Pooecetes gramineus*						Yes	G5/S5 (AZ), S4B (NV)
bird	western bluebird	*Sialia mexicana*	E						G5/S5 (AZ), S3 (NV)
bird	western burrowing owl	*Athene cunicularia*	E			Yes		Yes (AZ and NV)	G4T4/S3B (NV)
bird	western screech owl	*Otus kennicotti*	WL						G5/S5 (AZ), S4 (NV)
bird	yellow-breasted chat	*Icteria virens*				Yes		Yes	G5/S4 (AZ), S3B (NV)
mammal	Allen's big-eared bat	*Idionycteris phyllotis*	WL					Yes (AZ and NV)	G2G3/S2S3 (AZ), S1 (NV)
mammal	big free-tailed bat	*Nyctinomops macrotis*	WL					Yes (AZ and NV)	G5/S3(AZ), S1N (NV)
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*				Yes		Yes	G5/S3S4 (AZ), S3S4 (NV)
mammal	California leaf-nosed bat	*Macrotus californicus*	WL				WSC	Yes	G4/S3(AZ), S2 (NV)
mammal	California myotis	*Myotis californicus*						Yes	G5/S3B (NV)

Table 1-4 Special Status Species Addressed in the Virgin River Conservation Management Assessment

Taxon	Common Name	Scientific Name	Species Status and Protection Levels: Clark County MSHCP[a]	Federal ESA[b]	Critical Habitat	State of Nevada	State of Arizona[d]	BLM Sensitive Species	Global and State Ranking[e]
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*						Yes	G4T4/S3S4(AZ), S4 (NV)
mammal	desert kangaroo rat	*Dipodomys deserti*	E						G5/S5(AZ), S2S3 (NV)
mammal	desert pocket mouse	*Chaetodipus penicillatus*	E						G5/S5 (AZ), S1S2 (NV)
mammal	fringed myotis	*Myotis thysanodes*	E					Yes (AZ and NV)	G4G5/S2B (NV)
mammal	greater western mastiff bat	*Eumops perotis californicus*	WL					Yes	T4G5/S1 (NV)
mammal	hoary bat	*Lasiurus cinereus*						Yes	G5/S4 (AZ), S3 (NV)
mammal	kit fox	*Vulpes macrotis*	E						G4/S4(AZ), S3 (NV)
mammal	little brown myotis	*Myotis lucifugus*						Yes	G5/S1S2 (NV)
mammal	long-eared myotis	*Myotis evotis*	C			Yes		Yes (AZ and NV)	G5/S3S4 (AZ), S4 (NV)
mammal	long-legged myotis	*Myotis volans*	C					Yes (AZ and NV)	G5/S3S4 (AZ), S4 (NV)
mammal	Merriam's shrew	*Sorex merriami*							G5/S3(AZ), S3 (NV)
mammal	pallid bat	*Antrozous pallidus*				Yes		NC	G5/S4S5 (AZ), S3 (NV)
mammal	silver-haired bat	*Lasionycteris noctivagans*	C					Yes	G5/S3S4 (AZ), S3 (NV)
mammal	spotted bat	*Euderma maculatum*	WL			Yes		Yes	G4/S1S2 (AZ), S2 (NV)
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*						Yes	G4/S3B (NV)
mammal	western pipistrelle	*Pipistrellus hesperus*						Yes	G5/S5 (AZ), S4 (NV)
mammal	western small-footed myotis	*Myotis ciliolabrum*	E					Yes	G5/S3B (NV)
mammal	western red bat	*Lasiurus blossevillii*				Yes		Yes	G5/S2 (AZ), S1 (NV)
mammal	Yuma myotis	*Myotis yumanensis*	WL						G5/S3S4 (AZ)
plant	alpine stinking lomatium	*Lomatium graveolens* var. *alpinum*							G5?T3?/S2S3 (NV)
plant	Antelope Canyon goldenbush	*Ericameria cervina*							G3?/S1(NV)
plant	Aven Nelson's phacelia	*Phacelia anelsonii*							G2G3/S1S2 (NV)
plant	barrel cactus	*Ferocactus acanthoides* var. *lecontei*	WL			CY	SR		G5T4?Q/ S3 (AZ), NV (S4)
plant	Beaver Dam scurf pea	*Pediomelum castoreum*	WL						G3/S1 (AZ)
plant	catchfly gentian	*Eustoma exaltatum*						Yes	G4G5/SNR (AZ), S1 (NV)
plant	chalk liveforever	*Dudleya pulverulenta*	WL						G4G5/SNR (AZ), S3(NV)
plant	Clark Mountain agave	*Agave utahensis* var. *nevadensis*							G4T3Q/S3 (NV)
plant	Clarke phacelia	*Phacelia filiae*						Yes	G2/S2 (NV)
plant	Clokey fleabane	*Erigeron clokeyi*	WL						G4G5/S4 (NV)

Table 1-4 Special Status Species Addressed in the Virgin River Conservation Management Assessment

Taxon	Common Name	Scientific Name	Species Status and Protection Levels						
			Clark County MSHCP[a]	Federal ESA[b]	Critical Habitat	State of Nevada	State of Arizona[d]	BLM Sensitive Species	Global and State Ranking[e]
plant	Clokey pincushion	*Coryphantha vivipara* ssp. *rosea*	WL						G3/S3 (AZ), S3 (NV)
plant	crossidium moss	*Crossidium seriatum*	E						G2/S2 (NV)
plant	dune linanthus	*Linanthus arenicola*							G3G4/S3 (NV)
plant	dune sunflower	*Helianthus deserticola*							
plant	fissidens sublimbatus	*Fissidens sublimbatus*	WL						G2G4
plant	forked (Pahrump Valley) buckwheat	*Eriogonum bifurcatum*	C						G2/S2 (NV)
plant	Las Vegas bearpoppy	*Arctomecon californica*	C			CE	SR	Yes	G3/ S2 (AZ,) S3 (NV)
plant	Las Vegas buckwheat	*Eriogonum corymbosum* var. *nilesii*	E	C				Yes	G5T2T3/S2 (NV)
plant	Littlefield milkvetch	*Astragalus preussii* var. *laxiflorus*							G4T2T3/S1 (AZ), S1S2 (NV)
plant	Mokiak milkvetch	*Astragalus mokiacensis*	E					Yes	G2G3Q/S1S2 (NV)
plant	Nevada didymodon	*Didymodon nevadensis*						Yes	G2G3/S1 (NV)
plant	Nevada willowherb	*Epilobium nevadense*	E					Yes	G2/S2 (NV)
plant	Nye milkvetch	*Astragalus nyensis*							G3/S3 (NV)
plant	rayless tansy aster	*Machaeranthera grindelioides* var. *depressa*							G5T3T4, S3 (NV), S1 (AZ)
plant	rock phacelia	*Phacelia petrosa*						Yes	G3G4/SNR (AZ), S2 (NV)
plant	rosy twotone beardtongue	*Penstemon bicolor* ssp. *roseus*	WL					Yes	G3T3Q/S2 (AZ), S3 (NV)
plant	Shockley rockcress	*Arabis shockleyi*							G3/S3 (NV)
plant	silverleaf sunray	*Enceliopsis argophylla*	E					Yes (AZ and NV)	G2G3/S2 (AZ), S1? (NV)
plant	splachnobryum obtusum	*Splachnobryum obtusum*	WL						G5
plant	sticky buckwheat	*Eriogonum viscidulum*	C			CE		Yes	G2/S2 (AZ), S2(NV)
plant	sticky ringstem	*Anulocaulis leisolenus*	C					Yes	G4/S3 (AZ), S2 (NV)
plant	straw milkvetch	*Astragalus lentiginosus* var. *stramineus*							T2T3G5/S1S2 (NV)
plant	syntrichia princeps	*Syntrichia princeps*	C						
plant	threecorner milkvetch	*Astragalus geyeri* var. *triquetrus*	C			CE		Yes (AZ and NV)	G4T2T3/S2S3(NV)
plant	trichostomum moss	*Trichostomum sweetii*	E						G2?/S1 (NV)
plant	white bearpoppy	*Arctomecon merriamii*	C					Yes	G3/S3 (NV)
reptile	banded gecko	*Coleonyx variegatus*	C						G5/S5 (AZ), S4 (NV)
reptile	banded Gila monster	*Heloderma suspectum cinctum*	E			Yes		Yes (AZ and NV)	G4T4/S4(AZ), S2 (NV)
reptile	California (common) king snake	*Lampropeltis getulus californiae*	C						G5T5/S5 (AZ), S4 (NV)
reptile	common zebra-tailed lizard	*Callisaurus draconoides*	WL						G5/S5 (AZ), S5 (NV)
reptile	desert iguana	*Dipsosaurus dorsalis*	C						G5/S5 (AZ), S3 (NV)
reptile	desert night lizard	*Xantusia vigilis*	E						G5/S4(AZ), S4(NV)

Table 1-4 Special Status Species Addressed in the Virgin River Conservation Management Assessment

Taxon	Common Name	Scientific Name	Species Status and Protection Levels						
			Clark County MSHCP[a]	Federal ESA[b]	Critical Habitat	State of Nevada	State of Arizona[d]	BLM Sensitive Species	Global and State Ranking[e]
reptile	desert tortoise	*Gopherus agassizii* (Mojave Population)	C	LT	Yes	Yes	WSC	Yes	G4T3Q/S2 (AZ) S2S3 (NV)
reptile	glossy snake	*Arizona elegans*	C						G5/S5 (AZ), S4 (NV)
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*	C						G5/S3? (AZ), S4 (NV)
reptile	large-spotted leopard lizard	*Gambelia wislizenii wislizenii*	C						G5/AZ (S5), NV (S4)
reptile	Mojave green rattlesnake	*Crotalus scutulatus scutulatus*	C						G5/S5(AZ), S4(NV)
reptile	sidewinder	*Crotalus cerastes*	C						G5/S5(AZ), S4(NV)
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*	C						G5T5/S5 (AZ), S4 (NV)
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*	E						G5T5/S5 (AZ)
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*	E						G5T5
reptile	speckled rattlesnake	*Crotalus mitchellii*	C						G5/S5(AZ), S4(NV)
reptile	western chuckwalla	*Sauromalus obesus*	C					Yes (AZ and NV)	G5/S4(AZ), S3(NV)
reptile	western leaf-nosed snake	*Phyllorhynchus decurtatus*	C						G5/S5 (AZ), S4 (NV)
reptile	western red-tailed skink	*Eumeces gilberti rubricaudatus*	C						G5T4Q/S3S4 (AZ), S2S3 (NV)

[a]C = Covered, E = Evaluation, WL = Watch List
[b]LE = Federally endangered, LT = Federally threatened, C = candidate species
[c]CE=critically endangered, CY = Protected as a cactus, yucca, or Christmas tree (N.R.S. 527.060-.120)
[d]WSC = wildlife species of concern, Arizona Native Plant Law: HS = highly safeguarded, no collection allowed; SR = salvage restricted: collection only with permit
[e]G= global rank, T = infraspecific taxon rank, S = state rank, 1 = critically imperiled, 2 = imperiled, 3 = vulnerable, 4 = apparently secure, 5 = secure (Nature Serve 2007)

1.4.2 Special Status Species Distributions within the VRCMA Boundary

Occurrence GIS data of sensitive species for the extent of the VRCMA Boundary were obtained from the Nevada and Arizona Natural Heritage Programs in July 2007 (ADWR 2007b, NNHP 2006; refer to Appendix B for available GIS datasets). Due to the sensitive nature of these locational datasets, they are not available for display purposes in this document.

Species that are not on the special status species list for this VRCMA were removed from the GIS dataset. High numbers of observations of desert tortoise were present in the two datasets (38 of 71 total observations, or 54 percent). In Nevada, the species occurrences (n = 17) were primarily in the area surrounding the Virgin River 100-year floodplain; only one occurrence was in the Virgin Mountains area of the VRCMA Boundary. In Arizona, data were presented in topographic blocks, which does not allow for identifying any patterns. Because these datasets are based on any observation of a given species, including casual observations, they likely do not fully represent species distribution patterns within the VRCMA Boundary.

1.4.3 Species-Habitat Relationships

A species-habitat matrix has been created for the special status species and habitats within the VRCMA Boundary. In Table 1-5, the SWReGAP land cover dataset has been used to designate potential “habitats” each species could be found in (USGS 2005).

Table 1-5 Species Habitat Relationship Matrix

				Cliffs and Canyon		Developed		Forest/ Woodland				Low Vegetation Desert				Scrub			Shrub			
Taxon	Common Name	Scientific Name	Agriculture	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Developed, Medium - High Intensity	Developed, Open Space - Low Intensity	Great Basin Pinyon-Juniper Woodland	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	North American Warm Desert Badland	North American Warm Desert Pavement	North American Warm Desert Playa	North American Warm Desert Wash	Mojave Mid-Elevation Mixed Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Rocky Mountain Gambel Oak-Mixed Montane Shrubland
amphibian	Pacific tree frog	*Hyla regilla*	•					•	•	•	•			•							•	
bird	American peregrine falcon	*Falco peregrinus anatum*		•	•				•	•	•			•								
bird	bald eagle	*Haliaeetus leucocephalus*	•				•	•								•	•	•	•	•		
bird	Bendire's thrasher	*Toxostoma bendirei*		•	•			•					•		•	•	•		•			
bird	black-chinned sparrow	*Spizella atrogularis*						•													•	
bird	blue grosbeak	*Guiraca caerulea*	•			•	•									•	•					
bird	Brewer's sparrow	*Spizella breweri*						•					•			•	•			•		•
bird	cactus wren	*Campylorhynchus brunneicapillus*			•										•	•			•		•	
bird	crissal thrasher	*Toxostoma crissale*													•						•	
bird	ferruginous hawk	*Buteo regalis*	•	•	•										•					•		
bird	flammulated owl	*Otus flammeolus*							•	•	•											
bird	golden eagle	*Aquila chrysaetos*	•	•	•			•	•	•	•			•	•	•	•	•	•	•	•	•
bird	gray vireo	*Vireo vicinior*						•							•			•			•	
bird	Le Conte's thrasher	*Toxostoma lecontei*													•	•	•					
bird	loggerhead shrike	*Lanius ludovicianus*	•	•			•	•							•	•	•	•	•	•	•	•
bird	long-eared owl	*Asio otus*	•					•	•	•	•					•	•			•	•	
bird	Lucy's warbler	*Vermivora luciae*									•				•							
bird	northern goshawk	*Accipiter gentilis*							•	•	•									•		
bird	northern saw-whet owl	*Aegolius acadius*	•				•		•	•											•	
bird	phainopepla	*Phainopepla nitens*	•						•						•	•					•	
bird	pinyon jay	*Gymnorhinus cyanocephalus*		•				•	•		•					•				•		•
bird	prairie falcon	*Falco mexicanus*	•								•						•				•	•
bird	Scott's oriole	*Icterus parisorum*						•								•					•	•
bird	summer tanager	*Piranga rubra*	•												•							•
bird	vesper sparrow	*Pooecetes gramineus*	•													•				•		
bird	western bluebird	*Sialia mexicana*		•				•	•	•	•											•

Table 1-5 Species Habitat Relationship Matrix

				Cliffs and Canyon		Developed		Forest/ Woodland				Low Vegetation Desert				Scrub			Shrub			
Taxon	Common Name	Scientific Name	Agriculture	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Developed, Medium - High Intensity	Developed, Open Space - Low Intensity	Great Basin Pinyon-Juniper Woodland	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	North American Warm Desert Badland	North American Warm Desert Pavement	North American Warm Desert Playa	North American Warm Desert Wash	Mojave Mid-Elevation Mixed Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Rocky Mountain Gambel Oak-Mixed Montane Shrubland
bird	western burrowing owl	*Speotyto cunicularia hypugea*	•				•							•		•		•	•			
bird	western screech-owl	*Otus kennicotti*	•				•	•			•				•							
bird	yellow-breasted chat	*Icteria virens*																			•	•
mammal	Allen's big-eared bat	*Idionycteris phyllotis*							•		•				•	•	•	•				
mammal	big free-tailed bat	*Nyctinomops macrotis*	•		•	•	•	•	•	•	•		•	•	•	•	•		•	•	•	•
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	•		•	•	•	•	•	•	•						•	•	•		•	•
mammal	California leaf-nosed bat	*Macrotus californicus*			•								•	•	•	•		•				
mammal	California myotis	*Myotis californicus*			•				•	•	•											•
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*		•				•	•	•	•				•						•	•
mammal	desert kangaroo rat	*Dipodomys deserti*													•							
mammal	desert pocket mouse	*Chaetodipus penicillatus*													•	•	•		•			
mammal	fringed myotis	*Myotis thysanodes*	•	•	•		•	•	•	•	•					•	•		•	•	•	•
mammal	greater western mastiff bat	*Eumops perotis californicus*			•	•	•															
mammal	hoary bat	*Lasiurus cinereus*													•							
mammal	kit fox	*Vulpes macrotis*		•				•				•			•							
mammal	little brown myotis	*Myotis lucifugus*	•	•	•	•	•	•								•						•
mammal	long-eared myotis	*Myotis evotis*		•				•	•	•	•										•	•
mammal	long-legged myotis	*Myotis volans*		•	•		•	•	•	•	•						•	•		•	•	•
mammal	Merriam's shrew	*Sorex merriami*						•	•	•	•									•	•	•
mammal	pallid bat	*Antrozous pallidus*	•	•	•		•	•									•	•	•		•	
mammal	silver-haired bat	*Lasionycteris noctivagans*		•																		
mammal	spotted bat	*Euderma maculatum*		•	•			•			•				•	•		•		•		
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	•	•	•	•	•	•	•	•	•					•	•		•	•	•	
mammal	western pipistrelle	*Pipistrellus hesperus*		•	•							•	•	•	•	•	•	•				

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Taxon	Common Name	Scientific Name	Agriculture	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Developed, Medium - High Intensity	Developed, Open Space - Low Intensity	Great Basin Pinyon-Juniper Woodland	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	North American Warm Desert Badland	North American Warm Desert Pavement	North American Warm Desert Playa	North American Warm Desert Wash	Mojave Mid-Elevation Mixed Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Rocky Mountain Gambel Oak-Mixed Montane Shrubland
mammal	western red bat	*Lasiurus blossevillii*													•							
mammal	western small-footed myotis	*Myotis ciliolabrum*	•	•	•		•	•								•	•		•	•		•
mammal	Yuma myotis	*Myotis yumanensis*		•	•				•	•				•				•		•	•	
plant	alpine stinking lomatium	*Lomatium graveolens* var. *alpinum*						•	•	•	•									•	•	•
plant	Antelope Canyon goldenbush	*Ericameria cervina*							•	•									•	•		
plant	Aven Nelson's phacelia	*Phacelia anelsonii*			•																	
plant	barrel cactus	*Ferocactus acanthoides* var. *lecontei*														•	•	•	•	•	•	•
plant	Beaver Dam scurfpea	*Pediomelum castoreum*										•	•	•	•	•	•	•				
plant	catchfly gentian	*Eustoma exaltatum*													•							
plant	chalk liveforever	*Dudleya pulverulenta*		•	•																•	
plant	Clark Mountain agave	Agave utahensis var. nevadensis						•								•	•	•				
plant	Clarke phacelia	*Phacelia filiae*														•	•	•	•	•	•	•
plant	Clokey fleabane	*Erigeron clokeyi*		•				•			•											
plant	Clokey pincushion	*Coryphantha vivipara* ssp. *rosea*						•								•	•					
plant	crossidium moss	*Crossidium seriatum*			•							•	•	•	•		•	•				
plant	dune linanthus	*Linanthus arenicola*										•	•	•	•	•	•	•				
plant	dune sunflower	*Helianthus deserticola*										•	•	•		•	•	•				
plant	fissidens sublimbatus	*Fissidens sublimbatus*		•	•			•	•	•	•								•	•	•	•
plant	forked (Pahrump Valley) buckwheat	*Eriogonum bifurcatum*												•			•					
plant	Las Vegas bearpoppy	*Arctomecon californica*										•	•	•			•	•				

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plant	Las Vegas Valley buckwheat	*Eriogonum corymbosum* var. *aureum*										•	•	•	•	•	•	•				
plant	Littlefield milkvetch	*Astragalus preussii* var. *laxiflorus*										•	•	•	•							
plant	Mokiak milkvetch	*Astragalus mokiacensis*		•	•							•			•							
plant	Nevada didymodon	*Didymodon nevadensis*										•	•	•	•	•	•	•				
plant	Nevada willowherb	*Epilobium nevadense*						•	•	•	•											
plant	Nye milkvetch	*Astragalus nyensis*										•	•	•	•	•	•	•				
plant	rayless tansy aster	*Machaeranthera grindelioides* var. *depressa*						•											•	•		
plant	rock phacelia	*Phacelia petrosa*														•		•	•	•		
plant	rosy twotone beardtongue	*Penstemon bicolor* ssp. *roseus*		•	•							•	•	•	•	•	•	•	•			
plant	Shockley rockcress	*Arabis shockleyi*						•										•		•		
plant	silverleaf sunray	*Enceliopsis argophylla*			•							•	•	•	•		•	•				
plant	splachnobryum obtusum	*Splachnobryum obtusum*											•	•	•							
plant	sticky buckwheat	*Eriogonum viscidulum*													•	•	•	•				
plant	sticky ringstem	*Anulocaulis leisolenus*														•	•	•				
plant	straw milkvetch	*Astragalus lentiginosus* var. *stramineus*													•		•	•				
plant	syntrichia princeps	*Syntrichia princeps*						•														
plant	threecorner milkvetch	*Astragalus geyeri* var. *triquetrus*													•	•	•	•				
plant	trichostomum moss	*Trichostomum sweetii*			•							•	•	•	•		•	•				
plant	white bearpoppy	*Arctomecon merriamii*														•	•	•	•			
reptile	banded gecko	*Coleonyx variegatus*						•						•	•	•	•	•			•	

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				Cliffs and Canyon		Developed		Forest/ Woodland				Low Vegetation Desert				Scrub			Shrub			
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reptile	banded Gila monster	*Heloderma suspectum cinctum*														•	•				•	
reptile	California (common) king snake	*Lampropeltis getulus californiae*	•	•	•						•	•	•	•	•	•	•	•	•			
reptile	common zebra-tailed lizard	*Callisaurus draconoides draconoides*										•	•	•	•	•	•	•	•			
reptile	desert iguana	*Dipsosaurus dorsalis*														•	•					
reptile	desert night lizard	*Xantusia vigilis*			•			•	•		•					•					•	
reptile	desert tortoise	*Gopherus agassizii*													•	•	•	•				
reptile	glossy snake	*Arizona elegans*		•											•		•			•		•
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*		•	•										•	•			•			
reptile	large-spotted leopard lizard	*Gambelia wislizenii wislizenii*														•	•		•	•		
reptile	Mojave green rattlesnake	*Crotalus scutulatus scutulatus*														•	•					
reptile	sidewinder	*Crotalus cerastes*														•	•					
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*		•	•						•					•					•	•
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*			•							•	•	•	•	•	•	•	•	•		
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*		•	•			•			•		•				•		•		•	
reptile	speckled rattlesnake	*Crotalus mitchelli*		•	•			•								•	•				•	
reptile	western chuckwalla	*Sauromalus obesus*		•	•																	
reptile	western leaf-nosed snake	*Phyllorhynchus decurtatus*															•					
reptile	western red-tailed skink	*Eumeces gilberti rubricaudatus*						•	•	•	•					•				•	•	

1.4.3.1 Habitat Condition

Some shrub and scrub habitats have also been compromised to a lesser extent through grazing, which is why in recent years the BLM has altered grazing allotment status for some allotments to include more intensive monitoring (BLM 1998, 1999, 2005, 2007a).

1.4.4 Existing Species Conservation Efforts in the VRCMA Boundary

A number of existing conservation and recovery efforts exist within or adjacent to the VRCMA Boundary and include:

- Clark County Multiple Species Habitat Conservation Plan (Clark County MSHCP),
- Wildlife Action Plans/Comprehensive Wildlife Conservancy Strategy Plans for Nevada and Arizona,
- Nevada and Arizona Partners in Flight Bird Conservation Plans,
- Nevada Bat Conservation Plan and Arizona Comprehensive Bat Plan,
- Virgin River Habitat Conservation and Recovery Program (adjacent to the VRCMA Boundary in the 100-year floodplain of the Lower Virgin River),
- The Virgin River Conservation Partnership (VRCP) currently serves as a forum to inform and gather stakeholder and public input into the VRHCRP process and consists of a representative from each of the participating parties of the VRHCRP as well as other federal, state and local agencies, conservation organizations, and other interested parties or individuals,
- Mormon Mesa Desert Wildlife Management Area Conservation Management Strategy and Gold Butte Desert Wildlife Management Area Conservation Management Strategy (adjacent to the VRCMA Boundary in the Mormon Mesa and Gold Butte DWMAs), and
- Desert Tortoise Recovery Plan (USFWS 1994).

1.4.4.1 Clark County MSHCP

In 2000, Clark County, Nevada, and other applicants and participants completed a multi-species habitat conservation plan (Clark County MSHCP) for a series of covered activities that would occur in Clark County over the next 30 years. Activities include development, recreation, agriculture, flood control, mineral activities, off-highway vehicle use, solid waste, transportation, utilities, and sewer and water. Seventy-eight species are Covered species under the plan with an additional 103 species included as Evaluation or Watch List species. No aquatic species associated with the Virgin River were covered in this MSHCP; rather, they were all considered Evaluation species (RECON 2000). Of the species addressed in the Clark County MSHCP, 25 Covered species and 18 Evaluation species are also addressed in this Virgin River Conservation Management Assessment.

1.4.4.2 Nevada and Arizona Wildlife Action Plans/Comprehensive Wildlife Conservation Strategies

These plans were developed to meet a federal mandate requiring a Wildlife Action Plan from each state to guarantee future State Wildlife Grant appropriations. These plans address special status wildlife species across each state and identify future conservation actions that can be taken. These documents will assist in directing wildlife conservation efforts across each state.

1.4.4.3 Nevada and Arizona Partners in Flight Bird Conservation Plans

Partners in Flight has developed voluntary state-level cooperative planning processes to address management concerns for priority bird species in each state. Priority bird species are associated with particular habitats (e.g., phainopepla is associated with catclaw acacia/mesquite), and management objectives are developed to improve population levels and/or habitats.

1.4.4.4 Nevada Bat Conservation Plan and Arizona Bat Conservation Strategic Plan

In coordination with the North American Bat Conservation Partnership (NABCP), Nevada and Arizona have developed state-wide voluntary plans for bat conservation. Components of these plans include research, inventory and monitoring, management, and education.

1.4.4.5 Virgin River Habitat Conservation and Recovery Program

To provide a coordinated effort for the protection of species listed as threatened or endangered under ESA and meet the demands of population growth, resource management agencies, and several other interested entities in the Lower Virgin River basin, have proposed to develop the Virgin River Habitat Conservation and Recovery Program (VRHCRP). The VRHCRP will develop, fund, and implement conservation actions necessary to offset impacts from proposed development actions to native species protected under ESA and lead to their recovery. The VRHCRP will also aid in the conservation of other species in the Lower Virgin River Watershed that are or might become candidates for listing as threatened or endangered species under ESA. Information from this Virgin Basin Conservation Management Assessment will directly assist the VRHCRP's planning efforts.

1.4.4.6 Mormon Mesa Desert Wildlife Management Area Conservation Management Strategy and Gold Butte Desert Wildlife Management Area Conservation Management Strategy

These conservation management strategies were developed for the Mormon Mesa and Gold Butte DWMAs for the purposes of developing and implementing conservation actions for Clark County MSHCP Covered, Evaluation, and Watch List species. These strategies will help implement the Clark County MSHCP and secure a greater likelihood of species persistence.

1.4.5 Threats to Special Status Species

While each of the special status species considered in this Virgin River Conservation Management Assessment is threatened by some type of activity, certain threats may occur to multiple species. To understand which threats occur to greater numbers of species, a summary of threats has been compiled, based on ESA listing factors, from information included in the species descriptions below (Table 1-6). These threats were derived from the Clark County MSHCP and other literature.

Table 1-6 Threats to Special Status Species

			A. Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range																B. Over-utilization		C. Disease/Predation							D. Inadequate Regulatory Mechanisms	E. Other Factors		
Taxon	Common Name	Scientific Name	Human Disturbance	Invasive Vegetation	Habitat Loss	Development	Non-Consumptive Resource Use	Mine Closures	Agriculture	Livestock	Habitat Fragmentation	Roads	Mining	Fire Regime	Recreation	Pesticides/Herbicides	Power Lines/Wind Harnessing Turbines	Forest Management	Collection	Shooting	Disease	Hybridization	Non-Native Species - Predation/Competition	Fungus	Bacteria Infections	Brood Parasitism	Upper Respiratory Tract Disease (URTD)		Pollution	Drought	Flood
amphibian	Pacific tree frog	*Hyla regilla*																													
bird	American peregrine falcon	*Falco peregrinus*	•		•																										
bird	bald eagle	*Haliaeetus leucocephalus*	•		•																										
bird	Bendire's thrasher	*Toxostoma bendirei*		•	•	•				•				•	•																
bird	black-chinned sparrow	*Spizella atrogularis*	•	•	•	•		•		•		•	•	•	•																
bird	blue grosbeak	*Guiraca caerulea*			•				•							•										•					
bird	Brewer's sparrow	*Spizella breweri*		•	•					•	•	•	•	•						•	•					•					
bird	cactus wren	*Campylorhynchus brunneicapillus*			•	•																									
bird	crissal thrasher	*Toxostoma crissale*		•	•										•																
bird	ferruginous hawk	*Buteo regalis*	•	•	•	•				•	•			•	•		•														
bird	flammulated owl	*Otus flammeolus*				•				•		•			•																
bird	golden eagle	*Aquila chrysaetos*				•			•			•	•	•	•																
bird	gray vireo	*Vireo vicinior*			•						•			•												•					
bird	Le Conte's thrasher	*Toxostoma lecontei*	•		•	•			•	•					•																
bird	loggerhead shrike	*Lanius ludovicianus*			•							•		•		•															

Table 1-6 Threats to Special Status Species

Taxon	Common Name	Scientific Name	A. Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range																B. Over-utilization		C. Disease/Predation							D. Inadequate Regulatory Mechanisms	E. Other Factors		
			Human Disturbance	Invasive Vegetation	Habitat Loss	Development	Non-Consumptive Resource Use	Mine Closures	Agriculture	Livestock	Habitat Fragmentation	Roads	Mining	Fire Regime	Recreation	Pesticides/Herbicides	Power Lines/Wind Harnessing Turbines	Forest Management	Collection	Shooting	Disease	Hybridization	Non-Native Species - Predation/Competition	Fungus	Bacteria Infections	Brood Parasitism	Upper Respiratory Tract Disease (URTD)		Pollution	Drought	Flood
bird	long-eared owl	*Asio otus*			•										•					•											
bird	Lucy's warbler	*Vermivora luciae*				•				•																•					
bird	northern goshawk	*Accipiter gentilis*	•		•					•			•		•					•	•										
bird	northern saw-whet owl	*Aegolius acadius*																•													
bird	phainopepla	*Phainopepla nitens*			•									•																	
bird	pinyon jay	*Gymnorhinus cyanocephalus*			•					•	•			•															•		
bird	prairie falcon	*Falco mexicanus*	•													•															
bird	Scott's oriole	*Icterus parisorum*			•																										
bird	summer tanager	*Piranga rubra*			•					•						•										•					
bird	vesper sparrow	*Pooecetes gramineus*			•				•	•																					
bird	western bluebird	*Sialia mexicana*			•	•			•	•	•			•																	
bird	western burrowing owl	*Speotyto cunicularia hypugea*			•	•					•			•																	
bird	western screech owl	*Otus kennicotti*			•							•																			
bird	yellow-breasted chat	*Icteria virens*			•	•			•																						

Table 1-6 Threats to Special Status Species

			A. Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range																B. Over-utilization		C. Disease/Predation							D. Inadequate Regulatory Mechanisms	E. Other Factors		
Taxon	Common Name	Scientific Name	Human Disturbance	Invasive Vegetation	Habitat Loss	Development	Non-Consumptive Resource Use	Mine Closures	Agriculture	Livestock	Habitat Fragmentation	Roads	Mining	Fire Regime	Recreation	Pesticides/Herbicides	Power Lines/Wind Harnessing Turbines	Forest Management	Collection	Shooting	Disease	Hybridization	Non-Native Species - Predation/Competition	Fungus	Bacteria Infections	Brood Parasitism	Upper Respiratory Tract Disease (URTD)		Pollution	Drought	Flood
mammal	Allen's big-eared bat	*Idionycteris phyllotis*	•					•		•		•				•															
mammal	big free-tailed bat	*Nyctinomops macrotis*			•	•		•					•	•	•	•															
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	•		•						•					•															
mammal	California leaf-nosed bat	*Macrotus californicus*			•	•	•	•		•			•		•	•															
mammal	California myotis	*Myotis californicus*			•	•		•					•																		
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*		•	•	•				•	•		•		•					•											
mammal	desert kangaroo rat	*Dipodomys deserti*			•	•			•		•	•							•											•	
mammal	desert pocket mouse	*Chaetodipus penicillatus*		•	•									•																	
mammal	fringed myotis	*Myotis thysanodes*			•	•		•					•		•																
mammal	greater western mastiff bat	*Eumops perotis californicus*			•	•		•		•			•	•	•	•															
mammal	hoary bat	*Lasiurus cinereus*														•		•													
mammal	kit fox	*Vulpes macrotis*			•	•			•		•																				
mammal	little brown myotis	*Myotis lucifugus*			•	•		•					•			•														•	
mammal	long-eared myotis	*Myotis evotis*	•		•			•					•		•																

Table 1-6 Threats to Special Status Species

			A. Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range																B. Over-utilization		C. Disease/Predation							D. Inadequate Regulatory Mechanisms	E. Other Factors		
Taxon	Common Name	Scientific Name	Human Disturbance	Invasive Vegetation	Habitat Loss	Development	Non-Consumptive Resource Use	Mine Closures	Agriculture	Livestock	Habitat Fragmentation	Roads	Mining	Fire Regime	Recreation	Pesticides/Herbicides	Power Lines/Wind Harnessing Turbines	Forest Management	Collection	Shooting	Disease	Hybridization	Non-Native Species - Predation/Competition	Fungus	Bacteria Infections	Brood Parasitism	Upper Respiratory Tract Disease (URTD)		Pollution	Drought	Flood
mammal	long-legged myotis	*Myotis volans*			•			•					•		•	•		•													
mammal	Merriam's shrew	*Sorex merriami*																													
mammal	pallid bat	*Antrozous pallidus*				•				•				•																	
mammal	silver-haired bat	*Lasionycteris noctivagans*												•	•	•		•													
mammal	spotted bat	*Euderma maculatum*	•		•										•				•												
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*			•	•		•					•																		
mammal	western pipistrelle	*Pipistrellus hesperus*			•	•		•					•			•														•	
mammal	western red bat	*Lasiurus blossevillii*													•				•												
mammal	western small-footed myotis	*Myotis ciliolabrum*			•	•		•					•			•															
mammal	Yuma myotis	*Myotis yumanensis*			•	•		•					•		•																
plant	Alpine stinking lomatium	*Lomatium graveolens* var. *alpinum*			•	•		•					•																		
plant	Antelope Canyon goldenbush	*Ericameria cervina*		•	•	•				•	•		•	•	•				•												
plant	Aven Nelson's phacelia	*Phacelia anelsonii*		•	•	•				•	•		•	•	•				•												

Table 1-6 Threats to Special Status Species

			A. Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range																B. Over-utilization		C. Disease/Predation							D. Inadequate Regulatory Mechanisms	E. Other Factors		
Taxon	Common Name	Scientific Name	Human Disturbance	Invasive Vegetation	Habitat Loss	Development	Non-Consumptive Resource Use	Mine Closures	Agriculture	Livestock	Habitat Fragmentation	Roads	Mining	Fire Regime	Recreation	Pesticides/Herbicides	Power Lines/Wind Harnessing Turbines	Forest Management	Collection	Shooting	Disease	Hybridization	Non-Native Species - Predation/Competition	Fungus	Bacteria Infections	Brood Parasitism	Upper Respiratory Tract Disease (URTD)		Pollution	Drought	Flood
plant	barrel cactus	*Ferocactus acanthoides* var. *lecontei*		•	•	•				•	•		•	•	•				•												
plant	Beaver Dam scurfpea (breadroot)	*Pediomelum castoreum*		•	•	•				•	•		•	•	•				•												
plant	catchfly gentian	*Eustoma exaltatum*				•				•																					
plant	chalk liveforever	*Dudleya pulverulenta*		•	•	•				•	•		•	•	•				•												
plant	Clark Mountain agave	Agave utahensis var. nevadensis		•	•	•				•	•		•	•	•				•												
plant	Clarke phacelia	*Phacelia filiae*			•																								•		
plant	Clokey fleabane	*Erigeron clokeyi*			•	•				•		•	•		•				•												
plant	Clokey pincushion	*Coryphantha vivipara* ssp. *rosea*			•	•				•		•	•	•	•				•												
plant	crossidium moss	*Crossidium seriatum*	Unknown																												
plant	dune linanthus	*Linanthus arenicola*	Unknown																												
plant	dune sunflower	*Helianthus deserticola*		•	•				•	•		•			•														•		
plant	fissidens sublimbatus	*Fissidens sublimbatus*			•										•															•	

Table 1-6 Threats to Special Status Species

			A. Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range																B. Over-utilization		C. Disease/Predation							D. Inadequate Regulatory Mechanisms	E. Other Factors		
Taxon	Common Name	Scientific Name	Human Disturbance	Invasive Vegetation	Habitat Loss	Development	Non-Consumptive Resource Use	Mine Closures	Agriculture	Livestock	Habitat Fragmentation	Roads	Mining	Fire Regime	Recreation	Pesticides/Herbicides	Power Lines/Wind Harnessing Turbines	Forest Management	Collection	Shooting	Disease	Hybridization	Non-Native Species - Predation/Competition	Fungus	Bacteria Infections	Brood Parasitism	Upper Respiratory Tract Disease (URTD)		Pollution	Drought	Flood
plant	forked (Pahrump Valley) buckwheat	*Eriogonum bifurcatum*			•	•				•					•				•												
plant	Las Vegas bearpoppy	*Arctomecon californica*		•	•	•				•	•		•	•	•				•												
plant	Las Vegas Valley buckwheat	*Eriogonum corymbosum* var. *aureum*		•	•	•				•	•		•	•	•				•												
plant	Littlefield milkvetch	*Astragalus preussii* var. *laxiflorus*	Unknown																												
plant	Mokiak milkvetch	*Astragalus mokiacensis*		•	•	•				•	•		•	•	•				•												
plant	Nevada didymodon	*Didymodon nevadensis*		•	•	•				•	•		•	•	•				•												
plant	Nevada willowherb	*Epilobium nevadense*		•	•	•				•	•		•	•	•				•												
plant	Nye milkvetch	*Astragalus nyensis*		•	•	•				•	•		•	•	•				•												
plant	rayless tansy aster	*Machaeranthera grindelioides* var. *depressa*	Unknown																												
plant	rock phacelia	*Phacelia petrosa*	Unknown																												
plant	rosy twotone beardtongue	*Penstemon bicolor* ssp. *roseus*								•									•												

Table 1-6 Threats to Special Status Species

			A. Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range																B. Over-utilization		C. Disease/Predation							D. Inadequate Regulatory Mechanisms	E. Other Factors		
Taxon	Common Name	Scientific Name	Human Disturbance	Invasive Vegetation	Habitat Loss	Development	Non-Consumptive Resource Use	Mine Closures	Agriculture	Livestock	Habitat Fragmentation	Roads	Mining	Fire Regime	Recreation	Pesticides/Herbicides	Power Lines/Wind Harnessing Turbines	Forest Management	Collection	Shooting	Disease	Hybridization	Non-Native Species - Predation/Competition	Fungus	Bacteria Infections	Brood Parasitism	Upper Respiratory Tract Disease (URTD)		Pollution	Drought	Flood
plant	Shockley rockcress	*Arabis shockleyi*	Unknown																												
plant	silverleaf sunray	*Enceliopsis argophylla*		•	•	•				•	•		•	•	•				•												
plant	splachnobryum obtusum	*Splachnobryum obtusum*	Unknown																												
plant	sticky buckwheat	*Eriogonum viscidulum*		•	•	•				•	•		•	•	•				•												
plant	sticky ringstem	*Anulocaulis leisolenus*			•	•				•			•		•																
plant	straw milkvetch	*Astragalus lentiginosus* var. *stramineus*	Unknown																												
plant	syntrichia princeps	*Syntrichia princeps*	Unknown																												
plant	threecorner milkvetch	*Astragalus geyeri* var. *triquetrus*		•	•	•				•	•		•	•	•				•												
plant	trichostomum moss	*Trichostomum sweetii*		•	•	•				•	•		•	•	•				•												
plant	white bearpoppy	*Arctomecon merriamii*			•	•				•			•		•																
reptile	banded gecko	*Coleonyx variegatus*									•	•			•				•												
reptile	banded Gila monster	*Heloderma suspectum cinctum*			•	•									•				•				•								

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			A. Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range																B. Over-utilization		C. Disease/Predation							D. Inadequate Regulatory Mechanisms	E. Other Factors		
Taxon	Common Name	Scientific Name	Human Disturbance	Invasive Vegetation	Habitat Loss	Development	Non-Consumptive Resource Use	Mine Closures	Agriculture	Livestock	Habitat Fragmentation	Roads	Mining	Fire Regime	Recreation	Pesticides/Herbicides	Power Lines/Wind Harnessing Turbines	Forest Management	Collection	Shooting	Disease	Hybridization	Non-Native Species - Predation/Competition	Fungus	Bacteria Infections	Brood Parasitism	Upper Respiratory Tract Disease (URTD)		Pollution	Drought	Flood
reptile	California (common) king snake	*Lampropeltis getulus californiae*			•	•					•			•																	
reptile	common zebra-tailed lizard	*Callisaurus draconoides draconoides*				•			•																						
reptile	desert iguana	*Dipsosaurus dorsalis*				•									•								•								
reptile	desert night lizard	*Xantusia vigilis*			•				•	•									•								•			•	
reptile	desert tortoise	*Gopherus agassizii*				•									•				•												
reptile	glossy snake	*Arizona elegans*		•	•	•				•	•			•	•				•												
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*										•							•												
reptile	large-spotted leopard lizard	*Gambelia wislizenii wislizenii*		•		•					•	•							•												
reptile	Mojave green rattlesnake	*Crotalus scutulatus scutulatus*			•						•								•												
reptile	sidewinder	*Crotalus cerastes*			•	•					•				•				•												
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*			•	•					•				•				•												

Table 1-6 Threats to Special Status Species

Taxon	Common Name	Scientific Name	A. Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range																B. Over-utilization		C. Disease/Predation							D. Inadequate Regulatory Mechanisms	E. Other Factors		
			Human Disturbance	Invasive Vegetation	Habitat Loss	Development	Non-Consumptive Resource Use	Mine Closures	Agriculture	Livestock	Habitat Fragmentation	Roads	Mining	Fire Regime	Recreation	Pesticides/Herbicides	Power Lines/Wind Harnessing Turbines	Forest Management	Collection	Shooting	Disease	Hybridization	Non-Native Species - Predation/Competition	Fungus	Bacteria Infections	Brood Parasitism	Upper Respiratory Tract Disease (URTD)		Pollution	Drought	Flood
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*			•	•					•				•				•												
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*			•	•					•				•				•												
reptile	speckled rattlesnake	*Crotalus mitchelli*			•	•						•			•				•				•								
reptile	western chuckwalla	*Sauromalus obesus*			•	•					•				•																
reptile	western leaf-nosed snake	*Phyllorhynchus decurtatus*			•						•								•												
reptile	western red-tailed skink	*Eumeces gilberti rubricaudatus*			•				•	•		•	•	•	•			•													

1.5 AMPHIBIAN SPECIES DESCRIPTIONS

Species descriptions presented in this section are organized by taxa (i.e., amphibian, bird, mammal, plant, reptile) and then alphabetically by common name within each taxon.

1.5.1 Pacific Tree Frog

Scientific Name: *Hyla regilla*

1.5.1.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S5 (NatureServe 2007).
- Arizona heritage rank of S2 (NatureServe 2007).
- Red List Category of Least Concern (IUCN 2006).

1.5.1.2 General Description

The Pacific tree frog is a small treefrog with large head and eyes, a slim waist, round pads on the toe tips, limited webbing between the toes, and a dark stripe through the middle of the eye, extending from the nostrils to the shoulders. Its legs are long and slender and its skin is smooth and moist (Californiaherps.com 2000). Many individuals have a dark triangular mark on their head. In males, the throat is dusky colored and wrinkled. When calling, the vocal sac expands the throat into a round balloon-like membranous pouch (Hollingsworth and Roberts 2007). Coloring in individuals is variable and can range from green, tan, brown, gray, reddish, and cream, but they are most often green or brown color. (Californiaherps.com 2000). Irregular dark markings on back and legs vary in intensity with different color phases. The belly or ventral side is cream-colored with yellow underneath the back legs (Californiaherps.com 2000). Pacific tree tadpoles can grow to 1.8 inches long (4.7 centimeters), and are blackish to dark brown on top and light below with a bronze sheen (Californiaherps.com 2000). The intestines are not visible. Viewed from above, the eyes extend to the outline of the head (Californiaherps.com 2000). The Pacific tree frog has large toe pads to allow it to climb easily, and cling to twigs or grass (Californiaherps.com 2000). A loud, two-part “kreck-eck” with the last syllable rising in inflection serves as their advertisement call (Hollingsworth and Roberts 2007).

1.5.1.3 Distribution

Historic Distribution

The range of the Pacific tree frog extends from southern British Columbia in Canada southward through the United States to southern Baja California, Mexico, and east to Montana, Idaho, and Nevada (NatureServe 2007). The species also occurs on the Channel Islands off southern California (Stebbins 2003, as cited in NatureServe 2007). The Pacific tree frog is distributed along 55.9 miles (90 kilometers) of the lower Colorado River and its backwaters from Davis Camp, to Castle Rock in upper Lake Havasu, (NatureServe 2007). Elevational range extends from sea level to around 11,614 feet (3,540 meters) (Stebbins 2003, as cited in Nature Serve 2007).

Current Distribution

The current distribution is mostly the same as the historic distribution, although it has been introduced in other places such as the desert populations in southern California (NatureServe 2007). In Arizona, this species has been recorded as an apparent introduction at Middle Spring and a nearby stock tank in the Virgin Mountains, Mohave County, and at two central Arizona plant nurseries (Rorabaugh et al. 2004, as cited in NatureServe 2007). An introduced population occurs in the Queen Charlotte Islands, British Columbia (Reimchen 1990, as cited in NatureServe 2007), Canada, and on Revillagigedo Island in Alexander Archipelago, Alaska, where it was introduced in 1960 and is breeding (Waters 1992; Hodge 2004, as cited in NatureServe 2007).

1.5.1.4 Habitat

The Pacific tree frog is found in a wide variety of habitats often not far from water, including forest, woodland, chaparral, grassland, pastures, desert streams and oases, and urban areas (Californiaherps.com). This species breeds in marshes, lakes, ponds, ditches, reservoirs and slow-moving streams (Stebbins and Peterson 1985, as cited in NatureServe 2007). The Pacific tree frog lays its eggs on submerged plant stems in fresh or sometimes in slightly brackish water (NatureServe 2007).

1.5.1.5 Life History

Reproductive Biology

Fertilization of the female Pacific tree frog is external (Californiaherps.com 2000). Breeding locations include slow streams, permanent and seasonal ponds, reservoirs, ditches, lakes, marshes, shallow vegetated wetlands, wet meadows, even potholes and roadside ditches (Californiaherps.com 2000). The Pacific tree frog has a wide range of breeding and egg-laying times. When considering the entire range of this species, breeding occurs between January and August (NatureServe 2007). More specifically, in northern California, breeding occurs in mid-May to early August, January-June in southern California, and in late April-early May in northern Idaho (NatureServe 2007). Females lay small, loose, irregular clusters of approximately ten to 70 eggs. The females attach eggs to sticks, stems, or grass in quiet shallow water (Californiaherps.com 2000). Eggs hatch in two to three weeks. Tadpoles metamorphose from June to late August (Californiaherps.com 2000).

Diet

The adult Pacific tree frog is mainly invertivorous while the juveniles are herbivores (NatureServe 2007). Adults eat arthropods, especially flies, spiders, ants and beetles (AGFD 2005). Tadpoles scrape periphyton off rocks, eat filamentous algae, and surface feed on epiphytic diatoms and pollen (AGFD 2005). Typical of most frogs, prey is located by vision and caught by a large, sticky tongue and brought to the mouth (Californiaherps.com 2000).

Behavior

This frog is chiefly nocturnal although can be found during the day (Californiaherps.com 2000). It spends most of the day beneath logs, rocks, or other debris (Hollingsworth and Roberts 2007). During breeding season, males will call to attract females. A number of calling males is known as a chorus. A dominant male, or chorus master, leads off the calling that is then followed by subordinate males. If an intruding male comes instead, the Pacific tree frog changes its usual two-part “ribbet” to a one-part encounter call (Hollingsworth and Roberts 2007).

1.5.1.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

This species is represented by many and/or large occurrences throughout most of the range (NatureServe 2007). The Pacific tree frog can use undeveloped habitats within urban and disturbed areas (Hallock and McAllister 2005). Therefore, destruction, modification, or curtailment of its habitat or range are unlikely.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no threat to this species due to over-utilization for commercial, recreation, scientific, or educational purposes. It is sometimes found in the international pet trade, but at levels that do not currently constitute a major threat (NatureServe 2007).

Disease or Predation

The major threats towards the Pacific tree frog are introduced/invasive species. The introduction of the mosquitofish (*Gambusia affinis*) may negatively affect Pacific tree frog populations (Goodsell and Kats 1999, as cited in NatureServe 2007). In lakes in the Sierra Nevada, distribution and abundance were negatively related to non-native trout presence (Matthews et al. 2001, as cited in NatureServe 2007).

The Inadequacy of Existing Regulatory Mechanisms

There are no existing regulatory mechanisms regarding the Pacific tree frog.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Separation barriers can be an issue that may affect the Pacific tree frog population. Such barriers include major highways that frogs rarely if ever successfully cross and intensive urban development dominated by buildings/pavement and that lack suitable vegetated frog refuges (NatureServe 2007).

1.5.1.7 Conservation

There have been no proposed conservation plans for this species (Hollingsworth and Roberts 2007).

1.5.1.8 Species Status

Rangewide

This species is represented by many and/or large occurrences throughout most of the range. Its population trend is not known, but likely is stable to slightly declining (NatureServe 2007).

VRCMA Boundary

The status of the Pacific tree frog within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6 BIRD SPECIES DESCRIPTIONS

1.6.1 American Peregrine Falcon

Scientific Name: *Falco peregrinus anatum*

1.6.1.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.
- 1999: Delisted from ESA (AGFD 2002e).

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- Forest Service Sensitive delisted (USFS Region 3, 1999).
- Classified as Protected and Endangered under NAC 503.050 (Protected, Endangered and Sensitive Birds).
- Arizona Wildlife of Special Concern (AGFD 2006a).
- BLM sensitive species in Nevada (BLM 2003a).
- Global heritage rank of G4T4 (NatureServe 2007).
- Arizona heritage rank of S4 (NatureServe 2007).

1.6.1.2 General Description

American peregrine falcon adult plumage is variable in color and pattern, although most individuals have a dark blue-gray dorsum and a light breast with dark barring that is variable in color. A dark helmet of color covers the head to the nape of the neck, and the sides of the face have dark malar stripes. Juveniles have a dark brownish dorsum and helmet, with light underparts that are heavily streaked with brown. Males typically are more blue than females on the dorsum, and they tend to have less barring on the breast (AGFD 2002d).

Wings are pointed; they are 39 inches (99 centimeters) long in males and 46 inches (117 centimeters) long in females. Females are up to 33 percent greater in length than males. Total length of males averages 14 to 16 inches (36 to 41 centimeters) and the weight of males averages between one to 1.5 pounds (450 and 680 grams). Females average 16 to 18 inches (41 to 46 centimeters) in total length and weigh 1.6 to 2.1 pounds (720 to 950 grams) (AGFD 2002d).

The American peregrine has a direct, flapping flight pattern and makes vertical plunges in pursuit of flying prey. Several calls are used by the species, with the most common being a constant “kak kak kak” used when the bird is irritated or an intruder is near the eyrie (nest) (AGFD 2002d).

1.6.1.3 Distribution

Historic Distribution

The American peregrine falcon occurs throughout much of North America from the subarctic boreal forests of Alaska and Canada south to Mexico (USFWS 1999).

Current Distribution

The current distribution is the same as the historic distribution (NatureServe 2007).

1.6.1.4 Habitat

Range-wide, this species inhabits many terrestrial biomes. Most commonly occupied habitats contain cliffs for nesting, with open gulfs of air, and generally open landscapes for foraging (NatureServe 2007). In Clark County, this species can be found in mixed conifer, pinyon-juniper, sagebrush, lowland riparian, grassland habitats, as well as agricultural and urban areas (Clark County 2006a). In addition to natural habitats, many artificial habitats are now used (urban, human-built environments such as towers, buildings, etc.) (White et al. 2002).

1.6.1.5 Life History

Reproductive Biology

Breeding usually begins mid-March, but may occur as early as February. Eggs begin to appear in late March, but peak laying activity is in April (White et al. 2002).

Usually three to four eggs are laid, but as few as two and as many as six eggs can be laid (Baicich and Harrison 1997, as cited in AGFD 2002d). Incubation lasts approximately 32 days and fledging occurs at six weeks (from May to August) (Glinski 1998, as cited in AGFD 2002d). According to Tibbitts (1989, as cited in AGFD 2002d), breeding activity typically begins in mid-March and eggs are laid around April 1st. Hatching occurs around the first or second week of May with fledging about the third week of June (Tibbitts 1989, as cited in AGFD 2002d).

Diet

The diet of the peregrine falcon consists primarily of birds, of a size varying from passerines to small geese. The frequency of birds in the falcon’s diet is estimated at about 77 to 99 percent (frequency not biomass). Occasionally, mammals and, rarely, amphibians, fish, and insects are prey (White et al. 2002). Average success rate in hunting seems to be in the 20 to 40 percent range (AGFD 2002d).

Migration

The wintering range of the peregrine falcon breeding in North America includes North America to as far south as Chile (AGFD 2002d). Birds that nest in lower latitudes exhibit variable migratory behavior; some individuals are nonmigratory (AGFD 2002d).

1.6.1.6 Threats Warranting Protection

Primary threats to the peregrine falcon include habitat degradation, disturbance from human activities, and accumulation of toxins in prey (AGFD 2002d). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to the peregrine falcon within the VRCMA Boundary include habitat modification and degradation, as well as disturbance due to rock climbing and mortality through collisions and electrocution with power lines (Clark County 2006a).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Illegal take is a threat to the peregrine falcon (Clark County 2006a).

Disease or Predation

The peregrine falcon is usually killed only by large avian predators such as eagles, gyrfalcons, or, at night, by great horned owls. Nestlings and immatures are subjected to greater array of predators, including other peregrines; ground nests are depredated by mammals (White et al. 2002).

The Inadequacy of Existing Regulatory Mechanisms

This species has been delisted from the threatened and endangered species list under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

The peregrine falcon is subject to accumulation of pesticides or other toxins contained in their prey, because they feed high up on the food chain. At high levels these chemicals can cause reproductive failure (AGFD 2002d).

1.6.1.7 Conservation

As of 1994, populations are being monitored, closures to humans occur at disturbed sites, and pesticide contamination monitoring exists (AGFD 2002d).

1.6.1.8 Species Status

Rangewide

Decline of the peregrine falcon in the 1950s and 1960s across the continental United States has been attributed to DDT contamination. This decline has apparently been reversed since the ban of DDT. In Arizona, the peregrine falcon is found in areas that would have formerly been considered marginal. This suggests populations may have reached levels saturating the optimal habitat available, and new breeding pairs are forced to breed in sub-optimal areas (AGFD 2002d).

VRCMA Boundary

Four occurrences of peregrine falcon have been recorded within the VRCMA Boundary (NNHP 2006, AGFD 2007d species datasets). These occurrences were along the Virgin River in the Arizona portion of the VRCMA Boundary; three sightings were breeding sightings from 1991, one was an observation from 1990 (AGFD 2007d).

1.6.2 Bald Eagle

Scientific Name: *Haliaeetus leucocephalus*

1.6.2.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.
- July 9, 2007: Delisted from threatened status (USFWS 2007).

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Protected under the Bald and Golden Eagle Protection Act.
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- Classified as Protected and Endangered under NAC 503.050 (Protected, Endangered and Sensitive Birds).
- BLM sensitive species in Nevada (BLM 2003a).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S1B (breeding), S3N (wintering) (NatureServe 2007).

- Arizona heritage rank of S2S3B (breeding, S4N (wintering) (NatureServe 2007).

1.6.2.2 General Description

The bald eagle is North America's second largest bird of prey with an average wingspan of seven feet (2.1 meters). The adult bald eagle sports distinctive white plumage on their heads and tails in contrast to their dark brown body and wings. The presence of bright yellow feet, eyes, and beak is another distinguishing feature among adults. Females tend to be about 25 percent larger than males but sexes are otherwise similar in appearance. The adult plumage is not acquired until at least age four. Before this time, young birds go through several plumage changes, which are similar in appearance to that of the golden eagle (Harris 2002; NSBERP 1983).

1.6.2.3 Distribution

Historic Distribution

The bald eagle is native to North America and originally bred from central Alaska and northern Canada south to Baja California, central Arizona, and the Gulf of Mexico (Harris 2002).

Current Distribution

It now has been extirpated in some southern areas of its range (Harris 2002) but has strong populations throughout the northwest. Numbers were severely reduced from the mid to late 1800s from loss of nesting habitat and direct killing. Extensive use of DDT for pest control after WWII led to unsuccessful hatching events due to weak, calcium deficient eggshells. In 1963, just 417 pairs of bald eagles were counted in the lower 48 states. After its listing as an endangered species, this species' numbers have increased steadily, and the 1998 count recorded a fraction under 6,000 bald eagle pairs in the lower 48 states (USFWS 1999b). The population in the lower 48 States is estimated at 9,789 breeding pairs today (USFWS 2007a).

1.6.2.4 Habitat

The bald eagle is able to live anywhere on the North American continent where there are adequate nesting trees, roosts and feeding grounds. Open water such as a lake or an ocean, however, is an absolute necessity (Harris 2002). The breeding range of the bald eagle is associated with aquatic habitats (coastal areas, rivers, lakes, and reservoirs) with forested shorelines or cliffs in North America. Throughout their range, they select large, super-canopy roost trees (mostly conifers) that are open, sturdy and accessible. They winter primarily in coastal estuaries and river systems of the lower 48 states and Alaska, where thousands of bald eagles migrate each fall to take advantage of salmon-spawning runs (USFWS 2004).

1.6.2.5 Life History

Reproductive Biology

The bald eagle is monogamous. Courtship and breeding vary by region. In Florida, breeding behavior commences in September, while breeding behavior in Ohio is not usually observed until February. When the female is ready to copulate, she makes a head down, bowing gesture, and the male closes his talons and mounts her. The male's tail goes down and hers goes up and mating is completed when their cloacae meet. Bald eagles sometimes copulate out of season. This behavior may account for the strong loyalty between mates. (Harris 2002).

A mated pair adds on to their nest each breeding year. The nests are primarily built of sticks and can eventually weigh up to two tons, making them some of the largest nests in the world. Females lay a clutch of between one and three eggs, but two eggs is the norm. Incubation lasts from five to six weeks. One problem that has hampered bald eagle recovery is sibling competition. A female lays her eggs a few days apart, and incubation begins with the first egg. One to two days is the normal age difference between eaglets. Older hatchlings are able to dominate the younger ones for food because of their size. In a three-egg brood, the third chick has little chance of survival (Harris 2002). Nest duties among the pair are shared equally; both the male and the female will hunt and offer food to the young eaglets.

Young eagles are able to fly after approximately 11 to 12 weeks. Parents continue feeding them for an additional four to six weeks while they are learning to hunt for themselves (USFWS 2004). The lifespan for a bald eagle seemingly depends on region. The maximum reported lifespan in Alaska was 28 years, while in Arizona, eagles exceeding 12 years are uncommon (USFWS 1999b). However, bald eagles in captivity have lived for over 40 years (USFWS 1999b).

Diet

The bald eagle is primarily a fish-eater that prefers salmon, but will also take avian prey. Waterfowl are an important secondary food source. The bald eagle may also eat small mammals, seabirds, amphibians, crustaceans, and carrion when available (USFWS 2004). When hunting, the bald eagle either seeks its prey from a perch or from high in the sky, then swoops down and snatches up the prey in its talons. Another method used by bald eagles to gain food is theft; bald eagles are often seen stealing prey from other birds (Harris 2002).

Migration

After breeding, some eagles may stay in the general vicinity while most will migrate many hundreds of miles to their wintering grounds. Wintering, or non-breeding grounds, are areas that offer an abundant and readily available food supply with suitable nighttime roosts. Such roosts must offer isolation and thermal protection from winds. Bald eagles wintering in parts of the continent away from the coast may rely on carrion and easily scavenged terrestrial prey (USFWS 1999b).

The northern bald eagle over-winters in areas such as the upper Mississippi River or the Great Lakes area. For the mid-continent bald eagle, wintering grounds may be the southern States. The southern bald eagle, which nests during the winter, often migrates to rich feeding grounds such as Chesapeake Bay or Yellowstone National Park during the summer (USFWS 1999b).

1.6.2.6 Threats Warranting Protection

Past threats to the bald eagle included hunting eagles directly, indirectly through hunting mammals and wildfowl utilized by eagles for food, poisoning after the consumption of poison-laced carrion intended for predators of livestock, use of DDT in aquatic ecosystems, and habitat loss through forest clearing and development (USFWS 1999b). Present threats to bald eagle populations are few. Indeed, the USFWS concluded, “Other threats are not currently of sufficient magnitude, individually or collectively, to place the species at risk of extinction” (USFWS 1999b). This, coupled with the increase in bald eagle abundance and range, provided the impetus to remove the species from the list of endangered and threatened organisms. A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat availability for both nesting and wintering is not limiting for the present size of the population and is unlikely to be a limiting factor in the future given current laws and legislature (USFWS 2007).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Not currently considered a threat (USFWS 2007).

Disease or Predation

Not currently considered a threat (USFWS 2007).

The Inadequacy of Existing Regulatory Mechanisms

Not currently considered a threat (USFWS 2007).

Other Natural or Manmade Factors Affecting the Species' Continued Existence

A widespread reduction in the use of persistent pesticides and the complete ban of DDT use in North America has helped strengthen the bald eagle population, while the Bald Eagle Protection Act of 1940 and the Migratory Bird Treaty Act of 1918 have outlawed any illegal trade or hunting of the birds. Deaths due to electrocution and strikes by wind turbines do occur (USFWS 1999), although in small enough numbers not to affect the general species' resurgence.

1.6.2.7 Conservation

Numerous habitat conservation plans and four safe harbor agreements have been developed to benefit the bald eagle. Recovery efforts have been made by U.S. Fish and Wildlife Service since the species' listing (USFWS 2007).

1.6.2.8 Species Status

Rangewide

The bald eagle has recently been delisted from the Endangered Species List. Fueled by a reduction in the threats to the bald eagle, the population in the lower 48 States has increased from approximately 487 breeding pairs in 1963, to an estimated 9,789 breeding pairs today (USFWS 2007a).

VRCMA Boundary

The status within the VRCMA Boundary is unknown. This species is known from the Virgin River Valley (BIO-WEST 2001); no occurrences within the VRCMA Boundary are recorded in the NNHP and AGFD species databases (NNHP 2006, AGFD 2007d).

1.6.3 Bendire's Thrasher

Scientific Name: *Toxostoma bendirei*

1.6.3.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Evaluation species (Medium Priority) for the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- Global heritage rank of G4G5 (NatureServe 2007).
- Nevada heritage rank of S1 (NatureServe 2007).
- Arizona heritage rank of S4 (NatureServe 2007).

1.6.3.2 General Description

Bendire's thrasher is a large, drab brown songbird. As with most thrashers, the bill is long and decurved, and the tail is long. Overall, it closely resembles the curve-billed thrasher. The Bendire's thrasher differs in having a shorter bill with a pale base on the lower mandible and light triangular-shaped spotting on the breast.

Immature birds appear similar to adults. Total length is nine to ten inches (22.9 to 25.4 centimeters) and the average weight is 2.1 ounces (60 grams) (Cornell Lab of Ornithology 2003d, Peterson 1990). The song is a continuous, clear double-noted warble, while the call is a soft “tirup” (Peterson 1990).

1.6.3.3 Distribution

Historic Distribution

Bendire’s thrasher is restricted to states in the desert southwest and western Mexico. It is found in southern California east to New Mexico, and north into Colorado, Utah, and Nevada (NatureServe 2007).

Current Distribution

The current distribution is the same as the historic distribution, although it is possible its range is expanding as more habitat becomes available (NatureServe 2007).

1.6.3.4 Habitat

Bendire’s thrashers use a variety of desert habitats with fairly large shrubs or cacti and open ground, or open woodland with scattered shrubs and trees, up to 1,805.5 feet (up to 550 meters) in elevation. Uninterrupted brushy cover and continuous grassland are avoided. In the northern parts of their range and at higher elevations, thrashers are found in sagebrush and scattered junipers. At lower elevations, it occurs in desert grassland and shrubland with spiny shrubs or cacti, such as cholla (*Opuntia* spp.), Joshua tree (*Yucca brevifolia*), mesquite (*Prosopis* spp.), catclaw (*Acacia greggii*), desert-thorn (*Lycium* spp.) or agave (*Agave* spp.) (Wildlife Action Plan Team 2006).

1.6.3.5 Life History

Reproductive Biology

Nests are located in low trees, shrubs, or cacti, usually about three to five feet (one to 1.5 meters) above the ground. Vegetation substrate nests are found in mesquite, cholla, juniper (*Juniperus* spp.), Joshua tree and other yucca species, but occasionally also in catclaw, willow (*Salix* spp.) and saltbush (*Atriplex* spp.). The nest is an open cup of sticks, lined with soft materials (Cornell Lab of Ornithology 2003d). Clutch size is between three to five eggs. This species may raise multiple broods (Wildlife Action Plan Team [WAPT] 2006). Little information is available regarding timing of incubation and fledging.

Diet

Bendire’s thrasher feeds on insects and other arthropods, especially caterpillars, beetles, grasshoppers, ants, and termites. It forages primarily on the ground, but will also pluck fruit and glean vegetation for insects. Feeding is primarily by gleaning and probing. They also dig with their bill in leaf litter and sandy soil, although not as extensively as other thrashers (WAPT 2006).

Migration

Birds in the northern half of the species’ range migrate south for the winter, supplementing populations of local birds. Northern breeding populations are migratory. Thrashers withdraw from the Mojave and Great Basin Deserts, Colorado Plateau and Arizona/New Mexico Plateau; most move south in September and return by early February. In southern Arizona, they are less abundant in winter than during the breeding season. Distribution in Mexico is poorly known. There are some records of birds in fall and winter in coastal California (NatureServe 2007).

1.6.3.6 Threats Warranting Protection

Most of what is known about the species is anecdotal. Habitat conversion (such as urban development and tilled agriculture) and removal of large shrubs and cacti that significantly alters habitat structure are detrimental, but there is no quantitative information on the impacts of other human activities. Threats are largely unknown (NatureServe 2007).

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Significant threats to the Bendire's thrasher within the VRCMA Boundary are habitat modification and degradation. Clearing of desert scrub habitats and harvesting of large desert cacti such as various yucca species are detrimental where the natural habitat structure is removed. Brood parasitism is probably rare. The introduction of wildfire into yucca types via exotic plant invasions has become a recent concern (WAPT 2006). Other potentially serious threats to this species include grazing by domestic livestock, urbanization, and off-road vehicle activity within its limited breeding range (Zeiner 1990).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

These factors are not known to be a significant threat to this species.

Disease or Predation

Predators of Bendire's thrashers are not well known. Raptors that specialize on birds are potential predators. Domestic and feral cats may prey on this species. Snakes and small mammals may take young or eggs from nests as well.

The Inadequacy of Existing Regulatory Mechanisms

This species is not listed as a threatened or endangered species under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Exposure to pesticides in agricultural areas may affect this species.

1.6.3.7 Conservation

The Partners in Flight North American Landbird Conservation Plan and Clark County MSHCP (WAPT 2006) cover Bendire's thrasher. The Bendire's thrasher is an Evaluation species of medium priority in the Clark County MSHCP, which includes conservation actions to offset effects from covered activities (RECON 2000).

1.6.3.8 Species Status

Rangewide

Bendire's thrashers are significantly declining in Nevada (WAPT 2006). Rangewide trends show declines in many areas but show high levels of variation in trends from location to location (NatureServe 2007).

VRCMA Boundary

The status of the Bendire's thrasher within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6.4 Black-chinned Sparrow

Scientific Name: *Spizella atrogularis*

1.6.4.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Global heritage rank of G5 (NatureServe 2008).
- Arizona heritage rank of S5 (AZNHP 2008).
- Nevada heritage rank S3S4B (NNHP 2008).
- Global/Continental Conservation Status: IUCN Red List Category: LC - Least concern.
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- National level - Bird of Management Concern (race *evura*); USFWS – MBSP 2007.
- Priority bird species for chaparral habitat (AZPIF - BCP 1999).

1.6.4.2 General Description

The black-chinned sparrow is an inconspicuous but locally common songbird of arid brushlands throughout the southwestern United States and south-central Mexico. In summer, it favors rocky slopes of mixed chaparral or sagebrush from near sea level to almost 8,200 feet (2,500 meters). A partial migrant, in winter it generally moves downslope or south into desert scrub and dry wash. The retiring habits and remote haunts of this species render it one of the least-known songbirds of its region; little is known of its behavior, food, predators, and most aspects of its breeding biology (Tenney 1997).

The black-chinned sparrow is the most sexually dimorphic *Spizella*; the male’s black chin patch, throat, and lores highlight a gray torso saddled with reddish brown back and wings. Its length ranges from five to six inches (12.5 to 15 centimeters); its mass ranges from 0.32 to 0.42 ounces (nine to 15 grams). Both sexes are best located by their vocalizations: the male by its distinctive song, a pure-toned, accelerating trill nearly always delivered from a prominent perch; the female by its strident chipping near nest or young. Individuals seldom stray far from the protective cover of shrubbery, foraging in low brush for seeds and insects and flying through alleyways or low over bushtops (NatureServe 2008). Four subspecies, based on variation in size and plumage coloration, are currently recognized. Subspecies character divergence is likely a response to differences in climate and migratory behavior across the range of this species (Tenney 1997).

1.6.4.3 Distribution

Historic Distribution

The black-chinned sparrow breeds from north-central California, southern Nevada, southwestern Utah, central Arizona, central New Mexico, western Texas, central Nuevo Leon, and southwestern Tamaulipas south to northern Baja California, southwestern California, and southeastern Arizona; and in Mexican Highlands (probably disjunct) from Durango, Coahuila to Guadalajara, Michoacan, Puebla, and Oaxaca (Tenney 1997, AOU 1998). During the non-breeding season they occur from coastal California (casual), southern Arizona, southern New Mexico, western Texas, and Nuevo Leon south to southern Baja California and through the breeding range in central Mexico (AOU 1998).

Current Distribution

Although regular and abundant on chaparral slopes fringing the Los Angeles Basin, where the black-chinned sparrow is sometimes the most common species, its occurrence elsewhere can be irregular and unpredictable.

Concurrent with documented declines in southern California is a possible post-1950 range extension north from central California to southern Oregon (NatureServe 2008).

1.6.4.4 Habitat

The black-chinned sparrow is a bird of arid brushlands on rugged mountain slopes from sea level to almost 8,200 feet (2,700 meters) in elevation. Brush is generally tall (3.2 to 6.5 feet [one to two meters]), at least moderately dense, of mixed species, and broken by rocky outcrops and scattered large shrubs or trees. Preferred topography is gently to steeply sloped with an aspect often south-facing (Shuford 1993, Burridge 1995). This species prefers young stands with openings or alleyways through brush and avoids overgrown stands (Shuford 1993). Where the species occurs in montane chaparral, it is associated with chamise, ceonothus, and scrub oak-dominated habitats; in Joshua Tree National Monument it uses open chaparral mixed with pinyon-juniper on steep slopes (Grinnell and Miller 1944, Miller and Stebbins 1964, USDA Forest Service 1994). Post-breeding the black-chinned sparrow may invade higher elevations in late summer (e.g., Grinnell and Swarth 1913).

Outside the breeding season, the species generally moves downslope or south into desert grassland scrub, where grass and forb seeds are an important winter food source. Individuals may forage beneath shrub canopy or in adjacent grassy areas (Tenney 1997).

1.6.4.5 Life History

Reproductive Biology

The black-chinned sparrow usually lays three to four light bluish-green eggs; some are unmarked, others with small scattered dull brown and brownish black spots (Dawson 1923, Oberholser 1974, Harrison 1979). The incubation period lasts about 12 to 13 days (Wheelock 1910). This species has one brood per season (Dawson 1923) and apparently only the female broods (Tenney 1997). Both parents tend the young. This species nests in loose local colonies (Rising 1996, Terres 1980).

Diet

During the breeding season the black-chinned sparrow eats adult and larval insects it gleans from inner foliage and ground (Weathers 1983). In winter they feed on seeds of grasses and forbs, which they extract directly from racemes, often while perched on twigs of mesquite or other shrubs (Oberholser 1974).

Migration

Breeding populations of the black-chinned sparrow in the northern part of their range are strongly migratory and winter in Baja California Sur, southern Arizona, Sonora, Chihuahua, and south. Border and interior Mexico populations are mostly resident, although they will move downslope. Migratory routes of the black-chinned sparrow are unknown (Tenney 1997).

1.6.4.6 Threats Warranting Protection

Most upland habitat of the black-chinned sparrow is either above current urban development or on rugged slopes not conducive to building (USDA Forest Service 1994), but the population declines evident in California foothills need investigation for impact of habitat changes. Local loss of breeding habitat has been observed due to mining, off-road vehicles, and overgrazing (Tenney 1997). Coastal scrub and lowland chaparral types have suffered serious losses to development in California. Depending on vegetation type, alteration of fire regimes in chaparral and shrubland habitats may have unknown impacts on the species (Keeley and Keeley 1988). Heavy grazing on wintering grounds in southwestern U.S. and northern Mexico have reduced and degraded native grasses and forb vegetation, and this may affect winter foraging habitat (DeSante and George 1994, Tenney 1997).

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Extensive mining and use of trail bikes and other off-road vehicles have caused degradation of black-chinned sparrow breeding habitat (Johnson and Cicero 1985). Population declines reported in California foothills may also be a consequence of habitat-altering human activities (Johnson and Cicero 1985). Overgrazing may negatively affect chaparral breeding habitat. Following removal of livestock from the Chisos Mountains in Texas, Wauer (1974) documented 30 years of reestablishment of chaparral and grassland habitat and increase in numbers of associated avifauna, including black-chinned sparrow. Extensive grazing of public lands in the western U.S. may be linked to declines in western sparrows (including black-chinned) resulting from habitat degradation on wintering grounds in southwestern U.S. and northwestern Mexico (Desante and George 1994).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Over-use of the black-chinned sparrow for these purposes has not been documented.

Disease or Predation

Black-chinned sparrow eggs are taken by garter snakes (*Thamnophis hammondi*) (Pemberton and Carriger 1916). Aggressive vocal response of adults toward the western scrub-jay (*Aphelocoma californica*) near nests suggests that it is a likely egg and/or nestling predator (Grinnell and Swarth 1913).

Mallophagan parasite nits have been found in plumage of all *Spizella* (Willoughby 1991).

The Inadequacy of Existing Regulatory Mechanisms

Population declines of the black-chinned sparrow in southern California suggest the need for habitat preservation as continued land development and other human activities invade foothill chaparral. Management in other southwestern states apparently is not needed (Tenney 1997). Elimination of overgrazing in winter grasslands is also a priority, since grass seed appears to be the black-chinned sparrow's primary winter food source (Tenney 1997).

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Periodic fires may be required for suitable chaparral habitat for the species. Grinnell and Miller (1944) suggested a preference for "old, burned-over tracts, well along in recovery of vegetation" by the black-chinned sparrow. In San Luis Obispo County, California, Marantz (1986) reported regular breeding in "recently burned (within 10 years) chaparral and coastal scrub." Habitat dependence on recurrent fires may vary regionally and with vegetation type. In the Santa Rosa Mountains, Riverside County, California, breeders thrive in senescent 40 year-old desert ceanothus (*Ceanothus greggii*; Weathers 1983). In Sonoma Co., California, the species breeds in chaparral as early as 18 to 24 months after fire (Burridge 1995).

1.6.4.7 Conservation

The black-chinned sparrow has largely been ignored, perhaps because of its secretive habits and preferred habitat of arid, often remote mountain slopes. Descriptive studies are needed to fill in knowledge gaps in nearly all aspects of the black-chinned sparrow's life history, especially breeding, diet, and behavior. Banding studies might help resolve questions of migration, demography, and distribution.

Investigation at the subspecific level is also needed. Further study of geographic variation in black-chinned sparrow plumage, size, and behavior might help answer lingering questions of subspecific status and distribution. The nominate *atrogularis*, the most divergent of the four races, is the least studied.

1.6.4.8 Species Status

Rangewide

North American Breeding Bird Survey (BBS) data show steep and significant population declines for the black-chinned sparrow in the western region (-6.1 percent per year; n = 47 survey routes), California (-7.3

percent per year; n = 34), and California foothills physiographic region (-11.7 percent per year; n = 16), 1966-1996. These are the only BBS areas for which sample sizes are sufficient for trend analysis. The survey-wide decline appears to be a persistent and steady trend throughout the 1966 to 1996 period. Mapped trends show a local population increase in central Arizona, but sample size is low in Arizona for statewide or physiographic region trends. Highest breeding season abundances for the species occur in southern California, central Arizona, and in southern New Mexico to far west Texas (Sauer et al. 1997). In contrast to the BBS, winter Christmas Bird Counts show a moderate but significant increase (1.7 percent per year; n = 60 survey circles), possibly focused in Arizona (2.4 percent per year; n = 22). Highest winter abundance occurs in southern Arizona (Sauer et al. 1996).

VRCMA Boundary

The black-chinned sparrow is uncommon during migration and breeding seasons, but a common winter resident within the VRCMA boundary (Prior-Magee et al. 2007).

1.6.5 Blue Grosbeak

Scientific Name: *Passerina caerulea*

1.6.5.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- Classified as Protected and Endangered under NAC 503.050 (Protected, Endangered and Sensitive Birds).
- Global heritage rank of G4T4 (NatureServe 2007).
- Nevada heritage rank of S3B (NatureServe 2007).
- Arizona heritage rank of S3B (NatureServe 2007).

1.6.5.2 General Description

The adult male blue grosbeak is a deep blue over most of the upperparts and underparts, with heavy black streaking on the back. Wings are black with two rufous and tan wingbars. The lores and feathering around the base of the blue bill are black. Females and immatures have warm brown upperparts with paler underparts with two tan wingbars. Immatures and females have some blue on the rump. Young males molting into adult plumage have large patches of new blue feathers and drab brown feathers retained from juvenile plumage. Total length is 5.9 to 7.5 inches (15 to 19 centimeters) (Peterson 1990). Wingspan is 11 inches (28 centimeters) (Cornell Lab of Ornithology 2003b).

The song is long and warbling, with rising and descending parts. Call is a sharp, metallic “chink” (Peterson 1990).

1.6.5.3 Distribution

Historic Distribution

The blue grosbeak occurs across the southern half of the United States and in the Great Plains north to North Dakota. They winter south to Panama and on some Caribbean islands (NatureServe 2007).

Current Distribution

The current distribution is the same as the historic distribution (NatureServe 2007).

1.6.5.4 Habitat

The blue grosbeak uses riparian areas and grasslands, thickets, wooded edges and agricultural areas. In Clark County, they likely depend on desert riparian areas along watercourses and oases. Urban areas may be used as well (RECON 2000).

1.6.5.5 Life History

Reproductive Biology

The nest is a compact cup made of twigs, bark, rootlets, and other fibers and strips of material, placed low in shrubs or small trees (Cornell Lab of Ornithology 2003b). Clutch size is two to five in northern populations (usually four). The blue grosbeak produces two broods per year in the south. Incubation, done by the female, lasts 11 to 12 days. Young are tended by both parents and leave the nest between nine and 13 days. The male will feed fledged young if the female renests (NatureServe 2007).

Diet

Grosbeaks eat mostly insects. They will also feed on snails, spiders, seeds, grains, and wild fruits and make use of bird feeders. They forage on the ground and in shrubs and trees. The blue grosbeak will obtain grit from roadsides or streams (NatureServe 2007).

Migration

Breeding populations in North America are long-distance migrants, wintering south to Panama and occasionally South America (NatureServe 2007).

1.6.5.6 Threats Warranting Protection

Primary threats to the blue grosbeak are habitat loss and degradation and brood parasitism by brown-headed cowbirds. Threats to the blue grosbeak south of the United States are not well known. A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to the blue grosbeak are primarily habitat modification and degradation. This includes river channelization and reduced water availability to riparian areas, exotic plant encroachment in riparian areas, and effects on water and vegetation from livestock grazing activities (RECON 2000).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Collection of blue grosbeaks is illegal under the Migratory Bird Treaty Act.

Disease or Predation

Predators of the blue grosbeak are not well known. Raptors that specialize on birds, such as sharp-shinned (*Accipiter striatus*) and Cooper's hawks (*Accipiter cooperii*), are potential predators. Domestic and feral cats may predate on this species. Snakes and small mammals may take young or eggs from nests as well.

The Inadequacy of Existing Regulatory Mechanisms

This species is not listed on the threatened and endangered species list under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

The blue grosbeak is vulnerable to brood parasitism by cowbirds (*Molothrus* spp.) (NatureServe 2007). Throughout their wintering and breeding ranges the blue grosbeak may be exposed to pesticides while feeding in agricultural areas, which may affect survivorship or reproduction.

1.6.5.7 Conservation

The blue grosbeak is covered in the Clark County MSHCP, which includes conservation actions to offset effects from covered activities (RECON 2000).

1.6.5.8 Species Status

Rangewide

Eastern populations of the grosbeak is increasing, western populations are decreasing (NatureServe 2007). Loss of riparian habitats and brood parasitism by cowbirds are potentially responsible for declines in western states.

VRCMA Boundary

Potential habitat for blue grosbeak in Clark County occurs along the Virgin, Muddy and Colorado River systems and in Las Vegas Valley Wash (RECON 2000). The status of the blue grosbeak within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6.6 Brewer's Sparrow

Scientific Name: *Spizella breweri*

1.6.6.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Global heritage rank of G5 (NatureServe 2008).
- Arizona heritage rank of S5 (AZNHP 2008).
- Nevada heritage rank S4?B (NNHP 2008).
- Global/Continental Conservation Status: IUCN 2004 Red List – NT (NatureServe 2008).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- Species of Continental Importance in Shrubsteppe (PIF NALBCP 2005).
- National level - Bird of Management Concern (USFWS – MBSP 2007).
- Nevada Species of Conservation Priority; Nevada Wildlife Action Plan (NWAP 2006).

1.6.6.2 General Description

The Brewer's sparrow is a typical *Spizella*: small, slim, long-tailed sparrow with thin conical bill and notched tail. Its length is four to six inches (12.5 to15 centimeters); mass 0.32 to 0.42 ounces (nine to 12 grams) (mass varies significantly among localities; Wiens and Rotenberry 1980). Slight sexual size dimorphism occurs, but sexes are otherwise similar in appearance. The Brewer's sparrow has a finely streaked brown crown; a median crown-stripe is frequently absent, but sometimes an indistinct one is present (Simon 1977, Kaufman 1990). Supercilia are pale gray, lores are unmarked, and a bold, complete white eye-ring is present. The auricular is brown, softly outlined with black and bordered below by a grayish white submustachial stripe; the black malar streak is thin, often indistinct. This sparrow's underparts are dull white, with grayish flanks. The breast is unstreaked in adults, although sometimes the flanks are streaked. The back and rump are brown, the latter streaked with black. There are little or no seasonal changes in plumage. It has a distinctive song consisting of buzzy trills (Rotenbery et al. 1999).

1.6.6.3 Distribution

Historic Distribution

The Brewer's sparrow breeds from southeastern Alaska and Saskatchewan south to southern California and southwestern Kansas. It winters from southern California, east to western Texas, and south to central Mexico (NatureServe 2008).

Current Distribution

No large-scale changes in range are known. Brewer's sparrow breeds throughout northern Nevada, has a year-round population in Southwest Nevada, and is a winter resident in extreme southeast Nevada (NWAP 2006).

1.6.6.4 Habitat

Brewer's sparrow breeds primarily in shrub steppe habitats and is considered to be shrub steppe obligates by Braun et al. (1976). However, Brewer's sparrow may also be found in high desert scrub (greasewood) habitats, particularly where these habitats are adjacent to shrub steppe. They may also breed in large sagebrush openings in pinyon-juniper habitat or coniferous forests. Primary habitat types used in Nevada are sagebrush, pinyon-juniper and mountain mahogany communities (Ammon 2003)**.**

1.6.6.5 Life History

Reproductive Biology

Upon arrival at breeding grounds, the male Brewer's sparrow establishes territories (usually about 1.2 acres [0.5 hectare]) which are vigorously defended both vocally and physically (Reynolds 1981). Nests are constructed in mid-May in sagebrush; however, other shrubs are occasionally used (Rotenberry et al. 1999). Clutch size is usually three to four eggs; incubation begins when the second-to-last egg is laid and the entire incubation period lasts for ten to 12 days (Rotenberry and Wiens 1991). Hatching begins in late May and peaks in the first two to three weeks in June (Howe et al. 1996). Both parents brood nestlings for eight to nine days. Adults feed nestlings almost exclusively insects (Petersen and Best 1986), which are caught within 165 feet (50 meters) of the nests (Rotenberry et al. 1999). Nestlings remain in the nest area (less than 33 feet [10 meters] from the nest) for several days before they are able to fly. Parents attend the nestlings after they leave the nest for several days, though it is not known exactly how long parents remain with the fledglings. Late nests (late June to mid July) may represent renesting after failed attempts or double brooding. Brewer's sparrows are frequent brown-headed cowbird hosts and often abandon parasitized nests (Rotenberry et al. 1999).

The Brewer's sparrow is not known to show fidelity to natal sites (Rotenberry et al. 1999).

Diet

The Brewer's sparrow is primarily insectivorous during the breeding season though its diet consists mostly of grass and weed seeds in winter (Rotenberry et al. 1999). The diet of the Brewer's sparrow changes throughout the breeding season and differs between years (probably in relation to food availability). It feeds on a wide variety of arthropods including spiders, leaf bugs, cicadas, snout beetles, caterpillars, crane flies, ants, and grasshoppers (Rotenberry et al. 1999). Nestlings are fed a similar diet, with most of the diet made up of caterpillars, butterflies, spiders, beetle larvae, crane flies, cicadas, and grasshoppers (Petersen and Best 1986).

Migration

The Brewer's sparrow is a Nearctic-Neotropical migrant. Most individuals breed in and around Great Basin and winter in Sonoran and Chihuahuan deserts of the southwestern U.S., western Mexico (including the Baja California peninsula), and the Mexican Plateau (Rappole et al. 1993). This species is less common in winter in the southern Mojave Desert. Northerly populations move farthest south, including the apparent leapfrog pattern of subspecies *S. taverneri*, the northernmost population, which winters farther south than *S. breweri*. Some southerly populations probably move only a short distance to wintering grounds (Rotenberry et al. 1999).

1.6.6.6 Threats Warranting Protection

Primary threats to the Brewer's sparrow include habitat destruction, alteration, and fragmentation. This species requires habitat with a dense shrub component, and sagebrush control, such as used for range management, causes significant decreases in numbers. Sagebrush habitats can be difficult to restore if heavy grazing causes invasion by non-native plants and grasses, in particular cheatgrass. This altered habitat is also prone to fires that result in grass-dominated landscapes (Rotenberry et al. 1999).

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Large-scale fragmentation and reduction in area of native shrublands has been occurring throughout the intermountain West (Braun et al. 1976), and may be responsible for the declines in the Brewer's sparrow as observed by the North American Breeding Bird Survey (Rotenberry 1998). Conservative estimates suggest that through the mid-1970s, 10 percent of native sagebrush shrublands had been converted to agricultural operations (Braun et al. 1976). Pace of loss has accelerated because of complex interactions among agriculture, livestock grazing, and invasion of exotic annual plants, especially cheatgrass (*Bromus tectorum*; Rotenberry 1998). Cheatgrass now occupies millions of hectares of western rangelands, has greatly increased fire frequency, and has substantially, and perhaps permanently, altered postfire successional pathways (Whisenant 1990). Modeling predicts loss of more than half of remaining shrublands (Rotenberry 1998).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Documentation of over-use of the Brewer's sparrow for these activities has not been documented.

Disease or Predation

The Brewer's sparrow has experienced intense episodic predation by the Townsend's ground squirrel (*Spermohpilus townsendii*). Other documented or suspected nest predators (of eggs and nestlings) include: gopher snake (*Pituophis melanoleucus*), loggerhead shrike (*Lanius ludovicianus*), common raven (*Corvus corax*), black-billed magpie (*Pica pica*), long-tailed weasel (*Mustela frenata*), least chipmunk (*Tamias minimus*), western rattlesnake (*Crotalus viridis*), and other snake species. Nest predation is a significant cause of nest failure, but impacts vary geographically and temporally. In 1976-1977, predation rate ranged from 11 percent in Oregon to 86 percent in Idaho and 100 percent in Nevada. (NatureServe 2008).

The American kestrel (*Falco sparverius*), prairie falcon (*Falco mexicanus*), loggerhead shrike, and coachwhip (*Masticophis flagellum*) have been reported preying on the adult Brewer's sparrow (Rotenberry et al. 1999). Predation appears higher in fragmented habitat than in areas of continuous shrubsteppe (Vander Haegen et al. 2002).

The Brewer's sparrow is known to be a host of blood protozoans such as Haemoproteus and Trypanosoma (Greiner et al. 1975), and biting lice (Mallophaga) *Ricinus fringillae* de Geer and *R. subdiffusus* Nelson (Emerson 1972). Flesh flies were reported in three (4 percent) of 69 broods in southeastern Idaho (Petersen et al. 1986), but with no effect on nestling growth or survival. The blowfly *Protocalliphora braueri* was reported in four individuals (6%) of 68 broods sampled in central Idaho with an average load of 2.5 larvae/infected nestling (Howe 1991).

The Inadequacy of Existing Regulatory Mechanisms

There are no existing regulatory mechanisms for the Brewer's sparrow except the MBTA (16 U.S.C. Sec. 703–7120) and being identified as a species of concern and relative importance (PIF NALBCP 2005 USFWS – MBSP 2007).

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Brewer's sparrow numbers continue to decline in shrubsteppe communities including those in Nevada (NatureServe 2008). Fragmented landscapes may act as population sinks (Knick and Rotenberry 1995). Habitat for the Brewer's sparrow has been and continues to be altered substantially by land management practices. Sagebrush often is removed via burning, spraying, chaining, or plowing, and treated areas are planted with non-native species (e.g., crested wheatgrass, alfalfa [*Medicago sativa*]) to increase forage for livestock (Rotenberry 1998). Although it is clear that complete removal of sagebrush eliminates suitable breeding habitat, our understanding of how other management practices affect the Brewer's sparrow is relatively poor (Rotenberry et al. 1999).

The Brewer's sparrow is parasitized by brown-headed cowbirds throughout their range but this factor has not been attributed to their population declines (NWAP 2006, NatureServe 2008).

1.6.6.7 Conservation

The most critical conservation measures for breeding birds are protection and restoration of native shrublands and shrub-steppe habitats (Rotenberry 1998, Paige and Ritter 1999). Successful long-term preservation of shrublands will require removal of exotic annual plants that have become self-perpetuating, and in doing so have shortened fire cycles to the point that many shrub species cannot persist.

Relatively little is known about the status and behavior of the Brewer's sparrow in winter, a time that may be critical in the regulation of populations (Rotenberry and Knick 1999). Research is needed to fill these significant data gaps for the Brewer's sparrow and those for habitat associations, diet, local and regional population dynamics, predation, effects of adverse weather, and movement patterns (Rotenberry et al. 1999).

Recovery Units

There are no recovery units proposed for the Brewer's sparrow; it is not currently a federally listed species.

Critical Habitat

No critical habitat is designated for the Brewer's sparrow; it is not currently a federally listed species.

1.6.6.8 Species Status

Rangewide

The Brewer's sparrow is often the most abundant bird species in appropriate sagebrush habitats, but has experienced significant decline throughout its range during the last ten to 20 years (Rotenberry et al. 1999). Saab and Rich (1997) categorize it as a species of high management concern in the Columbia River Basin. North American Breeding Bird Survey (BBS) data for 1966 through 1996 show significant and strong survey-wide declines averaging -3.7 percent per year (n = 397 survey routes). Significant declines are evident in California, Colorado, Montana, Nevada, Oregon, and Wyoming. These negative trends appear to be consistent throughout the 30-year survey period. Only Utah appears to have an apparently stable population. Increases have not been observed in any state or physiographic region. Sample sizes for Washington are too small for an accurate estimate. Christmas Bird Count (CBC) data for the U.S. for the period 1959 through 1988 indicate a stable survey-wide trend (0.2 percent average annual increase; n = 116 survey circles), and a significantly positive trend in Texas (6.7 percent average annual increase; n = 33). California and New Mexico did not have significant increases for the same period. Arizona populations experienced a nonsignificant decline (-1.4 percent average annual decline; n = 34) (Rotenberry et al. 1999, NatureServe 2008).

VRCMA Boundary

The Brewer's sparrow is known as uncommon during migration and breeding season and a common winter resident within the VRCMA boundary (NNHP 2008). The Southwest Regional Gap Project identifies potential habitat within the VRCMA boundary (Prior-Magee et al. 2007).

1.6.7 Cactus Wren

Scientific Name: *Campylorhynchus brunneicapillus*

1.6.7.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- Classified as Protected and Endangered under NAC 503.050 (Protected, Endangered and Sensitive Birds).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S4 (NatureServe 2007).
- Arizona heritage rank of S5 (NatureServe 2007).

1.6.7.2 General Description

The cactus wren is the largest American wren. The bill is long and slightly decurved. Its plumage consists of a variety of white, black and brown patterns, with a brown cap and brown transocular line. The white supercilium is conspicuous. The underparts are white with black spots and a black throat patch. Upperparts are black with white streaking on the back, and black barring on the wings and tail. Outer tail feathers are white. Plumages are alike between sexes; juvenile birds lack the black throat patch of adults. Total length is 7.1 to 8.7 inches (18 to 22 centimeters) with weights between 1.1 to 1.7 ounces (32 to 48 grams) (Peterson 1990).

The song is a monotonous, croaking "chuh-chuh-chuh-chuh-chuh" that gains rapidity (Peterson 1990).

1.6.7.3 Distribution

Historic Distribution

The cactus wren occurs in the desert southwest, from California east to Texas, north to Nevada and Utah and south into central Mexico (NatureServe 2007).

Current Distribution

The current distribution is the same as the historic distribution (NatureServe 2007).

1.6.7.4 Habitat

The cactus wren uses desert areas, particularly those with cholla cactus (*Opuntia* spp.) or yucca (*Yucca* spp.), mesquite (*Prosopis* spp.), arid scrub, coastal sage scrub, and trees in towns in arid regions (AGFD 2007b).

1.6.7.5 Life History

Reproductive Biology

The female selects the nest site. The nest is most often placed in cholla, but may also be built in other cacti, thorny trees and shrubs. Buildings may occasionally be used as well. Both the male and female build the nest (AGFD 2007b, NatureServe 2007).

The cactus wren's nest is a large, conspicuous, spherical structure usually built with dry grasses and annual plants; strips of discarded paper and cloth found along roadsides are frequently woven in it. A long, narrow-sided passage into an internal chamber, as well as the thorny substrate, protects the nest from most predators. As with most wren nests, the nest chamber is usually lined with feathers. In Arizona, Gambel's quail feathers seem to make up the bulk of the lining. The female cactus wren incubates, starting with the first egg, while the male builds a new nest in preparation for a second clutch. Additional nest structures are constructed and used as roosts throughout the year. The roost nests often lack the feather lining (AGFD 2007b).

During wet winters, breeding season begins as early as late February, allowing time for double and sometimes triple broods. A young cactus wren takes 16 days to hatch and another 19 to 23 days to fledge; it will remain dependent on the parents for food for approximately 30 days after leaving the nest (AGFD 2007b).

Diet

The cactus wren feeds on insects (e.g., beetles, ants, wasps, bugs, grasshoppers) and spiders. Occasionally, it eats small lizards and tree frogs. Fruits from cactus, elderberries, cascara berries and some seeds are also consumed (NatureServe 2007).

Migration

The cactus wren is not considered to be a migratory species (Peterson 1990).

1.6.7.6 Threats Warranting Protection

Habitat loss and degradation are most likely the biggest threats to the cactus wren, particularly on the fringes of developing urban areas. However, this species is considered secure and abundant in most of its range and is not immediately threatened by human activity (NatureServe 2007, AGFD 2007b).

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

The biggest threats to the cactus wren within the VRCMA Boundary are habitat modification and degradation.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

These factors are not a significant threat to this species.

Disease or Predation

House cats are known predators of the cactus wren (Anderson and Anderson 1963). Curve-billed thrashers are known to destroy cactus wren roosting nests with some regularity (Anderson et al. 1963), which leaves wrens vulnerable to climatic conditions and predators. Eggs and nestlings are frequently taken by gopher snakes (*Pituophis catenifer*), coachwhips, and whipsnakes (*Masticophis* spp.) (Zeiner 1990, AGFD 2007b). Wrens are occasionally shot by humans (Anderson and Anderson 1963). Raptors that specialize on birds, such as Cooper's (*Accipiter cooperii*) and sharp-shinned hawks (*Accipiter striatus*), are potential predators.

The Inadequacy of Existing Regulatory Mechanisms

This species is not currently listed or a candidate to be listed under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

No other factors are known to significantly affect the cactus wren.

1.6.7.7 Conservation

No conservation measures are in place to specifically protect this species.

1.6.7.8 Species Status

Rangewide

Cactus wren populations are secure in much of their range (NatureServe 2007). Populations in southern California have declined (Zeiner 1990), presumably as a result of habitat loss. In Utah, where their range is very restricted, they are listed as a vulnerable and imperiled species (NatureServe 2007).

VRCMA Boundary

The status of the cactus wren within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6.8 Crissal Thrasher

Scientific Name: *Toxostoma crissale*

1.6.8.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Evaluation species (Low Priority) for the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- Classified as Protected and Endangered under NAC 503.050 (Protected, Endangered and Sensitive Birds).
- BLM sensitive species in Nevada (NNHP 2004).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S3 (NatureServe 2007).
- Arizona heritage rank of S5 (NatureServe 2007).

1.6.8.2 General Description

The crissal thrasher is dark brown, with a long, deeply curved bill and long tail. Dark chestnut undertail coverts are distinct. This species is otherwise unmarked except for a dark malar stripe and white throat. The eye is orange. Its total length is 11.5 inches (29.2 centimeters); the average wingspan is 12.5 inches (31.8 centimeters) and the average weight is 2.2 ounces (62 grams) (Sibley 2000).

The crissal thrasher spends a significant portion of time on the ground and often prefer running to flying (Cornell Lab of Ornithology 2003c). Its song is a long series of rich, warbled, variable phrases. Its call note is a "pitchoree" (Cornell Lab of Ornithology 2003c).

1.6.8.3 Distribution

Historic Distribution

The crissal thrasher is a southwestern species, ranging from southern California east to Texas and north into Nevada and Utah. It is also found southward into southern Mexico (NatureServe 2007).

Current Distribution

The current distribution is thought to be similar to the historic distribution, although they may be extirpated from their small historic range in Utah (NatureServe 2007).

1.6.8.4 Habitat

The crissal thrasher is found in desert scrub, mesquite (*Prosopis* spp.), tall riparian brush and, locally, chaparral. They most often stay under dense cover (WAPT 2006).

1.6.8.5 Life History

Reproductive Biology

The breeding season lasts from February into June with a peak in March and April (Zeiner 1990). The clutch size ranges between two and four eggs, with three eggs per clutch on average. Incubation lasts 14 days, with both sexes participating. The altricial young are tended by both adults. Young fledge and leave the nest 11 to 12 days after hatching (NatureServe 2007).

Diet

Little information on the diet of the crissal thrasher is available. They are known to eat insects, berries, and, sometimes, small lizards (WAPT 2006).

Migration

The crissal thrasher is not considered a migratory species (Zeiner 1990).

1.6.8.6 Threats Warranting Protection

Primary threats to the crissal thrasher are thought to be habitat loss and degradation (Cornell Lab of Ornithology 2003c).

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to the crissal thrasher within the VRCMA Boundary include habitat modification and degradation (Cornell Lab of Ornithology 2003c). This includes the introduction and proliferation of non-native salt cedar in riparian habitats.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

No overutilization of this species is known to occur.

Disease or Predation

The crissal thrasher is known to eject cowbird eggs from their nests (Zeiner 1990) and, as such, is probably not seriously threatened by cowbird brood parasitism.

The Inadequacy of Existing Regulatory Mechanisms

This species is not on the threatened and endangered species list under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Off-road vehicle activity may degrade habitat and disturb thrashers (Zeiner 1990).

1.6.8.7 Conservation

The Nevada All Bird Count monitors this species. The Partners in Flight North American Landbird Conservation Plan and Clark County MSHCP account for crissal thrasher as well (WAPT 2006). The crissal thrasher is an Evaluation species of low priority in the Clark County MSHCP, which includes conservation actions to offset effects from covered activities (RECON 2000).

1.6.8.8 Species Status

Rangewide

General population trends for this species are not available (NatureServe 2007). In California, some populations are declining due to habitat loss (Zeiner 1990).

VRCMA Boundary

The status of the crissal thrasher within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6.9 Ferruginous Hawk

Scientific Name: *Buteo regalis*

1.6.9.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.
- Petitioned for listing under the federal ESA in 1991 but rejected.
- Formerly listed as a category 2 species by the USFWS.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- Listed as Species of Special Concern (CSC) and is fully protected by the State of California (CDFG 2006).
- Listed as a Sensitive Species by the BLM in Nevada (NNHP 2004).
- Categorized as Endangered by the state of Oregon.
- Global heritage rank is G4 (NatureServe 2007).
- Nevada heritage rank is S2 (NatureServe 2007).
- Arizona heritage ranks are S2B (breeding) and S4N (wintering) (NatureServe 2007).

1.6.9.2 General Description

The following description is summarized from the Birds of North America species account for the ferruginous hawk (Bechard and Schmutz 1995). The ferruginous hawk is a large broad-winged hawk measuring 22 to 23.2 inches (56 to 69 centimeters) in length with a mass of 34.5 to 73.2 ounces (977 to 2,074 grams). Sexes are similar in plumage, however females are larger in mass. In flight (viewing species from below), light-morph adults have light grey or white primary and secondary flight feathers and tail feathers are also white or light grey. From above, the head is whiter than that of most hawks, with back and shoulders rufous and a noticeable white area in widely extended primaries.

Adult and fledgling dark morphs have a plain light-colored tail and light area on upper and lower surfaces of the primaries, with the entire head, body, upper and under wing surfaces and tail coverts being dark in color.

While in flight, screams and calls are often sounded (Powers 1981, as cited by Bechard and Schmutz 1995). The alarm call of the adult ferruginous hawk is a “kree-a” or “kaah kaah,” while young utter short cheeping sounds, and fledglings give calls similar to adults (Bechard and Schmutz 1995).

1.6.9.3 Distribution

Historic Distribution

The historic range of the ferruginous hawk is similar to its current range, which is western North America from southernmost Canada between the Great Plains and Rocky Mountains south to Northern Arizona and New Mexico. However, studies cited by Bechard and Schmutz (1995) indicate that these birds historically wintered in Los Angeles. The ferruginous hawk was near extirpation from the northeast quarter of North Dakota, and experiencing declines in northern Utah and eastern Nevada by 1950 (Olendorff 1993).

Current Distribution

The breeding range of the ferruginous hawk encompasses the Rocky Mountains from Wyoming northward through Montana (except for the mountainous portion of western Montana) and into southeastern Alberta and southern Saskatchewan, and the planes of eastern Wyoming, Montana, Nebraska, North and South Dakota. The breeding range also extends westerly into Utah (except for the southwest corner of the state), the Great Basin in Nevada, the southern half of Idaho, the eastern half of Oregon, and southeastern quarter of Washington (Bechard and Schmutz 1995).

The winter range can be found in the western half to two thirds of Kansas, Oklahoma southward through Texas, the southern half of New Mexico and Arizona, most of California, the western edge of Nevada (from approximately Reno south and east towards Las Vegas). The winter range also extends south into Baja California and most of north central Mexico (Bechard and Schmutz 1995).

Year round, the ferruginous hawk can be found throughout northern New Mexico, Arizona, eastern and the north western quarter of Colorado, and Utah east of the Great Salt Lake south to the Colorado River.

1.6.9.4 Habitat

Breeding habitat includes flat and rolling grasslands or shrubsteppe regions (Bechard and Schmutz 1995). Additional habitats include sagebrush (*Artemesia* spp.), saltbrush (*Atriplex*)-greasewood (*Sacobatus vermiculatus*) shrublands, and the periphery of western pinyon (*Pinus*)-juniper (*Juniperus*) and other forests (Olendorff 1993, as cited by Bechard and Schmutz 1995).

Preferred nest sites include elevated land forms and structures (natural or manmade) such as boulders, creek banks, knolls, low cliffs, buttes, trees, large shrubs, utility structures, and haystacks (Bechard and Schmutz 1995). However, if elevated structures or land forms are not available, the ferruginous hawk will nest on nearly level ground.

Within its winter range, the ferruginous hawk prefers grassland and desert habitat where prairie dogs, lagomorphs or pocket gophers are present (Bechard and Schmutz 1995). Winter roosts in California can contain up to 24 birds (Olendorff 1993, as cited by Bechard and Schmutz 1995), while in Texas and Kansas small groups up to ten birds can be found perched around prairie-dog towns (Bechard and Schmutz 1995).

1.6.9.5 Life History

Reproductive Biology

Pair forming starts in late February through early March (Olendorff 1993, Smith and Murphy 1973, as cited by Bechard and Schmutz 1995). Nest building occurs shortly after pair forming, generally mid-March in southern to mid-latitudes and April in the northern breeding range (Bechard and Schmutz 1995). Egg laying occurs from April through May and is dependent upon latitude (Bechard and Schmutz 1995). Usually, clutch size ranges from two to four eggs, but can range from one to eight eggs depending on prey abundance (Smith and Murphy 1978, as cited by Bechard and Schmutz 1995). Fledging typically occurs 38 to 50 days after hatching (Powers 1981, Konrad and Gilmer 1984, as cited by Bechard and Schmutz 1995).

Because the ferruginous hawk nests in a wide variety of habitats, nest location can be highly variable as well. Nests are constructed at ground level if elevated structures are not available to a height of greater than 65.6 feet (20 meters) (Bechard and Schmutz 1995). Nests are usually constructed from old sagebrush stems, sticks, twigs and debris (Bechard and Schmutz 1995).

Brood parasitism is not known to occur (Bechard and Schmutz 1995).

Diet

The primary foraging strategy of the ferruginous hawk involves four types of pursuit: 1) still hunting flight from a perch, 2) short-distance strikes originating from the ground, 3) aerial hunting, 4) hovering when wind will allow (Bechard and Schmutz 1995). Foraging is variable throughout the day and ranges from early morning to late afternoon (Smith and Murphy 1973, Wakeley 1974, McAnnis 1990, as cited by Bechard and Schmutz 1995). West of the continental divide prey consists of jackrabbits (*Lepus*) or cottontail (*Sylvilagus*) rabbits, while east of the divide ground squirrels and prairie dogs are the primary prey (Olendorff 1993, as cited by Bechard and Schmutz 1995).

Migration

Washington, Montana, North Dakota, Alberta, and Saskatchewan populations are migratory (Bechard and Schmutz 1995). Fall migration of these populations begins in August and continues through early October (Bechard and Schmutz 1995). Spring migration occurs from late February through early April (Lokemoen and Duebbert 1976, Bechard and Schmutz 1995).

1.6.9.6 Threats

Declines in ferruginous hawk populations are attributed to a number of factors, which include shooting, egg-collecting, collisions with stationary or moving objects or structures, disturbance at nest and roost sites and degradation of breeding and wintering habitat (Bechard and Schmutz 1995). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to habitat or range include habitat loss to agricultural development, invasion of exotic annual species into shrub and grasslands, and disturbance by humans during the breeding season (Dechant et al. 2001).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

This threat is not known to affect the ferruginous hawk.

Disease or Predation

This threat is not known to affect the ferruginous hawk.

The Inadequacy of Existing Regulatory Mechanisms

This threat is not known to affect the ferruginous hawk.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Poisoning of prey and accidental shooting may also be threats to the ferruginous hawk (Dechant et al. 2001).

1.6.9.7 Conservation

Bechard and Schmutz (1995) cite Olendorff (1993) as suggesting that management measures aimed at maintaining current population numbers should include enhancing nest substrates, maintaining prey populations and mitigating development impacts from mining, pipeline construction, and urbanization. Bechard and Schmutz (1995) also suggest that wildland protection or an agricultural production system largely based on ranching, if maintained in substantial portions of both the breeding and wintering ranges, are consistent with ferruginous hawk conservation.

1.6.9.8 Species Status

Rangewide

The ferruginous hawk can be found throughout the western U.S., from the western edge of the great plains west to Washington, Oregon, and California, and from southern Canada southward through central Mexico. Olendorff (1993), as cited by Bechard and Schmutz (1995) states that since 1990 an estimated 5,842 to 11,330 individuals are found in North America. Bechard and Schmutz (1995) indicate that the population is considered to be declining; however, there is no data available on percent or reason for decline. Studies by Olendorff (1993, as cited by Bechard and Schmutz 1995), indicate that from 1979 through 1992 populations remained stable in Arizona, Colorado, Idaho, Kansas, Montana, Nebraska, North and South Dakota, Texas, Washington, and Saskatchewan, with an increase of 50 percent or more in Oregon, Wyoming, Alberta, and Manitoba during the same time period. Olendorff (1993, as cited by Bechard and Schmutz 1995) indicates that declines in the past ten years (1983 through 1993) have been confirmed in northern Utah and eastern Nevada.

VRCMA Boundary

The status of the ferruginous hawk in the VRCMA Boundary is unknown. No occurrences have been recorded in the NNHP, UDWR, or AGFD databases (NNHP 2006, UDWR 2007, AGFD 2007d).

1.6.10 Flammulated Owl

Scientific Name: *Otus flammeolus*

1.6.10.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- BLM sensitive species (BLM 2003a).
- Classified as Protected under NAC 503.050 (Protected, Endangered and Sensitive Birds).
- Global heritage rank is G4 (NatureServe 2007).

- Nevada heritage rank is S4B (NatureServe 2007).
- Arizona heritage rank is S4 (NatureServe 2007).

1.6.10.2 General Description

This species is monotypic and sexually dimorphic; the female is larger than the male. This is the only small owl in North America with dark irises. The flammulated owl has small ear tufts and a gray-brown beak. Markings include a grayish white facial disk bounded by a cinnamon-colored band. This facial disk is divided by a V-shaped band of white feathers from the beak to the ear tufts. Plumage coloration of mottled gray and rusty colored shoulder spots camouflages the species amongst trees. In the southern portion of the breeding range, the species is red/brown, while in the northern portion, it is gray (AGFD 2005g).

1.6.10.3 Distribution

Historic Distribution

The known historic distribution of the flammulated owl is the same as its current distribution.

Current Distribution

This species breeds from southern British Columbia south to southern California, Arizona, New Mexico, Texas, and central Mexico. The flammulated owl winters from central Mexico south to the highlands of Guatemala and El Salvador. Infrequently, individuals overwinter in southern Arizona, New Mexico, and southern California (AGFD 2005g).

1.6.10.4 Habitat

This species is a neo-tropical migrant that is present in Nevada in summer; the breeding season is April through July (Arsenault 2002; GBBO 2005). Breeding occurs in the mid- to high coniferous forest areas that are comprised of ponderosa pine, white fir, and sometimes limber pine, in forest patches as small as 98.8 acres (40 hectares) (Arsenault 2002). Breeding often occurs in loose clusters of multiple pairs (GBBO 2005). The flammulated owl prefers nest cavities excavated by the northern flicker or other woodpeckers that excavate similarly large cavities in large snags (Arsenault 2002; GBBO 2005). Roost sites are found in dense tree canopies or thickets that provide shade and protection from predators (GBBO 2005; NatureServe 2007). Key habitat attributes include existing nest cavities, dense forested areas, and an abundance of large nocturnal insects. Based on mapped occurrences of the flammulated owl from a report by Arsenault (2002), the species shows a GIS-derived association with three vegetation series as classified through SWReGAP at elevations between 7,110 and 9,143 feet (2,167.1 and 2,786.8 meters). The proportion of the species' habitat by vegetation series includes: 48 percent in Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland, 29 percent in Great Basin Pinyon-Juniper Woodland, and 24 percent in Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland.

1.6.10.5 Life History

Reproductive Biology

The flammulated owl mates monogamously. It nests in tree cavities in or adjacent to mature or old-growth stands. It nests in abandoned pileated woodpecker or Northern flicker tree cavities, typically 15 to 40 feet (4.6 to 12.2 meters) high. Three to four eggs are laid per clutch between mid-April and July. Incubation lasts 21 to 22 days. Owlets are born altricial with their eyes closed. Young are tended by both sexes. Young fledge at 21 to 25 days, and are fed by adults for at least a week after fledging (Ashley and Stival 2004, as cited in AGFD 2005g). After four weeks, young flammulated owls are independent (AGFD 2005g).

Diet

The flammulated owl is entirely insectivorous, and forage on nocturnal insects, such as large moths, beetles, and crickets, in the coniferous forest (Arsenault 2002; GBBO 2005). Foraging primarily happens during dusk and dawn hours. Yellow pine and/or Douglas-fir forests are preferred foraging habitats (AGFD 2005g). Hawk-gleaning, hover-gleaning, drop-pounce, and hawking are the four known foraging tactics used by this species (Glinski 1998, as cited in AGFD 2005g).

Migration

This migratory bird winters from central Mexico south to the highlands of Guatemala and El Salvador. Some individuals overwinter in southern Arizona, New Mexico, and southern California, but this is rare (AGFD 2005g).

1.6.10.6 Threats Warranting Protection

Range-wide, populations are apparently most sensitive to variation in adult survival; this life history strategy makes populations vulnerable to environmental perturbation such as habitat loss and fragmentation, and slow to recover from population declines (NatureServe 2007). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats include loss of snags and trees for nest cavities because of fuel-reduction projects and safety considerations resulting in the removal of snags within a certain distance of camping areas, picnic sites, trailheads, and alongside trails. This species is most susceptible to disturbance during peak breeding season in June and July (NatureServe 2007), when recreation (dispersed camping, hiking, access to rock climbing sites) is on the increase. Reductions of any large primary cavity nesters on which the owl depends to create nesting cavities, such as flickers and other woodpeckers, within the forest community could result in reduced availability of nesting sites (NatureServe 2007).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

It is unknown if this is a threat to the flammulated owl.

Disease or Predation

It is unknown if this is a threat to the flammulated owl.

The Inadequacy of Existing Regulatory Mechanisms

It is unknown if this is a threat to the flammulated owl.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Insecticides may affect these owls. This species depends on other cavity nesters to excavate its cavities, so a loss of some of these species would affect reproduction (AGFD 2005g).

1.6.10.7 Conservation

There are no known conservation efforts for the flammulated owl (AGFD 2005g).

1.6.10.8 Species Status

Rangewide

Rangewide species status is not well understood.

VRCMA Boundary

The status of this species in the VRCMA Boundary is unknown. No occurrences of this species have been recorded within the VRCMA Boundary (NNHP 2006, AGFD 2007d).

1.6.11 Golden Eagle

Scientific Name: *Aquila chrysaetos*

1.6.11.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- BLM sensitive species in Nevada (BLM 2003a).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S4 (NatureServe 2007).
- Arizona heritage rank of S4 (NatureServe 2007).
- Bald and Golden Eagle Protection Act (Kochert et al. 2002).

1.6.11.2 General Description

The golden eagle is an extremely large raptor. It has a mostly brown plumage with a golden wash on the back of its head and neck (AGFD 2002b). The bill is black tipped, fading to gray at the base. Its tail is faintly banded with gray bars, and its eyes are dark brown (AGFD 2002b, Kochert et al. 2002). Its wings are long and rounded and it has slow powerful wing beats, which are often alternated with gliding or soaring. Feathers are located on the entire leg all the way down to their toes (AGFD 2002b). Adult plumage differs from the juvenile and subadult plumages. The juvenile plumage (zero to one year) is often distinguished from adults by a much darker (unfaded) color and by white at the base of the secondaries and inner primaries (Kochert et al. 2002).

1.6.11.3 Distribution

Historic Distribution

Historically, the golden eagle nested throughout most of North America; however, there are no breeding records from Iowa, Minnesota, or Indiana (Kochert et al. 2002).

Current Distribution

Breeding occurs mainly in western North America from Alaska south to central Mexico, with small numbers in eastern Canada and the eastern United States (Kochert et al. 2002). In Nevada, breeding has been confirmed in the northwestern portion of the state with possible breeding records in the southern portion (Floyd et al. 2007).

1.6.11.4 Habitat

The golden eagle breeds in open to semi-open habitats, including tundra, shrublands, grasslands, woodland-brushlands, and coniferous forests, from near sea level to 11,909 feet (3,630 meters) above sea level. They have also been found in farmland and riparian habitats, but tend to avoid heavily forested areas. In the western U.S., they are found primarily in the mountainous canyon land, rimrock terrain of open deserts, and grassland areas (Kochert et al. 2002).

The golden eagle primarily winters in humid temperate and dry ecoregions from southern Alaska and Canada to central Mexico. They have been known to frequent areas in western North America greater than 1,499 feet (457 meters) in elevation and winter up to 8,200 feet (2,500 meters). The golden eagle tends to be absent from harsh, dry areas with less than 7.9 inches (20 centimeters) annual precipitation, like the Sonoran Desert and central Nevada. Across much of the western U.S., they prefer open habitats with native vegetation including sagebrush communities, riparian areas, grasslands, and rolling oak savanna. They typically avoid urban, agricultural, and forested areas (Kochert et al. 2002).

1.6.11.5 Life History

Reproductive Biology

In temperate areas where pairs remain on the nesting territory year-round, new pairs will form throughout the year. Otherwise, pair formation begins upon return to the nesting grounds. The golden eagle has only one brood per season, but is known to nest again if the first nest fails. Nests are usually built on cliffs, but they can also be located in trees, on the ground, and on human-made structures, including windmills, observation towers, and nesting platforms (Kochert et al. 2002). On average, one to three eggs are laid, which incubate for 41 to 45 days. Hatchlings will remain in the nest for about 45 days, being fed by both parents. Young will fledge the nest between 45 and 81 days, while still being fed by their parents. Independence occurs somewhere between 75 and 85 days after fledging (Kochert et al. 2002).

Diet

The golden eagle typically forages in open habitats (grasslands or steppe-like vegetation), by either soaring, still-hunting from a perch, or low contouring flight. The main prey items taken include small to medium-sized mammals: hares (*Lepus* spp.) and rabbits (*Sylvilagus* spp.), ground squirrels (*Spermophilus* spp.), prairie dogs (*Cynomys* spp.), and marmots (*Marmota* spp.). Rarely do golden eagles feed on birds (Gallinaceous birds), reptiles, or fish (Kochert et al. 2002).

Migration

The golden eagle is considered short- to medium-distance partial migrants. Individuals from northern breeding areas (greater than 55°N) are usually migratory and will migrate longer distances than individuals nesting farther south (Kochert et al. 2002).

1.6.11.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Many of the fires since 1980 have caused large-scale losses of shrubs and jackrabbit habitat in a number of the areas used by golden eagles throughout the Intermountain West, which has adversely affected the nesting populations in portions of the eagle’s range (Kochert et al. 2002).

Mining and various types of energy developments occurring in eagle nesting and wintering habitat have the potential to affect the eagles. For example, surface coal mines threaten the already limited nesting sites available and mine high walls, which provide new nesting habitat for the eagles, are being eliminated because of reclamation laws (Kochert et al. 2002).

Urbanization and human-population growth have made areas historically used by eagles unsuitable, while extensive agricultural development has reduced jackrabbit populations and made areas less suitable for nesting and wintering eagles (Kochert et al. 2002).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Recreation and other human activity near nests can cause breeding failure, but most evidence is anecdotal or correlative. However, climbers have been known to kill eggs/young when they: 1) spend too much time at nest and cause parents to abandon eggs or young, 2) keep parents off the nest long enough to subject eggs or young to overheating or cooling, 3) flush an adult, who kicks an egg or young out of nest; 4) cause a nest to collapse, or 5) cause young to fledge prematurely (Kochert et al. 2002).

Disease or Predation

Human predation has affected the golden eagle population. The golden eagle was traditionally shot in parts of North America where they were suspected of killing domestic sheep. Unregulated aerial hunting of eagles began in California as early as 1936, with greater than 200 killed that winter. It is estimated that from 1941 to 1961, 20,000 eagles may have been shot from airplanes in southwestern states. Illegal shooting continues to occur; however, there is no information on recent trends or levels (Kochert et al. 2002). Birds have also been incidentally trapped and poisoned throughout western North America in an attempt to bait and kill mammalian carnivores.

Native Americans have harvested young golden eagles for religious purposes in southwestern states for many years. Members of the Hopi tribe will remove nestlings from nests in April, raise them in captivity, and sacrifice them when they become fully feathered in July. The U.S. Fish and Wildlife Service issued a permit in 1986 to the Hopi to legally conduct these activities (Kochert et al. 2002).

The Inadequacy of Existing Regulatory Mechanisms

This activity was not listed as a threat currently affecting this species.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Humans, indirectly or directly, cause more than 70 percent of the recorded golden eagle deaths. Accidental trauma (collisions with vehicles, power lines, or other structures) is the leading cause of death (27 percent), followed by electrocution (25 percent), gunshot (15 percent), and poisoning (six percent) (Kochert et al. 2002).

An additional factor affecting this species includes the ingestion of lead. Eagles have been known to suffer from lead poisoning as a result of consuming prey with high lead levels. Sources of lead have not been definitively documented; but it is likely that ammunition in hunter-killed upland game birds and mammals, particularly deer and ground squirrels as the source, with waterfowl as a secondary source. It is believed that chronic subclinical lead exposure may weaken eagles, predisposing them to injury, predation, starvation, disease, or reproductive failure. Mortality from ingested shot and bullet fragments occurs occasionally (Kochert et al. 2002).

A number of birds every year are killed by collisions with cars, fences, wires, and wind turbines. Nearly 1,000 were killed on highways near Rock Springs, Wyoming, in the winter of 1984 to 1985. These birds are also vulnerable to electrocution when landing on power poles, with the less-adept immature eagles being the most susceptible. Risk increases when inclement weather hampers flight or when wet feathers increase conductivity. From 1986 to 1996, greater than 272 electrocution deaths occurred in western North America, with 3-phase and single-phase transformers causing most electrocutions (Kochert et al. 2002).

1.6.11.7 Conservation

Adults, young, eggs, and nests have been protected since 1962 in the U.S. by the Bald and Golden Eagle Protection Act. In addition, federal regulations were implemented which outlawed use of aircraft to kill eagles in the U.S. in the fall of 1962. The Migratory Bird Treaty Act also protects eagles in Canada, Mexico, and the U.S. (Kochert et al. 2002).

Biologists, engineers, and government officials have cooperated in developing and publicizing power-pole designs that reduce raptor electrocutions.

Hacking techniques have been used to establish or re-establish populations in parts of the range. Hacking involves placing six- to eight-week-old nestlings in artificial cages. Humans then care for the young until they are 12 weeks old, at which point the cage is opened and birds are allowed to leave and begin feeding themselves. Fledglings continue to be fed at hack sites for four to six weeks until young achieve independence (Kochert et al. 2002).

The golden eagle is occasionally responsible for losses of young domestic sheep in several western states during lambing season, particularly in cool, wet springs when rabbit populations are low. Federal programs have been developed that assist livestock operators by trapping and relocating eagles suspected of killing livestock (Kochert et al. 2002).

1.6.11.8 Species Status

Rangewide

Rangewide the golden eagle populations are secure and considered not at risk (NatureServe 2007).

VRCMA Boundary

The status of the golden eagle within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6.12 Gray Vireo

Scientific Name: *Vireo vicinior*

1.6.12.1 Protection Warranted

Endangered Species Act

- Not listed, proposed, or a candidate for listing as threatened or endangered under the Endangered Species Act of 1973, as amended.

Other Protections

- Evaluation species (Medium Priority) for the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- Classified as Protected and Endangered under NAC 503.050 (Protected, Endangered and Sensitive Birds).
- BLM sensitive species in Nevada (NNHP 2004).
- Global heritage rank of G4 (NatureServe 2007).
- Nevada heritage rank of S3B (NatureServe 2007).
- Arizona heritage rank of S4 (NatureServe 2007).

1.6.12.2 General Description

The gray vireo is overall drab and gray with pale underparts. This species is distinct from other North American vireos in having a thin, white eye-ring and a faint wing bar. Sexes have identical plumage characteristics, but males may be slightly larger. The total length ranges from 5.1 to 5.9 inches (13 to 15 centimeters), and its wingspan is 8.3 inches (21 centimeters). The weight of the gray vireo is between 0.4 to 0.5 ounce (12 to 15 grams) (Cornell Lab of Ornithology 2003d).

The gray vireo song is broken into burry two- or three-syllable phrases. Its call is a rapid, buzzy “eh-eh-eh-eh-eh ” (Cornell Lab of Ornithology 2003d).

1.6.12.3 Distribution

Historic Distribution

The historic distribution of the gray vireo extended across the desert southwest of the United States and into northern Mexico, from southern California east to western Texas and from Utah and Colorado south into mainland and Baja Mexico (NatureServe 2007).

Current Distribution

The current distribution is the same as the historic distribution (NatureServe 2007).

1.6.12.4 Habitat

The gray vireo breeds primarily in hot, semi-arid, shrubby habitats, especially mesquite and brushy pinyon-juniper woodlands. Chaparral, desert scrub, thorn scrub, oak-juniper woodland and juniper-cholla habitats are used as well. In southern Nevada, vireos occur in pinyon, juniper and sagebrush with the addition of mountain-mahogany, Gambel oak, Mexican manzanita, squaw-apple, and cliffrose (WAPT 2006).

1.6.12.5 Life History

Reproductive Biology

The adult gray vireo arrives on breeding territories in March and April (NatureServe 2007). A cup nest is built and suspended from a forked twig in a shrub or tree 1.6 to 6.6 feet (0.5 to two meters) tall. The nest is usually located 1.6 to 11.5 feet (0.5 to 3.5 meters) above ground. Clutch size ranges from three to five eggs. Both sexes incubate and tend young. Incubation takes 13 to 14 days and young fledge in 13 to 14 days (NatureServe 2007).

Diet

When breeding, vireos feed on insects (e.g., *Orthoptera*, *Coleoptera*) gleaned from trees and shrubs. They will sometimes scratch on the ground like a towhee. In winter in the coastal desert of Sonora, Mexico, they feed largely on the fruit of the elephant tree (*Busera microphylla*) from September through April. Insects are also represented in the species' diet (NatureServe 2007).

Migration

The winter range closely overlaps the range of elephant trees throughout the coastal deserts surrounding the Gulf of California. A single disjunct wintering population occurs outside the range of elephant trees in the Chisos Mountains, Big Bend National Park, Texas (NatureServe 2007).

1.6.12.6 Threats Warranting Protection

Loss of habitat to urban development and cowbird brood parasitism are threats to gray vireos (WAPT 2006). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Primary threats to the gray vireo within the VRCMA Boundary include habitat modification and degradation, wildfire, and broad-scale pinyon-juniper control. Habitat fragmentation, which creates more edge habitat, may increase the likelihood of brood parasitism by brown-headed cowbirds (*Molothrus ater*) (Evans and Gates 1997).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

These factors are not known to be a significant threat to this species.

Disease or Predation

The gray vireo is subject to frequent brood parasitism by brown-headed cowbirds, which can result in the loss of eggs or young (Zeiner 1990). Predators of the gray vireo are not well known. Raptors that specialize on birds, such as the sharp-shinned hawk (*Accipiter striatus*) and Cooper's hawk (*Accipiter cooperii*), are potential predators. Domestic and feral cats may potentially predate on this species. Snakes and small mammals may take young or eggs from nests as well (Zeiner 1990).

The Inadequacy of Existing Regulatory Mechanisms

This species is not listed as a threatened or endangered species list under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Vireos may have a dependency on elephant tree for food in their winter range (NatureServe 2007). Substantial losses of this plant may be detrimental to gray vireo survivorship in winter. Threats in the winter range of gray vireo are not well known.

1.6.12.7 Conservation

The gray vireo is monitored by the Nevada All Bird Count. The Nevada Partners in Flight Plan and Partners in Flight North American Landbird Conservation Plan address this species. The gray vireo is also covered in the Clark County MSHCP, which includes conservation actions to offset effects from covered activities (RECON 2000).

1.6.12.8 Species Status

Rangewide

Gray vireo is declining throughout its range, with the possible exception of Nevada (Zeiner 1990, WAPT 2006, NatureServe 2007). Cowbird parasitism is potentially a significant factor in the decline of this species (Zeiner 1990).

VRCMA Boundary

The status of the gray vireo within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6.13 LeConte's Thrasher

Scientific Name: *Toxostoma lecontei*

1.6.13.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Evaluation species (Medium Priority) for the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- Classified as Protected and Endangered under NAC 503.050 (Protected, Endangered and Sensitive Birds).
- BLM sensitive species in Nevada and California (NNHP 2004).

- Global heritage rank of G3 (NatureServe 2007).
- Nevada heritage rank of S2 (NatureServe 2007).
- Arizona heritage rank of S3 (NatureServe 2007).

1.6.13.2 General Description

Le Conte's thrasher in adult plumage are a very pale gray-brown, with a slightly contrasting darker tail. Undertail coverts are buff-colored. The eye is dark. Like most thrashers, the Le Conte's thrasher has a long, sickle-shaped bill and long tail. Sexes are similar (Peterson 1990). Juvenile birds are paler than adults, with paler undertail coverts (Cornell 2003). Total length is between 9.8 to 11 inches (25 to 28 centimeters) (Peterson 1990). Weight ranges between 1.9 and 2.7 ounces (55 and 76 grams) (Cornell Lab of Ornithology 2003e).

Its song is a long series of warbled, variable phrases, with many slurred notes. Its call is two-noted, with the second higher in pitch (Cornell Lab of Ornithology 2003e).

1.6.13.3 Distribution

Historic Distribution

The Le Conte's Thrasher occurs in California, Nevada, Arizona and south into western Mexico (NatureServe 2007).

Current Distribution

The current distribution is the same as the historic distribution (NatureServe 2007).

1.6.13.4 Habitat

Desert scrub, particularly creosote bush (*Larrea tridentata*) associations, saltbush (*Atriplex* spp), and cholla (*Opuntia* spp.), are favored habitat for the Le Conte's thrasher. In Nevada, this species seems particularly associated with saltbush flats and wash systems (WAPT 2006).

1.6.13.5 Life History

Reproductive Biology

The breeding season extends from late January into early June, with a peak from mid-March to mid-April. Clutch size ranges from two to four eggs (usually three)..The Le Conte's thrasher frequently attempts two or three broods per year. Incubation lasts 14 to 20 days; fledging begins at 14 to 18 days (Zeiner 1990). It nests in cholla cactus, sagebrush, small trees, or shrubs. Nests are usually built two to 11.5 feet (0.5 to 3.5 meters) above the ground. Eggs are laid between February and June. Both sexes incubate eggs, and young are tended by both adults (WAPT 2006).

Diet

The Le Conte's thrasher feeds on a variety of insects and other terrestrial arthropods, as well as occasionally on seeds, small lizards, and other small vertebrates (Zeiner 1990).

Migration

The Le Conte's thrasher is a sedentary species (Zeiner 1990).

1.6.13.6 Threats Warranting Protection

This species is vulnerable to habitat modification and degradation. A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Le Conte's thrasher is threatened by habitat modification and degradation. Development of agricultural areas and housing removes suitable habitat. Fragile habitat is easily altered by vehicular (OHV, etc.) traffic or by the addition of water (e.g., irrigated fills, golf courses, lawns) (WAPT 2006, NatureServe 2007). Grazing by livestock can cause habitat loss as well. Cats and dogs from housing developments can cause disturbance (NatureServe 2007).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

These factors are not a significant threat to this species.

Disease or Predation

Little information is available on disease and predation of the Le Conte's thrasher.

The Inadequacy of Existing Regulatory Mechanisms

This species has not been included on the threatened and endangered species list under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Distribution of Le Conte's thrasher is patchy. It is vulnerable to local extirpation as they are mostly sedentary and have a large home range requirement (Zeiner 1990). The Le Conte's thrasher is particularly susceptible to disturbance by humans as well (Zeiner 1990).

1.6.13.7 Conservation

The Nevada All Bird Count captures this species. It is addressed in the Nevada Partners in Flight Plan and Partners in Flight North American Landbird Conservation Plan (WAPT 2006). The Le Conte's thrasher is covered in the Clark County MSHCP, which includes conservation actions to offset effects from covered activities (RECON 2000).

1.6.13.8 Species Status

Rangewide

Le Conte's thrasher populations seem to be stable, although some historic locations are no longer occupied. The San Joaquin Valley population, in southern California, is known to be declining (NatureServe 2007).

VRCMA Boundary

The status of the Le Conte's thrasher within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6.14 Loggerhead Shrike

Scientific Name: *Lanius ludovicianus*

1.6.14.1 Protection Warranted

Endangered Species Act

- Not listed, proposed, or a candidate for listing as threatened or endangered under the Endangered Species Act of 1973, as amended.

Other Protections

- Evaluation species (Low Priority) for the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- Classified as Protected and Endangered under NAC 503.050 (Protected, Endangered and Sensitive Birds).
- Protected under NRS 501.
- BLM sensitive species in Nevada and Arizona (BLM 2003a).
- Global heritage rank of G4 (NatureServe 2007).
- Nevada and Arizona heritage rank of S4 (NatureServe 2007).

1.6.14.2 General Description

The loggerhead shrike is unique among passerines in that they often prey on birds, rodents and lizards. The black bill is long, thick and hooked. A black "mask" covers the eyes and auriculars. Underparts are grayish to white. The back is gray; wings and tail are black and white. Plumage of adults is similar between sexes year-round. Juveniles are browner with fine barring on the underparts and back. Overall length is 10 inches (25.4 centimeters), wingspan is 14.5 inches (36.8 centimeters), and average weight is 65 grams (165.1 centimeters) (Sibley 2000).

The song consists of sharp, two-syllable "krr-di" phrases given repeatedly. Calls include a harsh, scolding "jaaa" and a grating "teeen raad raad raad" (Sibley 2000).

1.6.14.3 Distribution

Historic Distribution

The loggerhead shrike is found throughout much of the United States, north into central Canada and south to southern Mexico. They are considerably less abundant east of the Great Lakes and north of North Carolina (NatureServe 2007).

Current Distribution

The loggerhead shrike has declined in many areas of their eastern range and has been extirpated or is listed as critically imperiled in many northeastern states (NatureServe 2007). It has been declining in North America since the 1960s. Decline has been recorded in all regions of the country, even those areas with great amounts of habitat (AGFD 2004c).

1.6.14.4 Habitat

The loggerhead shrike is found in open country with scattered trees and shrubs, savanna, grasslands, agricultural areas, wetlands, desert scrub and occasionally open woodland (AGFD 2004c, NatureServe 2007). Hunting perches are an important component to habitat (NatureServe 2007).

1.6.14.5 Life History

Reproductive Biology

During courtship, the male feeds the female and performs a flight display. Mock pursuits also occur. Shrikes nest in open areas in forests or in open country. They may nest in hedgerows or trees. The nest is bulky, cup-shaped, and made of twigs lined with rootlets, grasses, string, feathers, or deer hair. Nests are typically located at a height of eight to 15 feet (2.4 to 4.6 meters) above ground. Both males and females select the site and gather materials, but the female constructs the nest. The clutch size ranges from four to seven eggs that are dull white to light gray or buff and spotted. Incubation is typically performed by the female although males have also been known to incubate on rare occasions. The incubation period lasts 14 to 16 days, and most often two broods are produced per season. Both adults tend the young, which reach independence in about 36 days (AGFD 2004c).

Diet

Shrikes are unique in being predatory songbirds. They are known to prey on other songbirds, small rodents, lizards, frogs and insects (NatureServe 2007). Prey may be impaled on thorns of plants or barbed wire for later consumption.

Migration

The loggerhead shrike is present year-round in the southern United States (Sibley 2000), although this does not mean these are non-migratory individuals. In the northern areas of their range, shrikes breed but migrate south in winter. In Arizona, shrikes are present throughout the year (AGFD 2004c).

1.6.14.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to the loggerhead shrike include habitat modification and degradation, and poisoning from pesticides used in agricultural areas. Fire exclusion, habitat loss, and dependency on edge habitat, which increases predation pressure, have also been implicated as threats to the species (AGFD 2004c).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

These factors are not a significant threat to this species.

Disease or Predation

Suspected nest and fledgling predators in the northeastern North America include black rat snake (*Elaphe obsoleta*), blue jay (*Cyanocitta cristata*), sharp-shinned hawk (*Accipiter striatus*), domestic cat (*Felis silvestris catus*), and house wren (*Troglodytes aedon*). Brood parasitism by brown-headed cowbirds is not thought to be common with this species (NatureServe 2007).

The Inadequacy of Existing Regulatory Mechanisms

This species is not listed as a threatened or endangered species list under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

The loggerhead shrike, being high on the food chain, is particularly subject to pesticide poisoning through bio-accumulation (AGFD 2004c). Shrikes often forage along roadways and are vulnerable to collisions with vehicles (NatureServe 2007).

1.6.14.7 Conservation

No known monitoring programs exist for the loggerhead shrike. The loggerhead shrike is an Evaluation species of low priority in the Clark County MSHCP, which includes conservation actions to offset effects from covered activities (RECON 2000).

1.6.14.8 Species Status

Rangewide

Declines in loggerhead shrike populations have been noted throughout their range in the United States, particularly in the northeast. Reasons for this decline are not well understood, as suitable habitat is plentiful throughout much of their range (NatureServe 2007).

VRCMA Boundary

The status of the loggerhead shrike within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6.15 Long-eared Owl

Scientific Name: *Asio otus*

1.6.15.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- BLM sensitive species in Nevada (BLM 2003a).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S4 (NatureServe 2007).
- Arizona heritage rank of S2B, S3S4N (NatureServe 2007).

1.6.15.2 General Description

The long-eared owl is a medium sized owl. The total length is 13.8 to 14.8 inches (35 to 37.5 centimeters) for males and 14.6 to 15.7 inches (37 to 40 centimeters) for females. Their legs and toes are densely feathered and they have a large round head with conspicuous “ear” tufts (not visible in flight). They have yellow to golden yellow eyes and wings that are long and rounded with ten functional primaries (Marks et al. 1994). The back of the owl is a mix of black, brown, gray, buff, and white. They also have a buff patch on the upper wing just distal to the bend of the wing. Their facial disk is buff with white “eyebrows” and white patch below the bill. Both their lores and bill are black. Males in general tend to be paler than females, especially their facial disk, tarsi, and underwing coverts. Overall, female plumage tends to have more dark brown and richer buff (Marks et al. 1994).

1.6.15.3 Distribution

Historic Distribution

There are little data available on their historical distribution; however, a comparison of the current breeding distribution compared to eggs collected from 1889 to 1961 reveals a substantial area of extirpation along the coastal areas of southern California (Marks et al. 1994).

Current Distribution

Their current breeding distribution ranges from southeastern Yukon, northeastern British Columbia, and northern Alberta across central Canada to the Maritime Provinces; south to northern Baja California, southern Arizona, southern New Mexico,; and east to Pennsylvania, New York, and northern New England, as well as down the Appalachian Mountains to Virginia. Their wintering distribution encompasses their breeding localities, excluding the northernmost areas of the breeding range (Marks et al. 1994).

1.6.15.4 Habitat

The long-eared owl inhabits dense vegetation adjacent to grasslands or shrublands, as well as open forests from near sea level to greater than 6,562 feet (2,000 meters). Nesting occurs in dense or brushy vegetation intermixed with open habitats in California, Arizona, Nevada, and Utah, as well as other states in the western U.S. (Marks et al. 1994).

This habitat is similar to its breeding habitat with many of the same tree groves used for both wintering and breeding. In the western U.S., the long-eared owl forms communal roosts in dense willow thickets and groves of salt cedar (*Tamarix* spp.), palo verde (*Cercidium floridum*), and conifers. Roost groves are typically adjacent to open habitats used for foraging (Marks et al. 1994).

1.6.15.5 Life History

Reproductive Biology

The actual time of pair formation is unknown, but is thought to begin at communal roosts from January through March. Typically, there is only one brood per year, laid from mid-March to mid-May. However, a second brood may be laid if the first one is lost. The long-eared owl does not build a nest; they use a stick nest built by another species of bird, such as ravens and coopers hawks (Marks et al 1994). Incubation is performed solely by the female. Incubation lasts 26 to 28 days, after which nestlings will be fed by the male before they fledge at 21 days after hatching (still being fed by the male), and become fully independent at 9.5 to 11 weeks (Marks et al 1994).

Diet

This species is a typical nocturnal hunter, but may begin hunting before sunset during brood-rearing. The long-eared owl hunts below the canopy in open forests with most food captured on the ground or from low vegetation. The main type of food taken includes small mammals and sometimes birds. The owls often kill small mammals by biting the back of the skull and then swallowing the prey whole (Marks et al. 1994).

Migration

The migratory nature of the long-eared owl is poorly understood. In northern Europe, a nomadic response to fluctuating prey numbers has been well documented, but this has not been documented in North America. Spring and fall movements observed in the appropriate directions in various U.S. locations suggest a regular migration for the owl (Marks et al. 1994).

1.6.15.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

The continued loss of riparian woodlands and isolated tree groves could be highly detrimental to long-eared owls, especially in the arid West, where much of its nesting habitat occurs in narrow bands along watercourses (Marks et al. 1994).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Recreation and other human activity near nests can cause breeding failures. It has also been noted that branchers and fledgers are sometimes killed or taken by humans near recreation areas (Marks et al. 1994).

Disease or Predation

This activity is not listed as a threat currently affecting this species.

The Inadequacy of Existing Regulatory Mechanisms

This activity is not listed as a threat currently affecting this species.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Hunters have been known to accidentally shoot and kill these owls while hunting, but the problem is not large enough to influence the population numbers (Marks et al. 1994).

1.6.15.7 Conservation

In the west, maintenance of healthy riparian stands in long-eared owl ranges would undoubtedly be beneficial (Marks et al. 1994). It has been observed that plantings in desert environments and around ranches have proven to be acceptable nesting habitat (Floyd et al. 2007).

1.6.15.8 Species Status

Rangewide

Rangewide, long-eared owl populations are considered secure due to their extensive range (NatureServe 2007).

VRCMA Boundary

The status of the long-eared owl within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6.16 <u>Lucy's Warbler</u>

Scientific Name: *Vermivora luciae*

1.6.16.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Watch list for NNHP (NNHP 2004).
- Global heritage rank of G5 (NatureServe 2007).
- Arizona heritage rank of S5 (NatureServe 2007).
- Nevada heritage rank of S2S3B (NatureServe 2007).
- California Species of Concern List 2003 (Otahal 2006).
- United States Fish and Wildlife Service Migratory Non-game Birds of Management Concern list 1995 (Otahal 2006).
- Partners in Flight Watch List (Otahal 2006).
- Audubon Watch List (2002) (Otahal 2006).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).

1.6.16.2 General Description

The Lucy's warbler is a small, active, insectivorous bird. It has a thin, pointed bill and dark legs. Its plumage ranges from a whitish to pale gray underparts, with plain gray wings and rusty uppertail coverts. The average length of both male and female is 4.3 inches (11 centimeters), and the average weight is approximately 0.2 ounce (7 grams) (NatureServe 2007). The male has a small rusty patch on its crown. The female and immature are similar to the male, but are somewhat paler and may have some buff on its underparts (Otahal 2006).

1.6.16.3 Distribution

Historic Distribution

According to the California Partners in Flight Desert Bird Conservation Plan, in the 1940's Lucy's warblers occurred occasionally in the Imperial and Coachella valleys in California, where they may have bred formerly (Otahal 2006). Lucy's warbler may be expanding its range in some areas. Populations appear to be moving toward the Colorado River in the Grand Canyon, Arizona (Otahal 2006). Lucy's warbler appears to have occupied its present range in New Mexico only since the 1920's (Hubbard 1978, Dunn and Garrett 1997, as cited in Otahal 2006). Lucy's warbler colonized San Diego County, California in 1900, but is still rare (a few dozen pairs or less). It is confirmed nesting at only one site: the mesquite bosques in the center of Borrego Valley, California (Unitt 2004, as cited in Otahal 2006).

Current Distribution

Lucy's warblers breed in the southwestern United States, mainly from southeastern California, southern Nevada, and Utah south to southern Arizona, northern Mexico, and western Texas (Otahal 2006). In California, this species breeds along the lower Colorado River (Otahal 2006). Lucy's warbler may also breed in Chihuahua, Mexico, adjacent to the Rio Grande Valley of western Texas (NGS 1987, as cited in Otahal 2006). Lucy's warbler winters mainly in a narrow band along the Pacific Slope and adjacent interior of Mexico from southern Sonora and northern Jalisco south to Gurerrero (Johnson et al. 1997, as cited in Otahal 2006) and in smaller numbers to Oaxaca (Bent 1953, as cited in Otahal 2006).

1.6.16.4 Habitat

The Lucy's warbler is classified as a generalist, but its preferred habitat is dense mesquite (Latta et al. 1999). Lucy's warbler will also use salt cedar, screwbean mesquite and cottonwood willow (non-gallery) (Rosenberg et al. 1991, as cited in Latta et al. 1999).Lucy's warbler prefers to breed in deserts, mesquite along streams, and riparian woodlands (willows and cottonwoods) (NatureServe 2007). This species prefers to nest in tree cavities, behind bark, in abandoned woodpecker holes, or in verdin nests (NatureServe 2007).

1.6.16.5 Life History

Reproductive Biology

The Lucy's warbler appears to be monogamous (Otahal 2006). This species clutch is between four and five, and it lays its eggs in a period of approximately four days (Otahal 2006). The female has been observed doing most of the work of nest building (NatureServe 2007). Lucy's warblers possibly have two broods per season (BLM No Date, as cited in NatureServe 2007). Incubation is poorly documented for the Lucy's warbler. Incubation is carried out by the female, possibly with the help of the male (Baicich and Harrison 1997, as cited in Otahal 2006), but the role of the male is not well documented. The incubation period is also unknown, but is estimated at 12 days (Otahal 2006). The female may desert the nest if disturbed. Recent ABBA information recorded fledging dates for the Lucy's warbler between May 13 and August 15 (ABBA, unpubl. data, as cited in Latta et al. 1999).

Diet

The diet of the Lucy's warbler consists mainly of insects, and the species of insect varies with the season (Otahal 2006). This species feeds on a variety of arthropods including spiders, true bugs, leafhoppers, beetles, flies, moth larvae, wasps, biting lice, and thrips (Otahal 2006). The Lucy's warbler is known to forage in foliage and flowers, in mesquite, and other desert vegetation (NatureServe 2007).

Migration

Spring migration is not well understood since this species is rarely encountered in spring away from breeding and wintering grounds (Dunn and Garrett 1997, as cited in Otahal 2006). Otahal (2007) states that the warbler arrives on breeding grounds earlier than most migrant species, beginning about 10 March on the lower Colorado River to about 20-25 March in northern breeding localities. This species arrives abruptly, in numbers, on the breeding grounds, with males arriving before females (Coues 1878, as cited in Otahal 2006). Lucy's warblers begin dispersing away from breeding localities by late July or early August, with most birds having migrated by early September (Dunn and Garrett 1997, as cited in Otahal 2006). This species is an annual fall migrant to coastal California, especially from Santa Barbara County south, with most records being from late August to early November (Dunn and Garrett 1997, as cited in Otahal 2006).

1.6.16.6 Threats Warranting Protection

Primary threats to the Lucy's warbler include habitat degradation from overgrazing as well as human influences; brood parasitism is also a concern (Otahal 2006). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

The destruction of riparian mesquite by urban development is a threat (Audubon Watch List 2007). Also, since the Lucy's warbler also breeds in cottonwood and willow, degradation and destruction of southwestern riparian habitats has had a heavy impact on this species (Otahal 2006).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Overgrazing on mesquite scrub may also negatively affect the species (Audubon Watch List 2007).

Disease or Predation

Brood parasitism is a concern for Lucy's warbler (Audubon Watch List 2007).

The Inadequacy of Existing Regulatory Mechanisms

The Lucy's warbler is not protected at the state or federal level, beyond the Migratory Bird Treaty Act.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other factors are unknown for this species.

1.6.16.7 Conservation

No direct management actions specifically targeting this warbler have been taken, but generalized riparian restoration efforts should eventually benefit this species (Otahal 2006).

1.6.16.8 Species Status

Rangewide

As a result of habitat loss throughout the breeding range, Lucy's warbler populations are diminishing (Audubon Watch List 2007).

VRCMA Boundary

The status of the Lucy's warbler within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6.17 Northern Goshawk

Scientific Name: *Accipiter gentilis*

1.6.17.1 Protection Warranted

Endangered Species Act

Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- Conservation Agreement species in Utah (UDWR 2006a).
- Global heritage rank is G5 (NatureServe 2007).
- Nevada heritage rank is S2 (NatureServe 2007).
- Arizona heritage rank is S3 (NatureServe 2007).

1.6.17.2 General Description

The northern goshawk is the largest accipiter in the United States. Female goshawks are larger than males; they average 2.4 pounds (110 grams) while males average 1.9 pounds (0.9 kilogram). Adult lengths range from 18.7 to 23.6 inches (47.5 to 60 centimeters) and the wingspan ranges from 38.0 to 46.1 inches (96.5 to 117.0 centimeters). The goshawk, like other accipiters, has short wings and a long tail. Markings include a conspicuous light eyebrow, flaring behind the eye, and a black crown against a variably gray back. Underparts are white with fine gray barring, which can appear gray at a distance. Under-tail coverts are conspicuously fluffy, and the tail is gray with black bars (AGFD 2003b).

The juvenile goshawk is brown above, buffy below and has blurry streaks along its breast and flanks. Under-tail coverts have dark streaks and the tail has wavy dark bands bordered with white, and a thin white tip. A light-colored eyebrow stripe is present on the juvenile, which can be confused with the Cooper's hawk juvenile (AGFD 2003b).

1.6.17.3 Distribution

Historic Distribution

The historic distribution of this species is unknown.

Current Distribution

The northern goshawk is found from western and central Alaska south through Canada to central California, southern Arizona, the eastern foothills of the Rockies, to central Michigan, Pennsylvania, northwestern Connecticut, and the Appalachians south to West Virginia and Maryland (NatureServe 2007).

1.6.17.4 Habitat

Rangewide, the northern goshawk occurs in forested habitats including true fir, mixed conifer, lodgepole pine, ponderosa pine, Jeffrey pine, montane riparian deciduous forest, and Douglas-fir (Morrison 2005). Home ranges often consist of a wide range of forest age classes and conditions, but nest sites are associated with patches of relatively larger, denser forest than the surrounding landscape (Morrison 2005). Nests are constructed in very large trees with sturdy branches in the lower part of the canopy and typically occur in mature or old-growth forests with high canopy closure and sparse groundcover, near water, meadow habitat, or forest openings (GBBO 2005; NatureServe 2007).

The northern goshawk is distributed throughout the Great Basin in Nevada, and primary habitats used are aspen and montane riparian (GBBO 2005). The goshawk is present in Nevada year-round (GBBO 2005). A key habitat attribute is a wide range of forest age classes, with old-growth forests for nesting and younger forests for hunting. Based on mapped occurrences of the northern goshawk by the Great Basin Bird Observatory, the species shows a GIS-derived association with nine vegetation series as classified through SWReGAP at elevations between 7,204 and 9,092 feet (2,195.8 and 2,771.2 meters). The proportion of the species' habitat by vegetation series includes: 48 percent in Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland, 31 percent in Great Basin Pinyon-Juniper Woodland, 11 percent in Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland, and small percentages within other vegetation associations.

1.6.17.5 Life History

Reproductive Biology

Reproductive maturity occurs at two years. Eggs may be laid earlier, but they are generally infertile. Lifelong pair bonds are formed at sexual maturity. Nesting pairs have a strong site fidelity; they may attempt renesting at a site for one to five years after it has been logged, even with low reproductive success (AGFD 2003b).

Nests are constructed in March; breeding activity commences around mid-April. Eggs are typically laid by late April. Up to eight alternate nests can be maintained by a pair in a nest area. Nests are usually built in the lower one-third of trees, or just below the forest canopy. Nest heights range from eight to 140 feet (2.4 to 42.7 meters) above the ground (NatureServe 2007). Usually two to four pale, bluish-white eggs are laid. Incubation is principally performed by the female and takes 28 to 38 days. It is primarily the female that broods and feeds nestlings; the male brings food to the nest. Fledglings begin flying at 35 to 42 days and become independent at about 70 days (AGFD 2003b).

Diet

The northern goshawk preys on birds such as the American robin, mourning doves, woodpeckers, sapsuckers, and jays, as well as small to medium-sized mammals (e.g., squirrels, chipmunks, cottontails) (GBBO 2005). Other birds it preys upon include band-tailed pigeons, Stellar's jays, and northern flickers (Snyder and Snyder 1991, as cited in AGFD 2003b). Mammalian prey include tree squirrels, rock squirrels, and cottontails (AGFD 2003b). The northern goshawk alternates foraging on short flights and searching for prey from a perch. It hunts by flying along forest edges, across openings, and through dense vegetation.

Migration

Southern populations of the northern goshawk are believed to be sedentary, while northern populations are irruptive migrants (Hawk Mountain 2007).

1.6.17.6 Threats Warranting Protection

Main threats to the northern goshawk include habitat loss and illegal shooting, trapping, and poisoning (Hawk Mountain 2007). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats on breeding populations include timber harvest, as well as the deterioration or loss of nesting habitat due to fire suppression, grazing, and insect and tree disease outbreaks (NatureServe 2007). Groundwater depletion, springhead use, livestock management, habitat conversion, and disturbance of recreation sites and facilities are also identified as threats (UDWR 2006).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

This threat is not known to affect the northern goshawk.

Disease or Predation

Threats to breeding populations include the presence of great horned owls, which prey on both nestlings and adults (NatureServe 2007).

The Inadequacy of Existing Regulatory Mechanisms

This threat is not known to affect the northern goshawk.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Loss of large diameter trees to fire and insects results in loss of nesting habitat for the northern goshawk (UDWR 2006). Drought and unnatural fire regimes are also identified as threats (AGFD 2006a).

1.6.17.7 Conservation

Partners in Flight Plans and Wildlife Action Plans for Arizona and Nevada have identified conservation actions for the Northern goshawk (NDOW 2006, AGFD 2006a).

1.6.17.8 Species Status

Rangewide

Populations appear to have dramatically declined in the last 50 years. In the Kaibab National Forest in Arizona, 130 breeding pairs in 1972 were reduced to approximately 30 occupied territories by 1990 (AGFD 2003b).

VRCMA Boundary

The status of this species within the VRCMA Boundary is unknown. No occurrences have been recorded in the VRCMA Boundary in the NNHP and AGFD natural heritage species occurrence databases (NNHP 2006, AGFD 2007d).

1.6.18 Northern Saw-whet Owl

Scientific Name: *Aegolius acadicus*

1.6.18.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S4 (NatureServe 2007).
- Arizona heritage rank of S4 (NatureServe 2007).

1.6.18.2 General Description

The northern saw-whet owl is a small owl, with a total length of seven to 7.9 inches (18 to 20 centimeters) for males and 7.9 to 8.5 inches (20 to 21.5 centimeters) for females (Cannings 1993). They have short legs, which are densely feathered down to their talons. Their head is large, round, and without ear tufts. They have yellow to golden eyes; golden tends to be much more common in adults and occasionally juveniles. The adult's upperparts are typically brown-streaked with white on the crown and nape, and have white spots on the back, wings, and tail. Their facial disk is white above and between the eyes, and streaked pale brown with dark brown and white laterally. Tufts of black bristle-like feathers are present between the eyes. Their underparts are typically white with broad brown stripes. Juveniles lack the white markings above (except on wings and tail) and have an unmarked brown breast and buff abdomen. Their facial disk is also blackish-brown with a conspicuous Y-shaped white marking between and above the eyes (Cannings 1993).

1.6.18.3 Distribution

Historic Distribution

There is no historical data available for this species.

Current Distribution

This owl is restricted to North America and breeds within most wooded areas within its range. Its breeding range is restricted to the higher elevation mountainous areas in the southern U.S. and Mexico. There is little data on the northern limits of their breeding range. Their wintering range generally encompasses their breeding range, although there have been some incidental sightings in Newfoundland, Bermuda, and St. Lawrence and St. Paul Islands in Alaska (Cannings 1993).

1.6.18.4 Habitat

The northern saw-whet owl is associated with forests and woodlands of all types throughout its range, although population densities seem to be highest in coniferous forests. It has also been associated with coniferous or mixed coniferous-deciduous forests with a well-developed middle canopy layer of coniferous trees 6.6 to 13.1 feet (two to four meters) high. In the western mountains, the lower to middle elevation forests seem to support relatively dense population numbers. This owl is also known to be a common inhabitant of the open ponderosa pine forests. It often breeds in riparian woodlands in shrub-steppe environments, foraging in the big sagebrush (*Artemisia tridentata*) and antelope bitterbrush (*Purshia tridentata*) habitats (Cannings 1993).

The northern saw-whet owl tends to winter in a wide range of habitats. The presence of dense vegetation for roosting and perches for foraging seems to be a critical factor (Cannings 1993).

1.6.18.5 Life History

Reproductive Biology

Pair formation in the northern saw-whet owl begins in late winter when the male starts advertising calls and when the female arrives. These owls typically nest in old woodpecker cavities, natural cavities, or nest boxes. A single brood each year is most common, with egg-laying occurring from early to mid-March. However, there are limited records of eggs being present in June and July, which could represent second broods rather than late first broods or re-nesting attempts. Females often leave first nests when nestlings are fully feathered, while males continue to care for the young; therefore, second broods are more likely cases of sequential polyandry than the second brood of the same pair. Incubation is completed solely by the female and lasts 27 to 29 days, after which nestlings are fed mostly by the male and sometimes the female before they fledge (Cannings 1993).

Diet

The northern saw-whet owl hunts almost entirely at dusk and dawn, starting within a half-hour after sunset and ending about a half-hour before sunrise. They hunt along forest edges, in forest openings, and/or wherever perches are available in open habitats. They prey primarily on small mammals with small birds and insects consumed on rare occasion (Cannings 1993).

Migration

Most populations are present year-round within their breeding range; however, in eastern North America there are considerable numbers that move south in autumn. Movements in the western mountains are less obvious and poorly documented, but most likely involve both vertical and latitudinal movements (Cannings 1993).

1.6.18.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

The accelerated logging rates of forests in southern Canada and northern United States has without doubt reduced the amount of suitable breeding habitat, due particularly to the loss of nesting snags. Typically, young, regenerating forests are too thick and lack the edge habitat and open understory favored for foraging. Wintering habitat may be less critical for this owl, since it seems to survive well during winter in rural and semi-rural habitats, which are extensive compared to forested breeding habitat (Cannings 1993).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

This activity is not listed as a threat currently affecting this species.

Disease or Predation

This activity is not listed as a threat currently affecting this species.

The Inadequacy of Existing Regulatory Mechanisms

This activity is not listed as a threat currently affecting this species.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

This activity is not listed as a threat currently affecting this species.

1.6.18.7 Conservation

Nest boxes could be used as mitigation for the loss of nesting snags in areas that have been selectively logged (Cannings 1993). In addition, protection of big trees and standing dead wood, where cavities typically occur would undoubtedly help manage and conserve this species (Floyd 2007).

1.6.18.8 Species Status

Rangewide

Northern saw-whet owl populations are considered secure throughout their extensive range (NatureServe 2007). Trend data is not available, but populations are probably declining slowly as habitat is lost (Cunnings 1993).

VRCMA Boundary

The status of the northern saw-whet owl within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been documented within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6.19 Phainopepla

Scientific Name: *Phainopepla nitens*

1.6.19.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- Priority species by the Nevada Partners in Flight Bird Conservation Plan (Neel 1999).
- BLM sensitive species in the state of Nevada (BLM 2003a).
- State-protected species by Nevada Department of Wildlife (NNHP 2004).
- Classified as Protected under NAC 503.050 (Protected, Endangered and Sensitive Birds).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S2B (NatureServe 2007).
- Arizona heritage rank of S5 (NatureServe 2007).

1.6.19.2 General Description

The phainopepla is a medium-sized, frugivorous songbird (7.1 to 8.3 inches [18 to 21 centimeters]), with a wingspan of 11.4 inches (29 centimeters). It has a tall, wispy crest and is slender with a long tail. Its wings are broad and rounded. It is a dimorphous species. The male is shiny black; the female is all gray. In flight, the male's white wing patches are visible. The female has light grey wing patches. Its eyes are red; its bill, legs, and feet are black. The immature phainopepla resembles a female bird, although they are more brownish in color and have brown eyes (Cornell Lab of Ornithology 2006).

The phainopepla has a complex song with 14 different identifiable elements (Cornell Lab of Ornithology 2006).

1.6.19.3 Distribution

Historic Distribution

The phainopepla occurs from the coastal woodlands of California southeast to Arizona, southern Nevada, western Texas, and northwestern New Mexico (Neel 1999). In southern Nevada, the phainopepla occurs in mesquite and catclaw habitats.

This species inhabits arid woodland and desert habitats of the southwestern United States and Mexico. In the United States, its range encompasses southern California, extreme southern Nevada, extreme southwestern Utah, southern New Mexico, southwestern Texas, and most of Arizona (Chu and Walsberg 1999). In Nevada, the phainopepla occurs in the Spring Mountains, the Lake Mead National Recreation Area, the Las Vegas Valley, and Meadow Valley Wash (Hiatt and Boone 2004). It breeds throughout Piute and Eldorado valleys in extreme southern Clark County (Hiatt and Boone 2004).

Current Distribution

The current distribution is the same as the historic distribution (NatureServe 2007).

1.6.19.4 Habitat

In Nevada, the phainopepla occurs in wash systems dominated by catclaw acacia and mesquite woodlands. In higher elevations, they can be found in pinyon-juniper woodlands. Older aged stands are preferred because they typically have greater densities of mistletoe, a prerequisite for the presence of phainopepla (Neel 1999). Mistletoe density is more important than host density, although structural parameters seem to be somewhat variable (Neel 1999). Mistletoe abundance is the only factor that appears to predict woodland occupancy and breeding success (Crampton 2004, as cited in Crampton et al. 2006).

Mesquite and acacia woodlands in southern Nevada greatly vary in the density and extent of mistletoe (Krueger 1998 and Crampton 2004, as cited in Crampton et al. 2006). Woodlands south of Las Vegas are more infected than the mesquite woodlands west of the Spring Mountains and the acacia woodlands northeast of Las Vegas (Crampton et al. 2006). Within mistletoe infected woodlands, phainopepla prefer tall host trees (Krueger 1998 as cited in Crampton et al. 2006) and areas where tree density and canopy cover is high. This is likely because of how these factors affect nest predation levels (Crampton et al. 2006).

Phainopepla generally prefer flat and open areas. In winter and breeding seasons, they will occur up to 3,000 feet (900 meters) in elevation; in the summer, they can occur up to 7,000 feet (2,100 meters) (Neel 1999). However, they prefer habitat at lower elevations (Crampton 2004, as cited in Crampton et al. 2006).

Range-wide, the phainopepla is found within two types of habitat based on season (Chu and Walsberg 1999). It is typically restricted to the Sonoran Desert and portions of the Mojave Desert, in desert riparian areas along washes, and is closely associated with mistletoe during most of the year (Chu and Walsberg 1999). However, during late spring and summer it moves to semiarid woodlands, including riparian woodlands in chaparral habitats, live-oak woodlands, and Joshua-tree woodlands in an effort to follow the mistletoe berries (Chu and Walsberg 1999). In Clark County, it is found in lowland riparian and mesquite/catclaw habitats where washes, riparian areas, and other habitats supporting brushy growth of mesquite, catclaw, ironwood, and paloverde are infested with mistletoe (Clark County 2006a).

1.6.19.5 Life History

Reproductive Biology

The phainopepla nests in a small, shallow, woven cup comprised of twigs and fibers, on a tree limb, fork, or mistletoe clump 6.6 to 16.4 feet (two to five meters) above ground. (Cornell Lab of Ornithology 2006). The nest is constructed primarily by the male (NDOW No Date). Clutch size is usually two to three eggs; clutches range from two to four (Cornell Lab of Ornithology 2006). The eggs are incubated for about 14 or 15 days by both parents. Nestlings are cared for by both parents and fledge in about 18 days (NDOW No date). Breeding success is highest in non-isolated, large, mistletoe-infected woodlands in Nevada (Crampton et al. 2006).

Diet

Phainopepla have a highly specialized digestive tract, which is able to process large amounts of mistletoe berries (Walsberg 1975, as cited in Neel 1999). Insects also are an important part of the phainopepla's diet during breeding season, as it provides a protein source for its young (Walsberg 1977, 1978; as cited in Neel 1999). Mistletoe berry and insect seasons overlap only during this time of the year (Walsbert 1977, as cited in Neel 1999).

There is a symbiotic relationship between the phainopepla and mistletoe, a parasitic plant. The phainopepla eats the mistletoe's berries, one of its main food sources, and digests the pulp. The berry's seeds pass through the bird's digestive system and are deposited on the branches of the host trees, where they germinate and grow (NDOW No Date).

Migration

Phainopepla arrive on breeding grounds in October and occur in flocks until the initiation of the breeding season in February or March when territories are established and nests are built. Summer distribution of phainopepla in Nevada is not well understood (Neel et al. 1999). The phainopepla is a resident of southern Nevada in desert scrub and riparian areas, but is a transient in woodlands (Alcorn 1988).

1.6.19.6 Threats Warranting Protection

Main threats to the phainopepla include habitat fragmentation and habitat alteration or degradation from development and other human activities such as groundwater use and OHV use. A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Alteration of habitat from tamarisk colonizing areas recently disturbed by fire, conversion of habitat to residential use, alteration or destruction of habitat from wildfires and uncontrolled firewood cutting, OHV use in desert wash habitats, declining groundwater levels and their effects on the long-term existence of mesquite woodlands are the main threats to phainopepla and their habitat (Neel 1999). Phainopepla are, on average, 30 times more abundant in unfragmented habitat than in fragments or urban areas (Crooks et al. 2004).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Threats to the phainopepla that have been identified within the VRCMA Boundary include poaching, illegal collection, or killing of flora and fauna (Clark County 2006a).

Disease or Predation

The phainopepla breeds prior to the arrival of brown-headed cowbirds, resulting in minimal parasitism (Neel 1999).

The Inadequacy of Existing Regulatory Mechanisms

It is unknown whether existing regulatory mechanisms are inadequate for the phainopepla.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other factors that are threats to the phainopepla within the VRCMA Boundary include habitat degradation and wildlife displacement from mineral extraction and habitat degradation from wood collection and litter removal (Clark County 2006a).

1.6.19.7 Conservation

Partners in Flight plans for Nevada, Arizona, and Utah address the phainopepla, including identification of threats and recommendations for conservation actions (NDOW 2006). The phainopepla is covered in the Clark County MSHCP, which includes conservation actions to offset effects from covered activities (RECON 2000). A conservation management strategy has been developed for mesquite and acacia woodlands within Clark County, Nevada (Crampton et al. 2006).

1.6.19.8 Species Status

Rangewide

Status and trend of the phainopepla is unknown (NDOW 2006). Because phainopepla are closely tied to mistletoe production and mistletoe is sensitive to cold temperatures, abnormally cold winter temperatures can result in subsequent declines in phainopepla populations. For this reason, population trends of the phainopepla should only be analyzed when climatic fluctuations are considered (Neel 1999).

VRCMA Boundary

The status of the phainopepla within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6.20 Pinyon Jay

Scientific Name: *Gymnorhinus cyanocephalus*

1.6.20.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- BLM sensitive species in Nevada (BLM 2003a).
- NNHP Watch List species (NNHP 2004).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S3S4 (NatureServe 2007).
- Arizona heritage rank of S5 (NatureServe 2007).

1.6.20.2 General Description

The pinyon jay is a Corvid that is dull blue except for a whitish chin. It has a relatively short tail and a large, pointed, black bill. Its wingspan is 18 inches (46 centimeters), it is ten to 11 inches (26 to 29 centimeters) in length, and it weighs 3.18 to 4.24 ounces (90 to 120 grams) (Cornell Lab of Ornithology 2003f).

The sexes are similar in appearance, but the male has a longer bill and a darker crown. The immature pinyon jay is similar to the adult, but is duller in color (Cornell Lab of Ornithology 2003f).

The pinyon jay's song is a high pitched, nasal cawing that is inflected upwardly (Cornell Lab of Ornithology 2003f).

1.6.20.3 Distribution

Historic Distribution

This species is known to occur in most western states (Oregon, Idaho, Montana, Wyoming, South Dakota, Nebraska, Colorado, Utah, Nevada, California, Arizona, New Mexico, and Oklahoma) (NatureServe 2007).

Current Distribution

The current distribution of the pinyon jay is the same as the historic distribution. When pine crops fail, the species becomes irruptive and individuals disperse outside their normal range (BirdLife International 2006).

1.6.20.4 Habitat

Habitat for this species occurs in pinyon-juniper woodland, sagebrush, scrub oak, chaparral, and pine forests (Cornell Lab of Ornithology 2003f).

1.6.20.5 Life History

Reproductive Biology

This highly gregarious species breeds in colonies of up to 150. Breeding behavior is triggered primarily by the consumption of pine nuts. The availability of caches of pine nuts enables the pinyon jay to breed in late winter; breeding in the summer occurs when there is a bumper crop of pine nuts (Ehrlich et al. 1988).

During courtship, males engage in pursuit flight of females, and the male feeds the female. One brood is typical, with two broods per year occurring occasionally. The species nests in juniper or pine, occasionally oak. The male selects the site. The nest, made of a bulky platform of twigs and bark with an interior cup of shredded bark, plant fibers, rootlets, papers, and hair is built in five to nine days. Eggs are bluish, greenish, or grayish white and marked with brown spots. Eggs are incubated for 16 to 17 days before hatching. Nestlings are reared for 21 days in the nest by both the male and the female prior to fledging (Ehrlich et al. 1988).

Diet

This species feeds on pine nuts, conifer and other seeds, fruits, insects, bird eggs, and nestlings (Ehrlich et al. 1988). The pinyon jay is also known to eat acorns, juniper berries, other wild berries, cultured grains, arthropods, lizards, snakes, and small mammals (Cornell Lab of Ornithology 2003f). The young are fed mostly insects and a few pine seeds (Ehrlich et al. 1988).

Migration

This species is non-migratory, but can wander in winter in large flocks of hundreds of individuals (Ehrlich et al. 1988).

1.6.20.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Destruction of pinyon-juniper habitat for grazing and changes in fire regimes have led to the loss of pinyon pines, which provide habitat for this species (Cornell Lab of Ornithology 2003f). This species may be particularly susceptible to habitat loss and fragmentation from timber harvests and development (Audubon Watch List 2007).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization of this species is unknown to occur.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown. This species is not protected under federal or state laws.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Fluctuations in population levels from year to year can put this species at additional risk when combined with other threats (Audubon Watch List 2007).

1.6.20.7 Conservation

Limited conservation action has directly focused on the pinyon jay. Partners in Flight programs have identified conservation actions for this species, including managing pinyon-juniper forests for mature forests and limiting roads and trails (Audubon Watch List 2007).

1.6.20.8 Species Status

Rangewide

The pinyon jay's population is declining due to loss and alteration of pinyon-juniper habitat (Cornell Lab of Ornithology 2003f). Breeding Bird Survey (BBS) trend analyses indicate a rangewide decline of 4.3 percent per year from 1966 to 2001 (Audubon Watch List 2007).

VRCMA Boundary

The status of the pinyon jay within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6.21 Prairie Falcon

Scientific Name: *Falco mexicanus*

1.6.21.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Protected bird species under NAC 503.050 (Protected, endangered, and sensitive birds).
- BLM sensitive species in Nevada (BLM 2003a).
- NNHP Watch List species (NNHP 2004).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S4 (NatureServe 2007).
- Arizona heritage rank of S4 (NatureServe 2007).

1.6.21.2 General Description

The prairie falcon is a medium-sized falcon with pointed wings and hooked bill. It is distinguished from other falcons by having dark patches in the "wingpits". Adults are pale brown above and white with heavy spotting below. Immatures are buffy below. The prairie falcon's head has a narrow dark streak extending downward from each eye (NatureServe 2007). Its average length is 15.4 to 19.7 inches (39 to 50 centimeters) and its wingspan is 35.0 to 42.9 inches (89 to 109 centimeters) (NGS 1983, as cited in NatureServe 2007).

1.6.21.3 Distribution

Historic Distribution

The breeding range of this species includes western Canada (British Columbia, Alberta, and Saskatchewan) and the western United States (Washington to North Dakota south to California and Texas) (NatureServe 2007). Its nonbreeding range is from southern Canada south to Baja California and central Mexico (Steenhof 1988, as cited in NatureServe 2007).

Current Distribution

The current distribution of the prairie falcon is the same as the historic distribution.

1.6.21.4 Habitat

The prairie falcon occurs in dry grasslands, prairies, and alpine tundra in northern areas. Suitable breeding habitat requires cliffs for nest sites. During winter, the prairie falcon is also found in cultivated fields and along lake shores (Steenhof 1988).

1.6.21.5 Life History

Reproductive Biology

During courtship, the male performs aerial gymnastics and calling in front of a perched female. The female calls in return and occasionally joins the male in flight. The male will also strut on the ledge where nesting occurs (Ehrlich et al. 1988).

Nesting occurs on cliff ledges and occasionally in a rock crevice at least 20 feet (6.1 meters) and up to 400 feet (121.9 meters) off the ground. The nest is always facing open habitat. It is usually unlined. Eggs are a white to pinkish-white and marked with brown spots. Four to five eggs are typically laid in one brood per season. The eggs are incubated for 29 to 33 days. Young are born semialtricial and fledge after 35 to 42 days. Parent birds continue to care for their young after fledging (Ehrlich et al. 1988).

Diet

The prairie falcon hunts other birds. It flushes ground-dwellers by flying low, but it will also hover and stoop for other prey (Ehrlich et al. 1988). It is also a predator of medium-sized desert mammals and lizards. Ground squirrels are a main source of its diet during the nesting season. Horned larks and western meadowlarks are important prey sources during the winter. This species is known to cache prey, which may enable it to maximize food intake and reduce fluctuations in availability of prey during breeding (BLM 2007c).

Migration

This species is migratory (NatureServe 2007). During the winter it is most abundant in the Great Basin and central latitudes of the Great Plains (Root 1988, as cited in NatureServe 2007).

1.6.21.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Removal of vegetation in foraging habitats may impact prey populations (Steenhof 1988, as cited in NatureServe 2007).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Shooting is the most commonly reported source of adult mortality (van Tighem 1967, as cited in NatureServe 2007).

Disease or Predation

Rock doves (*Columba livia*) infected with trichomoniasis and herpesvirus can infect falcons when consumed (Steenhof 1988, as cited in NatureServe 2007). The impacts on falcon populations are unknown (NatureServe 2007).

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown. This species is protected under the Migratory Bird Treaty Act and is recognized as protected in the state of Nevada.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

This species can be sensitive to human disturbance, depending upon the type of activity, proximity to nest or roost site, the time of year, and the duration of the activity (Steenhof 1988, as cited in NatureServe 2007). It is most sensitive prior to egg laying (NatureServe 2007).

The prairie falcon is susceptible to eggshell thinning from DDE (Noble and Elliott 1990, as cited in NatureServe 2007) and may have reproductive failure from DDE and hexachlorobenzene (Jarman et al. 1996, as cited in NatureServe 2007). It may also be susceptible to organophosphates and carbonates in agricultural areas (Kirk and Banosch 1996, as cited in NatureServe 2007).

1.6.21.7 Conservation

Conservation actions for this species are limited. In Idaho, the Snake River Birds of Prey National Conservation Area was established on BLM lands to protect the largest concentration of birds of prey, including the prairie falcon, in North America (BLM 2007c). This is the only site specifically managed for prairie falcon (TNC 2001).

1.6.21.8 Species Status

Rangewide

The prairie falcon population is stable, but local declines have been recorded in some areas, including areas in Texas, Alberta, and southwestern Idaho (BLM 2007c).

VRCMA Boundary

The status of the prairie falcon within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6.22 Scott's Oriole

Scientific Name: *Icterus parisorum*

1.6.22.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S4B (NatureServe 2007).
- Arizona heritage rank of S5 (NatureServe 2007).

1.6.22.2 General Description

The Scott's oriole is a medium-sized oriole with a wing chord of 3.6 to 4.1 inches (92 to 10.3 centimeters) and a tail length of three to 3.6 inches (7.7 to 9.1 centimeters) with a straight, relatively slender bill. The Scott's oriole is sexually dimorphic in plumage and size with little geographic variation (Pyle 1997, as cited in Flood 2002). The mature male has a black hood, breast, and back, contrasting with a lemon-colored body. The wings are black, with a white wingbar and a yellow epaulet bordered in white. All rectrices have yellow bases, but the central two to four are predominantly black, whereas the outer eight to ten rectrices are yellow for roughly two-thirds of their length, although the extent is variable. Retrice tips are black. The adult female has some black spots or streaks on the head, back, and throat, with an olive-gray back and yellow to yellowish-olive underparts. Female wings are brownish black, with two whitish wing-bars (lower wider than upper), and have an olive tail. The amount of black coloration on the head, back and throat of the female can range from being restricted to only a few feathers to being almost as extensive as that of a mature male (Jaramillo and Burke 1999, as cited in Flood 2002). Like other orioles, males show delayed plumage maturation, and individuals in their first potential breeding season (yearlings) are intermediate between females and adult males in appearance. The juvenile plumage of both sexes is typically dull olive and unpatterned. The song of the Scott's oriole is a rapid series of whistled notes and its common call is a harsh *shack* (Flood 2002).

1.6.22.3 Distribution

Historic Distribution

During breeding season, the Scott's oriole is found at elevations ranging from sea level to 9,843 feet (3,000 meters) in north and central Mexico and in the western and southwestern United States. (American Ornithological Union 1998, as cited in Flood 2002). During the winter season, the Scott's oriole is found mainly in Mexico, from central Baja California (occasionally in n. Baja) south, and through central Mexico (Flood 2002).

Current Distribution

Climatic change has been implicated in an extension of this oriole's range north into southeastern Idaho, northern Nevada, central Utah, southwestern Wyoming, and western Colorado. Additionally, there has been an increase in wintering records in the U.S. over the past 20 years (Flood 2002).

1.6.22.4 Habitat

The Scott's oriole is found most commonly in relatively elevated, arid habitats, particularly desert-facing slopes of mountains, the pinyon-juniper belt in foothills, and semiarid plains between mountain ranges, where yuccas are common. This species tends to avoid real deserts, where cacti are dominant and its preferred nesting trees are rare (Bent 1958, as cited in Flood 2002).

1.6.22.5 Life History

Reproductive Biology

Reproduction usually begins with pair formation and nest building occurring in March and April. Nests are most frequently constructed in yucca trees and less commonly in palms of desert habitats in pinyon pine and juniper, and in some montane semidesert areas and canyons, Nests may also occur in sycamores, oaks, or cottonwoods. Nests are basket-like and constructed with plant fibers (Flood 2002).

Usually one to five pale blue eggs are laid, with clutches of three eggs being most common. Incubation lasts approximately 15 days and fledging occurs at another 12 to 13 days after hatching. Both parents participate in feeding at the nest and in nest defense (Flood 2002).

Diet

The diet of the Scott's oriole consists primarily of insects (grasshoppers, beetles, caterpillars, etc.), fruit (cactus fruit and berries), and nectar. This species forages in foliage for insects and berries (NatureServe 2007).

Migration

The Scott's oriole is migratory in the northern part of its breeding range; it generally migrates south of the U.S.-Mexico border for winter. The species returns to its U.S. nesting range usually by the end of March or during the first half of April, with males preceding females (Terres 1980, as cited in NatureServe 2007).

1.6.22.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction or degradation is likely the major threat to this species because of its relatively specialized habitat preferences, although lack of detailed studies on habitat preference make this uncertain. Carter and Barker (1993, as cited in Flood 2002) describe the Scott's oriole as facing "moderate" habitat loss on both breeding and wintering grounds (loss of 11 to 25 percent of habitat) used throughout its range.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Eggs, nestlings and fledglings are subject to predation by various reptilian, mammalian, and avian predators (Flood 2002).

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.6.22.7 Conservation

No specific conservation measures have either been proposed or taken for this species.

1.6.22.8 Species Status

Rangewide

This species is currently expanding its range; however, it has been subjected to moderate habitat loss, has somewhat specialized ecological requirements, and is not particularly widespread in its distribution (American Ornithological Union 1998, Carter and Barker 1993, as cited in Flood 2002; Flood 2002).

VRCMA Boundary

The status of the Scott's oriole within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6.23 Summer Tanager

Scientific Name: *Piranga rubra*

1.6.23.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- Classified as Protected and Endangered in Nevada under NAC 503.050 (Protected, Endangered and Sensitive Birds).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S2B (NatureServe 2007).
- Arizona heritage rank of S4 (NatureServe 2007).

1.6.23.2 General Description

The adult male summer tanager is completely bright red with a long, yellow-gray bill. The female and the younger immature birds are yellow. An immature male molting into adult plumage has a patchy appearance of red and yellow. The summer tanager appears slightly crested. Total length is 7.8 inches (19.7 centimeters), and the wingspan is 12 inches (30.5 centimeters). It weighs roughly one ounce (23.3 grams) (Sibley 2000).

Summer tanager songs are musical and robin-like, consisting of three-syllable phrases (Sibley 2000). Common calls are a dry “pituk” and “pikitukituk” (Sibley 2000).

1.6.23.3 Distribution

Historic Distribution

The summer tanager is found throughout much of the eastern United States south of the Great Lakes. In the west, it is limited to desert riparian areas in southern Nevada and Utah and along the states bordering Mexico. The species winters south to South America (NatureServe 2007).

Current Distribution

The current distribution is the same as the historic distribution (NatureServe 2007).

1.6.23.4 Habitat

The summer tanager uses a variety of forest types, usually dominated by deciduous trees (NatureServe 2007). In the southwest, the summer tanager is found in mature desert riparian habitats, favoring cottonwood-willow associations along streams (RECON 2000).

1.6.23.5 Life History

Reproductive Biology

Nests are built in trees, usually well out on a horizontal lower branch, 9.8 to 36.1 feet (three to 11 meters) above ground. Eggs are laid in May and June. Clutch size is three to five (usually four). Incubation lasts 12 days. Young leave the nest eight to ten days after hatching and are tended by both parents for two to four weeks after fledging (NatureServe 2007).

Diet

This species eats various insects (especially bees and wasps), spiders, and small fruits. It is known to tear into wasp and bee nests for larvae and pupae, catch insects in flight, pick prey from leaves and branches, and utilize bird feeders (NatureServe 2007).

Migration

Small numbers of summer tanagers are found in the United States year-round, particularly in the southern states. Most migrate south to Central and South America during the winter (NatureServe 2007).

1.6.23.6 Threats Warranting Protection

Primary threats to summer tanagers are related to habitat loss and habitat degradation (RECON 2000). Other threats in their wintering areas and migratory paths are not well known.

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats include reduction and degradation of habitat (including river channelization), reduced water availability to riparian areas, livestock grazing and pesticide use in and adjacent to riparian areas, exotic plant encroachment and parasitism by cowbirds (RECON 2000).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

These factors are not a significant threat to this species.

Disease or Predation

Raptors that specialize on birds, such as sharp-shinned hawks (*Accipiter striatus*) and Cooper's hawks (*Accipiter cooperii*), are potential predators of the summer tanager. Housecats may prey on tanagers as well (ABC 2007). Squirrels are known to prey on the eggs and nestlings of a variety of bird species (Zugmeyer and Koprowski 2007) and may prey on summer tanagers. Bronzed (*Molothrus aeneus*) and brown-headed cowbirds (*Molothrus ater*) may parasitize summer tanagers as well.

The Inadequacy of Existing Regulatory Mechanisms

This species is not listed as a threatened or endangered species list under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Summer tanagers, as with many insectivorous songbirds, are at risk of exposure to and ingestion of pesticides.

1.6.23.7 Conservation

As a Covered species under the Clark County MSHCP, there are conservation measures in place in Clark County, Nevada for this species (RECON 2000).

1.6.23.8 Species Status

Rangewide

Summer tanager populations appear to be secure in much of their range (NatureServe 2007). In California, Nevada and Utah, where populations are small and localized, the summer tanager is imperiled (NatureServe 2007). Declines have been noted along the Lower Colorado River (NatureServe 2007).

VRCMA Boundary

This species is uncommon in Clark County. Potential habitat is found along the Lower Virgin River (RECON 2000). The status of the summer tanager within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6.24 Vesper Sparrow

Scientific Name: *Pooecetes gramineus*

1.6.24.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- Global heritage rank of G5 (NatureServe 2007).
- Arizona heritage rank of S5 (NatureServe 2007).

1.6.24.2 General Description

The vesper sparrow is a medium to large sparrow about 5.9 inches (15 centimeters) in length and 0.9 ounces (24.7 grams) in weight. Its color is grayish brown above and whitish below. The upperparts and underparts are streaked with blackish brown. Additional identifying characteristics include a narrow whitish eye-ring, pale-centered ear-coverts with a dark border, a suggestion of a pale wedge extending from whitish malar around the rear of the ear-coverts, white outer tail-feathers, distinctive rufous lesser wing-coverts (rarely visible in field), and pale supercilium obscured by streaks over and behind the eye. The sexes are alike, and juveniles closely resemble adults. However, juvenile lesser wing-coverts have little or no rufous. Compared with similar sparrows, the vesper sparrow is relatively large and longer-tailed. Plumages are similar throughout the year, but plumage colors may become more grayish and streaking may become more distinctive in spring and summer (Jones and Cornely 2002).

1.6.24.3 Distribution

Historic Distribution

This Nearctic species breeds from interior British Columbia east to Nova Scotia and south to southern California, southcentral New Mexico, southwestern Kansas, southern Illinois, northeastern Tennessee, and western Virginia. It winters from central California, east through the southwest, south, and throughout most of Mexico (Jones and Cornely 2002).

Current Distribution

The current distribution is the same as its historic range; however, the vesper sparrow has a diminishing range and declining numbers throughout many American central and northeastern states due to habitat loss (Jones and Cornely 2002).

1.6.24.4 Habitat

The vesper sparrow occupies a broad range of grassland habitat types, including native prairie, semidesert grasslands, montane and desert shrublands, sagebrush steppe, montane meadows, old fields, pastures, haylands, reclaimed surface mines, weedy fencelines, croplands, weedy roadsides, and woodland edges with scattered trees and shrubs. It likely requires song perches, such as fences, shrubs, crop residue, tall weeds, and woodlands bordering fields (Best and Rodenhouse 1984, as cited by Jones and Cornely 2002).

1.6.24.5 Life History

Reproductive Biology

Reproduction usually occurs mid-March through mid-August, with nest building occurring as early as April (Best and Rodenhouse 1984, Peck and James 1987, as cited by Jones and Cornely 2002).

Its nest is usually a woven cup of grasses with a shallow bowl. The exterior is constructed with coarse and fine dry grasses, forbs, sedges, rootlets, mosses, fine twigs, and bark strips. The interior is often lined with fine grasses and moose (*Alces alces*) or horse (*Equus* spp.) hair, rootlets, down feathers, and sometimes pine needles (Jones and Cornely 2002)

Eggs are usually three to five in number, but occasionally six eggs are laid (Peck and James 1987, as cited by Jones and Cornely 2002). Incubation lasts approximately 11 to 14 days and fledging occurs when the young are around ten days old (Dawson and Evans 1960, as cited by Jones and Cornely 2002). Fledglings are still dependent on adults for 20 to 29 days after fledging (Perry and Perry 1918, as cited by Jones and Cornely 2002). Females may generally produce two to three broods per year (NatureServe, 2007)

Diet

The diet of the vesper sparrow is comprised mainly of invertebrates, including insects and spiders, as well as grass seeds, weed seeds, and waste grains (Berger 1968, as cited by Jones and Cornely 2002).

Migration

The vesper sparrow is a partial migrant; northern populations migrate south for winter. Migrants of this species from the north often winter in southern areas occupied during summer, but the extent of mixing between migrant and non-migrants is unknown (Berger 1968, as cited by Jones and Cornely 2002).

1.6.24.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

The vesper sparrow has been using croplands as habitat and breeding areas since European colonization, and changes in farming practices, such as chemical use and tillage, have been implicated in declines of this species rangewide (Jones and Cornely 2002, NatureServe, 2007). In Arizona and Nevada, heavy overgrazing of sageland habitat by cattle has resulted in depressed populations (Bock and Bock 1999, Kantrud and Kologiski 1982, as cited by Jones and Cornely 2002).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization of the vesper sparrow is not known to occur.

Disease or Predation

As a small bird nesting in low shrubs and grasslands, the vesper sparrow is subject to predation by a variety of predators, especially during breeding. Predators include birds of prey, crows, snakes, foxes, skunks and raccoons (Jones and Cornely 2002).

The Inadequacy of Existing Regulatory Mechanisms

The vesper sparrow is not protected by federal or state regulations in Nevada or Arizona (NDOW 2006, AGFD 2007).

Other Natural or Manmade Factors Affecting the Species' Continued Existence

No other factors are known to be threats to the vesper sparrow.

1.6.24.7 Conservation

There have been no direct management actions taken to improve the vesper sparrow's status (Jones and Cornely 2002).

1.6.24.8 Species Status

Rangewide

Rangewide, the vesper sparrow is relatively secure in western North America and in major regional decline in eastern North America. This regional decline is a result of changes in grassland characteristics in eastern North America, from changing agricultural practices (NatureServe 2007).

VRCMA Boundary

The status of the vesper sparrow within the VRCMA Boundary is unknown, although potential habitat does occur there. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6.25 Western Bluebird

Scientific Name: *Sialia mexicana*

1.6.25.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Evaluation species (Low Priority) for the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S3 (NatureServe 2007).
- Arizona heritage rank of S5 (NatureServe 2007).

1.6.25.2 General Description

The western bluebird is relatively small, 6.5 to 7.5 inches (16.5 to 19 centimeters) in length (Godfrey 1986, as cited in Guinan et al. 2000), with a mass of approximately 0.8 to 1.1 ounces (24 to 31 grams) (JAG and PAG unpubl., as cited in Guinan et al. 2000). Western bluebirds exhibit sexually dimorphic plumage. Adult males have a bright, deep, cobalt-blue head (including chin and throat) and upperparts (including wings and tail), with a chestnut breast (chestnut coloration may be bisected, laterally, by blue). The underparts are grayish, becoming blue-gray on the belly and undertail-coverts. The upperparts may be entirely blue, but a variable amount of chestnut coloration may also be present ranging from smudges on the scapulars, to the entire back and scapular region being chestnut. This trait is individually and geographically variable. Adult females are considerably duller and not as extensively blue-colored as males. Females have a head and throat that is gray, a gray-brown back, and a grayish abdomen and undertail-coverts, with blue in the wings and tail. Adult plumages are similar throughout the year. Immature bluebirds resemble adults but are slightly duller. Juveniles are gray-brown above and streaked with white. The breast is light rust colored and heavily streaked with white. The wings and tail are blue. Juveniles have a white eye-ring. The juvenile female has duller blue in the wings and tail and is more heavily streaked with white overall than juvenile males (Guinan et al. 2000).

1.6.25.3 Distribution

Historic Distribution

The western bluebird historically occurred as a resident from southern British Columbia and central Montana, south in the mountains to northern Baja California and central mainland of Mexico (NatureServe 2007).

Current Distribution

The current distribution is the same as the historic distribution, although the western bluebird has possibly been extirpated from Wyoming (NatureServe 2007).

1.6.25.4 Habitat

Western bluebirds utilize open woodlands, farmlands, orchards, savanna, riparian woodlands, and burned woodlands. They also inhabit desert areas during the winter and are particularly attracted to mesquite-mistletoe groves (NatureServe 2007). Throughout a large portion of its range, the western bluebird is found at transition zone elevations typically ranging from 6,562 to 8,858 feet (2,000 to 2,700 meters) (Scott and Patton 1975, Lowe 1894, as cited in Guinan et al. 2000).

1.6.25.5 Life History

Reproductive Biology

Reproductive pair formation can vary widely based on location but typically occurs between January and April. Nest building and egg laying generally occur in April and May. A second brood may be produced in June and July (Guinan et al. 2000).

Western bluebirds nest in tree cavities within the forest canopy. They will also occasionally use building crevices, mud swallow nests, and metal poles. Western bluebirds readily nest in artificial nesting boxes (Guinan et al. 2000).

Clutch size ranges between two to six pale blue or occasionally white colored eggs. Hatching typically occurs two weeks after laying, with fledging occurring another three weeks later (Guinan et al. 2000). Brooding and incubation is performed by the female only, although the male may deliver food items to the female during egg laying and incubation (Dickinson et al. 1996, as cited in Guinan et al. 2000). Fledging typically occurs approximately 21 days after hatching (Guinan et al. 2000).

Cases of brood helping (feeding young) by other adult males, adult pairs, and juveniles from earlier broods has been recorded in Oregon, California, and Arizona (Eltzroth 1983, Dickinson et al. 1996, Racey 1945, Finley 1907, as cited in Guinan et al. 2000).

Diet

Western bluebirds are mainly insectivorous, feeding on grasshoppers, caterpillars, and beetles, although they will also eat other invertebrates such as spiders, earthworms, and sow bugs. Foraging is performed by flycatching and by dropping from the perch to the ground. Western bluebirds also feed seasonally on berries and other fruit (NatureServe 2007).

Migration

Western bluebirds are medium to short-distance partial migrants. Over much of their breeding range, migration involves a change in altitude rather than latitude, and migration occurs over relatively short distances (Guinan et al. 2000).

1.6.25.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat degradation (loss of suitable nest sites and foraging areas) due to extensive logging, natural-fire suppression, grazing, industrialization, and urbanization is likely the most important contributor to declines in western bluebird populations (Herlugson 1975, as cited in Guinan et al. 2000). The western bluebird depends on the availability of snags, large living trees, and other suitable nesting sites, and, as a perch-forager, it relies on edge and burn areas, open forests, and small clearings with scattered trees. To this end, expansion of residential and industrial areas, fire suppression, clear-cutting, snag removal, and changes in agricultural practices have all led to a decline in suitable areas for breeding and foraging (Guinan et al. 2000).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization of this species is unknown.

Disease or Predation

Nestlings and eggs are subjected to a variety of predators including various rodents, weasels, snakes, raccoons and domestic and feral cats. Fledglings and adults may fall prey to cats and avian predators such as hawks (Guinan et al. 2000).

The Inadequacy of Existing Regulatory Mechanisms

The western bluebird is not protected by federal or state regulations in Nevada or Arizona (NDOW 2006, AGFD 2007).

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Competition for cavity nesting sites with invasive species such as house sparrows and European starlings may be a contributing factor in the decline of western bluebirds (Guinan et al. 2000).

1.6.25.7 Conservation

Short-term measures include use of nest boxes in favorable habitats. Nest boxes appear to be a viable short-term solution to the problem of nest-site limitation in many areas.

1.6.25.8 Species Status

Rangewide

Sharp declines in western mainland British Columbia and in the Pacific northwest have been observed due to lack of stable breeding population, loss of habitat, and competition with European starlings and house sparrows. Breeders are also now absent from Sacramento Valley, California, where they were once common (Guinan et al. 2000).

VRCMA Boundary

The status of the western bluebird within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6.26 Western Burrowing Owl

Scientific Name: *Athene cunicularia hypugaea*

1.6.26.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.
- February 28, 1996: Category 2 of candidate species was removed, no longer a candidate species, 61 CFR 7596-7613.
- November 15, 1994: Candidate for federal listing, Category 2, although information was lacking to support the finding of endangered or threatened (59 CFR 58982-59028).

Other Protections

- Evaluation species (High Priority) for the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- Protected under NAC 503.050 and NRS 501.
- Listed as State Endangered in Minnesota, Threatened in Colorado, and as a Species of Concern in California, Montana, Oklahoma, Oregon, Utah, Washington, and Wyoming.
- BLM sensitive species in Nevada (NNHP 2004).
- Global heritage rank is G4T4 (NatureServe 2007).
- Nevada heritage rank is S3B (NatureServe 2007).
- Arizona heritage rank is S3 (NatureServe 2007).

1.6.26.2 General Description

A relatively small, long-legged owl, the western burrowing owl is a ground-dwelling bird that stands 7.9 to 9.8 inches (20-25 centimeters) tall and weighs approximately 4.6 to 5.3 ounces (130 to 150 grams). Its rounded wings extend to a wingspan of approximately 23.6 inches (60 centimeters). Adults display brown plumage with white spotting on the back and a white belly marked with brown bars. Females are generally darker than males. The eyes of the western burrowing owl are bright yellow, while the bill is a pale yellow. It has a rounded head that lacks ear-tufts and yellow eyes that are placed relatively high on its face. Juveniles are similar in size to adults, but are buff in color and lack the streaking (Haug et al. 1993).

1.6.26.3 Distribution

Historic Distribution

In the United States the historical breeding range included much of the continental landmass: Utah, Nevada, Arizona, Texas, Wyoming, Colorado, New Mexico, North Dakota, South Dakota, Nebraska, eastern parts of Washington and Oregon, much of California, and parts of Montana, Idaho, Kansas, Oklahoma, Minnesota, and Iowa (Klute et al. 2003).

Current Distribution

In general, the breeding range of the western burrowing owl has contracted, primarily on the eastern and northern edges (Klute et al. 2003) and extends from southern Canada south into central Mexico.

1.6.26.4 Habitat

Although very little is known about the wintering and migratory habitats of burrowing owls, much is known about their breeding habitat requirements since they nest on the ground and are easily located and examined. Breeding habitats consist of open areas with mammal burrows including native prairie, tame pasture, hayland, fallow fields, road and railway rights-of-way, and some urban habitats (e.g., campuses, airports, and golf courses). They use a wide variety of arid and semi-arid environments, often associated with well-drained, level to gently sloping areas characterized by very little vegetation and bare ground (Klute et al. 2003). Black-tailed prairie dog burrows especially are favored and utilized by burrowing owls. When burrows are scarce however, these owls have been found nesting in natural rock and lava cavities (Gleason 1978, as cited in Klute et al. 2003). Satellite burrows are often used by owls and are thought to be an avoidance response to predation and or parasites. In the Mojave Desert, western burrowing owls often use desert tortoise burrows (Ronning, C., pers. comm.).

1.6.26.5 Life History

Reproductive Biology

Western burrowing owls are generally found on the northern breeding grounds from mid-March through September (Haug et al. 1993) and are capable of breeding at one year of age (Klute et al. 2003). Courtship and pair formation occur in March and April in most areas, but may begin as early as late December in California. Clutch size averages, over the entire range, between six and seven eggs, and ranges from four to 12 (Haug et al. 1993). Incubation, performed entirely by the female, lasts approximately one month. The male provides food during the incubation period and the early nestling stage. The burrowing owl averages between three and five fledglings per brood (NatureServe 2007). The young are able to run and forage for themselves at four weeks and achieve sustained flight at six weeks (NatureServe 2007, Klute et al. 2003).

Diet

Burrowing owls are opportunistic feeders, primarily taking large insects, small mammals, birds, amphibians and reptiles (Haug et al. 1993). Haug et al. (1993) found that vertebrates were more common in the winter diet and arthropods were taken more frequently during the summer months. Prey may be caught in flight or from the ground.

Migration

The western burrowing owl makes annual migrations from breeding sites in southern Canada and northern parts of the U.S. to the wintering grounds in the southern U.S. and parts of Mexico (Klute et al. 2003). There are some non-migratory populations. Breeding populations in southern California are sedentary and remain in the area year-round (NatureServe 2007).

Burrowing owls are known to migrate north during March and April, arriving the first week of May in southern Canada; although, little information exists on migration routes and times (Haug et al. 1993). The majority of burrowing owls that breed in Canada and the northern United States are believed to migrate south during September and October, spending the winter in southern parts of the U.S. and Mexico (Klute et al. 2003).

1.6.26.6 Threats Warranting Protection

Threats affecting burrowing owls include: habitat loss and fragmentation, reduction in burrow numbers, and predation by uncontrolled populations of small predators. A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under the ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Primary threats across the North American range of the burrowing owl are habitat loss and fragmentation primarily due to intensive agricultural and urban development, and habitat degradation due to declines in populations of colonial burrowing mammals (Grant 1965, Konrad and Gilmer 1984, Ratcliff 1986, Haug et al. 1993, Dundas and Jensen 1995, Rodriguez-Estrella et al. 1998, Sheffield 1997a, Dechant et al. 1999, as cited in Klute et al. 2003). The dramatic reduction of prairie habitat in the United States has been linked to reduction of burrowing owl populations (Sheffield 1997a, as cited in Klute et al. 2003). Fragmentation of nesting habitat may reduce the opportunity for unpaired owls to find mates (Sheffield 1997a, as cited in Klute et al. 2003).

Larger home ranges have been observed in fragmented landscapes (Warnock and James 1997, as cited in Klute et al. 2003).

Elimination of burrowing rodents through control programs has been identified as the primary factor in the recent and historical decline of burrowing owl populations (Butts and Lewis 1982; Pezzolesi 1994; Desmond and Savidge 1996, 1998, 1999; Toombs 1997, Dechant et al. 1999; Desmond et al. 2000; Murphy et al. 2001; all cited in Klute et al. 2003). For example, a 63 percent decline in burrowing owl numbers was associated with declines in black-tailed prairie dog densities at 17 colonies in western Nebraska over a seven-year period due to population control activities (Desmond et al. 2000, as cited in Klute et al. 2003).

Burrowing owls prefer grasslands moderately or heavily grazed by cattle or prairie dogs (James and Seabloom 1968, Butts 1973, Wedgwood 1976, MacCracken et al. 1985, Bock et al. 1993). Klute et al. (2003) speculates that the response of burrowing owls to cattle grazing is related to the effects of prairie dog grazing and must be evaluated in conjunction with the presence of previously excavated burrows.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

This threat was not included as a basis for warranting protection under state and federal regulations.

Disease or Predation

Usually tolerant of humans, and often found in urban or semi-urban areas, burrowing owls are susceptible to predation by dogs and cats (NatureServe 2007). Efforts to reintroduce the species into Minnesota over four years were abandoned after failure due to high predation rates (Martell et al. 2001, as cited in Klute et al. 2003). Disease is not thought to be a direct threat to burrowing owls (Klute et al. 2003).

Inadequacy of Regulatory Mechanisms

Burrowing owls are protected by the MBTA (1918) in the United States and Mexico, which makes it illegal to take, possess, buy, sell, purchase, or barter any migratory bird listed in 50 CFR, Part 10 (Klute et al. 2003). In the United States, the burrowing owl was listed as an ESA Category 2 Candidate species until February 1996, when the Category 2 designation was discontinued. Burrowing owls are listed as endangered in Canada and as threatened in Mexico (Klute et al. 2003).

Other Natural or Manmade Factors Affecting the Species Continued Existence

Burrowing owls may be susceptible to collisions with vehicles, because burrowing owls often fly low to the ground. Collisions with vehicles have been cited as a significant source of mortality by several researchers (Haug et al. 1993, as cited in Klute et al. 2003). Military aircraft have been involved with strikes to burrowing owls in eastern New Mexico (W. Howe, pers. comm., as cited in Klute et al. 2003). Additionally, Gillihan (2000) documented a burrowing owl killed by a collision with a barbed wire fence (Klute et al. 2003).

Pesticides, particularly insecticides and rodenticides in burrowing owl habitat, have been reported as a potential factor in burrowing owl declines (James and Espie 1997, as cited in Klute et al. 2003). Pesticides not only reduce the food supply and the number of burrowing mammals, but these chemicals also may be toxic to burrowing owls (Ratcliff 1986, James and Fox 1987, James et al. 1990, Baril 1993, Hjertaas 1997, Sheffield 1997b, as cited in Klute et al. 2003). Burrowing owls have been reported to ingest poison as a result of feeding on poisoned rodents and from foraging on the ground for insects where poison grains are present (Butts 1973, James et al. 1990, as cited in Klute et al. 2003).

1.6.26.7 Conservation

A status assessment and conservation plan has been prepared for the western burrowing owl by the USFWS (Klute et al. 2003). Included in this assessment and plan are conservation recommendations for burrowing owls in the United States. Recommendations for Nevada include (Klute et al. 2003):

- Development of best management practices (BMPs) for rangeland pesticides and minimizing use, particularly in areas of high burrowing owl density. The impacts of off-road vehicles could be mitigated by adjustment of sanctioned event routes and closure of casual use in burrowing owl breeding centers, presumably regulated by state and federal agencies.

- Artificial burrows should be used as a means of maintaining current populations or encouraging populations to immigrate to new sites. Artificial burrows should be placed in protected areas suitable to support burrowing owls.
- Surveys should be conducted to locate new nest sites or monitor known sites.
- Research on the impacts of rangeland pesticides and off-road vehicles on burrowing owls, and the degree to which populations are reliant on agriculture was also recommended in Nevada.
- Education of farmers and off-road vehicle enthusiasts should be targeted for education in Nevada. The USDA Natural Resource Conservation Service extension services could assist in this effort.
- Habitat protection and management, and burrowing animal management for Nevada included leaving drain ditches unburned and ditch banks and turnrows undisturbed, protecting burrow sites, establishing conservation easements with private landowners to secure good burrowing owl habitats, preserve salt desert scrub habitat and its burrowing mammal community, and work with developers in urban and suburban areas to preserve open space within developments for burrowing owls.

The Nevada Partners in Flight Plan (Neel 1999) identifies western burrowing owl as a priority bird species and establishes strategies to stabilize the current decreasing population trend of this species in Mojave shrub habitats in southern Nevada. Most of the plan's recommendations are reflected in the recommendations made above by Klute et al. (2003).

1.6.26.8 Species Status

Rangewide

Breeding bird surveys to establish trends for burrowing owls are largely limited by small sample size and limited geographic range. Surveys conducted during a breeding bird survey revealed a mixture of population trends throughout the burrowing owl breeding range in North America. However, when taken as a whole, generally declining populations are present in the northern half of the Great Plains, and generally increasing populations are present in the northwest interior and in some southwestern deserts of the U.S (Sauer et al. 2002 as cited in Klute et al. 2003). Reported densities include nearly one pair per hectare in agricultural lands along the Colorado River in Arizona (Brown 1998, as cited in NatureServe 2007).

Surveys in California in 1986 to 1991 found population decreases of 23 to 52 percent in the number of breeding groups and 12 to 27 percent in the number of breeding pairs of owls (DeSante et al. 1997). Populations in western Nebraska declined 58 percent (91 to 38 nesting pairs) between 1990 and 1996 (Desmond and Savidge 1998). Populations in New Mexico have exhibited mixed trends with stable or increasing populations associated with the presence of suitable habitat and increased precipitation and food availability, while decreasing populations were associated with loss of suitable habitat (Arrowood et al. 2001). In Wyoming, only 11 percent of 86 historical sites were occupied in 1998; however, the importance of this finding is uncertain due to the tendency for burrowing owl colonies to move (Korfanta et al. 2001). The Wyoming Game and Fish Department's Wildlife Observation System showed populations generally increasing between 1974 to 1980 and then decreasing between 1981 to 1997 (Korfanta et al. 2001). In North Dakota, the burrowing owl has disappeared from the eastern third of the state and is uncommon to rare in the best habitats north and east of the Missouri River (Murphy et al. 2001). In southwestern North Dakota, the current population trend is not clear, but is probably closely tied to populations of prairie dogs (Murphy et al. 2001). In Oklahoma, there are an estimated 800 to 1,000 breeding burrowing owls, restricted primarily to the panhandle of the state (Sheffield and Howery 2001). In a survey of National Grasslands, Sidle et al. (2001) found higher occupancy of active prairie dog towns by western burrowing owl in the southern Great Plains (93 percent) than in the northern Great Plains (59 percent).

VRCMA Boundary

Burrowing owls breed throughout the watershed in natural settings: salt desert scrub, Mojave shrub, and some sagebrush habitat, as well as in agricultural landscapes. Burrowing owls often breed around the fringes of agricultural lands and use crop and pasture lands for foraging during the breeding season. General habitat condition in many of the known nesting territories is poor. Excessive grazing by large ungulates does not seem to decrease nest site suitability, and may be preferred because of increased visibility. Burrowing owls also nest in open urban areas with open space (e.g., golf courses, airport runways, and industrial areas) if burrows are available. Over-wintering is more common in the southern half of Nevada, but has been recorded throughout the state during all months (Herron et al. 1985, as cited in Klute et al. 2003).

Habitat condition of salt desert scrub varies with grazing and fire history. Indian ricegrass was likely much more prevalent historically in this habitat than it is today, and is an important plant for kangaroo rats, a key component in the ecology of this habitat and a prey item for burrowing owls. Invasion of exotic plants such as cheatgrass, halogeton, Russian thistle, and in certain places, tamarisk, has compromised native communities (Neel 1999, as cited in Klute et al. 2003). The effect of this type of habitat conversion on burrowing owls has not been measured (Klute et al. 2003).

The status of the burrowing owl within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6.27 Western Screech Owl

Scientific Name: *Megascops kennicottii*

1.6.27.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S4 (NatureServe 2007).
- Arizona heritage rank of S5 (NatureServe 2007).

1.6.27.2 General Description

The western screech owl is a small owl with feathered “ear tufts”. Both sexes have similar plumage. Plumage varies across its distribution but is typically gray in southern deserts. Dorsal body-feathers are gray or brownish with a dark central streak and fine horizontal bars. Remiges and rectrices are dark gray or brown with whitish bars. The face ranges from pale white to pale gray or pale brown with a dark lateral border. Ventral body-feathers are whitish with a heavy, dark central streak and four or more fine horizontal bars. The feet and toes are bristled rather than feathered in the southern deserts. Eyes have lemon-yellow irises. The bill is typically blackish or dark gray in southern populations, except for the tip of the upper mandible (Cannings and Angell 2001).

Adult screech owls range from 7.5 to ten inches (19 to 25.5 centimeters) in length and females are typically larger than males. Screech owls have a distinctive call of five to 15 hollow, whistled hoots that speed up toward the end, likened to the sound of a bouncing ball (Cannings and Angell 2001).

1.6.27.3 Distribution

Historic Distribution

The western screech owl ranges throughout much of western North America, from southern coastal Alaska, south to interior and Baja Mexico. Its range extends east through parts of Montana, Wyoming, Colorado, and Texas (Cannings and Angell 2001).

Current Distribution

The current distribution is very similar to the historic distribution, though slow, eastward expansion may be under way all along eastern slopes of Rocky Mountains from New Mexico north to Alberta (Cannings and Angell 2001).

1.6.27.4 Habitat

The western screech owl occupies a diverse assortment of habitats but is generally associated with riparian habitats and deciduous trees over much of its range. It occurs in desert; conifer, hardwood, and mixed forests,; and shrubland/chaparral and suburban/orchard habitats (NatureServe 2007).

1.6.27.5 Life History

Reproductive Biology

Courtship between mating pairs typically begins in January and February, with males attracting females to a nest by calling. Nests are located in tree cavities, most commonly those excavated by northern flickers (*Colaptes auratus*), gilded flickers (*C. chrysoides*), or pileated woodpeckers (*Dryocopus pileatus*). It also uses natural tree cavities, such as those formed where branches have broken off a trunk, and nest boxes. Cottonwood seems to be favored wherever it occurs, probably because of its tendency to form large natural cavities. In southwestern deserts, flicker cavities in giant cacti such as saguaros and cardóns (*Pachycereus* spp.) are frequently used (Cannings and Angell 2001).

Breeding occurs in March and April and typically only one clutch is laid per year. Usually three to five white colored eggs are laid at the bottom of the nesting cavity. Incubation is performed by the female and lasts 26 to 34 days (Sumner 1928, Rains 1998, as cited in Cannings and Angell 2001). Both female and male adults participate in feeding until fledging approximately four weeks after hatching (Cannings and Angell 2001).

Diet

The diet of the western screech owl consists primarily of small mammals (mice and shrews), insects, birds and sometimes also other small vertebrates (NatureServe 2007).

Migration

The western screech owl is a resident species across its range and is non-migratory.

1.6.27.6 Threats Warranting Protection

The primary threat to the western screech owl is habitat degradation, especially riparian areas in the desert southwest (Cannings and Angell 2001). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat degradation, especially in riparian areas in the desert southwest, is a main threat to the western screech owl (Cannings and Angell 2001).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization of this species is not known to occur.

Disease or Predation

Natural predators include spotted owls (Gutierrez et al. 1995, as cited in Cannings and Angell 2001), great horned owls (RJC), and barred owls (J. Acker pers. comm., F. Sears pers. comm., RJC, as cited in Cannings and Angell 2001). Raccoons (*Procyon lotor*) occasionally take nestlings in nest boxes (J. Doremus pers. comm., as cited in Cannings and Angell 2001).

The Inadequacy of Existing Regulatory Mechanisms

This species receives no state or federal protection in Arizona or Nevada (NDOW 2006, AGFD 2007).

Other Natural or Manmade Factors Affecting the Species' Continued Existence

The western screech owl is vulnerable to vehicle collisions along highways (Cannings and Angell 2001).

1.6.27.7 Conservation

Wildlife action plans for Nevada and Arizona address the western screech owl (NDOW 2006, AGFD 2007). Some nesting box placement occurs in Arizona and Idaho.

1.6.27.8 Species Status

Rangewide

While still widespread with stable populations in many areas, populations in some areas are probably declining due to habitat loss and/or degradation, particularly the loss of riparian forests and woodlands (NatureServe 2007).

VRCMA Boundary

The status of the western screech owl within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.6.28 Yellow-breasted Chat

Scientific Name: *Icteria virens*

1.6.28.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Protected under the Migratory Bird Treaty Act (16 U.S.C. Sec. 703–712).
- BLM sensitive species in Nevada (BLM 2003a).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S3B (NatureServe 2007).

- Arizona heritage rank of S4 (NatureServe 2007).

1.6.28.2 General Description

The yellow-breasted chat is a large warbler. It is distinctly different in appearance from most warblers with a robust build, large, strongly curved bill, long tail and distinctive plumage. The upperparts of the chat are olive green to grayish olive, with a lemon-yellow chin, throat, and breast. The belly and under tail-coverts are white. The face is grayish with black lores, white supercilium, and a white eye-crescent on the lower eye-lid. Both sexes look very similar, but during breeding season, the female has gray colored lores, lower mandible, and pink mouth-lining, in contrast to the male's black lining. There is little difference in plumage between seasons but the upperparts of both sexes may be more brownish, the yellow underparts more olive, and the flanks may be more buffy or brownish. In winter, the male bill is typically more brownish (Dunn and Garrett 1997, as cited in Eckerle and Thompson 2001).

During breeding season, the male sings distinctive songs comprised of a series of irregularly spaced scolds, chuckles, mews, rattles, and other unmusical sounds. Otherwise, chats are typically quiet and retiring and often difficult to detect amidst the thick vegetation they usually inhabit (Eckerle 2001).

1.6.28.3 Distribution

Historic Distribution

During the breeding season, the yellow-breasted chat may be found throughout southern British Columbia, across southern Canada and the northern U.S. to southern Ontario and central New York, south to southern Baja California, to Sinaloa on Pacific slope and to Zacatecas in the interior over plateau, to southern Tamaulipas on the Atlantic slope, and to the Gulf Coast and northern Florida (AOU 1998, as cited in NatureServe 2007). During the winter, the yellow-breasted chat ranges to southern Baja California, southern Sinaloa, southern Texas, southern Louisiana, and southern Florida south (rarely north to Oregon, Great Lakes, New York, and New England) to western Panama (AOU 1998, as cited in NatureServe, 2007).

Current Distribution

Populations have expanded their range in some areas where forests were cleared and later abandoned in the nineteenth and twentieth centuries. Populations have been mostly stable in the twentieth century, but peripheral, regional, and local populations have fluctuated, sometimes leading to dramatic declines and local extirpations (Eckerle and Thompson 2001).

1.6.28.4 Habitat

During the breeding season, the yellow-breasted chat prefers secondary growth, shrubby old pastures, thickets, bushy areas, scrub, woodland undergrowth, and fence rows, including low wet places near streams, pond edges, or swamps; thickets with few tall trees; and early successional stages of forest regeneration. It commonly occurs in sites close to human habitation. In the winter, the yellow-breasted chat establishes territories in young second-growth forest and scrub (Dennis 1958, Thompson and Nolan 1973, Morse 1989, as cited in NatureServe 2007).

1.6.28.5 Life History

Reproductive Biology

Pair formation and nesting typically occur in April and May, but may occur through July, depending on the geographic location. Females rarely produce more than one brood per season. The yellow-breasted chat typically nests in low, dense vegetation in both riparian and upland habitat where the nest is usually built near the ground in dense thickets and shrubs that provide concealment (Eckerle and Thompson 2001). The nest is constructed entirely by the female, is cup shaped, is composed of grasses, leaves, strips of bark, and stems of weeds, and is lined with finer grasses, wiry plant stems, pine needles, and sometimes roots and hair (Eckerle and Thompson 2001).

Clutch size is typically three to five white or cream colored eggs with red, brown, gray and/or purple speckles. Egg incubation is performed by the female and lasts approximately 10 to 14 days (Eckerle and Thompson 2001, NatureServe 2007). Both parents participate in feeding the young, and fledging occurs approximately eight to 11 days after hatching (NatureServe 2007).

Diet

The diet of the yellow-breasted chat consists primarily of insects gleaned from foliage, as well as small fruits. (Stiles and Skutch 1989, as cited in NatureServe 2007).

Migration

The yellow-breasted chat migrates between breeding areas in southern Canada, the U.S., and northern Mexico, and wintering areas in central and southern Mexico and Central America. Some birds nay occasionally overwinter in the southern U.S. and northern Mexico (Eckerle and Thompson 2001).

1.6.28.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Primary threats to the yellow-breasted chat include habitat loss due to successional changes, clearing of land for agricultural or residential development and due to over grazing by cattle (NatureServe 2007, Eckerle et al 2001).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Predation on the yellow-breasted chat is primarily upon eggs and nestlings by a variety of snakes, blue jays, chipmunks, and other large mammalian predators (Eckerle and Thompson 2001).

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown. This species is protected under the Migratory Bird Treaty Act.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.6.28.7 Conservation

No management practices are known to have been undertaken for this species.

1.6.28.8 Species Status

Rangewide

While primarily stable through most of its range, peripheral, regional, and local populations have fluctuated, sometimes leading to dramatic declines and local extirpations (Eckerle and Thompson 2001).

VRCMA Boundary

The status of the yellow-breasted chat within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.7 MAMMAL SPECIES DESCRIPTIONS

1.7.1 Allen's Big-eared Bat

Scientific Name: *Idionycteris phyllotis*

1.7.1.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.
- Former Category 2 Candidate species.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Listed as a sensitive species by the state of Utah (UDWR 2006).
- Listed as a sensitive species by the BLM (BLM 2003a).
- Global heritage rank of G3G4 (NatureServe 2007).
- Nevada heritage rank of S1 (NatureServe 2007).
- Arizona heritage rank of S2S3 (NatureServe 2007).

1.7.1.2 General Description

The Allen's big-eared bat is a member of the Vespertilionidae family and the subfamily Vespertilioninae. Members of this largest family of bats are found worldwide and are primarily insectivores.

The Allen's big-eared bat is approximately four inches (11 centimeters) long with a wingspan of 12 inches (30 centimeters). It weighs 0.2 to 0.6 ounces (eight to 16 grams) (Czaplewski 1983). This species is tawny above with hairs that are dark brown at the base. Underparts are slightly lighter and a tuft of white hairs occurs at the posterior base of each ear (Czaplewski 1983, AGFD 2001a).

The Allen's big-eared bat has a loud distinctive call of a "peep" at 1-second intervals. This peep is similar to the spotted bat (*Euderma maculatum)*, but at a lower pitch. Individuals also emit a "rapid clicking" or "low, barely audible cheeping" similar to the Townsend's big-eared bat (*Corynorhinus townsendii*) (AGFD 2001a).

1.7.1.3 Distribution

Historic Distribution

The historic range of the Allen's big-eared bat appears to be similar to its current distribution. This species inhabits mountainous regions of the southwestern United States and Mexico (Czaplewski 1983, Oliver 2000).

Current Distribution

The Allen's big-eared bat appears to be slowly expanding its range northward. In 1969, the species was found in San Juan County, Utah and later it was observed in Kane, Garfield, and Wayne Counties (Oliver 2000). The species has also been observed in Clark County, Nevada and suspected to be in Lincoln and Nye Counties

(Bradley et al. 2006, NDOW 2006). It is considered to be one of the rarest bats in North America and, as such, little is known regarding its winter distribution.

1.7.1.4 Habitat

This species occupies a wide range of habitat types. Allen's big-eared bat has been found to occupy desert shrub, grassland, pinyon-juniper, riparian (cottonwood, willow) and mixed conifer over a wide elevational range (1,320 to 9,800 feet [403 to 3,225 meters]) (Oliver 2000, AGFD 2001a). Preferred roosting areas are forest trees or snags, caves, mines, and rocks (Siders 2005). In winter, the species is generally found at lower elevations (NDOW 2006).

Little is known about maternity and winter roost requirement (Bradley et al. 2006). Maternity roosts have been found in mine tunnels in low, open desert in western Arizona, as well as in a thirty-meter high pile of boulders, but additional results are unavailable (Czaplewski 1983).

1.7.1.5 Life History

Reproductive Biology

The reproductive biology of the Allen's big-eared bat is very poorly known. Females form maternity colonies in the early summer and young are born in mid to late June and begin to fledge in late July (Czaplewski 1983, AGFD 2001a). Females produce only one young per year (Czaplewski 1983). No reproductive information is available for males. They have not been observed with enlarged testes to indicate when breeding may occur.

Diet

The Allen's big-eared bat is an insectivore. The primary food appears to be soft-bodied insects, specifically small moths (*Microlepidoptera*, 0.24 to 0.47 inches [0.6 to 1.2 centimeters] in size). The species has also been reported to feed on soldier beetles (*Cantharidae*), dung beetles (*Scarabeidae*), leaf beetles (*Chrysomelidae*), roaches (*Blattidae*), and flying ants (*Formicidae*). Feeding can occur by gleaning the insects from vegetation or capturing during flight (Czaplewski 1983, AGFD 2001a).

Migration

The Allen's big-eared bat does not do a long-distance migration. However, the species does appear to shift elevations from summer to winter (Bradley et al. 2006).

1.7.1.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

The primary threats to the Allen's big-eared bat are from active mining, timber management and human recreational disturbance to roosts (WBWG 2005, Bradley et al. 2006, NDOW 2007). Active mining near a roost can result in the collapse of the roosting cave (WBWG 2005). Individuals inhabiting forests require exfoliating bark on trees for snag roosts, which may be lacking in areas utilized for timber harvesting (WBWG 2005). Maternity roosts are known to be easily disturbed and result in abandonment of the roost (NDOW 2006, NatureServe 2007). Many abandoned mines are protected for bats by using gates to keep people out. Preliminary information suggests that this species will not use mine gates (WBWG 2005).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

This is not a known threat for the Allen's big-eared bat.

Disease or Predation

This is not a known threat for the Allen's big-eared bat.

The Inadequacy of Existing Regulatory Mechanisms

In Arizona, all bats are protected through Commission Order 14, and cannot be taken alive or dead, under auspices of a hunting license. Bats cannot be imported, exported, or otherwise possessed, without a special permit issued pursuant to Article 4 (Live Wildlife Rules) (AGFD 2006a). Otherwise, this species receives no federal or state protection.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Lack of knowledge of foraging behavior, reproductive biology and population dynamics leaves many uncertainties to the requirements of this species (Bradley et al. 2006).

1.7.1.7 Conservation

In Nevada, the Nevada Bat Conservation Plan has been adopted. Under this plan, attempts will be made to learn more about the requirements and behavior of the Allen's big-eared bat (Bradley et al. 2006). In Arizona, the Arizona Bat Conservation Strategic Plan has also been adopted, which will address research, monitoring, and conservation actions for the Allen's big-eared bat (AGFD 2005a). Also in Arizona, all bats are protected by law by Commission Order 14 and Arizona Revised Statutes 17; it is illegal to take any bat species (AGFD 2005a). Special licenses to take bats and other restricted wildlife can be obtained from AGFD.

1.7.1.8 Species Status

Rangewide

The Allen's big-eared bat appears to be on the decline throughout its range. However, much is lacking in observational data, as this is one of the rarest species found in North America. Surveys in Utah report that this species typically comprises less than two percent of the existing bat fauna in a given area (Oliver 2000). This species is rarely captured in mist nets and roosts are difficult to locate. They can be easily found in mines, but can be easily mistaken for the Townsend's big-eared bat (*Corynorhinus townsendii)* without disturbing the bats for identification purposes. Focused surveys throughout the range of this species need to be conducted to alleviate the large gaps of knowledge that currently exist (WBWG 2005).

VRCMA Boundary

Five occurrences of the Allen's big-eared bat have been reported in the VRCMA Boundary (NNHP 2006, AGFD 2007d). Five observations were made in Arizona near Littlefield in 1979 (AGFD 2007d). Prior to 1975, M.J. O'Farrell observed the species near the City of Mesquite, in Clark County, Nevada (NNHP 2006). It is unknown if surveys for this species have been conducted within the VRCMA Boundary.

1.7.2 <u>Big Free-tailed Bat</u>

Scientific Name: *Nyctinomops macrotis*

1.7.2.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Listed as a Sensitive Species by BLM in Nevada (BLM 2003a).
- Global heritage rank of G5 (NatureServe 2007)
- Nevada heritage rank of S1N (NatureServe 2007).
- Arizona heritage rank of S3 (NatureServe 2007).

1.7.2.2 General Description

The big free-tailed bat can be distinguished from other bats by the “free” tail extending beyond its tail membrane. This bat is bigger than other free-tailed bats, with a body length of 5.13 to 5.75 inches (13.0 to 14.6 centimeters) and a 17-inch (43.2-centimeter) wingspan (AGFD 2001b). It can also be distinguished from the Brazilian free-tailed bat by its longer ear length (University of Kansas No Date). The ears are joined at the base, are rather big, and extend out over the face like a bonnet. The big free-tailed bat has long hair, light reddish to dark brown in color; the underparts are lighter than the dorsum. The hair texture is velvety and somewhat greasy when touched. The ears are united for a short distance at the point where they meet on the forehead. The membranes, ears, and muzzle are black. The rare big free-tailed bat is the larger (over 12 inches [32.5 centimeters] in wingspread) model of the more common Brazilian free-tailed bat. The big free-tailed bat’s tail extends at least one-half its length beyond the tail membrane. Its narrow wing is well designed for rapid flight. The sexes are alike (AGFD 2001b).

The big free-tailed bat has an audible echolocation call, which is characterized as loud and with a frequency range of 17-30 kHz. Surveys based on echolocation calls for this species may be possible, as captures appear to be uncommon (outside of Big Bend National Park, where the most animals in North America have been documented).

1.7.2.3 Distribution

Historic Distribution

The big free-tailed bat ranges from most of South America northward to include Mexico, Arizona, New Mexico, southern and western Texas, southern California and southeastern Nevada, southern Utah, and north to central Colorado. The species is migratory, and there are some extra-limital records from British Columbia, Iowa, Kansas, and South Carolina (NatureServe 2007).

Current Distribution

The big free-tailed bat occurs mainly in southern California, Arizona, New Mexico, Texas, and Mexico. Only a few have been documented in Colorado, on both sides of the Continental Divide and as high as Gunnison (at 7,700 feet [2,347 meters]). Long thought to be an accidental wanderer in Colorado, recent preliminary data now suggest the presence of breeding colonies in southern Utah and adjacent Colorado (WBWG 2005).

1.7.2.4 Habitat

The big free-tailed bat is most commonly found in rugged, rocky habitats in arid landscapes. It has been found in a variety of plant associations, including desert shrub, woodlands, and evergreen forests, and is frequently captured over small pools or ponds. It appears to be associated with lowlands, but has been documented at around 8,000 feet (2,438 meters) in New Mexico. It builds its roosts by day in crevices on cliff faces. Its known elevation range is from near sea level to about 8,500 feet (2,591 meters) (AGFD 2001b).

Although big free-tailed bats are locally abundant, they are often absent from seemingly appropriate habitat. Since these fast flyers are rarely netted over any but the largest and most obstacle-free ponds, it is quite possible that they are limited by suitable drinking sites, which are known to have decreased in number during historic times.

1.7.2.5 Life History

Reproductive Biology

Big free-tailed bats roost mainly in crevices and rocks in cliff situations, although there is some documentation of roosts in buildings, caves, and tree cavities. Breeding probably occurs in midwinter while the species is in warmer latitudes. The females form maternity colonies, and females bear one young in mid-June to early July . Lactating females have been observed in July, August, and September, and volant juveniles recorded in August. Maternity roosts have been documented in rock crevices, with evidence of long-term use. It appears that the return to the roost site by this bat involves ritualized behavior, including a general reconnaissance of the site and several landing trials before entry (WBWG 2005).

Diet

The big free-tailed bat forages almost entirely on large moths, but occasional foraging on other insects, including grasshoppers, beetles, crickets, leafhoppers and flying ants has been documented. This bat emerges late in the evening and forages at high altitudes (WBWG 2005).

Migration

The big free-tailed bat is unable to hibernate, and therefore it is an obligate seasonal migrator (AGFD 2001b). It is also a powerful flyer. Individuals that are present in temperate areas of North America migrate to warmer areas in winter, traveling up to 80 kilometers one way on foraging ventures from large colonies (NatureServe 2007).

1.7.2.6 Threats Warranting Protection

No known threats to the species have been identified to date. However, some of the general threats to bats could apply to the big free-tailed bat. These could include impacts to foraging areas from grazing, riparian management, the use of pesticides, and in some places disturbance to the roost site (e.g., blasting of cliffs or water impoundments). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat conversion to livestock and human recreation uses are the only identified threats to big free-tailed bat habitat. Altered river flow and ground water flow could also decrease habitat availability for this species (AGFD 2006a).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Over-utilization threats to this species include scientific collecting (UDWR 2005).

Disease or Predation

Owls are the only documented predators of the big free-tailed bat. No disease information is available.

The Inadequacy of Existing Regulatory Mechanisms

The big free-tailed bat was proposed as a federal candidate species in 1994. This species is currently on the BLM’s special status species list for Nevada, Utah, and Colorado. It is considered a Species of Special Concern by the states of California and Utah. In Texas, it is not considered Endangered or Threatened, but little is known about population trends.

In Arizona, all bats are protected through Commission Order 14, and cannot be taken alive or dead, under auspices of a hunting license. Bats cannot be imported, exported, or otherwise possessed, without a special permit issued pursuant to Article 4 (Live Wildlife Rules) (AGFD 2006a). Otherwise, this species receives no federal or state protection.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Pesticide use in foraging areas may affect big free-tailed bat populations (UDWR 2005, AGFD 2006a). Although the evidence is too limited to evaluate this effect, it warrants further study. Where riparian areas border agricultural lands, pesticide use may affect the big free-tailed bat through reducing prey numbers or poisoning young if pesticides are sprayed where bats are breeding.

1.7.2.7 Conservation

The Nevada Bat Conservation Plan has been adopted. Under this plan, attempts will be made to learn more about the requirements and behavior of big free-tailed bat (Bradley et al. 2006). The Arizona Bat Conservation Strategic Plan has also been adopted, which will address research, monitoring, and conservation actions for the big free-tailed bat (AGFD 2005a). Also in Arizona, all bats are protected by law by Commission Order 14 and Arizona Revised Statutes 17; it is illegal to take any bat species (AGFD 2005a). Special licenses to take bats and other restricted wildlife can be obtained from AGFD.

1.7.2.8 Species Status

Rangewide

Populations of the big free-tailed bat are limited to southern Utah, but do not appear to use all suitable habitat areas. Distribution may be fairly fragmented. The habitat used is primarily in the southwest and southeast corners of Utah, as well as the south-central portion of the state (UDWR 2005).

VRCMA Boundary

Although the general characteristics of suitable habitat for the big free-tailed bat are known, no surveys delineating such habitat within the VRCMA Boundary have been performed to date.

One individual was observed in the Virgin River Mountains of Arizona in 1994 (AGFD 2007d). No other occurrences have been recorded in natural heritage species databases in the VRCMA Boundary (AGFD 2007d, NNHP 2006).

1.7.3 Brazilian Free-tailed Bat

Scientific Name: *Tadarida brasiliensis*

1.7.3.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Forest Service Sensitive (AGFD 2004h).
- BLM sensitive species in Nevada (BLM 2003a).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S3S4 (NatureServe 2007).
- Arizona heritage rank of S3S4 (NatureServe 2007).

1.7.3.2 General Description

The Brazilian free-tailed bat has short fur ranging in color from dark gray to smoky brown and possesses a nearly black muzzle, wing, and interfemoral membrane. Like other molossid species in the United States, the Brazilian free-tailed bat's tail extends beyond the interfemoral membrane. This species can be distinguished from other molossid species by the separation of the ears (not joined basally at the mid-line) (WBWG 2005).

This species is small to medium sized, weighing between 0.4 and 0.5 ounces (11 and 15 grams) with a wingspan of 11.8 to 13.8 inches (30 to 35 centimeters) (Harvey et al. 1999).

Brazilian free-tailed bats roost in large numbers, sometimes reaching twenty million. They forage on the wing and will generally fly more than 50 miles (80.5 kilometers) to feed (WBWG 2005).

1.7.3.3 Distribution

Historic Distribution

The Brazilian free-tailed bat is the most widespread mammalian species in the Western hemisphere. According to the WBWG (2005), two of the nine subspecies occur in the United States, with *T.b. mexicana* occurring in the western U.S. (southern Oregon south through Mexico and east through Nebraska) and *T.b. cynocephala* occurring in the southeastern U.S. (eastern Kentucky into South Carolina and south through Florida).

Current Distribution

The current distribution is the same as the historic distribution (NatureServe 2007).

1.7.3.4 Habitat

This species is a communal rooster and generally occupies caves or manmade structures that will support large numbers (mine tunnels, crevices in bridges, parking structures, buildings, and attics. They are considered a lowland species generally occupying desert scrub, but can be found at elevations over 9,842 feet (3,000 meters) in coniferous forests and coniferous woodlands (AGFD 2004h).

1.7.3.5 Life History

Reproductive Biology

Breeding is believed to occur in the lower latitude of its range in late February and early March (AFGD 2004h). After breeding, the females migrate northward to maternity roost sites where large numbers of individuals congregate to form large maternity colonies. Gestation takes between 90 and 100 days depending upon the locale (AFGD 2004h). Young are born between mid-June and mid-July. Litter size is one but females can carry two embryos. Young nurse for about 1.5 months and first flight occurs at six to seven weeks. Sexual maturity in males occurs within 18 to 22 months, while females may become pregnant within their first year (NatureServe 2007).

Diet

The diet of the Brazilian free-tailed bat is insectivorous. They consume a variety of agricultural pests, mostly moths, but will also forage on flying ants, weevils, stink-bugs and ground beetles (WBWG 2005). They will forage at various heights. Prey is identified via echolocation and taken in flight.

Migration

Populations of Brazilian free-tailed bats found in the east and along the West Coast of the U.S. hibernate but do not migrate. Most populations found in Texas and the great Plains through the southwestern U.S. migrate to Mexico or the southwestern U.S. For those populations that migrate, migration begins in late August and continues through the end of October, returning in March (NatureServe 2007).

1.7.3.6 Threats Warranting Protection

Primary threats to Brazilian free-tailed bats include pesticides and disturbance from human activities at roost sites (AGFD 2004h). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to the Brazilian free-tailed bat within the VRCMA Boundary may include habitat modification and degradation, as well as human disturbance due to rock climbing and cave and mine exploration (TPWD 2007c).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There appears to be no over-utilization of the species for commercial, recreational, scientific or educational purposes. However, guano derived from large colonies provides commercial value to the species. The literature reviewed for this species does not indicate that guano mining is a threat to the species, but it may be inferred that this constitutes a disturbance to roost sites.

Disease or Predation

Brazilian free-tailed bats usually fall prey to avian species such as American kestrels, Mississippi kites, red-tailed hawks, roadrunners, and great horned owls (AGFD 2004h). They are known carriers of rabies (AGFD 2004h).

The Inadequacy of Existing Regulatory Mechanisms

This species is not a federally listed species.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Brazilian free-tailed bats are subject to disturbances at the roost by human exploration. The number of suitable roost sites for large colonies are limited (AGFD 2004h). Deaths of humans from rabies attributed to the Brazilian free-tailed bat can create attitudes for destroying its roosts and colonies (TPWD 2007c).

1.7.3.7 Conservation

Clark County (RECON 2000) identified the need to protect caves and mines from human disturbance. In Nevada, the Nevada Bat Conservation Plan has been adopted. Under this plan, attempts will be made to learn more about the requirements and behavior of the Brazilian free-tailed bat (Bradley et al. 2006). In Arizona, the Arizona Bat Conservation Strategic Plan has also been adopted, which will address research, monitoring, and conservation actions for the Brazilian free-tailed bat (AGFD 2005a). Also in Arizona, all bats are protected by law by Commission Order 14 and Arizona Revised Statutes 17; it is illegal to take any bat species (AGFD 2005a). Special licenses to take bats and other restricted wildlife can be obtained from AGFD.

1.7.3.8 Species Status

Rangewide

The Brazilian free-tailed bat is has an estimated global abundance between 120 and 150 million and appears to be stable. The largest colonies within the United States are found in the southwest and limited to about 20 caves. Other populations are believed to be small and numerous. Information about the species wintering areas and aggregations is needed along with protection of the largest colonies and tropical winter areas (NatureServe 2007).

VRCMA Boundary

The status of the Brazilian free-tailed bat within the VRCMA Boundary is unknown, although potential habitat does occur there. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.7.4 California Leaf-nosed Bat

Scientific Name: *Macrotus californicus*

1.7.4.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- BLM sensitive species (BLM 2003a).
- Listed as a wildlife species of concern by the State of Arizona (AGFD 2006a).
- Global heritage rank of G4 (NatureServe 2007).
- Nevada heritage rank of S2 (NatureServe 2007).
- Arizona heritage rank of S3 (NatureServe 2007).

1.7.4.2 General Description

The California leaf-nosed bat is a member of the Phyllostomidae family. Members of this family have evolved to utilize food groups such as fruit, nectar, pollen, insects, frogs, other bats and small vertebrates, and even blood. The family gets its name from the often large, lance-shaped nose projection used to direct their sonar, though it is greatly reduced in some of the nectar- and pollen-feeders. Because these bats echolocate nasally, this "nose-leaf" is thought to serve some role in modifying and directing the echolocation call.

California leaf-nosed bats are small to medium sized, with a combined head and body length of 2.1 to 2.5 inches (5.3 to 6.4 centimeters). They have a visible tail that ranges from 1.4 to 1.6 inches (3.5 to 4.1 centimeters). These bats have a large noseleaf, large ears, and broad wings. Their fur is brown or gray. The underside is lighter, typically a brown or tan color (AGFD 2001c).

1.7.4.3 Distribution

Historic Distribution

In Nevada, the historic range of the California leaf-nosed bat is limited to Clark County (NNHP 2004, NDOW 2006). These bats occur primarily south of the Mogollon Plateau. There have been occasional reports of the bats being spotted in extreme southeastern and extreme northwestern Mohave County, Arizona in the summer (AGFD 2001c).

Current Distribution

The current distribution of the California leaf-nosed bat extends from northern Sinaloa through Sonora and all of Baja California to northern Arizona and southern Nevada and California (NatureServe 2007).

1.7.4.4 Habitat

The California leaf-nosed bat is primarily found in desert scrub with rocky soils at elevations from sea level to 4,000 feet (1,220 meters). These bats roost primarily in caves, abandoned mines, rock shelters, and anthropogenic structures including the "cave-like hollows" located at either end of bridges (SWReGAP 2005).

1.7.4.5 Life History

Reproductive Biology

California leaf-nosed bats create five different types of roosts: maternity/nursery roosts (100 to 500 individuals; frequently a few dominant males will guard small harems within the maternity roost), bachelor roosts (used in spring and summer), night roosts (resting places like bridges and rock shelters and other man-made structures; used for consuming large prey), lek roosts (established by males as territories that females fly into during courtship displays), and winter roosts (formed in late summer and early fall; hundreds of males and females together throughout the winter (can number over 1000 individuals (Bradley et al. 2006).

The breeding season occurs mainly in late September and early October. Gestation (embryonic development) is slow, with gestation lasting about eight months. These bats give birth to one young per year; most are born between May and June. Weaning takes place approximately one month after birth.

Diet

California leaf-nosed bats are primarily insectivores that glean insects from approximately three feet (one meter) above the ground. They feed on grasshoppers, cicadas, moths, butterflies, dragonflies, beetles, and caterpillars. These bats can also supplement their diet with cactus fruit including ripe saguaro fruit, for diversity and in times of prey shortages (SWReGAP 2005).

Migration

The California leaf-nosed bat is a year-round resident where they will typically forage within three miles (4.83 kilometers) of known roosts in the summer and within one mile of known roosts in the winter. Daytime foraging is limited to within a few hundred yards of the roosts (SWReGAP 2005). Because the California leaf-nosed bat uses warm winter roosts, this species does not hibernate.

1.7.4.6 Threats Warranting Protection

Main threats to the California leaf-nosed bat include habitat destruction and modification, disturbance of roosts, and mine closure. A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Human entry into mine or cave roosts and closure of mines for hazard abatement and renewed mining are the primary threats to the California leaf-nosed bat (WBWG 2005). Habitat destruction (closure by dynamiting, bulldozing, or otherwise blocking of caves and mines) or modification (altering air movement, humidity, temperature, or interfering with bat access) by partial blocking or improper gating are all potentially serious concerns affecting the California leaf-nosed bat. Mine closure for hazard abatement and renewal of mining activity at previously abandoned mines both present threats to existing colonies (AGFD 2006a).

Loss or conversion of desert wash riparian foraging habitat (as in the development of golf courses and housing areas in the Coachella Valley) are also responsible for population declines (WBWG 2005, NDOW 2006). Water impoundments, urbanization, agriculture, and rural expansion are also degrading and destroying habitat (AGFD 2006a). Other threats include renewed mining, water impoundments and loss or conversion of desert wash riparian vegetation where this species seems to concentrate its foraging (NDOW 2006).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

This is not a known threat.

Disease or Predation

The California leaf-nosed bat has very few known predators (NatureServe 2007).

The Inadequacy of Existing Regulatory Mechanisms

In Arizona, all bats are protected through Commission Order 14, and cannot be taken alive or dead, under auspices of a hunting license. Bats cannot be imported, exported, or otherwise possessed, without a special permit issued pursuant to Article 4 (Live Wildlife Rules) (AGFD 2006a). Otherwise, this species receives no federal or state protection.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Herbicide and pesticide use may affect the California leaf-nosed bat populations. Although the evidence is too limited to evaluate this effect, it warrants further study. Where riparian areas border agricultural lands, pesticide use may affect these bats through reducing prey numbers or poisoning young if pesticides are sprayed where bats are roosting (AGFD 2006a).

1.7.4.7 Conservation

Conservation of the California leaf-nosed bat is addressed in the Nevada Bat Conservation Plan. Under this plan, attempts will be made to learn more about the requirements and behavior of the California leaf-nosed bat (Bradley et al. 2006). The Arizona Bat Conservation Strategic Plan has also been adopted, which will address research, monitoring, and conservation actions for the California leaf-nosed bat (AGFD 2005a). Also in Arizona, all bats are protected by law by Commission Order 14 and Arizona Revised Statutes 17; it is illegal to take any bat species (AGFD 2005a). Special licenses to take bats and other restricted wildlife can be obtained from AGFD. The California leaf-nosed bat is also addressed in the Lower Colorado River MSCP, where conservation measures have been developed to offset any adverse effects on the California leaf-nosed bat by USBR and non-federal activities related to water levels along the Lower Colorado River (USBR 2004). This does not apply to lands within the VRCMA Boundary.

1.7.4.8 Species Status

Rangewide

The current rangewide populations of the California leaf-nosed bat are ranked as apparently secure (G5) by NatureServe (2007).

VRCMA Boundary

Occurrence of the California leaf-nosed bat is unlikely within the lowland riparian areas of the Lower Virgin River. There is potential for the species to occur in the VRCMA Boundary, as historical and present mining activities occur there. Five individuals were observed in 1945 above Littlefield, in Arizona (AGFD 2007d). No other occurrences have been recorded in natural heritage species databases within the VRCMA Boundary (AGFD 2007d, NNHP 2006).

1.7.5 California Myotis

Scientific Name: *Myotis californicus*

1.7.5.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S3B (NatureServe 2007).

1.7.5.2 General Description

The California myotis is a member of the Vespertilionidae family. Members of this family range in size from three to 13 centimeters in length (WBWG 2005). This family, with 42 genera and 355 species is the biggest family in the world.

California myotis is a small footed bat with short forearms, and a relatively long tail (AGFD 2004f). Its ears are proportionately large, extending slightly beyond the snout when laid forward. The ratio of foot to tibia is 37:46, with a ratio of tail to head and body of 91:98. The California myotis' pelage is full, long, and dull. Its skull profile rises sharply to the forehead with a decidedly flat-topped cranium. External measurements average the following: total length, 3.1 inches (7.8 centimeters); tail, 1.5 inches (3.7 centimeters); foot, 0.2 inch (5.5 centimeters.); ear, 0.5 inch (1.3 centimeters); forearm, 1.3 inches (3.2 centimeters); and a total weight of 0.1 to 0.2 ounce (three to five grams). Its flight is relatively slow, fluttery, and highly erratic (AGFD 2004f).

The California myotis is a small bat with dark brown to black ears and wing membranes, a distinctly keeled calcar, and pelage that varies from dark brown to pale reddish-yellow to blond (AGFD 2004f). It differs from the western small-footed myotis, which is sympatric and similar in appearance, by having a more globose skull, narrower rostrum, an overall more delicate appearance, and no black mask. These two species are often difficult to distinguish in the field.

1.7.5.3 Distribution

Historic Distribution

California myotis ranges from southern Mexico through the western U.S. through southern and western British Columbia to extreme southern Alaska (NatureServe 2007).

Current Distribution

The California myotis is thought to inhabit most of its historic range from southern Mexico through the western U.S. through southern and western British Columbia to extreme southern Alaska (NatureServe 2007).

1.7.5.4 Habitat

The California myotis occurs in dry canyon and mesa country of the western United States (WBWG 2005). It is most common in semi-desert shrublands and pinyon-juniper woodlands up to elevations of about 7,500 feet (2,290 meters). The California myotis uses abandoned structures, mines, caves, and cracks and crevices in cliff faces for night roosts. Day roosts are similar and include hollow trees and spaces under bark. Darkness, shelter from the wind and proximity to foraging area seem to be the determining factors as to where to roost (WBWG 2005).

Preferred habitat is desert shrub, grassland, pinyon-juniper, and riparian (cottonwood, willow). Roosting area preferences are forest trees or snags (foliage, cavity, and under bark roosts), caves, mines, buildings, and rocks from sea level to 9,000 feet (2,744 meters) in elevation (SWReGAP 2005). California myotis uses man-made structures for night roosts and forms maternity colonies in rock crevices, under bark, or under eaves of buildings (NatureServe 2007). The species is not an obligate cave dweller.

1.7.5.5 Life History

Reproductive Biology

Breeding season for the California myotis is late fall except in California where it is in early spring, Gestation periods are unknown for this species. Females give birth in late May to mid-June and July. Average life span for the California myotis is 15 years (NatureServe 2007). In summer, these bats roost alone or in extremely small groups, or small colonies of up to 25 individuals (NatureServe 2007). Females form maternity colonies of up to 100 individuals and give birth to only one litter of one young per year. They may be reproductively active for as long as fifteen years (AGFD 2004f).

Diet

The California myotis is an insectivore that primarily forages within five to ten feet (1.5 to three meters) of the ground along margins of tree clumps, around the edge of tree canopy, over water, and well above the ground in open country (NatureServe 2007). Specific food items are unknown, but this bat appears to feed primarily on small moths and beetles that occur between, within, or below the vegetative canopy. The species is nocturnal and the majority of foraging activity occurs just after sunset.

Migration

The California myotis hibernates in caves, mines, tunnels, or buildings, and is known to be active in winter even in temperatures below 43ºF (6ºC) (NatureServe 2007).

1.7.5.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

The California myotis may be affected by closure of abandoned mines without adequate surveys and by recreational caving. The species may be affected by some timber harvest practices, particularly the removal of large diameter snags. Like all bats, it could also be subject to contaminant poisoning (WBWG 2005, AGFD 2004f). Closure of abandoned mines is an activity occurring within the VRCMA Boundary. Threats from timber harvests are limited, due to the limited extent of forest within the VRCMA Boundary.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Threats in this category are unknown.

Disease or Predation

Bats are susceptible to rabies, a serious viral disease that results in death if untreated (AGFD 2004f). Rabid bats rarely attack humans or other animals, but there is no cure once symptoms emerge.

The Inadequacy of Existing Regulatory Mechanisms

In Arizona, all bats are protected through Commission Order 14, and cannot be taken alive or dead, under auspices of a hunting license. Bats cannot be imported, exported, or otherwise possessed, without a special permit issued pursuant to Article 4 (Live Wildlife Rules) (AGFD 2006a). Otherwise, this species receives no federal or state protection.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Like all bats it could be subject to contaminant poisoning (WBWG 2005, AGFD 2004b). Potential for pest control operations around developed areas could affect this species in the VRCMA Boundary.

1.7.5.7 Conservation

Conservation of the California myotis is addressed in the Nevada Bat Conservation Plan. Under this plan, attempts will be made to learn more about the requirements and behavior of the California myotis (Bradley et al. 2006). The Arizona Bat Conservation Strategic Plan has also been adopted, which will address research, monitoring, and conservation actions for the California myotis (AGFD 2005a). Also in Arizona, all bats are protected by law by Commission Order 14 and Arizona Revised Statutes 17; it is illegal to take any bat species (AGFD 2005a). Special licenses to take bats and other restricted wildlife can be obtained from AGFD.

1.7.5.8 Species Status

Rangewide

The rangewide status of this species is unknown.

VRCMA Boundary

The status of the California myotis within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.7.6 Desert Bighorn Sheep

Scientific Name: *Ovis canadensis nelsoni*

1.7.6.1 Protection Warranted

Endangered Species Act

The desert bighorn sheep is not listed or proposed as threatened or endangered (see below), or a candidate for listing, under the Endangered Species Act of 1973, as amended.

There are currently two federally endangered populations of bighorn sheep in North America: Sierra Nevada bighorn sheep (*Ovis canadensis sierrae*), recognized as a unique subspecies and the Peninsular bighorn sheep, a distinct population segment of Desert bighorn sheep (*Ovis canadensis nelsoni*) (USFWS 2008).

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Global heritage rank of G4T4 (NatureServe 2008).
- Arizona heritage rank of S3S4 (AGFD 2007).
- Nevada heritage rank S4 (NNHP 2007).
- Global/Continental Conservation Status: IUCN Red List Category: LR (Nature Serve 2008).

- Species of Greatest Conservation Need – CWCS – Arizona (AZGFD 2006).
- Nevada Bighorn Sheep Species Management Plan (NWAP 2007).

1.7.6.2 General Description

The desert bighorn sheep is a stocky, heavy-bodied sheep similar in size to mule deer. Their coat is brown, while the belly, rump, back of the legs, muzzle and eye patch are white. Weights of mature rams range from 125 to 200 pounds (55 to 900 grams), while ewes are somewhat smaller. Due to their unique padded hooves, the bighorn is able to climb the steep, rocky terrain of the desert mountains with speed and agility. (USFWS 2007a).

Both sexes develop horns soon after birth, with horn growth continuing more or less throughout life. Older rams have impressive sets of curling horns measuring over three feet (one meter) long with more than one foot (0.3 meter) of circumference at the base. The ewes' horns are much smaller and lighter and do not tend to curl (DesertUSA 2008).

The desert subspecies, *Ovis canadensis nelsoni*, is somewhat smaller and has flatter, wider-spreading horns than other subspecies (DesertUSA 2008).

1.7.6.3 Distribution

Historic Distribution

Originally, the bighorn sheep was widespread throughout the western United States, Canada, and northern Mexico. Populations of the desert bighorn sheep subspecies declined drastically with European colonization of the American Southwest beginning in the 1500s. (Buechner 1960, McCutchen 1995, AGFD 2008).

Current Distribution

The most recent science indicates that the sheep is one species that consists of three recognized subspecies: *O. canadensis canadensis*, *O. c. nelsoni* and *O. c. sierrae*. The subspecies *O. c. sierrae* is genetically distinct and only occurs in the Sierra Nevada; *O. c. nelsoni* occurs throughout the southwestern desert regions of the U.S. and Mexico, and *O. c. canadensis* occupies the U.S. and Canadian Rocky Mountains and the northwestern U.S (DOI 1998; USFWS 2008).

1.7.6.4 Habitat

Habitats used by the desert bighorn sheep include alpine dwarf-shrub, low sage, sagebrush, bitterbrush, pinyon-juniper, palm oasis, desert riparian, desert succulent shrub, subalpine conifer, perennial grassland, montane chaparral, and montane riparian communities (DeForge 1980, Monson and Sumner 1980, Wehausen 1980). The bighorn sheep prefers open areas of low-growing vegetation for feeding, with close proximity to steep, rugged terrain (DesertUSA 2008).

Water is critical in arid regions. The bighorn sheep uses springs, water in depressions, and human-made sources. The latter are a significant means of enhancing bighorn habitat (Leslie and Douglas 1979).

1.7.6.5 Life History

Reproductive Biology

The bighorn sheep is polygamous. Rutting occurs in November and December in northern populations, and may be yearlong for desert bighorn sheep, peaking in August and September. Gestation typically lasts five and a half to six months. Lambing season occurs in mid-April to early June, depending on conditions. The desert bighorn sheep may give birth at any time, but most births occur from January to April. Twins are rare and lambs are completely weaned by four to six months of age. Ewes reach sexual maturity at two and a half years, possibly as yearlings under good conditions. Rams reach sexual maturity at the same age, but are unlikely to mate until larger in size. A recruitment rate of 25 to 30 lambs/100 ewes is common in static populations (DesertUSA 2008, AGFD 2008).

Diet

The desert bighorn sheep is primarily a grazer on a wide variety of plant species. Green, succulent grasses and forbs are preferred, but browse is important all year, especially for populations in arid habitats. Preferred plant species vary with habitat quality, locality, and species availability, and may include fluff grass, catclaw, ocotillo spurges, buckwheat, mescal, janusia, slim triodia, Indian wheat, filaree, and weeds in season (AGFD 2008).

When summer temperatures become extreme and water sources dry up completely, the desert bighorn sheep relies on certain desert plants such as jojoba, pincushion and saguaro cactus for both food and moisture (AGFD 2008). They use their hooves and horns to remove spines from cacti, then eat the juicy insides. They are fond of the tender shoots of prickly pear and cholla, and the flowers of succulents like agave and squawgrass (DesertUSA 2008). Some populations use mineral licks, and some may be limited by phosphorus (DesertUSA 2008, AGFD 2008).

Migration

Although most desert bighorn sheep do not seasonally migrate along elevational gradients like many populations in higher latitude mountain ranges, they do exhibit seasonal differences in habitat use patterns. In many populations, animals will have a smaller home range in summer (Leslie and Douglas 1979), presumably due to their limited movement away from permanent water sources. During the cooler or wetter months of the year, the bighorn sheep often exhibits an expanded range as animals move farther from water sources (Simmons 1980). In addition, seasonal changes in habitat use are influenced by lambing and rutting behavior (Geist 1971).

1.7.6.6 Threats Warranting Protection

Current threats to the desert sheep includes: ongoing habitat loss and degradation (human induced), ongoing harvesting (hunting/gathering), ongoing harvesting for cultural/scientific/leisure activities, changes in native species dynamics (exposure to pathogens/parasites), and ongoing intrinsic factors (low populations densities and isolation) (IUCN 2004).

The bighorn sheep is extremely sensitive to disease, particularly those of livestock, which may be the major factor in decline and loss of populations. Feral ungulates and livestock compete with desert bighorns for water and may compete for forage (AZNHP 2008).

Any loss of important habitat (e.g., lambing and feeding areas, escape terrain, water sources, travel routes) may result in serious decline or loss of populations (Hicks and Elder 1979, Jessup 1981, Seegmiller and Ohmart 1981, DeForge et al. 1982, DeForge and Scott 1982, Dunn and Douglas 1982, Ginnett and Douglas 1982, Wehausen 1983, Shackleton 1985).

Predation may be a significant reason for loss in very small populations, such as recent transplants (Wehauser 1996).

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Potential threats must be approached from the standpoint of individual populations and metapopulations. Actions that impair the ability of bighorn sheep to move between mountain ranges (e.g. fencing along highways or other boundaries, canals, and high densities of human habitation) will limit the potential for natural colonization and gene exchange, both of which are key to metapopulation viability (Wehauser et al. 2004). Off-road vehicles, rock climbing, grazing, mining, depletion of water holes, homesteading, roads and poaching also may continue to threaten the bighorn sheep (DesertUSA 2008).

Only about one-third of desert bighorn lambs survive their first summer (DesertUSA 2008). Recent studies of high lamb death rates focus on viruses possibly introduced by domestic livestock, to which the native bighorn have little or no immunity (DesertUSA 2008). When production of lambs declines in any given year, the effects are not realized until six to ten years later when those rams would normally reach a prime age and horn size (RGJ 2008).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Regulated hunting has occurred since 1953, when it was determined that limited hunting of trophy rams and the attention and dollars gained from hunters might be the only way to save these animals. Since establishing bighorns as trophies, permit numbers, the number of units open to hunting, the number of rams taken, and hunt success have gradually increased. About 100 rams, mostly desert bighorns, are being taken each year in Arizona. This number will only increase, however, when the disease problem and other limiting factors are under control (AGFD 2008).

Since 1952, sheep hunting has been allowed but continues to be closely regulated (RGJ 2008). Tags to hunt desert sheep have steadily increased from 72 in 1976, to 154 in 2006 when hunters scored a combined 92 percent success rate hunting in various management areas in Southern Nevada.

Disease or Predation

A susceptibility to disease carried by domestic sheep is the leading cause of the desert bighorn sheep decline (Singer, 2001). The greatest threats include pneumonia and chronic frontal sinusitis (AGFD 2008). Lungworms are also prevalent. Recently, blindness has been observed in several bighorn sheep in the Silver Bell Mountains, Arizona. This condition may have been contracted from a domestic goat herd that escaped a nearby allotment. A similar disease resulted in a 60 percent mortality rate in a Yellowstone bighorn population during the early 1980s (AGFD 2008)

Mountain lions, golden eagles, bobcats, and coyotes have all been implicated as predators on the desert bighorn sheep. (AGFD 2008)

The Inadequacy of Existing Regulatory Mechanisms

Hunting has been prohibited or controlled since the early 1900s, but illegal poaching still occurs (DesertUSA 2008, IUNC 2004). The subspecies *Ovis canadensis auduboni* of the Black Hills and adjacent areas became extinct around 1905 because of unregulated hunting (Williams and Nowak 1993, Ziswiler 1967).

There continues to be challenges in the expansion and leasing of livestock grazing allotments and activities where bighorn sheep may be exposed to fatal diseases (NSC 2008, AGFD 2007).

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Prolonged drought is a natural factor that can have negative impacts on desert bighorn sheep populations, either by limiting water sources or by affecting forage quality (Monson 1980, Douglas and Leslie 1986, Wehausen et al. 1987). Desert bighorn sheep may be dependent on access to free water during summer (Seegmiller and Ohmart 1981) and the access to mineral licks may be important, especially in spring (Shackleton et al. 1999).

Isolation of small metapopulations can be detrimental to desert bighorn viability. Once populations become isolated at relatively low densities, extinction risk increases due to reduced resiliency of that population to other factors such as predation, disease, annual forage and moisture fluctuations, and reduced genetic variability. Ability to cope with limiting factors is likely reduced as populations become bottlenecked (reduced in population size) and individuals in the population become more closely related (AGFD 2008).

The establishment of reserves, such as the Kofa and Cabeza Prieta National Wildlife Refuges in 1939 that set aside 1.5 million acres (3.7 million hectares) of southwest Arizona for the desert bighorn sheep and other wildlife was important in the species survival. Further help came with the formation of the Organ Pipe National Monument, Lake Mead National Recreation Area, and the Havasu and Imperial National Wildlife Refuges (McCutchen 1995, USFWS 2007b, FDB 2008).

1.7.6.7 Conservation

Conservation of the desert bighorn sheep is accomplished primarily through habitat protection and limiting disturbance, contact with livestock, and stress from all sources (USFWS 2007b, FDB 2008). Waterhole maintenance, active monitoring, and research are the management tools used. In Arizona, the Cabeza Prieta National Wildlife Refuge is one of several wildlife refuges set aside to preserve the desert bighorn sheep. The upward trend associated with desert bighorn numbers is directly due to conservation measures, including habitat preservation (McCutchen 1995, USFWS 2007b, FDB 2008). Nevada has recognized a high global responsibility for the stewardship of this subspecies as well (NDOW 2008).

Decreasing population sizes can lead to decreasing levels of genetic variation within populations that may have negative demographic effects through inbreeding depression and loss of adaptability. A small amount of genetic exchange among herds by movements of males can counteract inbreeding and associated increases in homozygosity that might otherwise develop within small, isolated populations (USFWS 2008).

Through the efforts of a number of sportsmen organizations like Nevada Bighorns Unlimited, Fraternity of the Desert Bighorn, and Safari Club International, Nevada has conducted an aggressive trapping and transplant program for all three wild sheep subspecies in Nevada. Sheep have even been introduced into areas of southern Nevada where they did not previously exist because of an insufficient water source (RGJ 2008).

Recovery Units

There are no recovery units proposed for the desert bighorn sheep, it is not currently a federally listed species.

Critical Habitat

No critical habitat is designated for the desert bighorn sheep as a whole; it is not currently a federally listed species (see below).

The current designation of 814,972 acres (329,948 hectares) of critical habitat for the distinct population segment of Peninsular bighorn sheep will remain in place until the Service completes a new revised final habitat designation (65 FR 41405 and 66 FR 8650, USFWS 2008).

Approximately 417,577 acres (1669,060 hectares) of the species' essential habitat has been proposed for the Sierra Nevada bighorn sheep (USFWS 2007a).

1.7.6.8 Species Status

Rangewide

The desert bighorn sheep generally will not be found in areas of human activity. Open terrain with broad vistas and steep boulder-strewn slopes are their preferred habitat. In such areas they may be found from hillsides of only a few hundred feet (100 meters) to over 10,000 feet (3,000 meters) in some of the highest desert mountains of eastern California, much of Nevada, northwestern Arizona, and southern Utah. Today's total population is roughly 13,000, about 10 percent of what existed before the settlement of the west (Mojave DW 2008). Both the Sierra Nevada and Peninsular bighorn sheep are listed as federally endangered species, and the Black Hills subspecies has been hunted to extinction.

Desert bighorn sheep population trends have been upward since the 1960s. The upward trend is due to conservation measures, including habitat preservation. Designated wildlife refugees have contributed greatly to bighorn survival (McCutchen 1995, USFWS 2007b, FDB 2008).

Today, Nevada is home to more desert sheep than any single geographic area in North America (RGJ 2008, NDOW 2008), and populations persist in fragmented groups throughout western North America (Harraka 2002). The natural state of bighorn sheep populations follows a pattern of disjoint distribution across western North America. This pattern of scattered populations is dispersed among mountain ranges, foothills and deserts (Harraka 2002).

VRCMA Boundary

The desert bighorn sheep is known to occur within the VRCMA boundary (Prior-Magee et al. 2007, NDOW 2008).

1.7.7 Desert Kangaroo Rat

Scientific Name: *Dipodomys deserti*

1.7.7.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Evaluation species (High Priority) for the Clark County MSHCP (RECON 2000).
- Global heritage rank of G5 (NatureServe 2008).
- Arizona heritage rank of S5 (AZNHP 2006).
- Nevada heritage rank S2S3 (NNHP 2007).
- Global/Continental Conservation Status: IUCN Red List Category: LC (NatureServe 2008).
- Focal Species – CWCS – Arizona (AGFD 2006)
- Nevada Animal Watch List (NNHP 2007).

1.7.7.2 General Description

The desert kangaroo rat has a long tail and big hind feet each with four toes. They have a large head with big eyes and small ears, and are a sandy brown color with a white underbelly. Its length is approximately 15 inches (38 centimeters) including the tail, and it weighs approximately 4.9 ounces (138 grams) (NatureServe 2008).

The desert kangaroo rat lives in the desert scrub of the Mojave and Sonoran deserts of California and Arizona, and west through southern Nevada in the most arid desert regions in the United States. The species lives in large dens with wide openings at the base of bushes, like creosote bush, or in the banks of wind drifted sand. Their burrows are up to 4.5 feet (1.5 meters) deep, with many passages which connect to food storage rooms and a nest chamber. Their nest is made out of grass and other plants. The desert kangaroo rat spends most of its day underground sleeping and comes out to feed at night when it is cooler (DesertUSA 2008). The desert kangaroo rat is an excellent swimmer (Stock 1965).

1.7.7.3 Distribution

Historic Distribution

The desert kangaroo rat occurs in western and southern Nevada (and a small section of northeastern California), south through southeastern California, extreme southwestern Utah, and western and southern Arizona to northeastern Baja California and Sonora. It occupies dunes within its geographic and elevational range (-197 feet [-60 meters] at Death Valley to 5,610 feet [1,710 meters] in Huntoon Valley, Mineral County, Nevada) (DesertUSA 2008, Best et al. 1989).

Current Distribution

There is no evidence that the historic distribution of the desert kangaroo rat has changed.

1.7.7.4 Habitat

Preferred habitats of the desert kangaroo rat include low deserts and scrublands with sandy soils and sparse vegetation, alkali sinks, shadscale scrub, and creosote bush scrub, including the following communities: Intermountain Cold Desert Scrub, Sand Dunes and Badlands, Mojave/Sonoran Warm Desert Scrub in the Lower and Upper Sonoran life zones, (NWAP 2006).

The desert kangaroo rat is nocturnal, active year-round and occurs in areas that receive little precipitation. Inactive periods of the day are spent in underground burrows, which are dug in mounds, often under vegetation. The species is mostly restricted to deposits of deep wind-blown sand (sometimes including deposits formed as result of human activity); is less abundant near edges of dunes, and has been recorded in gravelly soil in one area in Arizona. It nests in burrows dug in mounds, usually under vegetation. (NWAP 2006).

1.7.7.5 Life History

Reproductive Biology

Pregnant female desert kangaroo rats have been recorded from December through August in different areas. Gestation lasts 29 to 32 days. Litter size is one to six (usually three to four pups). It is possible for this species to produce two litters per year. Young are weaned in 15 to25 days and reach adult size in about three months. Reproductive success in the desert kangaroo rat closely follows success of winter annuals (Best et al. 1989).

Diet

The kangaroo rat mostly eats seeds, leaves, stems and insects. It has adapted to desert life by getting its water from the food it eats, including the seeds and heads of Glyptopleura, the seeds of Lupinus, Gilia, Larrea, and Artemisia, and plant parts of Atriplex and Penstemon (Hall 1981). Although the desert kangaroo rat primarily eats seeds, green vegetation and insects are also occasionally consumed (UDWR 2008).

The desert kangaroo rat can survive long periods on a dry diet, but will drink water freely if available (Butterworth 1964).

Migration

The desert kangaroo rat is sedentary with no migration or seasonal movements. However, these rodents are capable of making long moves if needed (NatureServe 2007).Home ranges generally are small or very small, and scant dispersal data suggest that dispersal usually may be less than a few hundred meters (Best et al. 1989).

1.7.7.6 Threats Warranting Protection

No threats warranting protective status have been identified for the desert kangaroo rat (RECON 2000).

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Destruction of dune habitat, primarily due to unregulated recreation activities in sensitive habitats can threaten the desert kangaroo rat (NWAP 2006). In addition, interruptions in kangaroo rat movements may be created by major water barriers and major roads (NatureServe 2008). Major roads can be substantial barriers to movement of small mammals and a cause of mortality (Oxley et al. 1974, Wilkins 1982, Garland and Bradley 1984).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is a suggestion that desert kangaroo rat populations may be reduced by commercial collection (RECON 2000).

Disease or Predation

Predators of the desert kangaroo rat include coyotes, bobcats, foxes, badgers, skunks, snakes, owls and hawks (NatureServe 2008, DesertUSA 2008, Best et al. 1989).

The desert kangaroo rat is host to parasites, ticks and lice (Best et al. 1989).

The Inadequacy of Existing Regulatory Mechanisms

No regulatory mechanisms exist for this species (RECON 2000, NWAP 2006).

Other Natural or Manmade Factors Affecting the Species' Continued Existence

The desert kangaroo rat is susceptible to stochastic events of narrow endemics and limited distribution species (see RECON 2000). The most important cause of the decline in kangaroo rats has been habitat degradation. This degradation is a result of mainly human development (Williams et. al. 1998), but changing weather patterns also have an effect. As agriculture and irrigation increased rapidly during the 1960's, *Dipodomys'* native habitats were drastically changed and often destroyed, while efforts to exterminate rodents further reduced population sizes (Williams et al. 1998).

Desert kangaroo rat colonies also may die out following successive years of drought (Best et al. 1989).

1.7.7.7 Conservation

Kangaroo rats have been identified as keystone species, and several of these species have been listed as endangered (USFWS 2005). Strong efforts have been initiated to maintain and restore kangaroo rat populations. The main focus of conservation efforts has been to protect existing habitat to minimize further damage to populations.(Williams et al. 1998). Furthermore, efforts to restore damaged habitats and enhance existing habitats are ongoing. Human developments such as gravel roads can hinder kangaroo rat movement, and efforts have been made to use less damaging dirt roads through kangaroo rat habitats (Brock and Kelt 2004). Studies have found that removing shrubs from desert environments improves the survival rate for *Dipodomys*. These findings indicate that shrub control could benefit kangaroo rats and increase population sizes (Price et al. 1994).

Recovery Units

There are no recovery units proposed for the desert kangaroo rat; it is not currently a federally listed species.

Critical Habitat

No critical habitat is designated for the desert kangaroo rat; it is not currently a federally listed species.

1.7.7.8 Species Status

Rangewide

The desert kangaroo rat is a southwestern desert endemic associated with dunes and other fine sand habitat (RECON 2000). Kangaroo rats serve as a keystone species in many of the desert habitats in which they live. *Dipodomys* play vital roles in these communities by heavily influencing other animal populations, soil quality (from burrowing and foraging), and plant distribution (Williams et al. 1998).

VRCMA Boundary

The desert kangaroo rat is known to occur within the VRCMA boundary (NWAP 2006, Prior-Magee 2006, RECON 2000).

1.7.8 Desert Pocket Mouse

Scientific Name: *Chaetodipus penicillatus*

1.7.8.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Evaluation species (High Priority) for the Clark County MSHCP (RECON 2000).
- Watch List for NNHP (NNHP 2004).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S1S2 (NatureServe 2007).

1.7.8.2 General Description

Chaetodipus penicillatus is a medium-sized pocket mouse with a long, heavily crested, and tufted tail. Its pelage is coarse, but lacks spines on the rump. The sole of the hind foot is naked to the heel, and upperparts are vinaceous buff and finely sprinkled with black, imparting a grayish tone. The underparts and tail to tuft are white. The coloring of its sides are like the back with no lateral line. External measurements average the following: total length, 8.1 inches (20.5 centimeters); tail, 4.3 inches (10.9 centimeters); hind foot, 1.0 inch (2.5 centimeters). The species' weight ranges from 0.5 to 0.8 ounces (15 to 23 grams) (Davis and Schmidly 1994).

1.7.8.3 Distribution

Historic Distribution

The desert pocket mouse occurs in much of Mexico and the southwestern United States. In the United States, this species is found in the following states: Arizona, California, New Mexico, Nevada, and Utah (NatureServe 2007). According to NatureServe (2007), the desert pocket mouse occurs in watershed region 15, especially around the Fort Pierce Wash and Lower Virgin watersheds.

Current Distribution

The current distribution is the same as the historic distribution (NatureServe 2007).

1.7.8.4 Habitat

The preferred habitat of the desert pocket mouse is sandy desert with sparse vegetation (UDWR 2007). According to Hall (1946, as cited in NatureServe 2007), the desert pocket mouse seems to prefer rock-free bottomland soils along rivers and streams. It sleeps and rears young in underground burrows. The home range size for adults and juveniles of both sexes is about 0.5 acre (0.2 hectare) (NatureServe 2007).

1.7.8.5 Life History

Reproductive Biology

The desert pocket mouse breeds in spring and summer with a litter size averaging between two and five young (NatureServe 2007). According to Davis and Schmidly (1994), the breeding season of this pocket mouse begins in late February, the peak of pregnancies among females was in April, and the peak of juveniles in the population occurred in May. Lesser peaks of pregnancy occurred in June and August. Also, many young females reach sexual maturity early and become pregnant while still in their juvenile pelage (Davis and Schmidly 1994).

Diet

According to the Utah Division of Wildlife Resources (2007a), desert pocket mice primarily eat seeds; more specifically, those of mesquite, creosote bush, and broomweed have been found in their cheek pouches (Davis and Schmidly 1994). Similar to other pocket mouse species, the desert pocket mouse has external fur-lined cheek pouches used for temporary food storage. Long-term seed storage occurs in underground burrows (UDWR 2007a). Adult and immature eating habits are the same (NatureServe 2007).

Behavior

The desert pocket mouse is a nocturnal, non-migrant species (NatureServe 2007). Both adults and juveniles hibernate/aestivate and are nocturnal. The desert pocket mouse is most likely not as active in winter as in summer and may become torpid for several days.

1.7.8.6 Threats Warranting Protection

Primary threats to the desert pocket mouse include habitat degradation from development, unknown population trends, and the susceptibility to random events from a limited distribution (RECON 2000). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Direct mortality of the desert pocket mouse could result from habitat degradation and loss resulting from urban and rural development (RECON 2000).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

These threats are unknown for these species.

Disease or Predation

The desert pocket mouse is susceptible to random events of narrow endemics and limited distribution species (those with limited habitat or low relative densities) (RECON 2000).

The Inadequacy of Existing Regulatory Mechanisms

These threats are unknown for these species.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown.

1.7.8.7 Conservation

General and ecosystem level conservation actions from the Clark County MSHCP apply to the desert pocket mouse (RECON 2000). Additional conservation needs include evaluation of current distribution, potential threats, and population trends (RECON 2000).

1.7.8.8 Species Status

Rangewide

Population trends for the desert pocket mouse are unknown (RECON 2000).

VRCMA Boundary

The status of the desert pocket mouse within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.7.9 Fringed Myotis

Scientific Name: *Myotis thysanodes*

1.7.9.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.
- Former Category 2 candidate species (NNHP 2004).

Other Protections

- Evaluation species (Medium Priority) for Clark County MSHCP (RECON 2000).
- BLM sensitive species in Nevada (NNHP 2004).
- Global heritage rank of G4G5 (NatureServe 2007).
- Nevada heritage rank of S2 (NatureServe 2007).
- Arizona heritage rank of S3S4 (NatureServe 2007).

1.7.9.2 General Description

The fringed myotis is part of the long eared myotis group, which is characterized by long ears projecting 0.12 to 0.20 inch (3.5 centimeters) beyond its muzzle when laid forward (AGFD 2003h). It weighs on average 0.18 to 0.25 ounce (57 grams). Its fur ranges in color from yellowish brown to darker olivaceous tones, with little difference between ventral and dorsal surfaces. Ears and membranes are glossy black. Females have significantly larger heads and bodies, as well as longer forearms. The robust calcar is not distinctly keeled. Its wing membranes are moderately thick and elastic and are resistant to puncture (O'Farrell and Studier 1980, as cited in AGFD 2003h).

1.7.9.3 Distribution

Historical Distribution

The fringed myotis is widespread in western North America, from south central British Columbia south through the western United States to southern Mexico (NatureServe 2007).

Current Distribution

The current distribution is the same as the historic distribution.

1.7.9.4 Habitat

Rangewide, this species is found in desert, grassland, and woodland habitats (NatureServe 2007). It roosts in caves, mines, rock crevices, buildings, and other protected sites (Hiatt and Boone 2004, NatureServe 2007). Colonial maternity roosts occur in caves, mines, and sometimes buildings; they can also occur in rock crevices and cliffs or in trees or snags (Ramsey 1997). The fringed myotis is insectivorous with a preference for beetles, and forages by gleaning insects from the ground or near the canopy of thick and thorny vegetation (NatureServe 2007). A survey showed this species to have low activity at night, confined to the periods of one hour after sunset and one hour before sunrise (O'Farrell 2002b). In Clark County, the fringed myotis occupies an elevation range of 4,000 to 7,000 feet (1,200 to 2,100 meters) (Hiatt and Boone 2004). This species is mostly found at the higher elevations, but can occur at the lower elevations during spring and fall migration (Hiatt and Boone 2004). Key habitat attributes are caves, mines, and rock crevices for roosting.

1.7.9.5 Life History

Reproductive Biology

Females do not copulate until after leaving the maternity roost in the fall (O'Farrell and Studier 1973, as cited in AGFD 2003h). Copulation can occur at hibernacula. According to a study by O'Farrell and Studier (1973, as cited in AGFD 2003h), ovulation, fertilization, and implantation occurred between April 28 and May 15; gestation lasted from 50 to 60 days; and parturition began June 25 and concluded by July 7.

Young have open eyes and erect pinnae shortly after birth. During lactation two to ten adults are always present in the roost to care for the young. The neonate is huge in proportion to the mother, at 22 percent of her body mass and 54 percent of her total length. Females deposit newborns in a separate roost site and only visit them to nurse or to assist young in distress. Young are capable of limited flight after approximately 16.5 days. After 21 days, young are indistinguishable from adults in both flight and form. Gender ratio is equal at birth (AGFD 2003h).

Diet

The fringed myotis eats mostly small beetles (73 percent frequency); moths are also common prey. Observations have indicated slow, highly maneuverable flight with foraging occurring in and around vegetation. This bat may land to pick up prey from the ground (AGFD 2003h).

Migration

The fringed myotis migrates, although migration patterns and destinations are not well understood. Fall migrations may be short distances to lower elevation sites or more southerly areas where periodic activity in winter would be possible. Physiological studies of fringed myotis have demonstrated the species to have control over body temperature regulation and that it can fly at low ambient and body temperatures (AGFD 2003h).

Spring migration to maternity roosts is rapid (lasting less than a month) and occurs from mid- to late April, (AGFD 2003h).

1.7.9.6 Threats Warranting Protection

In Clark County, the greatest threat to the fringed myotis is human disturbance at roost sites, especially maternity colonies, through recreational caving and mine exploration (NatureServe 2007). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Recreational caving, mine reclamation, renewed mining, timber harvest, indiscriminate pest control, bridge replacements and building demolition that do not consider presence and use patterns of bat species may pose threats. Fringed myotis are extremely sensitive to disturbance (NDOW 2006). Other threats include: closure of abandoned mines, renewed mining at historic sites, toxic material impoundments, pesticide spraying, vegetation conversion, livestock grazing, timber harvest, and disturbance of water sources and riparian habitat (AGFD 2003h).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

It is unknown whether this is a threat to the fringed myotis.

Disease or Predation

It is unknown whether this is a threat to the fringed myotis.

The Inadequacy of Existing Regulatory Mechanisms

In Arizona, all bats are protected through Commission Order 14, and cannot be taken alive or dead, under auspices of a hunting license. Bats cannot be imported, exported, or otherwise possessed, without a special permit issued pursuant to Article 4 (Live Wildlife Rules) (AGFD 2006a). Otherwise, this species receives no federal or state protection.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

The lack of understanding of intra-specific variation within this species compromises the effectiveness of current management policy (AGFD 2003h).

1.7.9.7 Conservation

Conservation of the fringed myotis is addressed in the Nevada Bat Conservation Plan. Under this plan, attempts will be made to learn more about the requirements and behavior of the fringed myotis (Bradley et al. 2006). The Arizona Bat Conservation Strategic Plan has also been adopted, which will address research, monitoring, and conservation actions for the fringed myotis (AGFD 2005a). Also in Arizona, all bats are protected by law by Commission Order 14 and Arizona Revised Statutes 17; it is illegal to take any bat species (AGFD 2005a). Special licenses to take bats and other restricted wildlife can be obtained from AGFD. The fringed myotis is also addressed in the Clark County MSHCP, where conservation measures have been developed to offset any adverse effects on the fringed myotis from activities covered in the Clark County MSHCP (RECON 2000).

1.7.9.8 Species Status

Rangewide

The fringed myotis' population is rare and declining in Nevada (NDOW 2006). The species appears to be stable in Arizona (AGFD 2003h).

VRCMA Boundary

The status of the fringed myotis within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.7.10 Great Western Mastiff Bat

Scientific Name: *Eumops perotis californicus*

1.7.10.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Global heritage rank of T4G5 (NatureServe 2007).
- Nevada heritage rank of S1 (Nature Serve 2007).

- Arizona heritage rank of S1S2 (NatureServe 2007).

1.7.10.2 General Description

The great western mastiff bat is a member of the Molossidae family. Members of this family are a diverse group of fast-flying, aerial insectivores. Molossidae currently includes over 13 genera and 80 species.

The great western mastiff bat is the largest bat in the United States (AGFD 2002c). It can be distinguished from all other North American molossid (free-tail) species based on size. With a forearm of 2.87 to 3.27 inches (7.3 to 8.3 centimeters), it is also North America's largest bat species.

The tail of the great western mastiff bat extends far beyond the interfemoral membrane (AGFD 2002d). The dorsum, wings, tail, and ears are dark, where the venter barely contrasts. The dorsum usually is dark gray, brownish gray, or pale chocolate-brown with the white at the base of the hairs frequently showing through both ventrally and dorsally. The venter often is ashy brown.

The great western mastiff bat is a large bat of approximately six to seven inches (15.7 to 18.4 centimeters) total length with long slender wings of 20 to 21 inches (51.5 to 53.5 centimeters) and large ears of 1.5 to two inches (3.6 to 4.7 centimeters) long (AGFD 2002d). Males are significantly larger than females in cranial measurements. Members of the genus Eumops have large, rounded pinnae that arise from a single point or are joined medially on the forehead. Smooth upper lips distinguish Eumops from Tadarida. The absence of a gap between the two upper incisors, which project forward in contact with each other except at the tips, is another distinguishing feature of Eumops (AGFD 2002d).

1.7.10.3 Distribution

Historic Distribution

The great western mastiff bat has a disjunctive distribution, with two subspecies confined to South America (AGFD 2002d). The subspecies that occurs in North America, the great western mastiff bat, ranges from California (San Francisco across to the Sierra Nevada and south) through Las Vegas, Nevada southern half of Arizona to Big Bend, Texas area and south to Sinaloa in northwestern Mexico and Zacatecas in Central Mexico (AGFD 2006a).

Current Distribution

The previously known range of the great western mastiff bat has been extended to the north in both Arizona (several localities near the Utah border) and California (to within a few miles of the Oregon border) (AGFD 2006a). Distribution in Nevada and Southern Utah is not well understood. Until recently, Nevada records were limited to a single record from Southern Nevada. A recent study in southern Nevada has acoustic records for the great western mastiff bat from June through October in 2004. The species has also been detected acoustically in southern Utah.

The species occurs only to 1,230 feet (375 meters) elevation in California, and 3,600 feet (1,100 meters) elevation in Texas (TPWD 2007a). Recent surveys in California, however, have documented roosts up to 1,400 m, and foraging animals at greater than 8,860 feet (2,700 meters) (SWReGAP 2005). Acoustic records of the great western mastiff bat in California document foraging or commuting at up to 10,000 feet (3,050 meters) in the southern Sierra Nevada. Recent surveys in northern Arizona have documented roosts at approximately 3,940 feet (1,200 meters), and foraging animals at greater than 8,200 feet (2,500 meters).

The distribution of the great western mastiff bat is likely geomorphically determined, with the species being present only where there are significant rock features offering suitable roosting habitat (SWReGAP 2005).

1.7.10.4 Habitat

The great western mastiff bat is primarily a cliff dwelling species, where maternity colonies of 30 to several hundred (typically fewer than 100) roost generally under exfoliating rock slabs (e.g. granite, sandstone or columnar basalt) (SWReGAP 2005). It has also been found in similar crevices in large boulders and buildings. Roosts are generally high above the ground, usually allowing a clear vertical drop of at least 9.8 feet (3 meters) below the entrance for flight (TPWD 2007a). Their preferred habitat is desert shrub, grassland, and riparian (cottonwood, willow) areas, with preferred roosting locations typically in buildings and rocks at 239.5 to 8,474.4 feet (73 to 2,583 meters) in elevation (SWReGAP 2005).

In California, the great western mastiff bat is most frequently encountered in broad open areas (SWReGAP 2005). Generally, this bat is found in a variety of habitats, from dry desert washes, flood plains, chaparral, oak woodland, open ponderosa pine forest, grassland, montane meadows, and agricultural areas.

The great western mastiff bat roosts in high dry places typically in rugged rocky canyons and cliffs with abundant fissures and crevices including shallow caves and on sides of cliffs and rock walls (SWReGAP 2005). They have also been associated with human structures, which include signboards, houses, tunnels, large warehouses, buildings within attics, and cracks in masonry walls. The great western mastiff bat requires large surfaces of open water for foraging. It uses only select drinking sites and are severely limited by the availability of drinking water (SWReGAP 2005).

1.7.10.5 Life History

Reproductive Biology

Although maternity roosts for many bat species contain only adult females and their young, some great western mastiff bat colonies contain adult males and females at all times of year (TPWD 2007a). The great western mastiff bat mates in late winter/early spring and gives birth to a single young in early to mid summer. Available data suggest that, although most great western mastiff bat young are born by early July, parturition dates vary extensively and births are not synchronous even within colonies. The average gestation period lasts 80-90 days (SWReGAP 2005).

Diet

Due to its audible echolocation call, great western mastiff bat can be readily detected in foraging areas. They feed near ground-level on small to large insects of soft to intermediate hardness that are typically low-flying and weak-flying. Their diet consists primarily of moths (Lepidoptera), but also includes crickets and katydids. However, officials in the state of Arizona indicate that the great western mastiff bat can feed at considerable heights (100 to 200 feet [30.5 to 61 meters] and sometimes more than 1,000 feet [304.8 meters]) (AGFD 2006a).

Migration

Unlike some Molossid species (e.g., *Tadarida brasiliensis*) which undergo long distance seasonal migrations, the great western mastiff bat is a non-migrant and appears to move relatively short distances seasonally from roost to roost (TPWD 2007a). It does not undergo prolonged hibernation, and appears to be periodically active all winter, and thus may seek winter refugia that are protected from prolonged freezing temperatures. The average foraging distance is 10 to 25 kilometers from roost sites (SWReGAP 2005).

1.7.10.6 Threats Warranting Protection

Loss of large open-water drinking sites seems to pose a serious threat to great western mastiff bats in the Southwest (TPWD 2007a). This species is also threatened by urban/suburban expansion, and by activities that disturb or destroy cliff habitat (e.g. water impoundments, highway construction, quarry operations). Recreational climbing is another potential threat. Pest control operations have eliminated most known building colonies in the Los Angeles basin. Grazing and pesticide applications in agricultural areas may impact foraging habitat (AGFD 2002d).

Like most other North American species of bat, the long term persistence of the great western mastiff bat is threatened by: low fecundity, high juvenile mortality, long generational turnover, loss of clean open water, loss of riparian vegetation, and pesticide application (Siders 2005). Population trends for this species are difficult to assess in many areas because of an absence of historical roost records.

The great western mastiff bat is particularly threatened by urban expansion (Siders 2005). When colonies are within or in close proximity to human dwellings, they are vulnerable to disturbance, vandalism and the hysteria which often surrounds bat colonies, causing extermination by pest control operators and public health departments.

Any construction activities (e.g., quarry operations, highway projects, water impoundments) that impact cliffs or boulders could also affect great western mastiff bat roosts (Siders 2005). Rock climbing may also disturb roosting bats, and is a rapidly-growing recreational activity in the range of the great western mastiff bat. Communication with avid rock climbers suggest bat encounters do occur on climbs, and that hands or temporary climbing aids inserted into a roost crevice could cause abandonment of a site.

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Like most other North American species of bat, the long term persistence of the great western mastiff bat is threatened by loss of clean, open water and loss of riparian vegetation. When colonies are within or in close proximity to human dwellings, they are vulnerable to disturbance, and vandalism. Any construction activities (e.g., quarry operations, highway projects, water impoundments) that impact cliffs or boulders could also affect great western mastiff bat roosts (WBWG 2005). Additionally, since the great western mastiff bat only selects limited drinking sites it is severely limited by the availability of drinking water (AGFD 2002d). Urban expansion, livestock management practices, and recreational use of habitats can decrease available habitat (AGFD 2006a).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

It is unknown whether this is a threat to the great western mastiff bat.

Disease or Predation

Great western mastiff bats that are active in the morning are known to be predated by raptors, but no information is currently available for regular predation or disease (TPW 2007).

The Inadequacy of Existing Regulatory Mechanisms

In Arizona, all bats are protected through Commission Order 14, and cannot be taken alive or dead, under auspices of a hunting license. Bats cannot be imported, exported, or otherwise possessed, without a special permit issued pursuant to Article 4 (Live Wildlife Rules) (AGFD 2006a). Otherwise, this species receives no federal or state protection.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

The great western mastiff bat forages over a large area, and thus the huge amount of pesticide applications in rural areas such as the Colorado River Valleys could have far-reaching effects (AGFD 2002d). Both pesticide and non-chemical methods can also reduce the prey base for western mastiff bat populations, which rely heavily on moths for their diet.

Rock climbing may also disturb roosting bats, and is a rapidly-growing recreational activity in the range of the great western mastiff bat (AGFD 2002d).

1.7.10.7 Conservation

Conservation of the great western mastiff bat is addressed in the Nevada Bat Conservation Plan. Under this plan, attempts will be made to learn more about the requirements and behavior of the great western mastiff bat (Bradley et al. 2006). The Arizona Bat Conservation Strategic Plan has also been adopted, which will address research, monitoring, and conservation actions for the great western mastiff bat (AGFD 2005a). Also in Arizona, all bats are protected by law by Commission Order 14 and Arizona Revised Statutes 17; it is illegal to take any bat species (AGFD 2005a). Special licenses to take bats and other restricted wildlife can be obtained from AGFD. The great western mastiff bat is also addressed in the Clark County MSHCP as a Watch List species (RECON 2000).

1.7.10.8 Species Status

Rangewide

Rangewide status of this species is unknown.

VRCMA Boundary

The great western mastiff bat has been found to have stable populations in all Arizona counties except Yavapai, Navajo, Apache and Santa Cruz (AGFD 2002d). No occurrences of this species have been recorded in the NNHP or AGFD species databases (NNHP 2006, AGFD 2007d species datasets).

1.7.11 Hoary Bat

Scientific Name: *Lasiurus cinereus*

1.7.11.1 Protection Warranted

Endangered Species Act

- Populations within North America are not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.
- Hawaiian subspecies *L.c. semotus* of Hawaii is listed as endangered (NatureServe 2007).

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Forest Service Sensitive (AGFD 2004e).
- BLM sensitive species in Nevada (BLM 2003a).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S3 (NatureServe 2007).
- Arizona heritage rank of S4 (NatureServe 2007).

1.7.11.2 General Description

Hoary bats have thick fur that has a golden coloration around the face. Their body fur is also golden colored but is tipped in white giving this species a frosty appearance. The uropatagium and dorsal side of the hoary bat is also heavily furred. They have rounded ears that are outlined in black and a blunt tragus (AGFD 2004e).

Hoary bats are large; adults weigh between 0.9 and 1.1 ounce (25 and 30 grams). They have a wingspan ranging from 15.0 to 16.1 inches (38 to 41 centimeters) (AGFD 2004e). Hoary bats have a flight pattern that is swift and direct, allowing for identification on the wing (Harvey et al. 1999).

1.7.11.3 Distribution

Historic Distribution

The hoary bat is the most widespread bat in North America ranging from southern Canada south through South America. It is the only land based mammal native to Hawaii (NatureServe 2007).

Current Distribution

There appears to be no difference between the historical range and current range of this species.

1.7.11.4 Habitat

Rangewide, this species inhabits many terrestrial biomes. It prefers deciduous and coniferous forests and woodlands. This species roosts in tree foliage and is rarely found in rock crevices or caves for roosting. Hoary bats are solitary roosters (NatureServe 2007).

1.7.11.5 Life History

Reproductive Biology

In North America, reproduction occurs between September and November and fertilization is delayed. Gestation lasts 90 days and birth occurs between mid-May and early June. Hoary bats usually bear two young. During daytime, roosting young will cling to the mother, but are left clinging to the roost tree by themselves as the mother forages at night (Harvey et al. 1999)

Diet

The diet of the hoary bat consists primarily of moths, true bugs, mosquitoes and other insects. Occasionally, hoary bats will prey on other bats (Harvey et al. 1999).

Migration

Hoary bats are migratory, generally moving between summer and wintering areas in the spring and fall. Some individuals in the northern extent of its range and Texas will hibernate rather than migrate south (NatureServe 2007). For those that migrate, the winter range includes southern California, southeastern United States, Mexico and Guatemala (AGFD 2004e).

1.7.11.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

A primary threat to the hoary bat is the loss of roosting and foraging habitat due to timber harvest (WBWG 2005).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Over-utilization for commercial, recreational, scientific or educational purposes does not appear to impact this species.

Disease or Predation

Hoary bats may fall prey to various hawks, owls and snakes (AGFD 2004e).

The Inadequacy of Existing Regulatory Mechanisms

This species is not a federally listed species in the continental United States.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Use of pesticides in public forest lands are identified as a potential source of mortality to roosting bats and their insect prey (WBWG 2005).

1.7.11.7 Conservation

No conservation measures are currently in place.

1.7.11.8 Species Status

Rangewide

Hoary bat population trends are unknown, however the subspecies *L.c. semotus* is listed by the USFWS as endangered (NatureServe 2007). *L.c. semotus* is restricted to the Hawaiian Islands and is the only native land mammal present in the island chain (Harvey et al. 1999).

VRCMA Boundary

The status of the hoary bat within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.7.12 Kit Fox

Scientific Name: *Vulpes macrotis*

1.7.12.1 Protection Warranted

Endangered Species Act

- The species is not listed as threatened or endangered under the ESA.
- However, the San Joaquin kit fox, *Vulpes macrotis mutica*, is one of two recognized subspecies of the kit fox and the U.S. Department of the Interior declared the San Joaquin kit fox an endangered species in 1967. California placed the San Joaquin kit fox on their state endangered species list in 1971 as a threatened species (USFWS 2008b).

Other Protections

- Evaluation species (High Priority) for the Clark County MSHCP (RECON 2000).
- Ranked as apparently secure across its entire range (G4, NatureServe 2007).
- Vulnerable to extirpation or extinction in the states of Nevada and Utah (S3, NatureServe 2007).
- Listed as a species of concern by the State of Utah (UDWR 2006).

1.7.12.2 General Description

The kit fox is a member of the Canidae family. Members of this family are primarily medium-sized carnivores, and are widely distributed occurring on all continents except Antarctica. This family is represented by 14 genera and 34 species.

Kit foxes are among the smallest foxes of the Americas, with their most conspicuous characteristic being exceptionally large, closely set ears, which help dissipate heat in their desert environment. This fox has a slender body, long legs and a very bushy tail, which sticks straight out behind it and is tipped in black. The color of the coat varies with the season, ranging from rusty-tan to buff-grey in the summer, to silvery grey in the winter, with a whitish belly. The hair is dense between the footpads, giving the fox better traction on the sandy soil of its habitat, whilst also protecting the paws from the heat of the desert sand. The kit fox and the more easterly swift fox (*Vulpes velox*) were previously considered a single species, but more recent evidence implies the two species are distinct.

The kit fox has several recognized subspecies. The San Joaquin kit fox (*Vulpes macrotis mutica*) was formerly common in the San Joaquin Valley of California. The desert kit fox (*Vulpes macrotis arsipus*) lives in the Mojave Desert (Kilburn and Kilburn 1992, USFWS 2008b).

1.7.12.3 Distribution

Historic Distribution

The kit fox originally ranged from the plains of western Canada and across the Great Plains of North America south through southern California, Baja California Texas and central Mexico (NatureServe 2006). Kit foxes disappeared entirely from Canada in the 1930s, but have been reintroduced there.

Current Distribution

The kit fox currently can be found throughout the Great Basin (southwestern Oregon through southern Utah and Nevada), extending northward through western Colorado and western New Mexico and through Texas and into central Mexico. At present there are a few scattered populations of the kit fox in the Great Plains of the U.S. and in western Canada. The largest population is in Colorado, Kansas, New Mexico, and Wyoming, where the species is stable. There are currently approximately only 350 individuals located in Southeast Alberta and Southwest Saskatchewan (UDWR 2005).

1.7.12.4 Habitat

The kit fox inhabit arid and semi-arid regions encompassing desert scrub, chaparral, halophytic and grassland communities. It is found at elevations of 400 to 1,900 meters, generally avoiding rugged terrain with slopes >5 percent. Loose textured soils may be perfect for denning. Kit foxes will use agricultural lands, particularly orchards, on a limited basis and can also inhabit urban environments (UDWR 2005).

1.7.12.5 Life History

Reproductive Biology

Male and female kit foxes establish pairs during October and November. These pairs can change year to year. Breeding season is typically from December to February, when they use larger family dens. Gestation lasts anywhere from 49 to 56 days. Litters are born throughout March and April, usually containing three to 14 young. Weaning young can forage at three to five months in age. The kit fox usually lives to be 10 to 12 years old (UDWR 2005).

Diet

The kit fox is mostly a nocturnal animal but will occasionally venture out of its den during the daytime. The kit fox usually goes out to hunt shortly after sunset, mostly eating small animals like kangaroo rats, jackrabbits, insects, fish, and small birds. Different kit fox families can occupy the same hunting grounds, but do not generally go hunting at the same time (UDWR 2005).

Kit fox pups are able to forage with the adults at three to four months of age, where the males join females at the natal den in October or November. The family groups (pups and adults) split up in October and feed on the most abundant nocturnal rodent or lagomorph in the area, and may feed opportunistically on birds, reptiles and insects (NatureServe 2006).

Migration

The kit fox does not migrate (NatureServe 2006). The average seasonal home range in Utah is less than five square kilometers, with no overlap for same-sex adults. In western Arizona, the average seasonal home is 9.8 square kilometers for females and 12.3 sq km for males; home ranges commonly overlap. California home ranges are 2.6 to 5.2 square kilometers and vary from 260 to 520 hectares to up to 1,160 hectares during times of prey scarcity (NatureServe 2006).

1.7.12.6 Threats Warranting Protection

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

The main threat to the long-term survival of the kit fox is habitat conversion, mainly to agriculture but also to urban and industrial development. In both western and eastern Mexico, prairie dog towns, which support important populations of kit foxes, are being converted to agricultural fields, and in eastern Mexico the road network is expanding, producing a concomitant increase in the risk of vehicle mortality. In the San Joaquin Valley of California, habitat conversion for agriculture is slowing, but habitat loss, fragmentation, and degradation associated with industrial and urban development are still occurring at a rapid pace (Sillero-Zubiri et al. 2004).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Fur harvest is the only known source of kit fox over-utilization. These fur harvests occur in Texas, New Mexico, Arizona, Utah, and Nevada (Sillero-Zubiri et al 2004).

Disease or Predation

There are very low rates of predation on kit fox. Coyotes have been known to eat kit fox, but it is very rare. Expansion of coyotes and other competitors into kit fox habitat is resulting in their dependence on artificial water sources (UDWR 2005).

The Inadequacy of Existing Regulatory Mechanisms

It is unknown whether existing regulatory mechanisms are inadequate for this species. The Southern California kit fox (*Vulpes macrotis macrotis*) was a population of kit foxes native to desert regions of Southern California which became extinct in 1903 (USFWS 2008b).

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Bioaccumulation of rodenticides and possible red fox invasion into historical kit fox range in east and central Nevada can both have a negative impact on kit fox propagation (UDWR 2005, NDOW 2006).

1.7.12.7 Conservation

No conservation plans exist in Nevada (NDOW 2006). Kit fox is addressed in the BLM and AGFD 1983 management plan for the Virgin River area (BLM and AGFD 1983). The San Joaquin kit fox is listed as both state (CA) and federally endangered. A recovery plan for this species was completed in 1983 that outlines objectives to halt the decline of the species and increase population sizes above the 1981 level (U.S. Fish and Wildlife Service 1998).

1.7.12.8 Species Status

Rangewide

The rangewide status of kit fox is unknown.

VRCMA Boundary

The kit fox has been documented in southern Nevada (NDOW 2006).

1.7.13 <u>Little Brown Myotis</u>

Scientific Name: *Myotis lucifugus*

1.7.13.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Little brown myotis is a species of special concern in California (Zeiner et al. 1990).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S3 (NatureServe 2007).

1.7.13.2 General Description

The little brown myotis is cinnamon-buff to dark brown above, buffy to pale gray below, and the hairs on its back have long glossy tips. The ears, when laid forward, reach approximately the nostril. The tragus is about half as high as the ear. The calcar lacks a keel. The length of the little brown myotis' head and body is 1.61 to 2.13 inches (4.1 to 5.4 centimeters), the ear is 0.43 to 0.61 inches (1.1 to 1.6 centimeters), and the forearm is 1.30 to 1.61 inches (3.3 to 4.1 centimeters). The braincase rises gradually from the rostrum. The greatest length of the skull is 0.55 to 0.63 inches (1.4 to 1.6 centimeters) and the length of the upper tooth row is 0.20 to 0.26 inches (0.5 to 0.7 centimeters) (NatureServe 2007).

Summer colonies usually range from 50 to 2,500 animals, winter groups may contain tens of thousands. From April to May through September to October, bats are active and breeding; they are hibernating the rest of the year (NatureServe 2007). Day roosts, night roosts, hibernation roosts and nursery roosts are separately used (Zeiner et al. 1990).

1.7.13.3 Distribution

Historic Distribution

There is a questionable historic presence in Clark County. However, it is present in Lincoln County, Nevada (NNHP 2004). NDOW states that this species is only present in Northern, NV: Esmeralda, Washoe, Storey, Churchill, Lander, Elko and White Pine counties. (NDOW 2006).

Current Distribution

Little brown myotis occur throughout Canada south through the United States, being less common or absent from the Great Plains and from Arizona east to Louisiana. Although one of the most common bats in the U.S., the distribution of the little brown myotis in Nevada seems to be restricted to the northern part of the state for unknown reasons (NDOW 2006).

1.7.13.4 Habitat

Little brown myotis utilize a variety of woodland habitats, and can also be found in grasslands, fields, orchards, chaparral, suburban areas and urban areas. Natural structures such as caves, hollow trees and snags are used for resting and maternity sites, as well as man-made structures such as tunnels, abandoned mines and buildings. A narrow microclimate is necessary for raising young and suitable maternity sites may limit distribution and abundance (NDOW 2006).

1.7.13.5 Life History

Reproductive Biology

Little brown myotis mate from September to October, where ovulation and fertilization will be delayed until spring. Gestation lasts 50 to 60 days, followed by birth of one young in late spring or early summer. Females are able to produce young in their first or second year. Little brown myotis have been documented delaying or foregoing reproduction in wet years in British Columbia. Females may breed up to 12 years of age (NatureServe 2007).

Diet

Flying insects such as mosquitoes, midges, caddisflies, moths, hoppers, small beetles and spiders are most frequently consumed. Little brown myotis often forage over water and along the margins of lakes and streams and detect prey by echolocation at a range of one meter (WBWG 2005).

Migration

Eastern populations are known to migrate hundreds of miles between summer and winter habitats. Western populations are thought to hibernate near their summer range (NatureServe 2007).

1.7.13.6 Threats Warranting Protection

Habitat loss, pesticides, disturbance, and control efforts are threats to the little brown myotis (WBWG 2005).

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

The little brown myotis is threatened by alterations in snag density, recruitment by timber harvest, conversion of habitat for agricultural or residential uses, and riparian forest alteration for flood control. Highly aggregated hibernation in abandoned mines in eastern and central North America suggests closure of cold mines without adequate surveys could have major population impacts. Populations in montane forest islands, especially near the southern range limit, are at greater risk because population sizes and available habitat are small and development pressures (e.g., forest recreation) can be high (WBWG 2005). The conversion of pinyon-juniper habitat, building demolition, mine reclamation, and renewed mining decreases habitat. Disturbance to hibernating colonies is also a threat (NDOW 2007).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species (NatureServe 2007).

Disease or Predation

Predators include birds, snakes, house cats, mice and other small mammals (Fenton and Barclay 1980, Zeiner et al. 1990). Little brown myotis are also known to be susceptible to rabies (Zeiner et al. 1990).

The Inadequacy of Existing Regulatory Mechanisms

In Arizona, all bats are protected through Commission Order 14, and cannot be taken alive or dead, under auspices of a hunting license. Bats cannot be imported, exported, or otherwise possessed, without a special permit issued pursuant to Article 4 (Live Wildlife Rules) (AGFD 2006a). Otherwise, this species receives no federal or state protection.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Fat-soluble pesticides are dangerous when combined with migratory stress and the depletion of fat reserves related to migration and hibernation. Disturbance in hibernating bats in winter is destructive because of the energy expense that is expended when myotis are aroused (Zeiner et al. 1990).

Accidents probably contribute to more mortality than either predators or parasites (i.e., impalement on barbed wire and burrdocks, and animals killed in hibernacula by flood waters) (Fenton and Barclay 1980).

1.7.13.7 Conservation

Conservation plans for the little brown myotis include the Nevada Bat Plan and the Arizona Comprehensive Bat Plan (NDOW 2006, AGFD 2003a). Conservation of the little brown myotis is addressed in the Nevada Bat Conservation Plan. Under this plan, attempts will be made to learn more about the requirements and behavior of little brown myotis (Bradley et al. 2006). The Arizona Bat Conservation Strategic Plan has also been adopted, which will address research, monitoring, and conservation actions for the little brown myotis (AGFD 2005a).

1.7.13.8 Species Status

Rangewide

The little brown myotis is widespread and common throughout its range, with apparently no significant population declines (NatureServe 2007).

VRCMA Boundary

Conversion of pinyon juniper habitat and disturbances to abandoned and active mines are possible within the VRCMA Boundary. There is potential for pest control operations around developed areas to affect this species in the VRCMA Boundary.

The status of the little brown myotis within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.7.14 Long-eared Myotis

Scientific Name: *Myotis evotis*

1.7.14.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- BLM sensitive species in Nevada (BLM 2003a).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S4 (NatureServe 2007).
- Arizona heritage rank of S3S4 (NatureServe 2007).

1.7.14.2 General Description

The long-eared myotis is a small bat that has a pale brownish to straw colored pelage (WBWG 2005). They have long, dark-colored ears (relative to other bats of this size) measuring between 0.7 to 0.9 inch (18 to 2.3 centimeters) (AGFD 2003g). This species typically weighs 0.2 to 0.3 ounce (5 to 8 grams), with a wingspan of 9.8 to 11.8 inches (25 to 30 centimeters) (Harvey et al. 1999).

Long-eared myotis forage by gleaning prey from foliage, tree trunks, rocks and the ground (AGFD 2003g). This species is long-lived with individuals living up to 22 years (Harvey et al. 1999).

1.7.14.3 Distribution

Historic Distribution

The long-eared myotis occurs throughout much of western North America from the desert southwest, north into southern British Columbia, Alberta and Saskatchewan (Harvey et al. 1999).

Current Distribution

There appears to be no difference between the historic and current distribution of this species.

1.7.14.4 Habitat

This species often occurs in semiarid shrublands, sage, chaparral and agricultural areas. Roosting habitat includes buildings, bridges, hollow trees, under exfoliating tree bark, caves, mines, cliff crevices, sinkholes, and rocky outcrops on the ground (WBWG 2005). They may be found from sea level up to 10,032 feet (3,058 meters) (AGFD 2003g).

1.7.14.5 Life History

Reproductive Biology

Mating occurs in the fall; ovulation and fertilization occur the following spring. There appears to be latitudinal variances in pregnancy with an early reported pregnancy of mid-May in California and a late reported pregnancy of early July in British Columbia. One offspring is born in late June or July, and females form small maternity colonies in the summer. Males and barren females remain singly or in small groups. Occasionally, males and barren females can be found in maternity roosts but they roost apart from the maternity colony (AGFD 2003g).

Diet

The diet of the long-eared myotis consists primarily of moths, beetles, flies, net-wing insects and true bugs. Males consume more moths than females (Harvey et al. 1999).

Migration

Banfield (1974) indicates that this species is probably migratory (as cited by NatureServe 2007). However, the winter range is not known (NatureServe 2007).

1.7.14.6 Threats Warranting Protection

Long-eared myotis may be threatened by loss of suitable habitat (NatureServe 2007), closure of abandoned mines without surveys, recreational caving, forest-management practices, and activities that impact cliff faces or rock outcroppings (WBWG 2005). RECON (2000) identifies the following ecosystem-level threats for the long-eared myotis: 1) disturbance of roosts from recreational activities, 2) bridge replacement, 3) effects of insecticides on prey base or on bats directly, 4) loss of roosts through mining activities or mine closures, 5) building demolition, 6) loss of foraging habitat or access to water sources in species habitat.

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to the long-eared myotis include habitat modification and degradation, as well as disturbance of roosts from recreational activities (Clark County 2006a).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Over-utilization for commercial, recreational, scientific or educational purposes does not appear to impact this species.

Disease or Predation

The long-eared myotis is usually preyed upon by snakes, raccoons, hawks, and owls (Harvey et al. 1999).

The Inadequacy of Existing Regulatory Mechanisms

This species is not a federally listed species.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

The long-eared myotis is subject to disturbances resulting from recreational climbing, spelunking, and mine closures (RECON 2000).

1.7.14.7 Conservation

Conservation actions within Clark County (RECON 2000) include general management actions for mid-elevation habitats, including recreation site monitoring, campground management, environmental education programs, fire management, focusing of recreation development outside of sensitive areas, habitat restoration and enhancement at recreation sites, and wildhorse and burro management. Additional conservation actions also include management actions for cliffs and in rocky areas, including distribution of educational material to climbers and surveys prior to development of new climbing routes. USFS, BLM and NPS include education, inventory and monitoring programs for bats throughout Clark County as well as programs for conservation of bats in caves and during the mine closure process.

1.7.14.8 Species Status

Rangewide

Population trends for this species are unknown (RECON 2000), but according to NatureServe (2007) the global abundance for this species may be greater than one million individuals.

VRCMA Boundary

The status of the long-eared myotis within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.7.15 Long-legged Myotis

Scientific Name: *Myotis volans*

1.7.15.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- BLM sensitive species in Nevada (BLM 2003a).

- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S4 (NatureServe 2007).
- Arizona heritage rank of S3S4 (NatureServe 2007).

1.7.15.2 General Description

The long-legged myotis, one of the larger species of *Myotis* (AGFD 2003m), has short rounded ears, small hind feet, long tibia, distinctly keeled calcar, and long, dense fur on the underside of the wing membrane, which extends from the body to a line joining the elbow and the knees. The species is usually dark brown, although there is some variation in color (TPWD 2007d). This bat species is 3.76 to 4.28 inches (9.4 to 10.7 centimeters) (AGFD 2003m). The species is sexually dimorphic, with the female having slightly larger lengths for the forearm and condylocanine (Warner and Czapleweski 1984, as cited in AGFD 2003m).

1.7.15.3 Distribution

Historic Distribution

This species' range includes western North America (British Columbia and Alberta, Canada; Washington east to North Dakota and south to California and Texas; northern Mexico) (RECON 2000).

Current Distribution

Current distribution for the long-legged myotis is the same as its historic distribution (NatureServe 2007).

1.7.15.4 Habitat

In Clark County, habitats include mixed conifer forest and pinyon-juniper woodland greater than 4,000 feet (1,219 meters) in elevation. Other habitats include ponderosa pine, mountain shrub, juniper, sagebrush, and sagebrush/perennial grassland (RECON 2000).

Hibernacula are typically mines and caves. These areas may also serve as night roosts. Day roosts include hollow trees (particularly large diameter snags), under bark, live trees with lightning scars, and, to a lesser extent, in rock crevices, mines, and buildings (RECON 2000).

Foraging occurs in scrub habitat, as well as arid grassland and desert habitats, to a lesser extent (RECON 2000).

1.7.15.5 Life History

Reproductive Biology

Copulation occurs in autumn. Females store sperm over the winter and ovulate in the spring (WBWG 2005). Females typically give birth between May and August (TPWD 2007d).

Diet

This species feeds primarily on small moths (RECON 2000). The long-legged myotis also consumes invertebrates such as fleas, termites, lacewings, wasps, and small beetles (Warner and Czaplewski 1984, as cited in NatureServe 2007). It can follow its prey for relatively long distances in the forest canopy, forest clearings, and over water (NatureServe 2007).

Migration

This species is non-migratory (NatureServe 2007).

1.7.15.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Loss of roosts through mining activities or mine closures is a threat to the long-legged myotis (RECON 2000). Without adequate surveys and specific forest-management practices, the long-legged myotis may be affected by closure of abandoned mines (TPWD 2007d).

Loss of foraging habitat, including access to water sources within its habitat, is another threat to the long-legged myotis (RECON 2000).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Recreation activities can disturbing roosting bats (RECON 2000).

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

In Oregon, DDT residues and its metabolites have been found in this species (TPWD 2007d).

1.7.15.7 Conservation

As a Covered species for the Clark County MSHCP, ecosystem and specific conservation measures have been identified for the long-legged myotis (RECON 2000).

In Nevada, the Nevada Bat Conservation Plan has been adopted. Under this plan, attempts will be made to learn more about the requirements and behavior of long-legged myotis (Bradley et al. 2006). In Arizona, the Arizona Bat Conservation Strategic Plan has also been adopted, which will address research, monitoring, and conservation actions for the long-legged myotis (AGFD 2005a). Also in Arizona, all bats are protected by law by Commission Order 14 and Arizona Revised Statutes 17; it is illegal to take any bat species (AGFD 2005a). Special licenses to take bats and other restricted wildlife can be obtained from AGFD.

1.7.15.8 Species Status

Rangewide

This species has a widespread distribution in western North America. State and Canadian province ranks indicate populations are secure through much of the long-legged myotis' range (NatureServe 2007).

VRCMA Boundary

The status of the long-legged myotis within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.7.16 Merriam's Shrew

Scientific Name: *Sorex merriami*

1.7.16.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Global heritage rank of G5 (NatureServe 2008).
- Arizona heritage rank of S3 (AZNHP 2006).
- Nevada heritage rank S3 (NNHP 2007).
- Global/Continental Conservation Status: IUCN Red List Category: LC (NatureServe 2008).
- Species of Greatest Conservation Need – CWCS – Arizona (AGFD 2006)
- Nevada Animal Watch List (NNHP 2007).

1.7.16.2 General Description

Merriam's shrew is a relatively small, pale shrew (NatureServe 2008). Its coloration in summer is grayish drab above, becoming paler on flanks, with nearly white underparts (faintly tinged with buff). Its winter pelage is somewhat brighter. The tail is distinctly bicolored, sparsely haired, drab above and white below. These shrews measure a total length of 3.5 to 4.2 inches (8.8 to 10.7 centimeters); tail length 1.3 to 1.65 inches (3.3 to 4.2 centimeters); hind foot 0.43 to 0.51 inch (1.1 to 1.3 centimeters); and weigh mass 0.16 to 0.23 ounce (4.4 to 6.5 grams) (Armstrong and Jones 1971).

Merriam's shrew differs from other members of its genus by the following combination of characteristics :it is small in size; pale in coloration; has a relatively short and broad skull; a flattened braincase; a relatively high and swollen interorbital region; a broad truncate rostrum; heavy, densely pigmented dentition, with the molars as broad as long, with the second unicuspid being the largest, and the third unicuspid larger than the fourth (Armstrong and Jones 1971).

The subspecies *S. m. leucogeny* occurs only in Nevada (Hall 1981).

1.7.16.3 Distribution

Historic Distribution

Merriam's shrew, *Sorex merriami*, ranges from north-central Washington south to Eastern California, down through Arizona to New Mexico. They range as far east as western Nebraska and North Dakota. Merriam's shrew occurs in the western U.S. in the Great Basin, Columbia Plateau, northern Great Plains and southern Rocky Mountains. (Verts and Carraway 1998, NWAP 2006). *S. m. leucogenys* apparently is restricted to the Great Basin - Mojave Desert transition zone in Tikaboo Valley in western Lincoln County (NWAP 2006).

Merriam's shrew occurs at elevations of 650 through 9,500 feet (198 to 2,895 meters) (Armstrong and Jones 1971).

Current Distribution

George (1990) provided information on range extensions of this species in New Mexico. Benedict et al. (1999) discussed new collections of Merriam's shrew in northwestern Nebraska (NatureServe 2008). A recent study discovered that the Merriam's shrew's known geographic range has now expanded as far north as British Columbia in Canada (Nagorsen et al., 2001; Verts and Carraway, 1998).

1.7.16.4 Habitat

The most commonly reported habitat of Merriam's shrew is sagebrush-steppe, but it also has been found in semi-arid grasslands, pinyon-juniper woodlands, high elevation brushlands, and even mixed woodlands of ponderosa pine, Douglas-fir. and cottonwood (Wilson and Ruff 1999). Based on captured specimens, this species is commonly reported to be associated with sagebrush (*Artemisia* spp.)-bunchgrass habitats in eastern Washington (James 1953, Johnson and Clanton 1954). Big sagebrush, rabbitbrush, and bitterbrush are commonly found in areas where Merriam's shrew is present (Ports and McAdoo 1986, Kirkland et al. 1997, Nagorsen et al. 2001). In eastern Nevada, Merriam's shrew habitat included areas of moderate shrub cover, sparse forb and bunchgrass understory and extensive bare ground as well as south-facing slopes of dense big sagebrush, bitterbrush, squaw current, and mountain snowberry (Ports and McAdoo 1986).

Merriam's shrew seems to prefer drier habitats than those used by other shrews in the arid Upper Sonoran and Lower Transition life zones including grasses in sagebrush scrub/pinyon-juniper habitat, and also in mountain-mahogany and mixed woodlands (Clark and Stromberg 1987, Benedict et al. 1999). This species may use burrows and runways of other animals especially Microtine rodents (Johnson and Clanton 1954, Hooper 1944, Armstrong, in Wilson and Ruff 1999). Merriam's shrew is active throughout the year.

1.7.16.5 Life History

Reproductive Biology

Not much is known about reproduction in the Merriam's shrew. It is thought that the breeding season is from mid-March to July, and that females can breed twice in a given year. Gestation for most shrews is 24 to 30 days, with females having between five and seven young per litter. The young are cared for until approximately 25 days, during which time they are completely dependent. Most shrews become sexually mature around one year of age. Rarely, some females will mate before five months of age. (Churchfield 1990, Johnson and Clanton 1954, Verts and Carraway 1998, Wilson and Ruff 1999).

Diet

Merriam's shrew feeds primarily on lepidopteran caterpillars, beetles, cave crickets (Ceuthophilus spp.), ichneumon wasps (Ichneumonidae), and spiders, as well as other arthropods (Johnson and Clanton 1954, cited in Verts and Carraway 1998; Clark and Stromberg 1987). Merriam's shrew has the highest relative bite force of all western shrews studied, indicating that it is adapted to forage on relatively large, hard-bodied prey (Verts and Carraway 1998). Aitchison (1987) suggested that during the winter shrews hunt insects beneath the snow layer by means of sound and vibrissae (touch receptors).

Migration

The Merriam's shrew is sedentary with no migration or seasonal movements. Dispersal of shrews is poorly known, but these mammals are mobile enough to cover fairly large distances (NatureServe 2008). Mature males especially may wander widely (Hawes 1977).

1.7.16.6 Threats Warranting Protection

Little information exists to document threats to Merriam's shrew, however, preferred grassland and shrub-steppe habitat continues to be lost to wild fire and rangelands converted to exotic cover types. The response of this species to grazing pressure is unknown (Verts and Carraway 1998). Because agricultural land uses have had a profound effect on steppe communities in the Columbia Basin (Vander Haegen et al. 2001), it is likely that populations of the Merriam's shrew have been impacted by related habitat loss, fragmentation, and degradation.

With the widespread decline and fragmentation of shrub-steppe, concern has focused on those species that might be most affected by these impacts (Jacobson and Snyder 2000, Vander Haegen et al. 2000), including the Merriam's shrew (Wunder and Carey 1994).

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat fragmentation most greatly impacts small mammals that have low mobility, such as the Merriam's shrew (Vander Haegen et al. 2001).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no documentation that this species is over-used for these activities.

Disease or Predation

Owl species are the only documented predators of Merriam's shrew (NatureServe 2008). However, it is likely that nocturnal carnivores who are capable of catching these animals probably occasionally do. It is thought that the pungent scent of these shrews may inhibit predation to some extent. (Wilson and Ruff 1999).

The Inadequacy of Existing Regulatory Mechanisms

No existing regulatory mechanisms exist for this species (NWAP 2006).

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Merriam's shrew is insectivorous, and the use of insecticides may negatively impact this species. Impacts also may occur to this species due to conversion of suitable habitat to croplands, chaining, spraying of chemicals, burning, or overgrazing (Azerrad 2004).

1.7.16.7 Conservation

Merriam's shrew is a little known species and is worthy of a detailed and dedicated research effort (Verts and Carraway 1998), especially regarding the impacts of cattle grazing on its distribution and abundance (NWAP 2006). Nowhere is Merriam's shrew abundant and typically several hundred trap-nights are needed to capture one animal (Verts and Carraway 1998).

The information available on the distribution and ecological needs of the Merriam's shrew is not adequate to provide species-specific conservation recommendations. Therefore, the following are generalized guidelines based on the major factors influencing species that depend on the availability of sagebrush-steppe communities.

This species is associated with arid shrub- and grass-dominated habitats. Consequently, these important areas should be conserved (Azerrad 2004). Because Merriam's shrew is found most often in sage-grass and undisturbed bunchgrass habitats (Larrison 1976), these habitats should not be degraded through activities such as conversion to croplands, chaining, spraying of chemicals, burning, or overgrazing (i.e., repeated grazing that exceeds the recovery capacity of the vegetation and creates or perpetuates a deteriorated plant community) (Azerrad 2004). Therefore, when identifying areas in need of protection for this species, one should attempt to not only protect patches of known habitat, but adjacent habitat corridors (e.g., riparian areas) that potentially allow individuals within a population to disperse and not become isolated and vulnerable (Azerrad 2004).

Our knowledge of shrews is principally based on work in forested habitats, and comparatively little is known about shrews associated with arid regions (Kirkland et al. 1997). Until more local research and surveys are conducted, the possibility for specific management geared towards the conservation of Merriam's shrew is limited. Research and monitoring are needed to more fully understand the distribution and ecological needs of Merriam's shrew. Researchers also should focus on understanding factors that influence the success of this species and of other small mammals that use steppe and other arid communities (Azerrad 2004).

Recovery Units

There are no recovery units proposed for Merriam's shrew, it is not currently a federally listed species.

Critical Habitat

No critical habitat is designated for Merriam's shrew; it is not currently a federally listed species.

1.7.16.8 Species Status

Rangewide

Merriam's shrew is sparsely distributed and uncommon, but its range is large (much of southwestern North America) and its conservation status is believed to be secure on a global basis (NatureServe 2008).

VRCMA Boundary

The Merriam's shrew is known to occur within the VRCMA boundary (NWAP 2006, Prior-Magee 2006).

1.7.17 Pallid Bat

Scientific Name: *Anatropous pallid us*

1.7.17.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- BLM sensitive species in Nevada (BLM 2003a).
- USFWS sensitive species (WBWG 2005).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S3 (NatureServe 2007).
- Arizona heritage rank of S4S5 (NatureServe 2007).

1.7.17.2 General Description

The pallid bat is a large bat weighing between 0.7 and 1.2 ounces (20 and 35 grams) and has a wingspan ranging from 14.6 to 16.1 inches (37 to 41 centimeters) (Harvey et al. 1999). This species is light in color with a light yellow washed with brown or grey dorsal fur and a pale cream ventral fur. Ears are relatively large at 1.2 to 1.4 inches (3.1 to 3.6 centimeters) from base to tip and are separated at the base. The pallid bat has a horseshoe-shaped ridge at the end of a spiral grove above each nostril (AGFD 2002a).

1.7.17.3 Distribution

Historic Distribution

The pallid bat occurs from central Mexico northward through the western United States (Texas west to California and north through Washington) extending into southern British Columbia (NatureServe 2007).

Current Distribution

There appears to be no difference between the historic and current distribution of this species.

1.7.17.4 Habitat

The pallid bat inhabits rocky arid deserts and canyon lands, shrub-steppe grasslands, karst formations and higher elevation coniferous forests and is most abundant in xeric ecosystems. This species roosts solitarily, in small groups (up to 20 individuals) or larger groups numbering in the hundreds. They roost in rocky crevices or outcrops, cliffs, caves, mines, trees, and various anthropogenic structures such as bridges, barns, bat houses and buildings (WBWG 2005).

1.7.17.5 Life History

Reproductive Biology

According to NatureServe (2007), the pallid bat mates between October and December. Like many other bats, they store sperm until ovulation in spring. Within the U.S., young are born between late may through late June. Usually two offspring are born to each female, which are weaned in six to eight weeks. Young fly at six weeks.

Diet

The pallid bat forages in multiple habitats, including shrub-steppe grasslands, oak savannah grasslands, open Ponderosa pine forests, talus slopes, gravel roads, lava flows, fruit orchards, and vineyards. The pallid bat employs echolocation, and passive acoustic cues to locate prey. This species gleans prey from surfaces and captures flying insects on the wing. Prey items include ant lions, beetles, centipedes, cicadas, crickets, grasshoppers, Jerusalem crickets, katydids, moths, praying mantids, scorpions, solpugids. The pallid bat has also taken larger prey like geckos, lizards, skinks, and small rodents (WBWG 2005).

Migration

According to NatureServe (2007), this species is a local migrant.

1.7.17.6 Threats Warranting Protection

Primary threats to the pallid bat include roost and hibernacula disturbances resulting from vandalism, mine closures and reclamation, rock climbing, timber harvest, demolition of occupied man-made structures, chemical treatments or intentional eradication and exclusion. Other threats include a loss or modification of foraging habitat (WBWG 2005). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat loss and modification resulting from prescribed fires, urban development, and agricultural expansion are identified as threats to habitat or range (WBWG 2005).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Over-utilization for commercial, recreational, scientific, or educational purposes does not appear to impact this species.

Disease or Predation

Predation by domestic cats on pallid bats does occur (AGFD 2002a).

The Inadequacy of Existing Regulatory Mechanisms

No regulatory mechanisms have been identified for this species. However, it should be noted that disturbances to roost and hibernacula might fall under protection of other bats, because the pallid bat can be found roosting with other colonial bat species.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

No other factors are known to affect the pallid bat.

1.7.17.7 Conservation

In Nevada, the Nevada Bat Conservation Plan has been adopted. Under this plan, attempts will be made to learn more about the requirements and behavior of pallid bat (Bradley et al. 2006). In Arizona, the Arizona Bat Conservation Strategic Plan has also been adopted, which will address research, monitoring, and conservation actions for the pallid bat (AGFD 2005a). Also in Arizona, all bats are protected by law by Commission Order 14 and Arizona Revised Statutes 17; it is illegal to take any bat species (AGFD 2005a). Special licenses to take bats and other restricted wildlife can be obtained from AGFD.

1.7.17.8 Species Status

Rangewide

According to the AGFD (2004), the pallid bat population seems to be stable.

VRCMA Boundary

The status of the pallid bat within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.7.18 Silver-haired Bat

Scientific Name: *Lasionycteris noctivagans*

1.7.18.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- BLM sensitive species in Nevada (BLM 2003a).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S3 (NatureServe 2007).
- Arizona heritage rank of S3S4 (NatureServe 2007).

1.7.18.2 General Description

The silver-haired bat is a medium sized bat weighing between 0.3 and 0.4 ounce (eight and 11 grams) (Harvey et al. 1999). Their wingspan ranges from 10.6 to 12.2 inches (27 to 31 centimeters) and have a body length of 3.5 to 3.9 inches (nine to 10 centimeters). The silver-haired bat has dark brown to black fur with silver tips resulting in a salt and pepper coloration. The fur covers the proximal half of the upper side of the interfemoral membrane. The ears are short and rounded lacking fur with a short blunt tragus (AGFD 2004d).

1.7.18.3 Distribution

Historic Distribution

The silver-haired bat occurs from northern Mexico northward throughout the contiguous United States, southern Canada, along the west coast of Canada to southern eastern Alaska (NatureServe 2007).

Current Distribution

There appears to be no difference between the historic and current distribution of this species.

1.7.18.4 Habitat

The silver-haired bat is considered a forest bat, occupying north temperate zone conifer and mixed conifer/hardwood forests (WBWG 2005). Additionally this species can be found in pinyon-juniper and high-elevation riparian habitats below 9,000 feet (2,743 meters). Summer roosts include hollow trees, snags, and under bark, while during winter months this species roosts in rock crevices, caves and buildings (RECON 2000).

1.7.18.5 Life History

Reproductive Biology

Reproduction begins in late September and may continue throughout winter. Females delay fertilization; ovulation peaks in late April and early May. Gestation takes 50 to 60 days and birth occurs in June and July. Usually two young are born (AGFD 2004d). Young are able to forage for themselves within 21 to 36 days of birth.

Diet

The silver-haired bat is insectivorous preying on small to medium-sized flying insects, primarily moths. This species forages in riparian zones along stream courses, above the forest canopy, and over open meadows (WBWG 2005).

Migration

According to NatureServe (2007), this species migrates south for winter. Migration occurs during the spring and fall months. The WBWG (2005) indicates that this species migrates to low elevation, and more xeric habitats for the winter. This suggests that migration in many areas may be elevational rather than longitudinal.

1.7.18.6 Threats Warranting Protection

Since this species is considered a tree roosting bat (AGFD 2004d) primary threats include habitat degradation from timber harvest. Another threat is the loss of foraging habitat in riparian areas (WBWG 2005). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

According to RECON (2000), threats to this species habitat include: 1) habitat degradation and modification due to fire suppression and fuels management, post fire suppression, historical fires management and fires, 2) dispersed recreation that degrades and modifies riparian habitat associated with ponds and streams within the mixed conifer ecosystem, 3) pesticide and herbicide use associated with golf course maintenance, and 4) wood removal, collection of downed logs and snags within the mixed conifer ecosystem.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Over-utilization for commercial, recreational, scientific or educational purposes does not appear to impact this species.

Disease or Predation

Predation on the silver-haired bat is primarily by owls (AGFD 2004d).

The Inadequacy of Existing Regulatory Mechanisms

This species is not a federally listed species.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

1.7.18.7 Pesticide use is known to be a threat to this species (WBWG 2005). Conservation

Conservation actions within RECON (2000) include general management actions for mid-elevation habitats such as recreation site monitoring, campground management, environmental education programs, fire management, focusing of recreation development outside of sensitive areas, habitat restoration and enhancement at recreation sites, and wild horse and burro management. Additional conservation actions include management actions for cliffs and in rocky areas, including distribution of educational material to climbers and surveys prior to development of new climbing routes. USFS, BLM and NPS include education, inventory and monitoring programs for bats throughout Clark County as well as programs for conservation of bats in caves and during the mine closure process.

1.7.18.8 Species Status

Rangewide

According to the AGFD (2004d), the silver-haired bat populations seems to be stable with fluctuations from year to year.

VRCMA Boundary

The status of the silver-haired bat within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.7.19 Spotted Bat

Scientific Name: *Euderma maculatum*

1.7.19.1 Protection Warranted

Endangered Species Act

Former Category 2 candidate species (NNHP 2004)

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Protected by the State of Nevada (NNHP 2004)
- Wildlife Species of Concern (AGFD 2006a)
- BLM Sensitive Species in Nevada (NNHP 2004)

1.7.19.2 General Description

The spotted bat is medium-sized, with an average body length 2.5 inches (6.35 centimeters), forearm 1.9 to 2.0 inches (4.8 to 5.1 centimeters); they have 34 teeth. Upper parts are blackish with three large white spots: one on each shoulder and one at base of tail. All hairs are black at the base, but hairs on under parts are white tipped and conceal the black bases. Ears are pinkish-red and long, the largest of any North American bat. Ears are curled at rest but erect and pointing forward when alert. The circular, bare throat patch is distinctive (AGFD 2003n).

1.7.19.3 Distribution

The spotted bat is widespread in western North America, but it is rarely abundant throughout its range (NatureServe 2006). It is found from southern British Columbia south through a portion of the western United States and into central Mexico (NatureServe 2006). It is found throughout Nevada (NatureServe 2006).

1.7.19.4 Habitat

Range-wide, this species is found in various habitats from desert to montane coniferous stands, including open ponderosa pine, pinyon-juniper woodland, canyon bottoms, open pasture, and hayfields (NatureServe 2006). It consistently roosts in caves and in cracks and crevices in cliffs and canyons (NatureServe 2006). Maternity roosts are solitary and occur in rock crevices or cliffs (Ramsey 1997). Its distribution is patchy and linked to the availability of cliff-roosting habitat (NatureServe 2006). Winter habits are poorly known (NatureServe 2006). It is insectivorous, primarily feeding on moths (NatureServe 2006). Key habitat attributes for the spotted bat are caves and rock crevices for roosting and open water for foraging.

1.7.19.5 Life History

Reproductive Biology

Reproduction is relatively unknown. Limited observations indicate one young per female per year. Young are born from late May to early July. Lactating females have been captured in June, July and August. Young can weigh one-fifth of their mothers' nonpregnant weight. Young are altricial and do not show the color pattern characteristic of adults. Their ears are large and floppy and not fully developed (AGFD 2003n).

Diet

Limited evidence suggests that moths (5 to 11 mm in size) are the dominant food item. Other prey items include June beetles and grasshoppers, which are taken while on the ground. Monitoring of echolocation calls in British Columbia and Colorado indicate this bat forages throughout the night.(AGFD 2003n).

Neighboring bats show evidence of mutual avoidance and both species have been observed to turn away when encountering one another near the boundaries of their hunting areas. This mutual avoidance has been interpreted as a mechanism to avoid competition (AGFD 2003n).

Migration

This species is considered by some biologists to be an elevational migrant (AGFD 2003n). Additional information about migration is unknown.

1.7.19.6 Threats Warranting Protection

Little is known about this bat and its life history, and threats are therefore speculations (AGFD 2003n). Potential threats include habitat destruction or disturbance of high cliffs and canyon walls.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

According to NatureServe (2007), this species is moderately threatened range-wide. Habitat destruction, such as construction of dams that inundate high cliffs and canyon walls, possibly is a threat (Snow 1974, as cited in AGFD 2003n).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Fenton et al. (1987, as cited in NatureServe 2007) stated that one of the two highest threats to the spotted bat appeared to be collection of specimens by humans.

Disease or Predation

Threats from disease and predation are unknown for spotted bat.

The Inadequacy of Existing Regulatory Mechanisms

Threats from inadequacy of regulatory mechanisms are unknown for spotted bat.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Fenton et al. (1987, as cited in NatureServe 2007) stated that one of the two highest threats to the spotted bat appeared to be the use of pesticides that the bats may accumulate through their diet and that kill their prey.

1.7.19.7 Conservation

Conservation plans for the spotted bat include the Nevada Bat Plan and the Arizona Comprehensive Bat Plan (NDOW 2006, AGFD 2003a).

1.7.19.8 Species Status

Rangewide

The spotted bat is known to occupy a wider total range than initially thought. However, population abundance and densities are very poorly known. Since the late 1980s, there are five areas where the spotted bat has been observed in some numbers or fairly regularly: Fort Pierce Wash area of southwestern Utah and northwestern Arizona; Big Bend, Texas; New Mexico; Dinosaur National Monument, Colorado; and Okanagan Valley, British Colombia (AGFD 2003n).

VRCMA Boundary

The spotted bat has been recorded along the Lower Virgin River and other areas near the VRCMA Boundary (Tomlinson, C., pers. comm.). No known occurrences within the VRCMA Boundary are known.

1.7.20 Townsend's Big-eared Bat

Scientific Name: *Corynorhinus townsendii*

1.7.20.1 Protection Warranted

Endangered Species Act

- Two eastern subspecies, Ozark big-eared bat (*Corynorhinus townsendii ingens*) and Virginia big-eared bat (*C.t. virginianus*) are listed by USFWS as Endangered (NatureServe 2007). No subspecies occurring in the VRCMA Boundary are protected under the ESA.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Listed as a California Species of Concern (Zeiner et al. 1990).
- Listed as a BLM Sensitive Species in Nevada (BLM 2003a).
- Listed as a sensitive species by the state of Utah (UDWR 2006a).
- Global heritage rank is G4 (NatureServe 2007).
- Nevada heritage rank is S2 (NatureServe 2007).
- Arizona heritage rank is S2S3 (NatureServe 2007).

1.7.20.2 General Description

Townsend's big-eared bat, also known as *Plecotus townsendii*, is a medium-sized light brown bat with a brown belly. The ears are very long and joined at the top of the head. Large glandular swellings are located on the sides of the snout (Jameson and Peeters 2004).

This species will night roost in more open settings, including under bridges. They roost in colonies of typically 20-200+ individuals, although males are often observed singly. Hibernates in mines and caves, often singly or in small clusters in the open where they can take advantage of the coldest air. This habit makes them highly susceptible to disturbance during winter (NDOW 2006).

1.7.20.3 Distribution

Historic Distribution

The historical range of the Townsend's big-eared bat is thought to be similar to its present range (USGS Northern Prairie Wildlife Research Center 1995). Townsend's big-eared bat populations have declined significantly in some parts of their range, particularly in the east. They are considered to be extirpated from Missouri (NatureServe 2007).

Current Distribution

Throughout the Western U.S. from Texas, Oklahoma, Colorado, Wyoming, and Montana to the coast. The range extends south through the majority Mexico and north into British Columbia, Canada. There are a few isolated populations in the eastern U.S. (Kunz and Martin 1982). Distribution is limited by specific cave requirements.

1.7.20.4 Habitat

Townsend's big-eared bat is highly dependent upon mines and caves. They occasionally use trees and buildings but these roosts must be "cave-like" spaces in order to be suitable. In northern Nevada, studies have shown over 95 percent of foraging activity to be concentrated in open forest habitats of pinyon and juniper (NDOW 2006). In California, they are found in all but subalpine and alpine habitats (Zeiner et al. 1990).

1.7.20.5 Life History

Reproductive Biology

Maternity roosts are located in caves, tunnels, mines and buildings. Maternity roosts are at warm sites and usually consist of less than 100 individuals (Zeiner et al. 1990).

Mating occurs from November to February, and many females are inseminated before hibernation begins. Sperm is stored until spring. Depending on local climate and hibernating conditions, gestation may last from 56 to 100 days. Townsend's bats give birth in May and June. A litter of one is produced annually. After six weeks, young are weaned and fly two and a half to three weeks after birth. Maternity groups disband in August (Zeiner et al. 1990).

Females mate in their first autumn, males in their first or second. Half of young females return to their birth site after their first hibernation, return rates afterward is 70 to 80 percent (Zeiner et al. 1990).

Maternity colonies are very sensitive to disturbance and will readily abandon a roost and their young (NDOW 2006).

Diet

Foraging for small moths occurs near vegetation and other surfaces where prey is gleaned (NDOW 2006).

Migration

Townsend's big-eared bat makes short migrations to hibernacula. Twenty miles (32.2 kilometers) is considered a long migration for the species (Zeiner et al. 1990).

1.7.20.6 Threats Warranting Protection

Loss of habitat, vandalism, disturbance of maternity roosts and hibernacula are threats to this species (NatureServe 2007). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats include loss of habitat (e.g., reclamation of abandoned mines), vandalism, and disturbance of maternity roosts and hibernacula. Disturbance of such occurrences is likely to cause the bats to abandon the site and move to an alternate roost. (NatureServe 2007). The primary threat to Townsend's big-eared bat is almost certainly related to disturbance and/or destruction of roost sites (e.g., recreational caving or mine exploration, mine reclamation, and renewed mining in historic districts). Like most other North American species of bat, the long-term persistence of Townsend's big-eared bat is threatened by both roosting and foraging habitat being impacted by timber harvest practices and loss of riparian habitat. (WBWG 2005, NDOW 2006). Loss of foraging habitat and large scale habitat conversions could negatively impact this species (NDOW 2006).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

This threat is not known to affect Townsend's big-eared bat.

Disease or Predation

Threats from predation are poorly documented, but include the black rat, eastern woodrat, black rat snake, spotted skunk, domestic cat, and ringtail (Montana) (Montana Fish, Wildlife and Parks No Date).

The Inadequacy of Existing Regulatory Mechanisms

In Arizona, all bats are protected through Commission Order 14, and cannot be taken alive or dead, under auspices of a hunting license. Bats cannot be imported, exported, or otherwise possessed, without a special permit issued pursuant to Article 4 (Live Wildlife Rules) (AGFD 2006a). Otherwise, this species receives no federal or state protection.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

This species is highly sensitive to disturbance at roost sites. Recreational caving, closure of abandoned mines, roost disturbance at abandoned mines, renewed mining, loss of foraging habitat, and large scale habitat conversions could negatively impact this species (NDOW 2006).

Although, there have not been any studies to confirm such impacts, pesticide spraying in forested and agricultural areas could affect the prey base (moths) of these bats. Threats to populations of these bats may also include the loss of genetic diversity and population connectivity due to reduced population sizes or available roost sites (WBWG 2005).

Disturbance of maternity roosts and hibernacula may cause bats to abandon the site and move to an alternate and less suitable roost site (NatureServe 2007).

1.7.20.7 Conservation

The Nevada Bat Plan, Clark County MSHCP, Species Conservation Assessment and Conservation Strategy for the Townsend's Big-eared Bat identify conservation measures for this species. Additionally, this species is covered in the Lower Colorado River MSCP (NDOW 2006). Townsend's big-eared bat is listed as a vulnerable species in the Sonoran Desert Conservation Plan-draft (Pima County 2002). This is a habitat conservation plan to offset effects of activities in Pima County, Arizona on multiple species, including the Townsend's big-eared bat. This species is a covered species under the Clark County MSHCP, which is a habitat conservation plan for various activities in Clark County, Nevada (RECON 2000).

This species is addressed in the Nevada Bat Plan and the Arizona Bat Conservation Strategic Plan (NDOW 2006). Conservation of the Townsend's big-eared bat is addressed in the Nevada Bat Conservation Plan. Under this plan, attempts will be made to learn more about the requirements and behavior of Townsend's big-eared bat (Bradley et al. 2006). In Arizona, the Arizona Bat Conservation Strategic Plan has also been adopted, which will address research, monitoring, and conservation actions for the Townsend's big-eared bat (AGFD 2005a).

The Species Conservation Assessment and Conservation Strategy for the Townsend's Big-eared Bat presents information on the life history and habitat requirements, historical and current distribution and abundance of this species throughout its range, its current status, and threats to the species in each of the western states. The conservation strategy is a plan with the goal of removing or minimizing identified threats and promote restoration or recovery of the species (Pierson et al. 1999).

1.7.20.8 Species Status

Rangewide

Range-wide, there has been serious population declines in the past 40 years (NDOW 2006). Townsend's big-eared bat populations are currently secure in most of the western U.S. and Mexico, but they are rare and declining in other parts of the range (NatureServe 2007). However, in California, all known nursery colonies in limestone caves have been abandoned, and numbers have declined steeply (Zeiner et al. 1990). In Nevada, they are common but declining (NDOW 2006).

VRCMA Boundary

Townsend's big-eared bat is present throughout Nevada (NDOW 2006). The status of the species within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.7.21 Western Pipistrelle

Scientific Name: *Pipistrellus hesperus*

1.7.21.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- BLM sensitive species in Nevada (BLM 2003a).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S4 (NatureServe 2007).
- Arizona heritage rank of S5 (NatureServe 2007).

1.7.21.2 General Description

The western pipistrelle bat is a small sized bat weighing between 0.1 and 0.2 ounce (3 and 6 grams) (Harvey et al. 1999). Their wingspan ranges from 7.5 to 8.3 inches (19 to 21 centimeters), and they have a body length of 2.4 to 3.1 inches (six to eight centimeters). The western pipistrelle bat ranges from a yellowish to dark gray dorsal fur with a pale to smokey grey ventral surface. The muzzle, wing and interfemoral membranes and ears are dark brown to black. The ears are also short and rounded with a club-shaped tragus that is bent forward (AGFD 2004g).

1.7.21.3 Distribution

Historic Distribution

The western pipistrelle bat is a common bat of the desert southwest (Texas, New Mexico, Arizona, Utah and the south and western portions of Nevada. This species also ranges southward into central and northern Mexico and west into California and north into eastern Oregon and western Idaho. This species is known to winter in Nevada, California, Arizona, and Texas, but its winter range is poorly defined (NatureServe 2007).

Current Distribution

There appears to be no difference between the historic and current distribution of this species.

1.7.21.4 Habitat

The western pipistrelle bat is commonly associated with arid desert landscapes of the southwestern U.S. This species is also known to be found in associations with significant rock features in lower elevation mixed conifer forests in California and up to fir-spruce forests in Arizona. It roosts in small crevices, and it is even possible that they roost under rocks or in rodent burrows (WBWG 2005). Western pipistrelle roost sites are generally close to water sources (AGFD 2004g).

1.7.21.5 Life History

Reproductive Biology

Reproduction begins in late summer and autumn continue through early spring. Females delay fertilization until they are aroused from torpor and return to a normal metabolic rate. Gestation takes about 40 days with birth occurring in June. Usually two young are born and are able to fly at one month (AGFD 2004g).

Diet

The western pipistrelle bat is insectivorous preying on small swarming insects. Prey items change seasonally. During the spring, the western pipistrelle bat consumes leafhoppers. Small moths dominate their diet during the winter and they consume mostly flying ants in the summer (AGFD 2004).

Migration

According to NatureServe (2007), this species is a non-migrant.

1.7.21.6 Threats Warranting Protection

The WBWG (2005) states that, "Without more knowledge of natural history, it is difficult to assess potential threats to this species."

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

According to the WBWG (2005), renewed mining, or other development such as road construction, housing developments or water impoundments threaten the destruction, modification or curtailment of its habitat or range.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Over-utilization for commercial, recreational, scientific or educational purposes does not appear to impact this species.

Disease or Predation

While it is not mentioned in the literature reviewed for this species description, predation on the western pipistrelle bat is likely because of their slow weak flight and roosting locations. Predators likely include owls, hawks, snakes, other mammals including larger bats.

The Inadequacy of Existing Regulatory Mechanisms

This species is not a federally listed species.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

No other factors are known to be threats to this species.

1.7.21.7 Conservation

In Nevada, the Nevada Bat Conservation Plan has been adopted. Under this plan, attempts will be made to learn more about the requirements and behavior of the western pipistrelle (Bradley et al. 2006). In Arizona, the Arizona Bat Conservation Strategic Plan has also been adopted, which will address research, monitoring, and conservation actions for the western pipistrelle (AGFD 2005a). Also in Arizona, all bats are protected by law by Commission Order 14 and Arizona Revised Statutes 17; it is illegal to take any bat species (AGFD 2005a). Special licenses to take bats and other restricted wildlife can be obtained from AGFD.

No conservations actions are identified for this species; however, it is likely that conservation actions set forth by the Clark County Multiple Species Habitat Conservation Plan (RECON 2000), will likely protect habitat for this and other bat species.

1.7.21.8 Species Status

Rangewide

According to the AGFD (2004g), the western pipistrelle bat population seems to be stable.

VRCMA Boundary

The status of the western pipistrelle within the VRCMA Boundary is unknown, although potential habitat does occur there. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.7.22 Western Red Bat

Scientific Name: *Lasiurus blossevillii*

1.7.22.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Arizona Wildlife Species of Special Concern (AGFD 2006a).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S1 (NatureServe 2007).
- Arizona heritage rank of S2 (NatureServe 2007).

1.7.22.2 General Description

A medium-sized bat with short, round ears and dense, shaggy fur. Fur ranges from yellow-brown to bright orange with white-tipped hairs. Distinct white bib under neck, contrasting with a jet-black wing membrane. The forearm is 1.5 inches (3.8 centimeters) and overall weight ranges from 0.25 to 0.5 ounce (7.1 to 14.2 grams). The wingspan is about 12 inches (30.5 centimeters) (AGFD 2006c).

The western red bat typically roosts alone in shaded foliage of a tree or shrub above three (one meter) off the ground, allowing individuals to drop into flight (AGFD 2006c).

1.7.22.3 Distribution

Historic Distribution

The western red bat seems to occupy most of their historic range, although some local populations are declining.

Current Distribution

The western red bat is found from British Columbia south throughout South America. In the United States, they are a western species and occur in Oregon, California, Nevada, Utah, Arizona and New Mexico (NatureServe 2007).

1.7.22.4 Habitat

This species utilizes rivers and streams and associated riparian habitats, mesquite bosques and desert washes (NDOW 2006), rarely in desert habitats (NatureServe 2007). Summer roost sites are in tree foliage. These bats avoid caves and buildings much of the year (NatureServe 2007). In Arizona, they are a mid-elevational species and are found from 2,400 to 7,200 feet (731.5 to 2,194.6 meters) (AGFD 2006c).

1.7.22.5 Life History

Reproductive Biology

Breeding occurs in late summer and early fall. Females may store sperm until spring, when eggs are fertilized. Gestation lasts up to 80 days and is followed by the birth of one to five young in May or June (AGFD 2006c, NatureServe 2007). Young are usually weaned in July (NatureServe 2007). Offspring may forage with females (AGFD 2006c).

Diet

The western red bat feeds primarily on moths, beetles and flying ants. Ground-dwelling crickets are also taken (AGFD 2006c).

Migration

Bats in northern populations may migrate south for the winter or may hibernate. In the southwest they are thought to be migratory and have only been documented from April to September (AGFD 2006c). Seasonal dispersal in California individuals is limited. The western red bat winters along the California coast and move to inland locations in summer (NatureServe 2007).

1.7.22.6 Threats Warranting Protection

Habitat loss is the primary threat to the western red bat. A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

The decline of cottonwood tree galleries and riparian areas in general is often cited as the primary cause of apparent population decline in this tree roosting species (NDOW 2006). Riparian forests utilized by western red bat have been lost primarily from development, agricultural conversion and the construction of water storage reservoirs. This has reduced both roosting and foraging habitat for the species (NatureServe 2007). Riparian forests have also become infested with tamarisk, such as those along the Virgin River (Neel 1999).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

No over-utilization or other impacts associated with these activities are known.

Disease or Predation

Little information is available on the diseases and predators of western red bat.

The Inadequacy of Existing Regulatory Mechanisms

In Nevada, the Nevada Bat Conservation Plan has been adopted. Under this plan, attempts will be made to learn more about the requirements and behavior of pallid bat (Bradley et al. 2006). In Arizona, the Arizona Bat Conservation Strategic Plan has also been adopted, which will address research, monitoring, and conservation actions for the pallid bat (AGFD 2005a). Also in Arizona, all bats are protected by law by Commission Order 14 and Arizona Revised Statutes 17; it is illegal to take any bat species (AGFD 2005a). Special licenses to take bats and other restricted wildlife can be obtained from AGFD.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Pesticide use in fruit orchards may threaten roosting bats and reduce available prey. Controlled burns may cause mortality, as western red bats roost in leaf litter during cold weather (NatureServe 2007).

1.7.22.7 Conservation

See the Nevada Bat Plan, Lower Colorado River MSCP, and NDOW statewide bat network for conservation measures.

1.7.22.8 Species Status

Rangewide

In the United States, the species may be declining due to loss of lowland riparian forest and other broad-leaved deciduous trees (NatureServe 2007). In Nevada, western red bat is a rare and localized species with declining populations (NDOW 2006).

VRCMA Boundary

The western red bat is present throughout western and southern Nevada (NDOW 2006). Historic range includes Clark County, Nevada (NNHP 2004). It is unknown if surveys have been conducted and the distribution within the VRCMA Boundary is unknown. No occurrences have been recorded in the natural heritage species occurrences databases within the VRCMA Boundary (AGFD 2007d, NNHP 2006).

1.7.23 Western Small-footed Myotis

Scientific Name: *Myotis ciliolabrum*

1.7.23.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.
- Former Category 2 Candidate species (NNHP 2004).

Other Protections

- Evaluation species (Medium Priority) for Clark County MSHCP (RECON 2000).
- BLM sensitive species in Nevada (NNHP 2004).
- Global heritage rank is G5 (NatureServe 2007).
- Nevada heritage rank is S3 (NatureServe 2007).
- Arizona heritage rank is S3 (NatureServe 2007).

1.7.23.2 General Description

This small bat species has a tiny foot (0.2 inch [0.6 centimeters]), short forearms (1.2 to 1.4 inches [3.0 to 3.6 centimeters]), a wingspan of 8.3 to 9.8 inches [21 to 25 centimeters], and weighs 0.1 to 0.2 ounce [4 to six grams]. Physical characteristics also include a keeled calcar, black ears and a black facial mask. Its fur is usually brown but can range from pale yellow or tan to dark brown dorsally, to nearly white ventrally. Individual hairs are blackish basally and are succeeded by pale intermediate section and flaxen tips. Fur is relatively long and silky and frequently glossy (AGFD 2003d).

1.7.23.3 Distribution

Historic Distribution

The western small-footed myotis is found in western North America from southern Canada south into central Mexico (NatureServe 2007). This species is found throughout the western United States east to western North and South Dakota and south to western Texas. It occurs throughout Nevada (NatureServe 2007).

Current Distribution

The current distribution is presumed to be the same as the historic distribution.

1.7.23.4 Habitat

This species inhabits desert scrub, grasslands, sagebrush steppe, pine-fir forests, blackbrush, greasewood, pinyon-juniper woodlands, and agricultural and urban areas (Bradley et al. 2006). It forms substantial colonies in caves, mines, and trees (O'Farrell 2006). Hibernacula are often found in the summer habitat (NatureServe 2007). Maternity roosts can be solitary or colonial and are formed in buildings or under bridges (Ramsey 1997). It hibernates individually or in large colonies (NatureServe 2007). This myotis is insectivorous and forages along cliffs and rocky slopes, such as talus, scree, and bare rock (NatureServe 2007). In southern Nevada, it is primarily found at elevations greater than 6,000 feet (1,829 meters), although it can occasionally be found at lower elevations (Bradley et al. 2006). Key habitat attributes are standing snags and hollow trees for roosting (NatureServe 2007). Based on mapped occurrences of foraging sites for the western small-footed myotis in the NRA by the Nevada Natural Heritage Program, and reports from O'Farrell (2002a, 2002b, 2006) and Ramsey (1997), the species shows a GIS-derived association with nine vegetation series as classified through SWReGAP at elevations between 4,980 and 8,680 feet (1,518 to 2,646 meters). The proportion of the species' habitat by vegetation series includes: 63 percent in Great Basin Pinyon-Juniper Woodland, 24 percent in Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland, 10 percent in Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland, and very small percentages within other vegetation associations.

1.7.23.5 Life History

Reproductive Biology

The small-footed myotis mates in the fall and stores sperm over the winter. Fertilization follows ovulation in the spring. Females produce one, sometimes two young. Young are born between May and July and begin to fly one month after birth. Small maternity colonies (up to 20 individual females with young) occur in buildings and tree cavities. Survival rates are significantly lower for females (42 percent) than for males (76 percent) (AGFD 2003d).

Diet

This species feeds on flying insects, including flies and ants. A study of eight western small-footed bats near Flagstaff, Arizona indicates that they feed primarily on lepidopterans (i.e., butterflies, moths, and skippers), coleopterans (beetles and weevils), and dipterans (true flies). Neuropterans (lacewings), hymenopterans (sawflies, wasps, bees, and ants), and hemipterans (true bugs) were also present, though to a lesser extent (AGFD 2003d).

This species prefers to hunt over rocks instead of water. Foraging for small moths, flies, ants, and beetles occurs in open areas (NDOW 2006). During the warmer months, it leaves the daytime roost shortly after sunset, with foraging activity peaks between ten and eleven pm and one to two am (AGFD 2003d).

Migration

Whether or not this species migrates is unknown.

1.7.23.6 Threats Warranting Protection

Range-wide, threats to the western small-footed myotis include disturbance of hibernacula and breeding colonies (NatureServe 2007), spring diversion, and spelunking (SWCA 2005). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to this species include human disturbance of hibernacula, recreational caving, pesticides, and disturbance of breeding colonies (AGFD 2003d).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization is not known to occur for this species.

Disease or Predation

It is unknown whether this is a threat to western small-footed myotis.

The Inadequacy of Existing Regulatory Mechanisms

In Arizona, all bats are protected through Commission Order 14, and cannot be taken alive or dead, under auspices of a hunting license. Bats cannot be imported, exported, or otherwise possessed, without a special permit issued pursuant to Article 4 (Live Wildlife Rules) (AGFD 2006a). Otherwise, this species receives no federal or state protection.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Wanton killing is a threat to this species (AGFD 2003d).

1.7.23.7 Conservation

This species is addressed in the Nevada Bat Plan and the Arizona Bat Conservation Strategic Plan and covered under the Clark County MSHCP (NDOW 2006). Conservation of the western small-footed myotis is addressed in the Nevada Bat Conservation Plan. Under this plan, attempts will be made to learn more about the requirements and behavior of western small-footed myotis (Bradley et al. 2006). The Arizona Bat Conservation Strategic Plan has also been adopted, which will address research, monitoring, and conservation actions for the western small-footed myotis (AGFD 2005a). The western small-footed myotis is also addressed in the Clark County MSHCP, where conservation measures have been developed to offset any adverse effects on the western small-footed myotis from activities covered in the Clark County MSHCP (RECON 2000).

1.7.23.8 Species Status

Rangewide

Information is needed on the current distribution and status of the species (NDOW 2006).

VRCMA Boundary

The status of the western small-footed myotis within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.7.24 <u>Yuma Myotis</u>

Scientific Name: *Myotis yumanensis*

1.7.24.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as a threatened or endangered species, or a candidate for listing, under the Endangered Species Act of 1973, as amended

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Global heritage rank of G5 (NatureServe 2007).

- Nevada heritage rank of S3S4 (NatureServe 2007).
- Arizona heritage rank of S3S4 (NatureServe 2007).

1.7.24.2 General Description

The Yuma myotis is one of the smallest Myotis species, with a total length of 3.0 to 3.5 inches (7.5 to 8.9 centimeters) and a forearm length of 1.3 to 1.5 inches (3.4 to 3.8 centimeters). It weighs 0.1 to 0.2 ounce (four to seven grams). Its fur is dull, without a brassy sheen typical of other myotis species. Upper parts are tawny, buffy, or brown; underneath, the fur is paler, a buffy to yellowish white. Dorsal hairs are not tipped with a brighter brown. Yuma myotis has large feet with a lobed calcar (no keel is on the calcar). Its short ears are usually light or pale, the color as its back, with a pointed tragus. The braincase lacks a sagital crest (AGFD 2003i).

1.7.24.3 Distribution

Historic Distribution

The historic distribution is unknown. It is expected that the historic range was similar to the current range.

Current Distribution

Yuma myotis is widespread throughout western North America from southwestern Canada south into Mexico (NatureServe 2007). This bat occurs in the western United States east to Montana and western Texas (NatureServe 2007). It is found in Nevada in the northern and extreme western portions of the state (NatureServe 2007).

1.7.24.4 Habitat

Range-wide, this species is found in a wide variety of upland and lowland habitats including riparian, desert scrub, moist woodlands and forests, but usually found near open water (NatureServe 2007). Maternity roosts are colonial and usually occur in buildings, under bridges, or in caves and mines (Ramsey 1997). This species often forages over ponds and streams on a variety of insects, flying just above the surface of the water (NatureServe 2007). Key habitat attributes for the Yuma myotis include caves and mines for roosting and open water for foraging (NatureServe 2007).

1.7.24.5 Life History

Reproductive Biology

Copulation probably occurs in the fall and fertilization in the spring. About 35 females occupy a roost. Nursery colonies are usually in buildings, caves, and mines or under bridges. One young is born between May 25 and June 5. By early July, most young are able to fly, but a few may be still be nursing (AGFD 2003i).

Diet

This species forages on the water surface, feeding extensively on small moths (78.6 percent by frequency) and other small insects including dipterans and even some ground beetles. It can consume up to half of their weight every night. It usually flies low to the water (about six feet [two meters]) to capture prey, either in their mouths or using its tail membrane as a pouch in which to snare larger prey. This bat responds to temporary patches of prey, such as ant swarms, although many authors report that regular foraging routes are followed (AGFD 2003i).

Migration

This nocturnal species probably makes local or short migrations to suitable hibernacula for the winter. For example, individuals that spend the summer at high elevations probably move to lower elevations (AGFD 2003i).

1.7.24.6 Threats Warranting Protection

Range-wide, the Yuma myotis is threatened by human disturbance of maternity colonies in caves and buildings (NatureServe 2007). This bat is more closely associated with water than most bats and some riparian management practices may be detrimental, resulting in the loss of potential roost sites (NatureServe 2007). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats include disturbance of maternity colonies (highly susceptible to disturbance; abandoning site), closure of abandoned mines, overgrazing, and pest control activities (UDWR 2006a). They are also threatened by unnatural fire regimes, urban growth, loss of riparian habitats, streambank channelization, and the decline in permanent water sources (AGFD 2003i).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

It is unknown if this is a threat to the Yuma myotis.

Disease or Predation

It is unknown if this is a threat to the Yuma myotis.

The Inadequacy of Existing Regulatory Mechanisms

In Arizona, all bats are protected through Commission Order 14, and cannot be taken alive or dead, under auspices of a hunting license. Bats cannot be imported, exported, or otherwise possessed, without a special permit issued pursuant to Article 4 (Live Wildlife Rules) (AGFD 2006a). Otherwise, this species receives no federal or state protection.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

They are reported to hybridize with closely related species in western North America (UDWR 2006a).

1.7.24.7 Conservation

This species is addressed in the Arizona Bat Conservation Strategic Plan (AGFD 2003i).

1.7.24.8 Species Status

Rangewide

Population trends rangewide are unknown.

VRCMA Boundary

The status of the Yuma myotis within the VRCMA Boundary is unknown, although potential habitat is present. One occurrence has been recorded in the VRCMA Boundary: one observation along Cedar Pockets Wash in Arizona in 2000 (AGFD 2007d).

1.8 PLANT SPECIES DESCRIPTIONS

1.8.1 Alpine Stinking Lomatium

Scientific Name: *Lomatium graveolens* var. *alpinum*

1.8.1.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- NNHP Watch List species (NNHP 2005).
- NNPS delisted species (NNHP 2005).
- Global heritage rank of G5?T3? (NatureServe 2007).
- Nevada heritage rank of S2S3 (NatureServe 2007).

1.8.1.2 General Description

This species is a perennial herb (NNHP 2001). Little information is available for this species.

1.8.1.3 Distribution

Historic Distribution

This species has a small range in Nevada (Clark County) and Utah (NNHP 2001).

Current Distribution

Little information is available regarding differences between the current and historic distributions of this species.

1.8.1.4 Habitat

Little information is available for this species. Alpine stinking lomatium has been recorded at 7,875 feet (2,400 meters) in Nevada (NNHP 2001).

1.8.1.5 Life History

Reproductive Biology

Alpine stinking lomatium flowers from late spring to summer (NNHP 2001).

1.8.1.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.1.7 Conservation

No known conservation measures are in place directly aimed at protecting this species (NNHP 2001).

1.8.1.8 Species Status

Rangewide

Rangewide population trends of alpine stinking lomatium are unknown (NNHP 2001).

VRCMA Boundary

The status of the alpine stinking lomatium within the VRCMA Boundary is unknown, although potential habitat and one occurrence are known within the boundary. One herbarium species was collected in the Nevada portion of the VRCMA Boundary in 1988, from the Virgin Mountains area (NNHP 2006).

1.8.2 Antelope Canyon Goldenbush

Scientific Name: *Ericameria cervina*

1.8.2.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Global heritage rank is G3? (NatureServe 2007).
- Nevada heritage rank is S1 (NatureServe 2007).
- Utah heritage rank is S2 (NatureServe 2007).

1.8.2.2 General Description

Antelope Canyon goldenbush is a shrub in the aster (Asteraceae) family.

This is a small shrub (0.3 to 1.3 feet [0.1 to 0.4 meters] tall) that is intricately branched. Stems ascending to spreading, green when young, becoming dark brown then gray. Twigs are stipitate-glandular and resin coated. Leaves are ascending. The blades are elliptic to obovate, 0.35 to 0.71 by 0.10 to 0.16 inch (nine to 18 by 2.5 to

0.4 centimeters) with prominent midveins and two fainter, collateral veins. One of the key identification features is the undulate leaf margins. The apices are usually obtuse to rounded, sometimes acute to apiculate. The surfaces are stipitate-glandular and resinous. Axillary leaf fascicles are reduced or absent (NNHP 2001).

Yellow flower heads appear on the ends of the leafy branches in September and October. The peduncles are 0.04 to 0.59 inch (0.1 to 1.5 centimeters) (bracts three to eight in number, gradually reduced, leafy). The involucres are obconic, 0.20 to 0.28 by 0.10 to 0.14 inch (0.5 to 0.7 by 0.25 to 0.35 centimeter). There are 22 to 30 phyllaries in four–five series, mostly tan, lanceolate to elliptic, 0.06 to 0.20 by 0.03 to 0.05 (1.5 to five by 0.08 to 0.12 centimeter), strongly unequal, chartaceous (bodies abruptly constricted at bases of appendages), midnerves usually inconspicuous, (margins scarious, entire or minutely lacerate) apices acute to acuminate or cuspidate, abaxial faces glabrous, lightly resinous, and sometimes gland-dotted. There are three to four ray florets and eight to nine disc florets (NNHP 2001).

1.8.2.3 Distribution

Historic Distribution

This species is found in Clark and Lincoln Counties, Nevada, in Mohave County, Arizona, and in Beaver, Juab, and Millard Counties, Utah (NatureServe 2007, NNHP 2001).

Current Distribution

The current and historic ranges are presumed to be the same although the current distribution within the range could be patchier than the historic distribution.

1.8.2.4 Habitat

Antelope Canyon goldenbush grows in rock crevices and talus in shadscale and Douglas fir-bristlecone pine vegetation communities (NNHP 2001). It is often on calcareous substrates and less commonly on ash flow tuff (NNHP 2001).

1.8.2.5 Life History

Little life history information is available for this plant.

Reproductive Biology

Antelope Canyon goldenbush flowers from summer to early fall, in September and October (NNHP 2001). No other information on the reproduction biology of the species was available.

1.8.2.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.2.7 Conservation

Conservation efforts for this species are unknown.

1.8.2.8 Species Status

Rangewide

Three occurrences have been mapped in Nevada. It also occurs in Arizona and Utah. In Nevada, there are an estimated 52 individuals (NNHP 2001). Population trends are not known.

VRCMA Boundary

Information on status specific to the VRCMA Boundary is lacking. One occurrence has been recorded within the watershed in the Virgin Mountains in Nevada (NNHP 2006). J. Tiehm observed this species there in 1979 (NNHP 2006). No other occurrences in the watershed have been recorded in natural heritage databases (UDWR 2007, AGFD 2007d).

1.8.3 Aven Nelson's Phacelia

Scientific Name: *Phacelia anelsonii*

1.8.3.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Global heritage rank is G2G3 (NatureServe 2007).
- Arizona heritage rank is SNR (NatureServe 2007).
- Nevada heritage rank is S1S2 (NatureServe 2007).

1.8.3.2 General Description

Aven Nelson's phacelia is an annual in the waterleaf (Hydrophyllaceae) family (Jepson Herbarium 1993b). It is an erect annual with a brownish, glandular pubescence and violet to white flowers (NNHP 2001). Its height varies from four to 19.7 inches (ten to 50 centimeters} (Jepson Herbarium 1993b).

1.8.3.3 Distribution

Historic Distribution

Aven Nelson's phacelia ranges from southern Nevada (Clark, Nye, and Lincoln counties) and southwestern Utah (Washington County) (NNHP 2001) west to Inyo and San Bernadino Counties, California (UDWR 1998). It occurs in an elevation band from 4,200 to 5,000 feet (1,280 to 1,530 meters) (NNHP 2001).

Current Distribution

Its current distribution appears to include two locations in Nevada plus occurrences in California and Utah (NNHP 2001).

1.8.3.4 Habitat

Aven Nelson's phacelia is found predominantly in sheltered places such as the north side of cliffs and ledges, in rocky or sandy or gravelly soil, at elevations of up to 4,920 feet (1,500 meters) (Cronquist et al. 1984, as cited in NNHP 2001).

1.8.3.5 Life History

Little life history information is available for this plant.

Reproductive Biology

No information on the reproductive biology of the species was available.

1.8.3.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.3.7 Conservation

Conservation efforts for this species are unknown.

1.8.3.8 Species Status

Rangewide

Two occurrences are mapped in Nevada with an unknown number of individuals. Population trends are unknown (NNHP 2001).

VRCMA Boundary

The status of the Aven Nelson phacelia within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.4 Barrel Cactus

Scientific Name: *Ferocactus cylindraceus var. lecontei*

1.8.4.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Protected as a cactus, yucca, or Christmas tree in Nevada (N.R.S. 527.060-.120) (NNHP 2005).
- USFS Region 4 (Humboldt-Toiyabe NF) sensitive species (NNHP 2005).
- Global heritage rank of G4T3Q (NatureServe 2007).
- Nevada heritage rank of S3 (NatureServe 2007).

1.8.4.2 General Description

Barrel cactus is a perennial stem succulent, nearly always single stemmed. The stem is straight, erect or nearly so, and cylindric. It can grow up to ten feet (3.05 meters) tall, but it is typically measures 1.5 to five feet (0.5 to 1.5 meters) by 0.8 to 1.3 feet (0.2 to 0.4 meter). The ribs, usually 21 to 31 in number, are shallowly notched immediately above each areole. There are generally 10 to 18 spines per areole, with the central spines and the larger radial spines whitish, yellow, pink, dull red, or brown. The spines are erect and spreading, with the longest recurved, generally with some red, becoming gray. Central spines are 3.0 to 6.7 inches (7.5 to 17 centimeters) long, with four per areole. Crowns of flowers are crowded among the dense spines at the stem tips. Flowers are 1.2 to 2.4 inches (3.0 to 6.1 centimeters) by 1.6 to 2.4 inches (4.1 to 6.1 centimeters), maroon on the outside, and yellow on the inside. The inner tepals are commonly yellow; stigma lobes are yellow to red. (AGFD 2005d).

Varieties *F. c. lecontei* and *F. c. eastwoodiae* occur at higher elevations (2,461 to 4,921 feet [750 to 1,500 meters] and 1,280 to 3,740 feet [390 to 1,140 meters], respectively) than variety *F. c. cylindraceus* (197 to 1,969 feet [60 to 600 meters]). The central spine of var. *lecontei* is shorter, while the central spine of var. *eastwoodiae* is conspicuously yellow or straw-yellow. The central spine of var. *cylindraceus* is much longer and more twisted on the lower part of the plant (AGFD 2005d).

1.8.4.3 Distribution

Historic Distribution

Barrel cactus is found in southeast California, central and southern Arizona, Clark County, Nevada, and northern Mexico. This subspecies is most abundant in Arizona (NatureServe 2007)

Current Distribution

The current range of barrel cactus is the same as its historic range (NatureServe 2007).

1.8.4.4 Habitat

Barrel cactus is found on gravelly or rocky hillsides, canyon walls, alluvial fans, and wash margins or sandy flats in the desert, most commonly between 2,461 and 4,921 feet (750 and 1,500 meters) in elevation (NatureServe 2007).

1.8.4.5 Life History

Reproductive Biology

Barrel cactus flowers during late spring to early summer following winter rains, usually from April to June, but sometimes it also flowers sporadically after summer rains (AGFD 2005d).

1.8.4.6 Threats Warranting Protection

Little information is available on threats to this species. However, a number of general threats exist for plants in the region. These include habitat loss, degradation and fragmentation from a number of human activities, livestock grazing and increased fire risk from encroaching exotic vegetation and herbicide use (RECON 2000).

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to this species are not well known. General threats to plants within the VRCMA Boundary include habitat loss, degradation and fragmentation from urban and rural development, construction and maintenance of roads and trails, military and mining activities, and illegal dumping (RECON 2000).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

For plants in general, OHV use, rock climbing and other recreational activities can degrade habitat or result in trampling of individuals. Illegal and commercial collection is a threat to barrel cactus as well (RECON 2000, AGFD 2005d).

Disease or Predation

The fruit and seeds of genus *Ferocactus* are eaten by rodents, birds, mule deer, bighorn sheep, and javelina. The plant itself is eaten by cactus beetles (*Moneilema gigas* and other species), jackrabbits, packrats, and javelina (AGFD 2005d).

The Inadequacy of Existing Regulatory Mechanisms

This species is not included on the threatened and endangered species list under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Runoff, pollution and erosion from highways and roads may negatively affect plant populations in close proximity (RECON 2000).

1.8.4.7 Conservation

Because the barrel cactus is protected under N.R.S. 527.060-.120 in Nevada, a permit must be obtained from Nevada Division of Forestry (NDF) prior to harvesting individuals of the species on private lands. On BLM lands in the Las Vegas and Arizona Strip Field Offices, collectors are also required to obtain permits prior to collecting (NDCNR 2007).

1.8.4.8 Species Status

Rangewide

This species is widely scattered over its range, but only abundant at the local level (AGFD 2005d).

VRCMA Boundary

The status of the barrel cactus within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.5 Beaver Dam Scurf Pea (Breadroot)

Scientific Name: *Pediomelum castoreum*

1.8.5.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Global heritage rank is G3 (NatureServe 2007).
- Arizona heritage rank is S1 (NatureServe 2007).

1.8.5.2 General Description

Beaver Dam breadroot/scurf pea is a herbaceous perennial in the pea (Fabaceae) family. It reaches up to 6.3 inches (16 centimeters) in height (AGFD 2005h).

This species is a low-growing, single-stemmed, deep-rooted, herbaceous perennial with glabrous, slender stems. The leaves are palmately compound with four to five leaflets. The leaflets are broadly cuneate-obovate, subcordate to rounded. The leaflets are pubescent and the pattern of pubescence, denser on the upper surface veins and near the edge, results in emphasis on the veination pattern and a white leaf edge (NNHP 2001).

1.8.5.3 Distribution

Historic Distribution

This species is endemic to the Mojave Desert region. It is known from Nevada and Arizona and may occur in California and Utah, though it has never been collected in Utah (AGFD 2005h). It is found within an elevation range from 1,279.5 to 5,000 feet (390 to 1,524 meters) (NNHP 2001, AGFD 2005h). In Arizona, elevations range from 1,750 to 3,920 feet. (534 to 1,196 meters) (AGFD 2005h). NNHP (2001) reports elevations in Nevada ranging from 1,280 to 5,000 feet. (390 to 1,524 meters).

Current Distribution

All Arizona localities are in the northwest corner of state in Mohave County. These include Beaver Dam Wash, above Mormon Well, north of Peach Springs, southeast of Littlefield, Black Rock Gulch (AGFD 2005h).

1.8.5.4 Habitat

This species is associated with desert shrub vegetation, pinyon-juniper woodland, and the juniper-*Mahonia fremontii* community. Associated species include *Acamptopappus* (goldenhead), *Ambrosia acanthicarpa* (flat-spine bursage), *Gutierrezia* (snakeweed), *Hilaria belangeri* (common curly-mesquite), and *Larrea tridentata* (creosotebush) (AGFD 2005h). The species can be found in sand or sandy gravel in open areas and on road cuts (NNHP 2001, AGFD 2005h).

1.8.5.5 Life History

Little life history information is available for this plant.

Reproductive Biology

This species flowers from April to June (AGFD 2005h). No other information on the reproductive biology of the species was available.

1.8.5.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.5.7 Conservation

Conservation efforts for this species are unknown.

1.8.5.8 Species Status

Rangewide

This species is known from BLM and NPS lands. It may also occur on Nevada state lands and private lands (NNHP 2001, AGFD 2005h).

VRCMA Boundary

The species' status within the VRCMA Boundary is unknown. Within the VRCMA Boundary, six occurrences have been recorded; six in Arizona and five in Nevada (NNHP 2006, UDWR 2007, AGFD 2007d). Of the three in Arizona, all were in the Virgin Mountains, two were observed in 1993, and one was collected in 1978 (AGFD 2007d). In Nevada, three were observed prior to 1971, as referenced in Rutman 1991, and one is an observation of unknown type by Knight from before 1971 (NNHP 2006). One is a specimen collected in 1976 by Holland (1976, as cited in NNHP 2006).

1.8.6 Catchfly Gentian

Scientific Name: *Eustoma exaltatum*

1.8.6.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- BLM sensitive species in Nevada (BLM 2003a).
- Global heritage rank of G4G5 (Nature Serve 2007).
- Nevada heritage rank of S1 (Nature Serve 2007).
- NNHP Watch List (NNHP 2004).

1.8.6.2 General Description

The catchfly gentian is an annual or short-lived perennial herb that can be upwards of 27.6 inches (70 centimeters) tall (Lady Bird Johnson Wildflower Center 2007). It prefers damp areas and seems to reach peak condition on moist prairies where it sometimes grows in profusion (Lady Bird Johnson Wildflower Center 2007). The large bell-shaped flowers are two to three inches (5.1 to 7.6 centimeters) across and have five to seven bluish-purple petals less than one inch long which are constricted into a small tube at the base and have prominent purple markings in the throat. The leaves are long and oval with pointed tips one to 2.5 inches (2.5 to 6.4 centimeters) long (Lady Bird Johnson Wildflower Center 2007).

1.8.6.3 Distribution

Historic Distribution

Catchfly gentian occurs throughout the southern portion of the United States from Florida west to California, and extends north into the interior, up to Montana and South Dakota (Lady Bird Johnson Wildflower Center 2007).

Current Distribution

The current distribution is the same as the historic distribution (NatureServe 2007).

1.8.6.4 Habitat

This species inhabits moist areas such as sandy coastal areas, moist places in prairies and fields, and saline to freshwater marshes (Lady Bird Johnson Wildflower Center 2007).

1.8.6.5 Life History

Reproductive Biology

Catchfly gentian has fruits that are ellipsoid capsules and seeds that are small and globose (Lady Bird Johnson Wildflower Center 2007). Flowering occurs in the spring through the fall, usually during the months between May and October (Lady Bird Johnson Wildflower Center 2007).

1.8.6.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threatened destruction of habitat for this species is due to livestock and human encroachment (NNNPS 1999).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Livestock impact on the area is considerable, endangering the survival of this species and others in the *Eustoma* genus in Nevada (NNNPS 1999). Grazing and trampling of this species is its biggest threat (NNNPS 1999).

Disease or Predation

This activity is not listed as a threat currently affecting this species

The Inadequacy of Existing Regulatory Mechanisms

NNNPS created a new listing category, “M” for Marginal or Disjunct and moved *Eustoma exaltatum* from NNNPS Watch List to the new Marginal (M) list, and recommend for BLM sensitive species status (NNNPS 2001).

Other Natural or Manmade Factors Affecting the Species’ Continued Existence

This activity is not listed as a threat currently affecting this species.

1.8.6.7 Conservation

There have been no proposed conservation plans for this species.

1.8.6.8 Species Status

Rangewide

This wide-ranging taxon is not abundant in any one location within its range; in southwestern deserts, it is rare (Kearney and Peebles 1960, as cited in NNNPS 1999).

VRCMA Boundary

The catchfly gentian has been recorded near the VRCMA Boundary. The population status within the VRCMA Boundary is unknown. This obligate wetland species has been reported from two sites in Nevada (NNNPS 1999). It was collected in 1964 (UNLV 1486) “in a marshy site along the Colorado River, one-half mile north of the Nevada-California boundary” (NNNPS 1999). This portion of Clark County has since undergone large-scale urban development, and it is not known if the Colorado River population still persists. The plant was collected again in 1997 (UNLV 35192, 37518) at Red Rock Springs, in the Gold Butte area of Clark County. Over 200 individuals were counted along the moist drainage from the springs. Most of the plants showed damage from grazing and/or trampling by cattle (NNNPS 1999).

1.8.7 Chalk Live-forever

Scientific Name: *Dudleya pulverulenta*

1.8.7.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000)
- Global heritage rank of G4G5 (NatureServe 2007).
- Nevada heritage rank of S3 (NatureServe 2007).

1.8.7.2 General Description

Chalk live-forever is a succulent perennial herb. The plant is covered with dense, mealy powder to chalky wax and has a simple caudex. The leaf is oblong to oblong-obovate. The inflorescence has three to 10 primary branches, simple or forked. The terminal branches are twisted at base. Flower sepals are deltate-ovate, and the petals are acute to obtuse (Jepson Herbarium 1993c).

1.8.7.3 Distribution

Historic Distribution

Chalk live-forever is found in southern California, southern Nevada, western Arizona and northwestern Mexico (NatureServe 2007, Jepson Herbarium 1993c).

Current Distribution

The current distribution is similar to the historic distribution (NatureServe 2007).

1.8.7.4 Habitat

Chalk live-forever is found in chaparral, coastal sage, and a variety of rocky habitats under 4,921.3 feet (1,500 meters) in elevation (Jepson Herbarium 1993c).

1.8.7.5 Life History

Reproductive Biology

Little information is available on the reproductive biology of chalk live-forever.

1.8.7.6 Threats Warranting Protection

Little information is available on threats to this species. However, a number of general threats exist for plants in the region. These include habitat loss, degradation and fragmentation from a number of human activities, livestock grazing and increased fire risk from encroaching exotic vegetation and herbicide use (RECON 2000).

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to plants include habitat loss, degradation and fragmentation from urban and rural development, construction and maintenance of roads and trails, military and mining activities, and illegal dumping (RECON 2000).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

OHV use, rock climbing and other recreational activities can degrade habitat or result in trampling of individual plants. Illegal collection is a threat to plants as well (RECON 2000).

Disease or Predation

Little information is available regarding disease and predation of this species. Livestock, wild horses, burros, or other ungulates may graze on plants (RECON 2000).

The Inadequacy of Existing Regulatory Mechanisms

This species is not included on the threatened and endangered species list under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Runoff, pollution, and erosion from highways and roads may negatively affect plant populations in close proximity (RECON 2000).

1.8.7.7 Conservation

No known conservation measures are in place directly aimed at protecting chalk live-forever. However, as a Watch List species for the Clark County MSHCP, this species is likely to benefit from conservation actions for Covered species (RECON 2000).

1.8.7.8 Species Status

Rangewide

Population trends are not known for chalk live-forever (NNHP 2001).

VRCMA Boundary

The status of the chalk live-forever within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.8 Clark Mountain Agave

Scientific Name: *Agave utahensis* var. *nevadensis*

1.8.8.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- NNPS delisted species of concern (NNHP 2005).
- NNHP Watch List species (NNHP 2005).
- Global heritage rank of G4T3Q (NatureServe 2007).
- Nevada heritage rank of S3 (NatureServe 2007).

1.8.8.2 General Description

Clark Mountain agave is a succulent perennial shrub. The plant is blue-glaucous; the caudex is 7.1 to 11.8 inches (18 to 30 centimeters) and branched. Large, straight, robust leaves are 5.8 to 11.8 inches (15 to 30 centimeters) and generally narrowly lanceolate. Lateral teeth are 0.08 to 0.16 inch (0.2 to 0.4 centimeters), blunt, and detachable. The inflorescence is raceme-like with no peduncle bracts. Deep yellow flowers occur in clusters of two to eight and have a perianth that is 1.0 to 1.2 inches (2.5 to 3.1 centimeters) in length with a tube 0.16 to 1.0 inch (0.25 to 0.4 centimeters) long and equal lobes. Filaments are attached near the base of the tube, and are 0.7 to 0.8 inch (1.8 to 2.0 centimeters) in length (Jepson Herbarium 1993a).

1.8.8.3 Distribution

Historic Distribution

Clark Mountain agave is patchily distributed in southeastern California and in Clark and Nye Counties in Nevada (Jepson Herbarium 1993a, NatureServe 2007).

Current Distribution

No information is available on changes in distribution of Clark Mountain agave.

1.8.8.4 Habitat

Clark Mountain agave is found in desert mountains, between 2,952.8 and 4,921.3 feet (900 and 1,500 meters) in elevation. They are mostly associated with shadscale scrub and Joshua-tree woodland (Jepson Herbarium 1993a). Utah agave (*Agave utahensis*) is primarily limited by winter minimum temperature and high monsoon precipitation (Cole and Arundel, in press).

1.8.8.5 Life History

Reproductive Biology

Clark Mountain agave flowers from May to July (Jepson Herbarium 1993a).

1.8.8.6 Threats Warranting Protection

Threats to this species are not well known. Changing weather patterns as a result of climate may change may negatively affect this species. High monsoon precipitation limits this plant from the Mogollon Rim area of western Arizona. Although many species are attacked by mold or fungus under moist conditions, the more likely limiting factors could be related to the high fire frequency in the chaparral plant communities of this area, and possibly to the infrequency of the steep rocky substrates that the species dominates throughout the rest of its range (Cole and Arundel, in press).

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to plants within the VRCMA Boundary include habitat loss, degradation and fragmentation from urban and rural development, construction and maintenance of roads and trails, military and mining activities, and illegal dumping (RECON 2000).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Other *Agave utahensis* subspecies are known to be horticulturally propagated for their use in commercial and private landscapes (see below) (AGFD 2005a). OHV use, rock climbing and other recreational activities can degrade habitat or result in trampling of individual plants.

Disease or Predation

Where available, deer and cattle may browse young flower stalks (AGFD 2005a).

The Inadequacy of Existing Regulatory Mechanisms

This species is not included on the threatened and endangered species list under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Runoff, pollution and erosion from highways and roads may negatively affect plant populations in close proximity (RECON 2000).

1.8.8.7 Conservation

Because the Clark Mountain agave is protected under N.R.S. 527.060-.120 in Nevada, a permit must be obtained from Nevada Division of Forestry (NDF) prior to harvesting individuals of the species on private lands. On BLM lands in the Las Vegas and Arizona Strip Field Offices, collectors are also required to obtain permits prior to collecting (NDCNR 2007).

1.8.8.8 Species Status

Rangewide

Population trends for this species are unknown.

VRCMA Boundary

The status of the Clark Mountain agave within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.9 Clarke Phacelia

Scientific Name: *Phacelia filiae*

1.8.9.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- NNPS Watch List species (NNHP 2005).
- BLM sensitive species in Nevada (BLM 2003a).
- Global heritage rank of G2 (NatureServe 2007).
- Nevada heritage rank of S2 (NatureServe 2007).

1.8.9.2 General Description

Clarke phacelia is an annual plant, 0.9 to 2.4 inches (2.3 to 6 centimeters) high. It is branched at or near the base, and its stems are 1.0 to 2.8 inches (2.5 to 7 centimeters) long and curved upward. The leaves are mostly basal and petiolate, and the blade is 0.3 to 1.2 inches (0.7 to 3.0 centimeters) by 0.2 to 0.6 inch (0.5 to

1.5 centimeters), ovate, elliptic, or oblong, and entire to few-toothed. The petiole is 0.1 to 0.6 inches (0.15 to 1.5 centimeters) long. The inflorescence consists of terminal secund cymes, 0.3 to 1.4 inches (0.6 to 3.5 centimeters) long. The flowers are tube-shaped (tubular-campanulate), with 6 to 7 lobes. The tube is pale yellow, and the limb is lavender (Atwood et al. 2002).

1.8.9.3 Distribution

Historic Distribution

Clarke phacelia is endemic to Nevada, found in Clark, including the Nellis Range, and in Nye and Lincoln counties (NatureServe 2007, Atwood et al. 2002).

Current Distribution

Several populations of this species likely were lost in the urban Las Vegas area prior to documentation (NatureServe 2007).

1.8.9.4 Habitat

Clarke phacelia is restricted to the Mojave desert and the transition zone of the Mojave desert and the Great Basin. The first specimens were collected at 3,080 feet (938.8 meters) (Atwood et al. 2002).

1.8.9.5 Life History

Reproductive Biology

Little information is available on the flowering periods of this species.

1.8.9.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.9.7 Conservation

Conservation efforts for this species are unknown.

1.8.9.8 Species Status

Rangewide

Little information is available on the population trends of Clarke phacelia. This species is new to science and was first described only in 2002 (Atwood et al. 2002).

VRCMA Boundary

The status of the Clarke phacelia within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.10 Clokey Fleabane

Scientific Name: *Erigeron clokeyi*

1.8.10.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Global heritage rank of G4G5 (NatureServe 2007).
- Nevada heritage rank of S4 (NatureServe 2007).

1.8.10.2 General Description

Clokey fleabane is a perennial species, stands two to 7.9 inches (5 to 20 centimeters) tall, grows from a stout taproot and a (sub) simple caudex, and ascends to be erect and unbranched. The hairs are short, stiffly spreading to reflexed. Leaves are basal and 0.8 to 3.1 inches (two to eight centimeters), sometimes oblanceolate; cauline not clasping, and generally are strongly reduced by mid-stem. It has an inflorescence with a single flower head, 0.3 to 0.5 inch (0.8 to 1.2 centimeters) in diameter. The phyllaries are roughly equal, sessile-glandular, hairs short, and stiffly spreading to reflexed. Ray flowers have 25 to 55 petals. Corollas are 0.2 to 0.4 inch (0.6 to 1.1 centimeters) in length, and the ligules are white to blue and reflexed (Jepson Herbarium 1993d).

1.8.10.3 Distribution

Historic Distribution

Clokey fleabane is found in California, Nevada, and Utah, in the southern high Sierra Nevada and other desert mountains (Jepson Herbarium 1993d, NatureServe 2007).

Current Distribution

The current distribution is similar to the historic distribution (NatureServe 2007).

1.8.10.4 Habitat

Clokey fleabane is a perennial herb found between 8,000 and 10,500 feet (2,438 and 3,200 meters) (CalFlora 2007) in sagebrush scrub and alpine talus (Jepson Herbarium 1993d).

1.8.10.5 Life History

Reproductive Biology

Clokey fleabane flowers between June and September (Jepson Herbarium 1993d).

1.8.10.6 Threats Warranting Protection

Little information is available on threats to this species. However, a number of general threats exist for plants in the region. These include habitat loss, degradation and fragmentation from a number of human activities, livestock grazing and increased fire risk from encroaching exotic vegetation and herbicide use (RECON 2000).

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to plants in the VRCMA Boundary include habitat loss, degradation and fragmentation from urban and rural development, construction and maintenance of roads and trails, military and mining activities, and illegal dumping (RECON 2000).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

OHV use, rock climbing and other recreational activities can degrade habitat or result in trampling of individual plants. Illegal collection is a threat to plants as well (RECON 2000).

Disease or Predation

Little information is available regarding disease and predation of this species. Livestock, wild horses, burros or other ungulates may graze on plants (RECON 2000).

The Inadequacy of Existing Regulatory Mechanisms

This species is not included on the threatened and endangered species list under the ESA. Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Runoff, pollution and erosion from highways and roads may negatively affect plant populations in close proximity (RECON 2000).

1.8.10.7 Conservation

No known conservation measures are in place directly aimed at protecting clokey fleabane, although as a Clark County MSHCP Watch List species, other conservation actions for Covered species in Clark County, Nevada, will likely benefit this species (RECON 2000).

1.8.10.8 Species Status

Rangewide

Populations of clokey fleabane appear to be stable. (NatureServe 2007).

VRCMA Boundary

The status of the clokey fleabane within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.11 Clokey Pincushion

Scientific Name: *Escobaria vivipara* var. *rosea*

1.8.11.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Global heritage rank is G5T3 (NatureServe 2007).
- Nevada heritage rank is S3 (NatureServe 2007).
- Arizona heritage rank is S3 (NatureServe 2007).

1.8.11.2 General Description

Clokey pincushion, also commonly called spinystar, is a member of the cactus (Cactaceae) family.

Clokey pincushion is a small, round cactus. This species grows to a size of approximately five inches (12.7 centimeters) tall by five inches (12.7 centimeters) wide. The Clokey pincushion has the appearance of a light-colored spiny ball. It has one to several ovoid-globular stems, without ribs, that are 2.8 to seven inches (seven to 18 centimeters) long, 2.8 to six inches (seven to 15 centimeters) in diameter. It is densely covered with spines. The stem is densely covered with relatively long, stout, straight white spines with red tips (none are fish-hook shaped), and all of the spines are pressed closely against the stem. At each aeriole there are 10 to 12 central spines that are white with pink to red colored tips, 0.8 to one inch (two to 2.5 centimeters) long, and 12-18 radial spines that are white and 0.4 to 0.8 inches (one to two centimeters) long. Spines completely obscure the stem (AGFD 2005c).

This plant blooms in early summer (June-July). Flowers are 1.2 to two inches (three to five centimeters) in diameter, narrowly lanceolate, magenta to rose to purplish colored, forming a circle near the top of the plant. The fruit is green with a reddish upper half, 0.8 to 1.2 inches (two to three centimeters) long and 0.6 inch (1.5 centimeters) in diameter. The seeds are brown and kidney shaped, and 0.1 inch (0.2 centimeters) long (AGFD 2005c).

1.8.11.3 Distribution

Historic Distribution

Clokey pincushion is known from 61 occurrences in Nevada plus an unknown number in California and Arizona (NatureServe 2007, as cited in AGFD 2005c).

Current Distribution

The current and historic ranges are presumed to be the same although the current distribution within the range could be patchier than the historic distribution.

1.8.11.4 Habitat

Clokey pincushion is associated with creosote bush scrub and pinyon-juniper woodland (CalFlora 2002, as cited in AGFD 2005c). It is found on limestone substrate, volcanic hills, and rocky, gravelly areas in desert mountains (AGFD 2005d). The elevation range extends from 4,920 to 9,000 feet (1,500 to 2,745 meters) across its range (Jepson Herbarium 1993d, AGFD 2005). It was collected in Arizona in 1940 at 3,900 feet (1,190 meters) (AGFD 2005c).

1.8.11.5 Life History

Little life history information is available for this perennial plant.

Reproductive Biology

This species is perennial. No other information on the reproduction biology of the species was available.

1.8.11.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to habitat include livestock grazing, off-road vehicle use, illegal commercial and noncommercial collecting, forest fire, and land development (mining and urbanization, AGFD 2005d).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Clokey pincushion is subject to horticultural collecting (AGFD 2005c).

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.11.7 Conservation

Conservation efforts for this species are unknown.

1.8.11.8 Species Status

Rangewide

Rangewide status of this species is unknown. It is considered very rare by the California Native Plant Society (AGFD 2005c).

This species is known from 61 occurrences in Nevada (NatureServe 2007). CalFlora (2002, as cited in AGFD 2005c) lists 12 observations, all on San Bernadino County. There are three specimens in Arizona herbariums (AGFD 2005c).

VRCMA Boundary

The species status within the VRCMA Boundary is unknown. Two occurrences have been recorded in the watershed, both from 1978 in the Mokac Mountain area of Arizona (AGFD 2007d). No other occurrences in the watershed have been recorded in natural heritage databases (NNHP 2006, UDWR 2007).

1.8.12 Crossidium Moss

Scientific Name: *Crossidium seriatum*

1.8.12.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Evaluation species (Medium Priority) for the Clark County MSHCP (RECON 2000).
- Global heritage rank is G2 (NatureServe 2007).
- Nevada heritage rank is S2 (NatureServe 2007).

1.8.12.2 General Description

Crossidium moss is a moss in the Pottiaceae family.

Plants form thin turfs or small cushions. Leaves are tiny, lingulate to oblong-ovate, and 0.02 to 0.05 inch (0.06 to 0.13 centimeters), with revolute margins from near the apex to near the base. Leaves are smooth-celled in the middle and base. The leaf apex is round to slightly emarginate. The costa are excurrent with an abaxial epidermis. Filaments have two to six subspheric cells, with several papillae per cell. The terminal cell is subspheric (Delgadillo 2006).

Sexually, the species is cladautoicous. Seta are 0.9 to 1.3 centimeters long. The capsule urn is oblong-cylindric, 0.06 to 0.09 inch (0.15 to 0.23 centimeter) long; the operculum 0.03 to 0.04 inch (0.07 to 0.11 centimeter); the peristome strongly twisted, 0.040 to 0.043 inch (1,015 to 1,100 micrometers). The spores are spherical, finely papillose, 0.00043 to 0.00051 inch (11 to 13 micrometers). Capsules mature from January to July (Delgadillo 2006).

1.8.12.3 Distribution

Historic Distribution

Crossidium moss is known to occupy areas in Clark County, Nevada. It also occurs in Arizona, Kansas, New Mexico, Mexico, British Columbia,, and Europe. In Nevada, the elevation range is 1,300 to 2,460 feet (400 to 750 meters) (NNHP 2001).

Current Distribution

The current and historic ranges are presumed to be the same although the current distribution within the range could be patchier than the historic distribution.

1.8.12.4 Habitat

Crossidium moss is often found in protected locations on the north or east sides of rocks or shrubs, or at the bases of bluffs, in the creosote-bursage zone (NNHP 2001). Suitable habitat occurs on sandstone and gypsiferous bluffs, outcrops, rock piles, and soils (NNHP 2001).

1.8.12.5 Life History

No information on the life history of this bryophyte was found.

Reproductive Biology

Crossidium moss is bisexual but does not normally produce "fruit" (NNHP 2001).

1.8.12.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.12.7 Conservation

Conservation efforts are unknown for this species.

1.8.12.8 Species Status

Rangewide

The last known survey in Nevada was in 1998. It is not known how much of the of total habitat that has been mapped or surveyed (NNHP 2001). Globally, it is known from fewer than ten populations with the most numerous being in the region north of Lake Mead (Stark 2001).

VRCMA Boundary

The status of crossidium moss within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.13 <u>Dune Linanthus</u>

Scientific Name: *Linanthus arenicola*

1.8.13.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Delisted from the NNPS species of concern list (NNHP 2005).
- BLM sensitive species in Nevada (BLM 2003a).
- Global heritage rank of G3 (NatureServe 2007).
- Nevada heritage rank of S3 (NatureServe 2007).

1.8.13.2 General Description

Dune linanthus is an annual herb, found in March and April. It is a desert dwarf, compactly di- or tri-chotomously branched, 0.75 to 2.5 inches (1.9 to 6.4 centimeters) high. It is equally leafy to the summit. The stems are thinly and microscopically puberulent. The shape of its leaves can vary considerably between plants. Some individuals are three-parted, some are two-parted, or they can be entire or mostly entire. Its flowers are solitary in the crowded axils from near the base of the plant upward, finally terminal on the branches. The corolla is salverform, yellow, equaling or shorter than the calyx, and 2.5 to 2.75 lines long; its lobes are about one-third as long as the tube and throat (Jepson Herbarium 1993f).

1.8.13.3 Distribution

Historic Distribution

Dune linanthus is found in southern California, southern Nevada, and southwestern Utah (NatureServe 2007).

Current Distribution

The current distribution is the same as the historic distribution (NatureServe 2007).

1.8.13.4 Habitat

Dune linanthus occurs on shifting sand dunes, desert washes and saline sandy flats, and sometimes on gypsum, between 500 and 2,400 feet (152.4 to 731.5 meters) (Jepson Herbarium 1993f, NatureServe 2007).

1.8.13.5 Life History

Reproductive Biology

Little information is available on the reproductive biology of dune linanthus.

1.8.13.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.13.7 Conservation

Conservation efforts for this species are unknown.

1.8.13.8 Species Status

Rangewide

There are no data available to determine the status of this species rangewide.

VRCMA Boundary

The status of the dune linanthus within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.14 Dune Sunflower

Scientific Name: *Helianthus deserticola*

1.8.14.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Global heritage rank is G3 for *Helianthus anomalus*, which NatureServe considers identical to *Helianthus deserticola* (NatureServe 2007).
- Arizona heritage rank is S2 for *Helianthus anomalus*, which NatureServe considers identical to *Helianthus deserticola* (NatureServe 2007).
- Utah heritage rank is S3 for *Helianthus anomalus*, which NatureServe considers identical to *Helianthus deserticola* (NatureServe 2007).

1.8.14.2 General Description

Dune sunflower is a member of the Asteraceae family.

This annual herb is 1.3 feet (0.4 meter) tall. It produces showy flower heads with yellow rays surrounding a purple disk (NNHP 2001).

Cronquist synomized this species with *H. anomalus*, but Loren Reiseberg considers this species to be distinct, both morphologically and molecularly (NNHP 2001).

1.8.14.3 Distribution

Historic Distribution

This species occurs in Churchill, Lyon, Clark, and Mineral counties in Nevada, as well as in Utah and Arizona. The western Nevada populations are disjunct and distinct (NNHP 2001).

Current Distribution

The current and historic ranges are presumed to be the same.

1.8.14.4 Habitat

This species is endemic to stabilized sandy soils on the desert floor in the Mojave Desert ecoregion (Reiseberg et al. 2000).

1.8.14.5 Life History

Reproductive biology information is known about this species. This species exhibits little disturbance tolerance (Reiseburg et al. 2000).

Reproductive Biology

This species typically germinates after heavy seasonal rains. It completes its reproductive cycle quickly (Seiler 2005). It appears to flower opportunistically, beginning in late spring and continuing as long as summer rains permit (NNHP 2001).

1.8.14.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown. Threats due to off road vehicle use, grazing, invasive species, etc. are unknown. This species is known to have a low threshold for disturbance (Reiseburg et al. 2000). Threats listed for *Helianthus anomalus* include loss of habitat from modernization and mechanization of agricultural practices, total abandonment of agricultural fields, and road construction (NatureServe 2007).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

This species can be used for production of sunflower oil for industrial uses (Seiler 2007).

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Whether existing regulatory mechanisms are inadequate is unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown.

1.8.14.7 Conservation

Conservation efforts are unknown for this species.

1.8.14.8 Species Status

Rangewide

Rangewide status is unknown (NNHP 2001).

VRCMA Boundary

Within the VRCMA Boundary, one occurrence of dune sunflower has been recorded in the Nevada portion by A. Tiehm in 1982 (NNHP 2006). Seiler (2007) mentioned a population of 250 located in 2000 in a habitat of sandy desert sagebrush in Washington County, Utah. No other occurrences have been recorded in natural heritage species occurrence databases (NNHP 2006, UDWR 2007, AGFD 2007d).

1.8.15 Fissidens Sublimbatus

Scientific Name: *Fissidens sublimbatus*

1.8.15.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Global heritage rank of G4T4 (NatureServe 2007).

1.8.15.2 General Description

This species is a bryophyte. Plants grow to 0.3 by 0.1 inch (six by 0.15 centimeters). The stem is usually branched. Axillary hyaline nodules are absent. A central strand is present. Leaves are in as many as 22 pairs, ovate to lanceolate, rounded to obtuse-apiculate. The apiculus is formed of a single, clear, sharp cell, up to 0.04 by 0.005 to 0.02 inch (one by 0.1 to 0.4 millimeter) in size. Perichaetial and larger leaves are oblong to oblong-ligulate and lanceolate. The dorsal lamina is usually narrowed abruptly proximally, often arched, and ends well before insertion (Pursell 2005).

1.8.15.3 Distribution

Historic Distribution

Fissidens sublimbatus is found in low altitude habitats in Baja California, California, Arizona and New Mexico (NatureServe 2007).

Current Distribution

Little information is available regarding in changes of distribution in this species.

1.8.15.4 Habitat

Fissidens sublimbatus is found in soil in arid areas where plants are often partially buried, often under overhanging rocks and boulder, and in the shade of trees and shrubs (Pursell 2005).

1.8.15.5 Life History

Reproductive Biology

The sexual condition of *Fissidens sublimbatus* can be cladautoicous, gonioautoicous, and possibly rhizautoicous. There is one sporophyte per perichaetium. The seta can be up to 0.2 inch (0.5 centimeter) long. In the capsule, the theca is exerted, slightly inclined, bilaterally symmetric to erect, and is radially symmetric up to 0.04 inch (1 millimeter) in length. The peristome is a *bryoides*-type. The operculum is 0.015 inch (0.3 millimeter) wide. The calyptra is cucullate, smooth, and up to 0.03 inch (0.6 millimeter) in length (Pursell 2005).

1.8.15.6 Threats Warranting Protection

Little information is available on threats to this Clark County MSHCP Watch List species. However, a number of general threats exist for plants and bryophytes in the region. These include habitat loss, degradation and fragmentation from a number of human activities, livestock grazing and increased fire risk from encroaching exotic vegetation and herbicide use (RECON 2000).

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Little information is available on threats to *Fissidens sublimbatus.* General threats to plants and bryophytes include habitat loss, degradation and fragmentation from urban and rural development, construction and maintenance of roads and trails, military and mining activities, and illegal dumping (RECON 2000).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Little information is available on threats to *Fissidens sublimbatus.* OHV use, rock climbing and other recreational activities can degrade habitat or result in trampling of bryophytes (RECON 2000).

Disease or Predation

Little information is available on disease or herbivory on *Fissidens sublimbatus.*

The Inadequacy of Existing Regulatory Mechanisms

This species has not been included on the threatened and endangered species list under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Little information is available on threats to *Fissidens sublimbatus.* Runoff, pollution, and erosion from highways and roads may negatively affect bryophyte populations in close proximity (RECON 2000).

1.8.15.7 Conservation

Little information is available on ongoing or planned conservation measures directed toward *Fissidens sublimbatus.*

1.8.15.8 Species Status

Rangewide

Little information is available on population trends of *Fissidens sublimbatus.*

VRCMA Boundary

The status of the *Fissidens sublimbatus* within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.16 Forked (Pahrump Valley) Buckwheat

Scientific Name: *Eriogonum bifurcatum*

1.8.16.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- NNHP Watch List species (NNHP 2005).
- NNPS threatened species (NNHP 2005).
- BLM sensitive species in Nevada (NNHP 2005).
- Global heritage rank of G2 (NatureServe 2007).
- Nevada heritage rank of S1 (NatureServe 2007).

1.8.16.2 General Description

The forked buckwheat is an annual herb and two to 15.7 inches (5 to 40 centimeters) high. It has aerial flowering stems erect, solid, not fistulose, often obscured by leaves, glabrous. The leaves are basal. The petiole is 0.4 to 1.6 inches (one to four centimeters) and tomentose. The blade is round-cordate and 0.2 to 1.2 inches (0.5 to 3.0 centimeters) in length. Inflorescences are cymose, spreading and flat-topped, and two to 11.8 by 0.4 to 19.7 inches (5 to 30 centimeters by 10 to 50 centimeters). Branches are glabrous; bracts are scalelike and 0.04 to 0.1 inch by 0.02 to 0.05 inch (0.01 to 0.15 by 0.04 to 0.1 centimeters). Flowers are glabrous and 0.1 to 0.2 inch (0.15 to 0.2 centimeters) in length. The perianth is white with greenish to reddish midribs that become faintly pinkish and glabrous (FNA 1993, Jepson Herbarium 1993j).

1.8.16.3 Distribution

Historic Distribution

Forked buckwheat is a Mojave desert endemic, found along the border of Nevada and California. Forked buckwheat is restricted to the Mesquite, Sandy, Pahrump, and Stewart valleys along the California-Nevada border in San Bernardino, southeastern Inyo, northwestern Clark, and southwestern Nye counties. It is most abundant in Pahrump Valley (NatureServe 2007, FNA 1993, RECON 2000).

Current Distribution

The current distribution is similar to the historic distribution (NatureServe 2007). Losses of habitat have been documented in Sandy and Pahrump valleys from urban and agricultural development (RECON 2000).

1.8.16.4 Habitat

This species occurs in salt scrub desert, saline flats with sandy soils and stabilized dune topography around dry lake beds and associated mesquite woodlands at approximately 2,500 feet (762 meters). Forked buckwheat is an ephemeral species and responds to precipitation events (RECON 2000).

1.8.16.5 Life History

Reproductive Biology

Forked buckwheat flowers in May and June (eFlora 2007).

1.8.16.6 Threats Warranting Protection

Primary threats to forked buckwheat, a Covered species under the Clark County MSHCP, include habitat degradation, disturbance and trampling associated with human activities (RECON 2000).

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to forked buckwheat within the VRCMA Boundary include dumping and waste disposal in illegal waste ponds. Urban and rural development can result in direct mortality, habitat degradation and habitat loss. Habitat modification, degradation and mortality from concentrated recreation can have adverse affects on this species. These activities include OHV events by organized groups (speed, non-speed, competitive, non-competitive, commercial, and non-commercial events), equestrian trail rides, dog field trials, flying machine events (remote control and piloted) and skydiving. Spectators associated with these events can trample habitat and individuals as well. The parking of vehicles for these events can damage habitat and cause mortality as well (RECON 2000).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Illegal collection is a threat to plants in Clark County (RECON 2000).

Disease or Predation

Little information is available regarding disease and predation of this species. Livestock, wild horses, burros or other ungulates may graze on plants (RECON 2000).

The Inadequacy of Existing Regulatory Mechanisms

This species is not included on the threatened and endangered species list under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

This species is tolerant of moderate disturbance (NatureServe 2007), but any activity that results in ground disturbance can result in habitat degradation or mortality of forked buckwheat. As an ephemeral species that responds to precipitation (RECON 2000), long droughts may have negative effects on this species.

1.8.16.7 Conservation

BLM management that particularly benefits this species includes consideration of conservation needs in activities involving land disposal and OHV management. A Mesquite Management Plan currently under development by BLM includes provisions for road closures and rehabilitation, signs and fences, and will address dumping and woodcutting problems which affect this species (RECON 2000). As a Covered species for the Clark County MSHCP, other conservation actions for the species also occur in Clark County, Nevada (RECON 2000).

1.8.16.8 Species Status

Rangewide

Forked buckwheat is declining rangewide. Habitat is being converted for urban development in some areas, but there have been no documented extirpations yet in Nevada (NatureServe 2007).

VRCMA Boundary

The status of the forked buckwheat within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.17 Las Vegas Bearpoppy

Scientific Name: *Arctomecon californica*

1.8.17.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Global heritage rank of G3 (NatureServe 2007).
- Nevada heritage rank of S3 (NatureServe 2007).
- Arizona heritage rank of S2 (NatureServe 2007).

1.8.17.2 General Description

This small, perennial herb has showy, yellow flowers. Flower stalks are 7.9 to 15.7 inches (20 to 40 centimeters) tall (NNHP 2001).

1.8.17.3 Distribution

Historic Distribution

This species is endemic to the Mojave desert in southeastern Nevada and northwestern Arizona. The majority of the population occurs in Clark County, Nevada, but several small and one large population occur in northwestern Arizona (RECON 2000).

Current Distribution

The current distribution is the same as the historic distribution, except for introduced populations in Utah (NNHP 2001).

1.8.17.4 Habitat

This species occurs primarily in Mojave desert scrub and salt desert scrub communities (RECON 2000).

1.8.17.5 Life History

Reproductive Biology

The Las Vegas bearpoppy flowers in May and June (NNHP 2001).

1.8.17.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to habitat include habitat degradation for development, facilities, highway and backcountry road development, and habitat loss and fragmentation due to urbanization (RECON 2000). Pollinator declines have occurred as a result of habitat fragmentation (NNHP 2001). Flood control is another threat to this species, through habitat loss (NNHP 2001).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Recreation, including collection of wildflowers, is a threat to this species (RECON 2000).

Disease or Predation

These are not known to be threats for the Las Vegas bearpoppy.

The Inadequacy of Existing Regulatory Mechanisms

This species is not listed as a threatened or endangered species list under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Soil and cryptogamic crust loss, trampling by livestock, and mining are all threats to this species (RECON 2000).

1.8.17.7 Conservation

The Las Vegas bearpoppy is a Covered species in the Clark County MSHCP, which includes conservation actions to offset effects from covered activities (RECON 2000).

The Southern Nevada Rare Plant Working Group has been established to prevent listing of rare plants, including the Las Vegas bearpoppy. They have assisted in addressing genetic questions of cross pollination of this species (NNNPS 2001).

Nellis AFB has committed to fencing known populations on the Air Force Base and the Las Vegas Valley Water District and Las Vegas Spring Preserve are protectively managing their populations (NNNPS 2001).

1.8.17.8 Species Status

Rangewide

This species has a declining population trend. In the Las Vegas Valley, as of 2000, 12 percent of the population was presumed extirpated, with an additional 16 percent of the population to become extirpated in the future as a result of development in the Las Vegas Valley (RECON 2000).

VRCMA Boundary

The status of the Las Vegas bearpoppy within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.18 Las Vegas Buckwheat

Scientific name: *Eriogonum corymbosum* var. *nilesii*

1.8.18.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Evaluation species (High Priority) under the Clark County MSHCP (RECON 2000).
- BLM sensitive species in Nevada (NNHP 2005).
- Listed as threatened by Nevada Native Plant Society (NNHP 2005).
- Global heritage rank of G5T2 (NatureServe 2007).
- Nevada heritage rank of S1S2 (NatureServe 2007).
- Utah heritage rank of SNR (NatureServe 2007).

1.8.18.2 General Description

Las Vegas buckwheat is a member of the buckwheat family (Polygonaceae) (NNHP 2001).

Las Vegas buckwheat is a long-lived shrub approximately one to four feet (0.3 to 1.2 meters) high and 1.3 to 7.5 feet (0.4 to 2.3 meters) across. It has leaves and flowery branches with silvery tufts of cobwebby hairs. Leaves are oval, stalked, and 0.4 to 1.6 inches (one to four centimeters) long. Flowers are numerous and in masses along upper branches, six-parted, bright to pale yellow, and 0.1 inch (0.2 to 0.3 centimeters) long. Seeds are triangular, light brown, and 6.5 to 8.2 feet (two to 2.5 meters) long (NNHP 2001).

Las Vegas buckwheat has had various scientific names in the past. The first, *Eriogonum corymbosum* var. *aureum*, was reportedly endemic to St. George, Utah. Subsequently, *Eriogonum corymtbosum* var. *glutinosum* was considered a more correct name for this taxon (Niles et al. 1999). However, a field study by Reveal (2002) determined that the Nevada populations of *Eriogonum corymbosum* were distinct from both *E. c.* var. *aureum* and *E. c.* var. *glutinosum*. Reveal (2002) described the Nevada populations as a new variety, *E. c.* var. *nilesii*. A peer reviewed scientific description was published in 2004. The evidence presented in this publication (morphologic difference strongly correlated with geographic distribution) is generally accepted by botanists as sufficient justification for intraspecific taxa in relatively no-motile organisms such as vascular plants. In addition, on August, 15, 2005, Mark W. Ellis and colleagues from Utah State University presented AFLP and chloroplast DNA evidence for genetic divergence in the Nevada populations at the Botanical Society of America meeting. Since that time, *E. c.* var. *nilesii* has been accepted in the Flora of North America series (vol. 5, p.258, Oxford Press, also peer reviewed) as a valid taxonomic variety, and no evidence to the contrary has been presented (NNHP 2007).

1.8.18.3 Distribution

Historic Distribution

Las Vegas buckwheat is known to occur in Clark County, Nevada and potentially Utah (NNHP 2001). It is unknown what the full extent of the historical distribution is.

Current Distribution

Las Vegas buckwheat is found in Clark and Lincoln Counties, Nevada (Morefield 2001) in the Mojave Desert in the Las Vegas Region Valley, in the Coyote Springs Valley, Toquop Wash in Lincoln County, within White Basin, and within about 52 acres (21 hectares) of the Anniversary Mine drainage in the Muddy Mountains Wilderness Area (Flora 1993). One collection has been recorded from the flood plain of the Paria River in Kane County, Utah; but, it has only temporarily been assigned to this variety (Flora 1993). The best data currently available indicate that 50 to 70 percent of the species historical population and habitat area remains within the Las Vegas Valley (NNHP 2007).

The maximum range of Las Vegas buckwheat is approximately 37.6 miles (60.6 kilometers). The current population consists of 5,188+ individuals scattered over a total estimated area of 420+ hectares (1,038+ acres [420 hectares]) within its range in Nevada. As of 2001, 15 extant occurrences were mapped at 0.6 mile (1.0 kilometers) separation. At this time, this species trend was declining rapidly (NNHP 2001).

1.8.18.4 Habitat

This species is found at elevations ranging from 1,900 to 3,839 feet (579 to 1,170 meters). It occurs on and near gypsum soils, often forming low mounds or outcrops in washes and drainages, or in areas of generally low relief. It is associated with other gypsum-tolerant species such as Las Vegas bearpoppy (*Arctomecon californica*). This species is generally surrounded by white bursage (*Ambrosia dumosa*), desert prince's plume (*Stanleya pinnata*), four-wing saltbush (*Atriplex canescens*), Torrey's mormon-tea (*Ephedra torreyana*), creosote bush (*Larrea tridentata*), catclaw acacia (*Acacia greggii*), shrubby seepweed (Suaeda torreyana), and Fremont's smokebush (*Psorothamnus fremontii*) (Morefield 2001). This species is found in sandy to gravelly soil in flats or washes in saltbush vegetation communities (FNA 1993).

1.8.18.5 Life History

This long-lived shrub is a perennial (NNHP 2001).

Reproductive Biology

This shrub flowers from summer to fall (August through November) (NNHP 2001).

1.8.18.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Las Vegas buckwheat is threatened by habitat conversion for residential and urban development, off-road vehicle use, dumping, flood control, road and utility corridors, and gypsum mining (NNHP 2001).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.18.7 Conservation

The BLM Las Vegas Field Office has developed conservation actions to offset potential adverse effects from activities on BLM lands. It also has developed a conservation management strategy for mesquite and acacia woodlands in Clark County, Nevada, which addresses Las Vegas buckwheat (Crampton et al. 2006).

1.8.18.8 Species Status

Rangewide

In Nevada, surveys for this species are ongoing and relatively complete. The most recent documented survey was in 2006 (Ronning, pers. comm.).

Extant populations include:

- North Las Vegas on both sides of Interstate Highway 15, from the vicinity of Craig Road northward and eastward into Area III of Nellis Air Force Base. Area III is a heavily disturbed area that supports a population of this species of more than 300 individuals.
- The northeast corner of Craig Road and Lamb Boulevard. This area was under development as of 1999 and supports a population of approximately 50 plants.
- Gold Butte area.
- Muddy Mountains west of Overton, Nevada.
- Lowell Wash in the Muddy Mountains and Bitter Spring Valley. Plants were sporadic in sandy or sandy-clay sites in the southeastern portion of White Basin (Niles et al. 1999).

VRCMA Boundary

The status of the Las Vegas buckwheat within the VRCMA Boundary is unknown. One occurrence of Las Vegas buckwheat observed in 2005 has been recorded within the Nevada portion of the VRCMA Boundary (NNHP 2006). No other occurrences of this species have been recorded in natural heritage species databases for the watershed (NNHP 2006, AGFD 2007d).

1.8.19 Littlefield Milkvetch

Scientific Name: *Astragalus preussii var. laxiflorus*

1.8.19.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- NNHP Watch List species (NNHP 2005).

- Global heritage rank of G4T2T3 (NatureServe 2007).
- Nevada heritage rank of S1S2 (NatureServe 2007).
- Arizona heritage rank of S1 (NatureServe 2007).
- IUCN Red List of Threatened Plants (AGFD 2004b).

1.8.19.2 General Description

This is a perennial species, but sometimes it flowers the first season (NatureServe 2007). It is rather coarse and robust and glabrous or nearly so below the inflorescence (AGFD 2004b). Stems form clumps from a branched root crown and stand 3.9 to 13.8 inches (ten to 35 centimeters) tall and are erect and ascending (NatureServe 2007). *Astragalus preussii* var. *laxiflorus* leaves average between 1.8 and 7.1 inches (4.5 and 18 centimeters) long, and are shortly petioled or the uppermost subsessile, with stiff rachis and 11 to 25 rather distant leaflets that are 0.1 to 1.1 inches (0.15 to 2.7 centimeters) long (NatureServe 2007). These leaflets vary in shape from suborbicular-obcordate through oblong-obovate to linear-elliptic, narrowly lanceolate, or linear and acute (NatureServe 2007). Flowers are pink or, when dried, bluish-purple, sometimes pallid but distally suffused with lilac-purple with a banner of about 0.6 inch (1.4 centimeters) (NatureServe 2007). The pod is sessile or nearly so, oblong-elipsoid; more or less round in cross-section, stiffly papery (NatureServe 2007). Ovules are smooth or nearly so, sometimes mottled with dull purple, and are 0.09 to 3.7 inches (0.24 to 0.37 centimeters) long (NatureServe 2007).

1.8.19.3 Distribution

Historic Distribution

This species is only known from the area around the common border point of Nevada, Arizona and Utah and disjunctly in eastern Los Angeles County (Lancaster) (NatureServe 2007).

Current Distribution

The current distribution is the same as the historic distribution (NatureServe 2007).

1.8.19.4 Habitat

The Littlefield milkvetch prefers gravelly or sandy washes and along gullied badlands from 1,200 to 2,500 feet (365.8 to 762 meters) in elevation (NatureServe 2007). This species also grows on alkaline clay flats in the southwest Mojave desert (NatureServe 2007). Littlefield milkvetch may prefer selenium rich soils, but this is unknown (NatureServe 2007).

1.8.19.5 Life History

Reproductive Biology

Flowering occurs in the spring from March to May (CNPS 2007).

1.8.19.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

These threats are unknown for these species.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

These threats are unknown for these species.

Disease or Predation

These threats are unknown for these species.

The Inadequacy of Existing Regulatory Mechanisms

These threats are unknown for these species.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

These threats are unknown for these species.

1.8.19.7 Conservation

There have been no proposed conservation plans for this species.

1.8.19.8 Species Status

Rangewide

According to Barneby (1964, as cited in NatureServe 2007), the Littlefield milkvetch is uncommon. According to the 2004 Rare Plant Committee Meeting, the Muddy Mountains (located near the VRCMA Boundary) is the central habitat for this species. Those portions in Lake Mead should be monitored by the National Park Service. Most of the range of this species is outside of the park (NNNPS 2004).

VRCMA Boundary

The status of the Littlefield milkvetch within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.20 Mokiak Milkvetch

Scientific Name: *Astragalus mokiacensis*

1.8.20.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.
- Former Category 2 Candidate species.

Other Protections

- Evaluation species (Medium Priority) for the Clark County MSHCP (RECON 2000).
- Listed by the BLM as a sensitive species (NNHP 2007).
- Global heritage rank is G2G3Q (NatureServe 2007)
- Nevada heritage rank is S1S2 (NatureServe 2007).

1.8.20.2 General Description

Mokiak milkvetch is a perennial herb with erect stems, 3.9 to 15.7 inches (ten to 40 centimeters) tall, and with purple flowers, which appear in April-June (NNHP 2001).

The flowering stage is essential for correct identification. The species is related to Preuss' milkvetch. The two species grow together and there is no obvious way to distinguish between the two without fruits being present (NNHP 2001).

1.8.20.3 Distribution

Historic Distribution

A. mokiacensis is endemic to northeastern Clark County, Nevada and northwestern Mohave County, Arizona. It has also been reported as occurring in Utah (NNHP 2001).

Current Distribution

The current and historic ranges are presumed to be the same although the current distribution within the range could be patchier than the historic distribution.

1.8.20.4 Habitat

This species is found in the canyons and valleys of Virgin and Colorado rivers on bluffs, cliff terraces, gullied badlands, and disturbed areas along streams (NNHP 2001). It is also known to occur in talus slopes in Arizona, wash beds and wash banks in Nevada (Bangle 2006), sandy soils (NNHP 2001), and on basalt in Arizona (Bangle 2006). It occurs at 2,460 to 5,020 feet (750 to 1,530 meters) in Nevada (NNHP 2001).

1.8.20.5 Life History

Very limited life history information is available. This species is perennial (NNHP 2001).

Reproductive Biology

Mokiak milkvetch flowers from April to June (NNHP 2001). Based on other species within the genus, this species is likely pollinated by bees (Green and Bohart 1975). Low dispersal distances are expected. This species is dependent on a seed bank. No other information on the reproductive biology of the species was available.

1.8.20.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.20.7 Conservation

Conservation efforts for this species are unknown.

1.8.20.8 Species Status

Rangewide

This species is extremely rare. There are six to seven known occurrences and an estimated 585 individuals. Population trends are unknown (NNHP 2001).

VRCMA Boundary

The status of the species' population within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.21 Nevada Didymodon

Scientific Name: *Didymodon nevadensis*

1.8.21.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- BLM sensitive species in Nevada (NNHP 2005).
- Watch List species by the Nevada Native Plant Society (NNHP 2005).
- Global heritage rank of G2G3 (NatureServe 2007).
- Nevada heritage rank of S1 (NatureServe 2007).

1.8.21.2 General Description

This moss forms a dense turf, blackish green above, reddish brown below. Stems reach 0.4 inch (one centimeter) in length, branching occasionally. It has few rhizoids, occasionally short, branching and thick-walled, arising from leaf axils. Cauline leaves are appressed, weakly twisted clockwise or counterclockwise when dry, weakly spreading when moist. Leaves are ovate to ovate-lanceolate, with the adaxial surface broadly channeled at midleaf, and narrowly channeled apically. The leaf base is ovate, with upper margins broadly recurved to revolute throughout. The costa is percurrent, ending in a broadly conical point. This moss is similar in appearance to, and difficult to distinguish from, several other mosses including *Didymodon brachyphyllus*, *D. australasiae*, *Bryoerythrophyllum columbianum*, *B. fuscinervis*, and *Pseudocrossidium crinitum* (NNHP 2001).

1.8.21.3 Distribution

Historic Distribution

Distribution data are known to be incomplete or has not been reviewed for Nevada didymodon (NatureServe 2007).

Current Distribution

While distribution information is incomplete, this species is known from southern British Columbia in Canada; southern Chihuahua in Mexico; and southern Nevada, northern Texas (FNA 1993, NatureServe 2007), Colorado, New Mexico, and Nebraska in the U.S. (FNA 1993).

1.8.21.4 Habitat

This species is found on or near gypsiferous deposits and outcrops or limestone boulders, especially on east to north facing slopes of loose uncompacted soil, often associated with other mosses and lichens (NNHP 2001).

1.8.21.5 Life History

Reproductive Biology

Nevada didymodon reproduces asexually by tubers, which are spherical or often elliptical and constricted medially, borne on branching rhizoids from axils of leaves at soil level. Sexual condition is apparently dioecious. This species is fertile from late-winter to spring, Seasonal growth is initiated in autumn from vegetative buds subtending the perichaetium. Stem elongation probably occurs through the cooler months of autumn, winter, and early spring with the production of a perichaetium in spring ending the vegetative growth cycle (NNHP 2001).

1.8.21.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.21.7 Conservation

Conservation efforts for this species are unknown.

1.8.21.8 Species Status

Rangewide

There are no data available to determine the status of this species rangewide.

VRCMA Boundary

The status of the Nevada didymodon within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.22 Nevada Willowherb

Scientific Name: *Epilobium nevadense*

1.8.22.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.
- Former Category 2 Candidate species (NNHP 2007).

Other Protections

- Evaluation species (High Priority) for the Clark County MSHCP (RECON 2000).
- BLM sensitive species in Arizona and Nevada (BLM 2003a, 2003b).
- Protected as a cactus, yucca, or Christmas tree (N.R.S. 527.060 -.120).
- Global heritage rank is G2 (NatureServe 2007).
- Nevada heritage rank is S2 (NatureServe 2007).
- Arizona heritage rank is S1 (NatureServe 2007).

1.8.22.2 General Description

This species is a shrubby perennial herb approximately 5.9 to 15.7 inches (15 to 40 centimeters) tall. It flowers from July to September; flowers are pink-purple in color (NNHP 2001).

1.8.22.3 Distribution

Nevada willowherb occurs in Clark, Eureka, and Lincoln counties in Nevada at elevations of 6,000 to 8,930 feet (1,829 to 2,722 meters), and also in Utah (NNHP 2001).

1.8.22.4 Habitat

Nevada willowherb occurs along slopes with limestone outcrops or talus and is associated with singleleaf pinyon and ponderosa pine (Morefield 2001). Based on mapped occurrences of Nevada willowherb by the Nevada Natural Heritage Program, the species shows a GIS derived association with four vegetation series as classified through SWReGAP at elevations ranging between 7,494 and 8,918 feet (2,284 to 2,718 meters). The habitat with which this species is associated includes: 57 percent in Great Basin Pinyon-Juniper Woodland, 20 percent in Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland, 20 percent in North American Warm Desert Bedrock Cliff and Outcrop, and three percent in Sonora-Mojave-Baja Semi-Desert Chaparral.

1.8.22.5 Life History

Very limited information is available about the life history of the Nevada willowherb. This species blooms from July to September (NNHP 2001).

Reproductive Biology

This species flowers from July to September (NNHP 2001).

1.8.22.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.22.7 Conservation

Conservation efforts for this species are unknown.

1.8.22.8 Species Status

Rangewide

Systematic surveys have been conducted in Nevada, but more potential habitat likely remains to be examined (NNHP 2001). Population trends are unknown (NNHP 2001).

VRCMA Boundary

The status of the Nevada willowherb within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.23 Nye Milkvetch

Scientific Name: *Astragalus nyensis*

1.8.23.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.
- Former Category 2 Candidate species.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Global heritage rank is G3 (NatureServe 2007).

- Nevada heritage rank is S3 (NNHP 2007).
- Utah heritage rank is S1 (NatureServe 2007).

1.8.23.2 General Description

Nye milkvetch is a short, herbaceous annual in the legume family (Fabaceae). It is characterized by compound leaves and heavy, long pubescence on both leaves and stem. It bears one to four whitish flowers with the upper petal (banner) faintly lilac-tinted (Mozingo and Williams 1980, as cited in NNHP 2001). The pods are hairy.

1.8.23.3 Distribution

Historic Distribution

Nye milkvetch is a Nevada endemic found in Clark, Lincoln, and Nye counties (NNHP 2001).

Current Distribution

The current and historic ranges are presumed to be the same although the current distribution within the range could be patchier than the historic distribution.

1.8.23.4 Habitat

It occurs in the foothills of desert mountains, where it is associated with creosote-white bursage and blackbrush vegetation communities (NNHP 2001). Typical substrates are calcareous outwash fans and gravelly flats. It sometimes occurs in sandy soil (NNHP 2001). The species is found from 1,100 to 5,600 feet (335 to 1,707 meters) (NNHP 2001).

1.8.23.5 Life History

Very limited life history information is available. This species is an annual (NNHP 2001).

Reproductive Biology

Nye milkvetch flowers in the spring (NNHP 2001). Based on other species within the genus, this species is likely pollinated by bees (Green and Bohart 1975).

1.8.23.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.23.7 Conservation

Conservation efforts for this species are unknown.

1.8.23.8 Species Status

Rangewide

There are 24 known occurrences and an estimated total of 1,126 individuals. It is considered to be declining (NNHP 2001).

VRCMA Boundary

The species status within the VRCMA Boundary is unknown. Within this watershed, four occurrences have been recorded in Nevada. Three were originally observed in 1906 and most recently in 1979 by M. Williams, J. Holland, and A. Tiehm. The fourth occurrence was recorded in 1979 by J. Tiehm (NNHP 2006). No other occurrences were recorded in natural heritage databases as occurring within the VRCMA Boundary (AGFD 2007d).

1.8.24 Rayless Tansy Aster

Scientific Name: *Machaeranthera grindelioides* var. *depressa*

1.8.24.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Global heritage rank of G5T3T4 (NatureServe 2007).
- Nevada heritage rank of S3 (NatureServe 2007).
- Arizona heritage rank of S1 (NatureServe 2007).

1.8.24.2 General Description

This small, perennial herb (NNHP 2001) is densely cespitose and up to 4.7 inches (12 centimeters) in height (FNA 1993). Its leaves are mostly crowded at the base of the stems, with margins that are conspicuously white bristled. Peduncles are 0.4 to 1.6 inches (one to four centimeters) in length and are usually ebracteate and occasionally bracteates (FNA 1993).

1.8.24.3 Distribution

Historic Distribution

Information on the historic distribution for this species could not be found.

Current Distribution

Rayless tansy aster is known from Clark, Elko, Eureka, Lincoln, Nye, and White Pine counties, Nevada, and in Arizona and Utah (NNHP 2001).

1.8.24.4 Habitat

Rayless tansy aster occurs on carbonate or calcareous, nearly barren rocky, rocky clay, and clay soils on ridges, slopes, low hills, and badlands in the upper blackbrush, sagebrush, pinyon-juniper, mountain mahogany, and lower subalpine conifer zones. The recorded elevation range for this species in Nevada is 5,000 to 9,200 feet (1,520 to 2,800 meters) (NNHP 2001).

1.8.24.5 Life History

Reproductive Biology

Rayless tansy aster flowers in late-spring to summer. First flowering occurs in May-June, and often re-flowers after summer rains in August and September (NNHP 2001).

1.8.24.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.24.7 Conservation

Conservation efforts for this species are unknown.

1.8.24.8 Species Status

Rangewide

There are no data available to determine the status of this species rangewide.

VRCMA Boundary

The status of the rayless tansy aster within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.25 Rock Phacelia

Scientific Name: *Phacelia petrosa*

1.8.25.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- BLM proposed sensitive species in Nevada (NNHP 2005).
- Global heritage rank of G3G4 (NatureServe 2007).
- Nevada heritage rank of S2 (NatureServe 2007).
- Arizona heritage rank of SNR (NatureServe 2007).

1.8.25.2 General Description

Rock phacelia is an annual plant that is 0.3 to one foot (1.0 to 3.2 decimeters) tall. Basal leaves are 1.3 to three inches (3.3 to 7.5 centimeters) long, rounded to oblong, toothed, and pinnatifid, with the petiole up to 1.2 inches (three centimeters) long and the blade one to two inches (2.5 to five centimeters) long. Cauline leaves are irregularly dentate, reduced upward, 0.3 to 1.2 inches (0.8 to 3.0 centimeters) long, 0.3 to 0.8 inch (0.8 to 2.0 centimeters) broad, with the petiole 0.4 to 0.9 inch (1.1 to 2.4 centimeters) long. The leaves are densely covered with spreading, shiny hairs. Rock phacelia has an inflorescence of paired terminal cymes with capitate multicellular hairs. The cymes elongate to 2.4 inches (six centimeters) long in fruit. Pedicels are 0.03 to 0.06 inch (0.08 to 0.15 centimeter) long in each flower. The lower pedicel reaches 0.2 inch (0.54 centimeter) in length. The calyx is 0.12 to 0.17 inch (0.3 to 0.4 centimeter) long, 0.04 to 0.06 inch (0.09 to 0.15 centimeter) wide, has oblanceolate lobes, and does not enlarge in fruit. The corolla is bell-shaped, 0.23 to 0.24 inch (0.58 to 0.6 centimeter) long and broad, blue, lighter at the base, and has lobes that are glabrous to pubescent externally. The stamens and style are exserted. Stamens are subequal to the style, 0.14 to 0.17 inch (0.37 to 0.43 centimeter) long, and have purple, glabrous filaments. The style is 0.11 to 0.18 inch (0.28 to 0.45 centimeter) long, bifid, and the lower portion is pubescent with glandular hairs. The capsule is globose. Mature capsules are 0.12 to 0.18 inch (0.3 to 0.4[up to 0.46] centimeter) broad and long, equaling to exceeding the calyx lobes, and finely puberulent with some glandular hairs, especially on the upper half. There are four oblong seeds (0.13 to 0.15 inch [0.33 to 0.38 centimeter] long, 0.06 to 0.12 inch [0.15 to 0.31 centimeter] wide), which are corrugated on the ventral surface along the inside margin and one side of the ridge and have a lighter stramineous margin and are light brown on the dorsal surface. The dorsal cells of the seeds are round in shape and raised with star-like rays (Atwood et al. 2002).

1.8.25.3 Distribution

Historic Distribution

Rock phacelia was newly described in 2002 and was mistakenly identified as other species in herbarium specimens prior to that (Atwood et al. 2002); therefore, this species' historic distribution is unknown.

Current Distribution

Rock phacelia occurs in southwestern Utah in Washington County, southeastern Utah along the San Juan River in San Juan County, northwestern Arizona along the Colorado River in Mohave and Coconino Counties, and southern Nevada in Lincoln and Clark Counties (Atwood et al. 2002).

1.8.25.4 Habitat

Rock phacelia occurs on dry limestone and volcanic talus slopes of foothills, washes, and gravelly canyon bottoms in mixed desert scrub, creosote bush, and blackbrush communities. It grows mostly on calcareous parent material but has been collected on dry volcanic talus slopes. This species grows at elevations from 2,500 to 5,800 feet (760 to 1,770 meters) (Atwood et al. 2002).

1.8.25.5 Life History

Reproductive Biology

No information on the reproductive biology of the species was available.

1.8.25.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.25.7 Conservation

Conservation efforts for this species are unknown.

1.8.25.8 Species Status

Rangewide

There are no data available to determine the status of this species rangewide.

VRCMA Boundary

The status of the rock phacelia within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.26 Rosy Twotone Beardtongue

Scientific Name: *Penstemon bicolor* ssp. *roseus*

1.8.26.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- BLM sensitive species in Nevada (BLM 2003a).
- U.S. Forest Service sensitive species in the Humboldt-Toiyabe National Forest (NNHP 2005).
- Watch List species by the Nevada Native Plant Society (NNHP 2005).
- Global heritage rank of G3T3Q (NatureServe 2007).
- Nevada heritage rank of S3 (NatureServe 2007).
- Arizona heritage rank of S2 (NatureServe 2007).

1.8.26.2 General Description

The rosy twotone beardtongue is a perennial herb that reaches a height of approximately five feet (1.5 meters). It has thick and leathery leaves with strongly toothed margins; the teeth are often somewhat spiny. The bases of the paired leaves are united around the stem. The inflorescence is densely glandular-hairy. The corolla is trumpet-shaped, and swells abruptly above the tube. Flowers are rose to rose-purple colored in this variety. The lips of the corolla are lobed and 0.2 to 0.3 inch (0.45 to 0.7 centimeter) long (AGFD 2003k).

1.8.26.3 Distribution

Historic Distribution

Information on the historic distribution for this species could not be found.

Current Distribution

The total range of the rosy twotone beardtongue extends from southern Nevada (Clark and Nye counties) to northwestern Arizona (Mohave County) and California (AGFD 2003k, NNHP 2001).

1.8.26.4 Habitat

The rosy twotone beardtongue occurs on gravel washes and disturbed roadsides, to outwash fans and plains (AGFD 2003k). In Nevada, this plant is found on rocky calcareous, granitic, or volcanic soils in washes, roadsides, scree at outcrop bases, rock crevices, or similar places receiving enhanced runoff, and in the creosote-bursage, blackbrush, and mixed-shrub zones at elevations of 1,800 to 5,480 feet (550 to 1,670 meters) (AGFD 2003k, NNHP 2001).

1.8.26.5 Life History

Reproductive Biology

This species flowers in May and June (AGFD 2003k).

1.8.26.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Horticultural collection is a threat to this species (AGFD 2003k).

Disease or Predation

Feral burros are a threat to rosy twotone beardtongue (AGFD 2003k).

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.26.7 Conservation

Conservation efforts for this species are unknown. However, as a Watch List species for the Clark County MSHCP, conservation actions for Covered species would be likely to be beneficial for this species (RECON 2000).

1.8.26.8 Species Status

Rangewide

Rangewide, this species is at moderate risk of extinction (NatureServe 2007). No additional information is available on the rangewide status for this species.

VRCMA Boundary

The status of the rosy twotone beardtongue within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.27 Shockley Rockcress

Scientific Name: *Arabis shockleyi*

1.8.27.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).

- Global heritage rank of G3 (NatureServe 2007).
- Nevada heritage rank of S3 (NatureServe 2007).

1.8.27.2 General Description

This perennial herb is in the mustard family (Brassicaceae) (Hickman 1993).

1.8.27.3 Distribution

Historic Distribution

Information on the historic distribution for this species could not be found in the literature.

Current Distribution

The current distribution of Shockley rockcress includes Clark, Lincoln, Mineral, Nye, White Pine, and potentially Esmeralda counties in Nevada, as well as portions of California and Utah (NNHP 2001).

1.8.27.4 Habitat

Shockley rockcress occurs in shadscale-galleta, ephedra-matchweed, sagebrush, mountain mahogany, and pinyon-juniper communities at elevations of approximately 4,000 to 8,600 feet (1,220 to 2,620 meters) (NNHP 2001). It occurs on calcareous and quartzite substrates (UDWR 1998).

1.8.27.5 Life History

Reproductive Biology

This species blooms from May to June (Hickman 1993).

1.8.27.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The potential for threats exists, but no active impacts appear to exist (NatureServe 2007).

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.27.7 Conservation

Conservation efforts for this species are unknown.

1.8.27.8 Species Status

Rangewide

In Nevada, there are 38 extant occurrences and one extirpated occurrence for this species (NatureServe 2007). It has been reported as rare or infrequently collected in southern Nevada (Kartesz 1987, as cited in UDWR 1998) and rare in the Mojave desert in California (Rollins in Hickman 1993, as cited in UDWR 1998)

VRCMA Boundary

The status of the Shockley rockcress within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.28 Silverleaf Sunray

Scientific Name: *Enceliopsis argophylla*

1.8.28.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Evaluation species (High Priority) for the Clark County MSHCP (RECON 2000).
- Listed by the BLM as a sensitive species in Nevada (NNHP 2007).
- Global heritage rank is G2G3 (NatureServe 2007).
- Nevada heritage rank is S1? (NatureServe 2007).
- Arizona heritage rank is S2 (NatureServe 2007).

1.8.28.2 General Description

Silverleaf sunray is a perennial in the aster (Asteraceae) family.

This is a scapose, caespitose perennial (7.9 to 23.6 inches [20 to 60 centimeters] tall) that rises from a superficial branching caudex. The herbage is tomentulose and silvery white. The leaf blades are broadly rhombic-ovate to orbicular, 1.57 to 4.72 inches (four to 12 centimeters) long, gradually tapering to a winged petiole. Scapes are stout, often with a reduced foliose bract. The disk of the inflorescence is 1.4 to 1.97 inches (3.5 to 5.0 centimeters) in diameter; there are typical 20 to 34 yellow ray flowers up to 1.57 inches (four centimeters) long. Achenes are 0.39 to 0.47 inch (1.0 to 1.2 centimeters) long, broadly obovate, and silky villous. The pappus is lacking or consists of two subulate awns (AGFD 2005).

1.8.28.3 Distribution

Historic Distribution

The species is found most frequently in the Lake Mead area in Clark County, Nevada. It can also be found in northern Arizona (Mohave County) and Beaver Dam Mountains (Washington County) in Utah (NNHP 2001, ADFG 2006).

Current Distribution

The current and historic ranges are presumed to be the same although the current distribution within the range could be patchier than the historic distribution.

1.8.28.4 Habitat

Silverleaf sunray grows in dry, open, relatively barren areas on slopes or sandy washes in the creosote-bursage zone (NNHP 2001, ADFG 2005m). It can also be found on gypsum badlands, volcanic gravels, loose sands, clay and gypsum cliffs to gravelly slopes and sandy washes (NNHP 2001, ADFG 2005m). The elevation range is 700 to 4,100 feet (215 to 1,250 meters) (ADFG 2005m).

1.8.28.5 Life History

Little life history information is available for this perennial plant.

Reproductive Biology

This perennial flowers continuously (NNHP 2001) but it may have increased flowering in the April to June (ADFG 2005m). No other information on the reproduction biology of the species was available.

1.8.28.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.28.7 Conservation

Conservation efforts for this species are unknown.

1.8.28.8 Species Status

Rangewide

There are three known populations. Population trends are unknown (NNHP 2001).

VRCMA Boundary

The species status within the VRCMA Boundary is unknown. Five occurrences east of Littlefield were recorded in 1973 (AGFD 2007d). No other occurrences have been noted in natural heritage databases in the VRCMA Boundary (NNHP 2006).

1.8.29 Splachnobryum Obtusum

Scientific Name: *Splachnobryum obtusum*

1.8.29.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Global heritage rank of G5 (NatureServe 2007).

1.8.29.2 General Description

Splachnobryum obtusum is a small, dull moss that is often encrusted with soil. It is difficult to find in the field because of its small size, drab aspect, and the lack of characteristics that could allow identification in the field. It has stems that reach one centimeter, but most are much shorter. The distal cell of axillary hairs is swollen, somewhat asymmetric, colorless, and often encrusted. Leaves are soft, commonly shriveled when dry, rarely uncontorted or nearly so, 0.02 to 0.03 inch (0.6 to 0.8 millimeter) long, oblong to obovate or spatulate, and sometimes decurrent from costa and margins. Leaf margins are plane or a little recurved proximally. The leaf midrib is weak to strong, extending half to nearly the full length of the leaf length, and is sometimes spurred or forked, or both, distally (FNA 1993).

1.8.29.3 Distribution

Historic Distribution

Distribution data are known to be incomplete or have not been reviewed for this species (NatureServe 2007).

Current Distribution

Distribution data are known to be incomplete or have not been reviewed for this species (NatureServe 2007). Distribution information provided by Flora of North America identifies *Splachnobryum obtusum* as occurring in Arizona, Texas, Oklahoma, Louisiana, and Florida; Mexico; West Indies; Central America; South America; Africa; and the Hawaiian Islands (FNA 1993). Stark and Whittemore note that the species is “reported from the ‘Virgin Basin, Lake Mead’ (Crum and Anderson 1981), which is likely to be in Clark Co., NV near the mouth of the Virgin River” (2000).

1.8.29.4 Habitat

Splachnobryum obtusum is known to grow on basic substrates in exposed areas on damp or periodically wet limestone, marl, calcareous soil, and mortar-work at low to moderate elevations (0 to 3,280 feet [0 to 1,000 meters]) (FNA 1993).

1.8.29.5 Life History

Reproductive Biology

This species reproduces asexually by gemmae on axillary rhizoids or by rhizoid tubers (FNA 1993).

1.8.29.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.29.7 Conservation

Conservation efforts for this species are unknown.

1.8.29.8 Species Status

Rangewide

There is no datum available to determine the status of this species rangewide.

VRCMA Boundary

The status of the *Splachnobryum obtusum* within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006), although it is known to occur near Lake Mead, which is near the VRCMA Boundary (Stark and Whittemore 2000).

1.8.30 Sticky Buckwheat

Scientific Name: *Eriogonum viscidulum*

1.8.30.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Listed by BLM as a sensitive species in Nevada (BLM 2003a).
- Categorized as Critically Endangered and fully protected by the State of Nevada, pursuant to NAC 527.010 (List of fully protected species of native flora).
- Global heritage rank is G2 (NatureServe 2007).
- Nevada heritage rank is S2 (NatureServe 2007).
- Arizona heritage rank is S1 (NatureServe 2007).

1.8.30.2 General Description

Sticky buckwheat is a tall, erect and spreading annual, 1.6 to 13.1 feet (0.5 to 4 meters) high and minutely viscid. Leaves are basal with leaf blades being elliptic to broadly ovate, 0.2 to 1.2 by 0.2 to 1.2 inches (0.5 to three by 0.5 to three centimeters), densely white-tomentose abaxially, thinly floccose to glabrate and greenish adaxially, margins mostly smooth and plane, petioles are 0.2 to 0.6 inch (0.5 to four centimeters) and floccose. Flowering stems are usually one per plant, 0.8 to 3.9 inches (two to 10 centimeters). Inflorescences are cymose, spreading and open, 1.2 to 13.8 inches (three to 35 centimeters) high, with three scale-like bracts measuring 0.04 to 0.08 by 0.04 to 0.08 inch (0.1 to 0.2 centimeter by 0.1 to 0.2 centimeter). The peduncles are filiform, erect or nearly erect, and 0.2 to 0.6 inch (0.5 to 1.5 centimeters) long. Involucres are narrowly turbinate measuring 0.04 to 0.05 by 0.20 to 0.59 inch (0.1 to 0.12 centimeters by 0.6 to 0.8 millimeter). Four teeth, 0.012 to 0.020 inch in length (0.3 to 0.5 millimeter), are present. Sticky buckwheat flowers are pale yellow and 0.05 to 0.06 inch (0.13 to 0.15 centimeter) at anthesis. In fruit, the flowers broaden to 0.06 to 0.08 inch (0.15 to 0.2 centimeter) and tinge with red. The stamens are included and are 0.035 to 0.043 inch (0.09 to 0.11 centimeter) long with glabrous filaments. The glabrous achenes are trigonous and are light to dark brown in color. They measure 0.03 to 0.04 inch (0.8 to 0.1 centimeter) in length (Reveal 2003).

1.8.30.3 Distribution

Historical Distribution

This buckwheat is found in Clark and Lincoln counties, Nevada and northwestern Arizona (NNHP 2001). Populations occur along the Muddy River from Weiser Wash to its confluence with the Virgin River and within the Virgin River drainage from Sand Hollow Wash to the confluence with the Colorado River at Middle Point.

Current Distribution

Sticky buckwheat is found within an area of 29.2 square miles (75.5 square kilometers) (NNHP 2001). This species overlaps with Three-corner milkvetch over much of its range.

Population census data in Nevada suggest that 29 different occurrences have been recorded using one kilometer of separation. When using 0.16 kilometer of separation, 37 occurrences have been mapped. Total population estimates exceed 25,000 individuals (NNHP 2001).

1.8.30.4 Habitat

In Nevada, sticky buckwheat is known to occupy deep loose sandy soils in washes, flats, roadsides, steep aeolian slopes, and stabilized dune areas. This species can withstand moderate temporary disturbance. It is dependent on sand dunes or deep sand in Nevada. Sticky buckwheat occurs between 1,200 to 2,200 feet (366 to 671 meters) in elevation within the Mojave desert scrub community (NNHP 2001).

1.8.30.5 Life History

The presence of this species, and the number and size of individuals, can vary considerably from year to year in a particular location and appear to be correlated with winter precipitation and possibly temperature (Niles et al. 1995, NPS 1999a, as cited in Jones & Stokes 2004b).

Reproductive Biology

The sticky buckwheat is a winter annual. Seeds germinate after winter rains, typically in late February to early March (Jones & Stokes 2004b). This species flowers from April to June (Reveal 2003).

1.8.30.6 Threats Warranting Protection

Perhaps the greatest threat to sticky buckwheat is the difficulty in managing potential habitat due to both the lack of information regarding its ecology and to unknown population trends. A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Grazing of both domestic livestock and feral animals may result in significant habitat destruction as well as trampling. Mining operations in the area directly and indirectly cause mortality. Changes in habitat can be caused by water projects (i.e. diversions and ground water pumping) and the subsequent lowering of the water table to a point at which water is no longer biologically available. Exotic species can cause habitat degradation, competition, and competitive exclusion (RECON 2000). Development is also a threat to the species (TNC 2007). In the city of Mesquite, a city park has been proposed in occupied habitat for the sticky buckwheat (Ronning, pers. comm.).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Threats include those sustained from concentrated human recreation. Off-road vehicles and off-road vehicle events cause habitat degradation as well as direct mortality of this species. Participant vehicles, spectators, and spectator vehicles all pose possible threats. Additional recreational activities which may result in possible impacts are equestrian trail rides, dog field trials, flying machine events (remote and piloted), skydiving, and associated parking for these events (RECON 2000).

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.30.7 Conservation

According to Jones & Stokes (2004a), no specific management actions have been implemented for the sticky buckwheat. Ongoing surveys for the sticky buckwheat are conducted by the University of Nevada, Las Vegas, as part of a five year Assistance Agreement between the University of Nevada, Las Vegas and the Nevada State Office of the BLM. This agreement provides for surveys of special-status plants on public lands in the eastern Mojave Desert within southern Nevada (Niles et al. 1995, 1997, as cited in Jones & Stokes 2004a).

Conservation efforts are undertaken by the BLM and NPS under the Clark County MSHCP (USFWS 2005b). For conservation activities not covered by mitigation requirements of the Clark County MSHCP, the LCR

MSCP will contribute $10,000.00 per year until 2030 to the Clark County MSHCP Rare Plant Workgroup to fund identified conservation activities for the sticky buckwheat and three-corner milkvetch that would contribute to recovery (USFWS 2005b).

In the Clark County MSHCP, the NPS has the following conservation measures that may benefit the sticky buckwheat (RECON 2000, as cited in Jones & Stokes 2004a):

- Coordinate the inventory of sticky buckwheat and three-corner milkvetch with other survey efforts on federal lands;
- Manage burro populations under the NPS burro management plan to ensure resources are protected; and
- Investigate the basic ecology of the obligate pollinators of target plant species listed in the Clark County MSHCP to ensure that conservation measures approved under the LCR MSHCP complement conservation recommendations and the location of protected areas and ensures the inclusion of the pollinators' full habitat and food source requirements.

1.8.30.8 Critical Habitat

No critical habitat has been designated for this species; it is not a federally listed species.

1.8.30.9 Species Status

Rangewide

Although sticky buckwheat is restricted to a relatively small range (northwestern corner of Arizona and eastern Nevada), it is found in several discrete populations within that range. Many of these populations were reported as "robust" during 1995 surveys (Niles et al. 1995, as cited in Jones & Stokes 2004b). However, these local populations occur within relatively small areas, are quite variable in size, and are vulnerable to extirpation (NPS 1999a, as cited in Jones & Stokes 2004b). Some of the largest populations occur along the shoreline of Lake Mead, where receding waters in previous years created ideal habitat for sticky buckwheat (Niles et al. 1995, NPS 1999a, as cited in Jones & Stokes 2004b). Apparently, high water levels at Lake Mead during 1998 to 2000 decimated these larger populations (NPS 1999a, Powell pers. comm., as cited in Jones & Stokes 2004b), although new sites have since been recolonized in the drawdown zone of Lake Mead (Powell pers. comm., as cited in Jones & Stokes 2004b).

VRCMA Boundary

The status of the sticky buckwheat within the VRCMA Boundary is unknown. Five occurrences have been recorded in the Nevada portion of the VRCMA Boundary (NNHP 2006). These data points have population estimates between two and 1000+ and were recorded in the NNHP database as having been observed between 1979 and 1995 (NNHP 2006). Two occurrences in Arizona were recorded in 1995; both occurred north of the Virgin River (AGFD 2007d). No other occurrences have been recorded in natural heritage species databases within the VRCMA Boundary (NNHP 2006, AGFD 2007d). Additionally in 2007, three plants of sticky buckwheat were recorded in a May 7, 2007 botanical report for the proposed Mesquite Community Park (Ronning, pers. comm.).

1.8.31 Sticky Ringstem

Scientific Name: *Anulocaulis leisolenus*

1.8.31.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- BLM sensitive species (RECON 2000).
- Global heritage rank of G4 (NatureServe 2007).
- Nevada heritage rank of S2 (NatureServe 2007).
- Arizona heritage rank of S3 (NatureServe 2007).

1.8.31.2 General Description

This perennial herb can reach a height of up to three feet (0.9 meter) tall. Leaves are opposite, in one to three pairs in the lower portion of the plant. Leaf stalks can reach four inches (10.2 centimeters) long and have a leathery and rough texture. The flower stalks range from two to three feet (0.6 to 0.9 meter) high and comprise the upper three-quarters of the plant. The plant gets its name from the internodes, which have sticky, glutinous bands. Flowers are pink to white, trumpet-shaped, about 1.2 inches (three centimeters) long, and scattered about the top. Seeds are conspicuously winged (Hiatt and Boone 2004).

1.8.31.3 Distribution

Historic Distribution

No historic distribution data are available.

Current Distribution

This species occurs in southern Nevada, portions of northern Arizona, New Mexico, western Texas, and into Mexico (NatureServe 2007). In Clark County, it has a patchy distribution. It is found primarily in the Frenchman Mountain area east of Las Vegas and further east to the Muddy Mountains and Gold Butte (RECON 2000).

1.8.31.4 Habitat

The sticky ringstem occupies soils composed of calcareous shales and clay, alkaline clay buffs, loose talus, and gypsum soils from 1,700 to 4,000 feet (518 to 1,219 meters) from June to October (Brian 2000). This species is commonly associated with the Las Vegas bearpoppy (RECON 2000).

1.8.31.5 Life History

Reproductive Biology

Flowering occurs from July to August (Hiatt and Boone 2004).

1.8.31.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to the sticky ringstem within the VRCMA Boundary include habitat modification and degradation due to urbanization and recreational activities, as well as mining activities and trampling by ungulates (RECON 2000).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

The large amount of recreational traffic through the area could affect the sticky ringstem. Increased recreation could result in the loss of individual plants as well as the loss of cryptogamic crust (RECON 2000).

Disease or Predation

This activity is not listed as a threat currently affecting this species.

The Inadequacy of Existing Regulatory Mechanisms

This activity is not listed as a threat currently affecting this species.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

The continued highway development and road proliferation in the backcountry could negatively affect this species (RECON 2000).

1.8.31.7 Conservation

A Memorandum of Agreement was developed for the Las Vegas bearpoppy with management objectives that would also benefit the sticky ringstem. In addition, BLM has designated habitat in Lovell Wash (Muddy Mountains) and the Bitter Springs as ACECs for the protection of the Las Vegas bearpoppy and sticky ringstem (RECON 2000).

1.8.31.8 Species Status

Rangewide

The rangewide status for the sticky ringstem is secure (NatureServe 2007).

VRCMA Boundary

The status of the sticky ringstem within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.32 Straw Milkvetch

Scientific Name: *Astragalus lentiginosus* var. *stramineus*

1.8.32.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended

Other Protections

- Not a species covered by the Clark County MSHCP (RECON 2000).
- Global heritage rank is G5T2T3 (NatureServe 2007).
- Nevada heritage rank is S1S1 (NatureServe 2007).
- Arizona heritage rank is SNR (NatureServe 2007).
- Utah heritage rank is S1 (NatureServe 2007).

1.8.32.2 General Description

Straw milkvetch is a biennial or short-lived perennial (USDA 2007).

1.8.32.3 Distribution

Historic Distribution

Straw milkvetch is endemic to the Lower Virgin River Valley in Mohave County, Arizona and Clark County, Nevada (Barneby 1989). In Utah, it is restricted to the western slope of the Beaver Dam Mountains., Washington County (Welsh et al. 1993, as cited in UDWR 1998). In Utah and Arizona, this species is locally common to abundant (Barneby 1989, as cited in UDWR 1998). It is rare in Nevada (Kartesz 1987, as cited in UDWR 1998).

Current Distribution

The current and historic ranges are presumed to be the same although the current distribution within the range could be patchier than the historic distribution.

1.8.32.4 Habitat

This species characteristically grows on deep loose sandy soils in washes, flats, roadsides, steep aeolian slopes, and stabilized dune areas, with the following species: white bursage (*Ambrosia dumosa*), creosotebush (*Larrea tridentate*), big galleta (*Pleuraphis rigida*), range ratany (*Krameria parvifolia*), Indian ricegrass (*Achnatherum hymenoides*), salt cedar (*Tamarix ramosissima), desert arrow-weed (Tessaria sericea),* three-cornered milkvetch (*Astragalus geyeri* var. *triquetrus*)*,* gravel milkvetch (*A. sabulonum*), little deserttrumpet (*Eriogonum trichopes*)*,* Mormon tea (*Ephedra torreyana*)*,* desert dicoria (*Dicoria canescens*)*,* Beaver Dam breadroot (*Pediomelum castoreum*)*,* California croton (*Croton californicus*)*,* sand dropseed (*Sporobolus cryptandrus*)*,* Fremont's dalea (*Psorothamnus fremontii*), sand verbena (*Abronia* spp.), crinklemat (*Tiquilia* spp.). It can withstand moderate temporary disturbance. In Nevada, it is dependent on sand dunes or deep sand (UDWR 1998).

1.8.32.5 Life History

Very little life history information is available.

Reproductive Biology

This species is a biennial to short-lived perennial (USDA 2007). Low dispersal distances are expected.

1.8.32.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

No information on threats or potential threats is available.

1.8.32.7 Conservation

Conservation efforts for the straw milkvetch are unknown.

1.8.32.8 Species Status

Rangewide

This species is locally plentiful over a very restricted range that includes the Lower Virgin River Valley in Mohave County, Arizona, and adjoining Clark County, Nevada. It has also been reported, perhaps incorrectly, from "south-eastern Utah" without precise locality (Barneby 1964, as cited in NatureServe 2007).

VRCMA Boundary

At least within the Arizona portion of the Virgin River Valley, it is locally plentiful. Eight occurrences are known to be present within the VRCMA Boundary (AGFD 2007d, NNHP 2006).

1.8.33 Syntrichia Princeps

Scientific Name: *Syntrichia princeps*

1.8.33.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Global heritage rank of G5 (NatureServe 2007).

1.8.33.2 General Description

This moss species is in the Pottiaceae family (FNA 1993). The stems of this species vary from 0.2 to 0.8 inch in length (0.5 to 2.0 centimeters). Its leaves occur in distinct whorls and are spatulate in shape. Leaf margins are revolute in the first half to three quarters of the leaf. Seta are red in color and vary from 0.4 to 0.7 inch (1.0 to 1.8 centimeters) in length. The capsule is brownish red, 0.1 to 0.2 inch (0.3 to 0.4 centimeter), with a brown operculum. Spores are nine to 13 µm in length and papillose (FNA 1993).

1.8.33.3 Distribution

Historic Distribution

The distribution of this species ranges from British Columbia, Canada, to the western U.S. (Arizona, California, Idaho, Montana, Nevada, Oregon, Utah, Washington), south to Mexico and western and southern South America. It also occurs in western Asia, Africa, Pacific Islands (including Hawaii and New Zealand), Australia, and Antarctica (FNA 1993).

Current Distribution

Historic and current distribution are the same for this species.

1.8.33.4 Habitat

This species occurs at low to moderate elevations on substrates of humus, soil, rock, and tree bark (FNA 1993).

1.8.33.5 Life History

Reproductive Biology

No specialized asexual reproduction is present. The species is synoicous and rarely dioicious (FNA 1993). Because this is a bisexual species, it is commonly found in fruit (Stark 2001).

1.8.33.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are unknown. Deliberate harm is unlikely.

1.8.33.7 Conservation

General and species-specific conservation measures have been identified in the Clark County MSHCP for Syntrichia princeps (RECON 2000).

1.8.33.8 Species Status

Rangewide

There are no data available to determine the status of this species rangewide. In the coastal western U.S., this species is fairly common. A single population occurs in Nevada, in Red Rock National Conservation Area, in the pinyon-juniper zone (Stark 2001).

VRCMA Boundary

The status of the syntrichia princeps within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.34 Three-corner Milkvetch

Scientific Name: *Astragalus geyeri* var. *triquetrus*

1.8.34.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.
- Former Category 2 Candidate species.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Listed as Critically Endangered (CE) by the State of Nevada.
- Listed by the BLM as a sensitive species in Nevada (BLM 2003a).
- Global heritage rank is G4T2T3 (NatureServe 2007).
- Nevada heritage rank is S2S3 (NatureServe 2007).
- Arizona heritage rank is S1 (NatureServe 2007).

1.8.34.2 General Description

This is a small forb in the legume Fabaceae family. It is a slender, spreading, fast maturing annual herb that consists of a few leaves that arise from a short, flexuous stem. The leaves are compound and gray-green. Leaves and stems are covered by a fine ashy pubescence. Leaves are 1.2 to two inches (three to five centimeters) long and bear about nine elliptical, retuse leaflets each 0.4 to 1.5 centimeters long (AGFD 2004a).

Flowers are borne in loose, two to eight flowered, racimes. They are pea-shaped with a calyx 0.08 to 0.16 inch (0.2 to 0.4 centimeter) long, white or partly fuscous-strigulose. The tube is 0.06 to 0.10 inch (0.15 to 0.25 centimeter) long. Petals of the flower are whitish with faint pink veining, which dries violet. The banner petal is moderately recurved, 0.2 to 03. inch (0.5 to 0.75 centimeter) long; the keel is 0.15 to 0.2 inch (0.38 to 0.5 centimeter) long. The ovary is strigulose; ovules number seven to 11. Pods are oblong, curved, and triangular in cross section with a prominent groove on the lower side, one centimeter long (AGFD 2004a).

1.8.34.3 Distribution

Historic Distribution

This species is found in Clark and Lincoln counties, Nevada and Mohave County Arizona (NNHP 2001, AGFD 2004a). In Arizona, it is found between 1,100 and 2,400 feet (335 and 732 meters) in elevation (AGFD 2004a). The elevation range in Nevada is 1,100 to 2,400 feet (335 to 732 meters) (NNHP 2001).

Current Distribution

The current and historic ranges are presumed to be the same although the current distribution within the range could be patchier than the historic distribution.

1.8.34.4 Habitat

This species is found in Mojave Desert scrub, specifically the creosote bush-white bursage vegetation association. It occurs on open, deep sandy soil or dunes, generally stabilized by vegetation and/or a gravel veneer. In Nevada, it is found on sand dunes or deep sand (NNHP 2001). In Arizona, it is limited to washes and small pockets of wind-deposited sand. It is found in sandy soils formed from sedimentary formations on stabilized sand with a sparse gravel covering (AGFD 2004a). The distribution is patchy and often clumped. This species is dependent on microsite conditions (Bangle, pers. comm.).

1.8.34.5 Life History

Reproductive Biology

This is an ephemeral annual that does not bloom every year (ADFG 2004a). Three-corner milkvetch blooms from April to May. Bees have been observed around the plants, but it is unknown if they are a source of pollination. It is not known if self pollination can occur (Bangle pers. comm.).

Fruit sets in four to six weeks (NNHP 2001, ADFG 2004a). Low dispersal distances are expected; seed dispersal is dependent on winds shifting sand dunes. This species is dependent on a seed bank (Bangle pers. comm.). Seeds geminate in wetter years (NNHP 2001).

1.8.34.6 Threats Warranting Protection

One of the greatest threats to three-corner milkvetch is the difficulty in managing potential habitat due to the lack of knowledge regarding its general ecology and population trends. Additional threats are those sustained from human recreational activities. Off-road vehicles and off-road vehicle events cause habitat degradation, as well as, direct mortality to three-corner milkvetch. Participant vehicles, spectators, and spectator vehicles all pose possible impacts. Additional recreational activities which may result in possible impacts are equestrian trail rides, dog field trials, flying machine events (remote and piloted), skydiving, and associated parking for these events (RECON 2000).

Grazing of both domestic livestock and feral animals such as burrows may result in significant habitat destruction as well as trampling. Sand and gravel mining operations in the area directly and indirectly cause mortality. Changes in habitat result from water projects (i.e., diversions and ground water pumping) and the subsequent lowering of the water table to a point at which water is no longer biologically available. Habitat degradation, competition, and competitive exclusion from exotic species also pose a threat to three-corner milkvetch (RECON 2000). The inundation caused by the filling of Lake Mead may have resulted in the loss of individuals and habitat (AGFD 2004a).

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction is an issue due to OHV use, residential expansion, sand and gravel mining, utility development and corridors. An unknown amount of habitat was lost to inundation of Lake Mead. (NNHP 2001, AGFD 2004a). All of these habitat alterations occur within the VRCMA Boundary.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

Regulatory threats, if any, are unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

A natural threat to a rare population could result from the species habit of germinating only during wet years, thus limiting population size and increasing the likelihood of catastrophic loss (NNHP 2001, AGFD 2004a). Other threats are unknown. Deliberate harm is unlikely.

1.8.34.7 Conservation

According to Jones & Stokes (2004a), no specific management actions have been implemented for three-corner milkvetch. Ongoing surveys for three-corner milkvetch are conducted by the University of Nevada, Las Vegas, as part of a five year Assistance Agreement between the university and the Nevada State Office of the BLM. This agreement provides for surveys of special-status plants on public lands in the eastern Mojave Desert within southern Nevada (Niles et al. 1995, 1997, as cited in Jones & Stokes 2004a).

Conservation efforts are undertaken by the BLM and NPS under the Clark County MSHCP (RECON 2000). For conservation activities not covered by mitigation requirements of the Clark County MSHCP, the LCR MSCP will contribute $10,000.00 per year until 2030 to the Clark County MSHCP Rare Plant Workgroup to fund identified conservation activities for sticky buckwheat and three-corner milkvetch that would contribute to recovery of the species (USFWS 2005a).

In the Clark County MSHCP, the NPS has the following conservation measures that may benefit three-corner milkvetch (RECON 2000):

- Coordinate the inventory of sticky buckwheat and three-corner milkvetch with other survey efforts on federal lands;
- Manage burro populations under the NPS burro management plan to ensure resources are protected; and
- Investigate the basic ecology of the obligate pollinators of target plant species listed in the Clark County MSHCP to ensure that conservation measures approved under the LCR MSHCP complement conservation recommendations and the location of protected areas and ensures the inclusion of the pollinators' full habitat and food source requirements.

Additional conservation measures were identified for three-corner milkvetch in the rare plant conservation management strategy for Clark County, Nevada (TNC 2007). They include: protect three-corner milkvetch from significant agricultural impacts along Virgin and Muddy rivers, manage viable populations of three-corner milkvetch, ensure construction of Mesquite airport does not significantly impact viability of three-corner milkvetch, and ensure conservation management for three-corner milkvetch above high water line and manage populations below high water line during Lake Mead low water years (TNC 2007).

1.8.34.8 Species Status

Rangewide

Although, three-corner milkvetch is restricted to a relatively small range, several populations occur within that range. Most extant populations appear to be relatively small and more than half of these populations consist of fewer than 100 individuals (Niles et al. 1995, 1997, NPS 1999a, as cited in Jones & Stokes 2004b). Many populations either do not appear on an annual basis or fluctuate in size from year to year (Jones & Stokes 2004b).

Population trends have not been well documented for three-corner milkvetch (Jones & Stokes 2004b). The variability in its appearance makes surveying difficult to assess long-term trends.

VRCMA Boundary

The species status within the VRCMA Boundary is unknown. This species was first discovered at the confluence of the Muddy and Virgin rivers (AGFD 2004a). Within the VRCMA Boundary, 12 occurrences have been recorded (NNHP 2006, AGFD 2007d). Eleven occurrences have been recorded within Nevada: one by J. Tiehm in 1979, four by Holland, Niles, and Landau in 1995, one by Landau in 1995, one by L. White in 1998, one by Knight in 1980, one by Niles, Holland, Leary and Landau in 1995, and one referenced in Holland, Niles, and Schramm 1980 that was noted prior to 1980 (NNHP 2006). One occurrence was noted northeast of Mesquite in Arizona in 1995 (AGFD 2007d). No other occurrences were recorded in natural heritage species databases for the VRCMA Boundary (NNHP 2006, AGFD 2007d).

1.8.35 Trichostomum Moss

Scientific Name: *Trichostomum sweetii*

1.8.35.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Evaluation species (Medium Priority) for the Clark County MSHCP (RECON 2000).
- Global heritage rank of G2? (NNHP 2001).
- Nevada heritage rank of S1 (NNHP 2001).

1.8.35.2 General Description

This moss (*Trichostomum sweetii*) is a bryophyte (moss) in the Pottiaceae family. It is named *Trichostomum planifolium* in the Bryophyte Flora of North America.

The stem is rounded-pentagonal in section. The leaves are flattened, ovate to elliptical, distal margins plane or weakly erect or rarely broadly involute, entire, not bordered; apex rounded or rounded-acute, plane to weakly concave, keeled or cucullate; basal cells evenly differentiated across leaf base or as a "U," only weakly running up margins if at all, not distinctly enlarged submarginally; distal laminal cells pluripapillose with low papillae; mucro short-conic, of three to four cells. Sexual condition is autoicous. Peristome teeth are absent to short-lanceolate (FNA 1993).

1.8.35.3 Distribution

Historic Distribution

This species is poorly known and its range is likewise poorly understood. It is known globally to occur in seven populations (Stark 2001) including two locations in Clark County, Nevada and others in Arizona, Colorado, New Mexico, and Utah (NNHP 2001).

Current Distribution

The species is known to occupy two locations in Clark County, Nevada (NNHP 2001). The current and historic ranges are presumed to be the same, although when habitat in Clark County was resurveyed, this species was only found above 1,969 feet (600 meters) (Stark 1996).

1.8.35.4 Habitat

This moss is found on sandstone-derived soils and sandstone bluffs (NNHP 2001). It is known from elevations above 1,969 feet (600 meters) in Clark County, Nevada, from 1,296 to 1,969 feet (395 to 600 meters) in the Chihuahua and Mojave deserts, and 4,190 to 6,135 feet (1,277 to 1,870 meters) in Utah and Colorado (Stark 1996).

1.8.35.5 Life History

Little life history information is available for this perennial plant.

Reproductive Biology

No information on the reproductive biology of the species was available.

1.8.35.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat destruction issues are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species.

Disease or Predation

Disease and predation issues are unknown.

The Inadequacy of Existing Regulatory Mechanisms

This species is not protected.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Threats due to off road vehicle use, grazing, etc. are unknown. Deliberate harm is unlikely.

1.8.35.7 Conservation

Conservation efforts for this species are unknown.

1.8.35.8 Species Status

Rangewide

Population trends are unknown (NNHP 2001). It has not been relocated at the supposed type locality in the Virgin Mountains (NNHP 2001). It is known globally from seven populations.

VRCMA Boundary

The status of this moss within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.8.36 White Bearpoppy

Scientific Name: *Arctomecon merriamii*

1.8.36.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Global heritage rank of G3 (NatureServe 2007).
- Nevada heritage rank of S3 (NatureServe 2007).

- BLM sensitive species (RECON 2000).
- USFWS Species of Concern (NNHP 2001).
- Forest Service Sensitive Species (NNHP 2001).

1.8.36.2 General Description

The white bearpoppy is a perennial herb with a stout taproot. It has basal leaves, wedge-shaped with three to five apical lobes; and is one to three inches (2.5 to 7.6 centimeters) long and covered with long spreading hairs. It has an inflorescence with a solitary flower head with several flowering steams up to 14 inches (35.6 centimeters) in height. Flowers have six white petals that are 1.6 inches (four centimeters) long (Hiatt and Boone 2004).

1.8.36.3 Distribution

Historic Distribution

No historic distribution datum is available.

Current Distribution

A Mojave Desert endemic, the white bearpoppy occurs in Clark County, the extreme southwest corner of Lincoln County, the southern tip of Nye County, Death Valley, and Inyo County, California (RECON 2000).

1.8.36.4 Habitat

The white bearpoppy is found in Salt Desertscrub and Mojave Desertscrub habitats (RECON 2000). It prefers a wide variety of dry to sometimes-moist basic soils, including alkaline clay and sand, gypsum, calcareous alluvial gravels, and carbonate rock outcrops (NNHP 2001). It is often found in association with *Atriplex* spp. (RECON 2000).

1.8.36.5 Life History

Reproductive Biology

Flowering occurs in the spring from April to July (NNHP 2001).

1.8.36.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to the white bearpoppy within the VRCMA Boundary include habitat modification and degradation due to urbanization and recreational activities, as well as ungulate trampling (RECON 2000).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

The large amount of recreational traffic through the area could affect the white bearpoppy. Increased recreation could result the loss of individual plants as well as the loss of cryptogamic crust (RECON 2000).

Disease or Predation

This activity is not listed as a threat currently affecting this species.

The Inadequacy of Existing Regulatory Mechanisms

This activity is not listed as a threat currently affecting this species.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

The continued highway development and road proliferation in the backcountry could negatively affect this species, as well as wildflower collections (RECON 2000).

1.8.36.7 Conservation

The Air Force (USAF) is working with The Nature Conservancy to provide long-term protection to this species on the NAFR. In addition, the USAF is currently monitoring this species and has proposed to manage populations consistent with the terms of the "Keystone Dialogue" (RECON 2000).

1.8.36.8 Species Status

Rangewide

The population trend of the white bearpoppy appears to be stable, except in the Las Vegas Valley (RECON 2000).

VRCMA Boundary

The status of the white bearpoppy within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.9 REPTILE SPECIES DESCRIPTIONS

1.9.1 Banded Gecko

Scientific Name: *Coleonyx variegatus*

1.9.1.1 Protection Warranted

Endangered Species Act

Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Global heritage rank is G5 (NatureServe 2007).
- Nevada heritage rank is S4 (NatureServe 2007).
- Arizona heritage rank is S5 (NatureServe 2007).

1.9.1.2 General Description

The banded gecko is a medium-sized gecko with soft skin, short limbs, a pointed snout, large eyes, and functional eyelids. Like other Eublepharid geckos, this species has movable eyelids, slender toes that lack villi, and pointed claws. Adults are approximately six inches (15 centimeters) in total length, with females measuring about 2.8 inches (seven centimeters) snout-vent length, and the smaller males measuring about 2.5inches (6.3 centimeters) snout-vent length.

Adults are typically pale-yellow or light-gray in color. Red-brown spots cover the top of the head, and red-brown spots or bands cross the back.

1.9.1.3 Distribution

Historic Distribution

The historic distribution is unknown. It is expected that the historic range was similar to the current range.

Current Distribution

The banded gecko occurs throughout the deserts of the southwestern United States, northwest Mexico, and Baja California (Stebbins 2003). In the United States, its range encompasses southern California, extreme southern Nevada, southwestern Utah, western Arizona, and extreme southwestern New Mexico (NatureServe 2007, Stebbins 2003).

1.9.1.4 Habitat

Range-wide, this species occurs from sea level to about 5,000 feet (1,524 meters) elevation, in primarily desert habitats in both rocky areas and barren dunes (NatureServe 2007, Stebbins 2003). In Clark County, it is known to inhabit Mojave desert scrub, and mesquite/catclaw habitats, and less commonly pinyon-juniper, blackbrush, sagebrush, and desert riparian habitats (Clark County 2006a; Hiatt and Boone 2003). It seeks shelter under rocks, crevices, fallen logs (primarily yucca), limbs, and rubbish piles. It is nocturnal, feeding on arthropods (Clark County 2006a), and is capable of surviving in very dry habitats (Stebbins 2003).

1.9.1.5 Life History

Reproductive Biology

The banded gecko breeds between May and September. They typically lay two eggs a breeding season (SDNHM 2007c). The young hatch in 45 days (Behler and King 1979).

Diet

The banded gecko’s diet is comprised of insects and other arthropods. It stores fat in its tail for times when food is scarce (SDNHM 2007c).

Migration

This species is not known to migrate (NatureServe 2007).

1.9.1.6 Threats Warranting Protection

Threats include: loss of habitat from Joshua tree wood collection; habitat fragmentation from roads and trails; mortality from vehicular traffic on highways, unimproved roads, and cross-country activities; loss from collection by commercial collectors and hobbyists; and, habitat modification and degradation due to concentrated recreation use (e.g., OHV events, equestrian trail rides, and parking for these events) (NatureServe 2007; Clark County 2006a).

Overall, the species is not threatened (NatureServe 2007). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to the banded gecko include habitat conversion (e.g., development of retirement communities and associated infrastructure), loss of habitat from Joshua tree wood collection; habitat fragmentation from roads and trails, and habitat modification and degradation due to concentrated recreation use (e.g., OHV events, equestrian trail rides, and parking for these events) (NatureServe 2007; Clark County 2006a).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Threats to the banded gecko include loss from collection by commercial collectors and hobbyists (NatureServe 2007; Clark County 2006a).

Disease or Predation

It is unknown whether this is a threat for the western banded gecko.

The Inadequacy of Existing Regulatory Mechanisms

It is unknown whether this is a threat for the western banded gecko.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Threats to the banded gecko include mortality from vehicular traffic on highways, unimproved roads, and cross-country activities (NatureServe 2007; Clark County 2006a).

1.9.1.7 Conservation

It is unknown whether conservation activities are occurring for this species, although actions have been identified in UDWR 2005.

1.9.1.8 Species Status

Rangewide

The rangewide species trend for banded gecko is stable (NatureServe 2007).

VRCMA Boundary

Status of populations in the VRCMA Boundary is unknown. No occurrences of this species have been recorded in natural heritage species databases for the VRCMA Boundary (AGFD 2007d, NNHP 2006).

1.9.2 Banded Gila Monster

Scientific Name: *Heloderma suspectum cinctum*

1.9.2.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended
- 1996: Category 2 of candidate species was removed, no longer a candidate species, 61 CFR 7596-7613.
- November 15, 1994: Candidate for federal listing, Category 2, 59 CFR 58994.
- 1989: Removed from candidate list, 54 CFR 559.
- 1985: Candidate for federal listing, 50 CFR 37963.

Other Protections

- Evaluation species (High Priority) for Clark County MSHCP (RECON 2000).
- BLM sensitive species in Nevada and Arizona (BLM 2003, 2005b).
- Protected under NAC 503.080 (Reptiles: Classification). The banded Gila monster is protected under NRS 501 (NNHP 2004).

- Global heritage rank is G4T4 (NatureServe 2007).
- Nevada heritage rank is S2 (NatureServe 2007).
- Arizona heritage rank is S4 (NatureServe 2007).

1.9.2.2 General Description

The banded Gila monster is a large, heavy-bodied lizard with a large-head, rounded body and short, swollen tail. This species can attain total lengths of up to 22 inches (56 centimeters). The legs are short and muscular with large feet and toes. Its fourth toe is nearly as long as its third toe, which is unusual among lizards (Stebbins 2003). The species coloration is primarily black and pink, although color variation can range from orange to yellowish in color (AGFD 2002g). The dorsal surfaces of the animal are covered with bead-like scales, and the ventral (belly) scales are squarer in shape. This species has a well-developed gular fold and loose folds of skin on the neck. This species also has a dark colored forked tongue that it uses in a snake-like fashion (Stebbins 2003).

1.9.2.3 Distribution

Historic Distribution

The historic distribution is unknown. It is expected that the historic range was similar to the current range.

Current Distribution

The banded Gila monster ranges from the Vermillion Cliffs (Washington County), Utah southward through the lower Colorado River basin, including extreme southern Nevada, southeastern California, and Arizona west of the Central Plateau to Yuma (Jennings and Hayes 1994). The elevational distribution of this species ranges from 150 feet (45 meters) along the lower Colorado River near Yuma to 3,500 feet (1,124 meters) at Congress (Yavapai County), Arizona. In California, the banded Gila monster is known from isolated records in the Clark, Kingston, Paiute, and Providence mountains of eastern San Bernardino County. No specimens or photographs are available to verify other California localities (Jennings and Hayes 1994). Within Nevada, the banded Gila monster is known to occur in Clark, Lincoln, and Nye counties. Its geographic range approximates that of the desert tortoise (NDOW 2005).

Habitat

The banded Gila monster inhabits shrubby, grassy and succulent desert type habitat, occasionally entering oak woodland (Stebbins 2003). They occur in several desert plant associations, but seem most common in the paloverde and saguaro dominated desert scrub. They may also occur in mesquite-grassland, creosote bush, and single-leaf pinyon and western juniper vegetation types (Jennings and Hayes 1994).

Vegetation communities that serve as habitat for the banded Gila monster are as follows: Mogollon Chaparral, Apacherian-Chihuahuan Mesquite Upland Scrub, Mojave Mid-Elevation Mixed Desert Scrub, Chihuahuan Succulent Desert Scrub, Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub, Sonoran Paloverde-Mixed Cacti Desert Scrub, Sonora-Mojave Creosotebush-White Bursage Desert Scrub, Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe, North American Warm Desert Lower Montane Riparian Woodland and Shrubland, North American Warm Desert Riparian Woodland and Shrubland, North American Warm Desert Riparian Mesquite Bosque, Chihuahuan-Sonoran Desert Bottomland and Swale Grassland, Madrean Pinyon-Juniper Woodland, Madrean Juniper Savanna, Sonoran Mid-Elevation Desert Scrub (Southwestern Regional GAP Analysis Project [SWReGAP] 2005a).

They typically inhabit desert washes and are occasionally found in alluvial fans. This species tends to frequent the lower slopes of mountains and nearby plains and beaches. They are found in canyon bottoms or arroyos with perennial or intermittent streams. They seek shelter in self-excavated burrows or alternatively, those made by small mammals, and occasionally in woodrat nests. They are also found in dense thickets, under rocks and in other natural cavities. This species seems to prefer rocky areas and are often found at dawn or dusk following warm summer rains. The banded Gila monster is primarily ground dwelling and subterranean, spending greater than 95 percent of their lives underground (NDOW 2005), but will occasionally climb trees in search of food resources (Saint Louis Zoo No Date).

Crevices generally found on rocky slopes are where banded Gila monsters find refuge in both the winter and summer (NDOW 2005). Significant differences exist between winter and summer homesites (Jennings and Hayes 1994). The banded Gila monster winters at more elevated locations (i.e., on rocky slopes, in rocky outcrops, or below cliffs) often with other reptiles such as rattlesnakes and desert tortoise. Summer ranges, however, are located in adjacent lower valleys or alluvial fans (Jennings and Hayes 1994). Preferred shelters normally face to the east, southeast, or south, and appear to be similar for both juveniles and adults (Jennings and Hayes 1994). Data are lacking on nest sites (Jennings and Hayes 1994).

1.9.2.4 Life History

Reproductive Biology

Banded Gila monster breeding generally occurs in the early summer. Mating adults pair up, occupying the same burrow, and probably mate underground (Jennings and Hayes 1994). Males appear to be territorial during the mating season, and often combat with other males (Jennings and Hayes 1994). Gravid females deposit two to 12 eggs (averaging five), averaging 2.4 (six centimeters) long and 1.2 inches (3.1 centimeters) wide, in a shallow depression excavated in moist sand arroyos or similar soils (Jennings and Hayes 1994, AGFD 2002g). Oviposition occurs just before or during the start of the rainy season of July and August. Deposited eggs overwinter underground and hatch during May of the following year after incubating approximately ten months.

The hatching schedule is dependent on soil temperature, which varies across latitude and elevation across the species’ range (AGFD 2002g). Hatching typically occurs between late April and early June. Hatchling Gila monsters average 4.7 inches (12 centimeters) for snout to vent length (SVL) at birth, growing approximately 0.28 to 0.39 inch (0.7 to 0.1 centimeter) SVL per year, slowing to 0.16 to 0.28 inch (0.4 to 0.7 centimeters) per year as adults (Jennings and Hayes 1994). Sexual maturity is reached at around four years of age, and individuals have lived up to 40 years old in captivity (Jennings and Hayes 1994).

Diet

The banded Gila monster is a diurnal predator, but has also been known to forage at night, using their tongue to locate prey, feeding primarily on bird eggs and young mammals. Primary prey include mourning dove (*Zenaida macroura*), Gambel’s quail (*Lophortyx gambelii*) desert tortoise eggs, desert cottontail (*Sylvilagus audubonii*), and ground squirrel (*Ammospermophilus leucurus)* young, which it finds while robbing nests over a broad area (Jennings and Hayes 1994). This species may travel up to 0.6 miles (one kilometer) per day looking for food (Jennings and Hayes 1994). The venom is thought to be used for defensive purposes, rather than for assisting in prey capture. When prey resources are abundant, usually in the spring, the Gila monster accumulates fat stores in their tail, to use as energy when food resources are scarce (Jennings and Hayes 1994). The amount of time spent foraging is highly variable and is dependant on prey availability and daily temperatures (Porzer 1982, as cited in Jennings and Hayes 1994).

Migration

This species does not migrate (AGFD 2002e).

1.9.2.5 Threats

Threats to the banded Gila monster and its habitat include natural and exotic predators, habitat alteration, development, habitat fragmentation, illegal collection, and pets. A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Destruction of habitat due to the rapid urbanization within this species' range is considered the main reason for declining populations. Phoenix had the largest human population increase of any city in the United States between 2004 and 2005; North Las Vegas, Nevada and Gilbert, Arizona are also on the list of the five biggest numerical population-gaining cities, according to a June 21, 2006 press release by the U.S. Census Bureau (U.S. Census Bureau 2006). From 1990 to 2006, Clark County has had an average rate of 5.63 percent annual growth (CCCP 2007).This rate of growth is typical for urban development throughout this species' range.

With rapid urbanization within the banded Gila monster's range comes the rapid construction of infrastructure. The fragmentation of habitat caused by roads is isolating populations from each other. More importantly, animals crossing the roads are subject to collision with vehicles.

Other factors contributing to population declines are off road vehicles and off road vehicle events causing habitat degradation as well as direct mortality of this species. Participant vehicles, spectators, and spectator vehicles all pose possible threats. Additional recreational activities which may result in possible impacts are equestrian trail rides, dog field trials, flying machine events (remote and piloted), skydiving, and subsequent parking for these events (RECON 2000).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Although the collection of the banded Gila monster is now illegal without proper permits, animals for sale in the pet trade are sold for as much as $2,000 a piece. Therefore, poaching for black market sales is also thought to be contributing to banded Gila monster declines (Jennings and Hayes 1994).

Disease or Predation

As urbanization becomes more prevalent in previously uninhabited deserts, human and pet densities increase. Pet encounters with wildlife are presumed to be a contributing factor in banded Gila monster declines (Jennings and Hayes 1994).

Inadequacy of Regulatory Mechanisms

Stringent prohibitions against commercial exploitation and unnecessary killing are needed (NDOW 2006).

Other Natural or Manmade Factors Affecting the Species Continued Existence

The banded Gila monster has a poisonous bite, and has therefore been the target of unwarranted persecution (NDOW 2006).

1.9.2.6 Conservation

The banded Gila monster is included in the Nevada Comprehensive Wildlife Conservation Strategy (NDOW 2006). Single-species investigations are recommended to develop an adequate conservation strategy. The banded Gila monster was identified in the Conservation Strategy as one of the highest priority reptilian species for conducting studies on. As part of the Conservation Strategy, a partnership was developed, Partners in Amphibian and Reptile Conservation (PARC), which includes staff from NDOW, federal land management agencies, National Park Service, University of Nevada system, and others (NDOW 2006).

1.9.2.7 Species Status

Rangewide

The banded Gila monster occurs in Clark, Lincoln, and Nye counties in Nevada, and portions of Arizona, California, and Utah. The rangewide status is not currently known.

While there is not much known about the abundance of the banded subspecies, the species' (*H. suspectum*) numbers are estimated to include a least several thousand individuals (NatureServe 2007). One study (Degenhardt et al. 1996), determined that the density of Gila monsters in one locality in New Mexico, was around five animals per acre. Campbell and Lamar (2004) have determined that the species is declining over the extent of its range. Beck (1985) estimated that the population in Utah has declined from a range of 2,000 to 5,000 individuals in the 1930s to between 450 and 800 individuals at the time the study was conducted.

VRCMA Boundary

The status of banded Gila monster within the VRCMA Boundary is unknown. Four occurrences of this species within the watershed have been recorded in the Virgin River Valley of Arizona from 1999 (AGFD 2007d). No other observations have been recorded in natural heritage databases for the watershed (NNHP 2006, AGFD 2007d datasets).

1.9.3 California (Common) Kingsnake

Scientific Name: *Lampropeltis getulus californiae*

1.9.3.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Global heritage rank of G5T5 (NatureServe 2007).
- Nevada heritage rank of S4 (NatureServe 2007).
- Arizona heritage rank of S5 (NatureServe 2007).

1.9.3.2 General Description

The California (common) kingsnake is a polymorphic species that varies in color and pattern phases. Colors and patterns consist primarily of alternating bands of black or brown and white or yellow (banded phase) or longitudinal stripes of these same colors (striped phase). Some individual's exhibit partial patterns of both and can appear marbled, spotted, or blotched. Scales are smooth and glossy and their snout is light colored. The head is barely wider than the neck (Californiaherps.com 2000).

The California kingsnake seldom exceeds 48 inches (121.9 centimeters). Most commonly found at 2.5 to 3.5 feet (0.8 to 1.1 meters) in length. Hatchlings are about 12 inches (30.5 centimeters) long. Kingsnakes are non-venomous and are considered non-threatening towards humans (Californiaherps.com 2000).

1.9.3.3 Distribution

Historic Distribution

The California kingsnake is found throughout California, except the damp redwood zone of the extreme northwest coast and the northeast corner. It is also absent from high elevations in the Sierras, the Trinity Alps, and the Cascades. The California kingsnake ranges north into southwestern Oregon, east into southern Nevada, southern Utah, southwestern Colorado and northwestern New Mexico, and south through much of Arizona into Sonora, Mexico, and south throughout the Baja California peninsula (Californiaherps.com 2000).

Current Distribution

The current distribution of this species is the same as the historic distribution.

1.9.3.4 Habitat

Range-wide, this species inhabits many terrestrial biomes. It is most commonly occupied in Mojave desert scrub and salt desert habitats near rock outcrops or clumps of vegetation (RECON 2000).

1.9.3.5 Life History

Reproductive Biology

Reproduction occurs between May and August. Five to 17 eggs are laid in mid summer, and hatching occurs in late summer and early fall (Californiaherps.com 2000).

Diet

The California kingsnake eats a wide variety of prey, including rodents and other small mammals, other snakes (e.g., rattlesnakes, as it is immune to venom), lizards, turtle eggs and hatchlings, frogs, birds' eggs and chicks, salamanders, and large invertebrates. It is a powerful constrictor, coiling tightly around its prey. (Californiaherps.com 2000).

Behavior

The California kingsnake is active during daylight in cooler weather and at night, dawn, and dusk when temperatures are high. Generally not aggressive, but sometimes vibrates the tail quickly, hisses, and rolls into a ball, hiding the head and showing the vent with it's lining exposed (Californiaherps.com 2000).

1.9.3.6 Threats Warranting Protection

Primary threats to the California kingsnake include habitat degradation, fragmentation and human disturbances (RECON 2000). There are no species specific threats identified. A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat degradation and habitat fragmentation by roads and trails and urban/rural development are threats to this species (RECON 2000). Habitat modification/degradation from competitive OHV races is also a threat (RECON 2000).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Commercial collection of flora and fauna reduces populations and mortality from competitive OHV races are threats to the California kingsnake (RECON 2000).

Disease or Predation

These threats are non-applicable to this species.

The Inadequacy of Existing Regulatory Mechanisms

This species is not specifically protected under federal or state laws.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats are non-applicable to this species.

1.9.3.7 Conservation

Because the California kingsnake is a Covered species under the Clark County MSHCP, conservation actions are applicable for the species These include livestock, wild horse and burro management, OHV management, education programs, road and trail consolidation, and habitat protection (RECON 2000).

1.9.3.8 Species Status

Rangewide

Population trends are unknown for this species (RECON 2000).

VRCMA Boundary

The status of the California kingsnake within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.9.4 Common Zebra-tailed Lizard

Scientific Name: *Callisaurus draconoides*

1.9.4.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Watch List species for the Clark County MSHCP (RECON 2000).
- Zebra-tailed lizard is a listed as a sensitive species by the state of Utah (UDWR 2006).
- Global heritage rank is G5 (NatureServe 2007).
- Nevada heritage rank is S5 (NatureServe 2007).
- Arizona heritage rank is S5 (NatureServe 2007).

1.9.4.2 General Description

At the species level, the zebra-tailed lizard is an average to medium-sized lizard with a flattened tail, long, slender limbs and a lean body built for speed. Snout-vent lengths average between 2.5 and 4.0 inches (6.4 to 10.2 centimeters). The body is yellow-tan with two dark side bars extending up from the belly. The upper surfaces of the body are marked with numerous cream spots or flecks; a series of small gray-brown spots run down the middle of the back, becoming bands on the tail. The back of each thigh is marked with a dark distinct horizontal line. Dark tail bands become black ventrally, where they starkly contrast the white background. The side bars on males extend onto the belly where they are surrounded by blue patches. Bars are faint or absent on females, and the belly lacks blue patches. During the breeding season, males may also form a bright red patch on the underside of their neck. External ear openings and the forward position of side bars distinguish it from the similar greater earless lizard (*Cophosaurus texanus*). The scales of this lizard are granular; the dorsal scales are small and the ventral scales are larger, with all grading into each other laterally; the throat has two folds (AGFD 2007b).

1.9.4.3 Distribution

Historic Distribution

With small localized exceptions, this species is extant within the boundaries of its historic distribution.

Current Distribution

This lizard ranges from northwestern Nevada and extreme southwestern Utah south through southeastern California, Arizona, and extreme southwestern New Mexico to southern Sinaloa and tip of Baja California, including Islas Magdalena and Santa Margarita along the Pacific coast of Baja California and several islands in Gulf of California. Elevational range extends from sea level in desert sinks to about 5,000 feet (1,520 meters) (NatureServe 2007).

1.9.4.4 Habitat

The zebra-tailed lizard occurs below sea level in desert sinks to around 4,986.9 feet (1,520 meters) (Stebbins 2003). Primary habitat is low desert scrub; with substrate ranging from fine windblown sand to firm soil habitats with little vegetation. (UDWR 2005). This lizard is usually found in sparsely vegetated desert areas on open sandy washes, dunes (e.g., Vizcaino Desert), floodplains, beaches, or desert pavement. At higher elevations, it sometimes occurs on rocky, relatively shady, leaf-litter substrates. Eggs are probably laid underground or under rocks (NatureServe 2007).

1.9.4.5 Life History

Reproductive Biology

Eggs laid mainly May-August in most areas. Clutch size averages about four in Arizona and five in Nevada. This species produces multiple clutches per year. Sexual maturity occurs at one year. This species is inactive in cold temperatures, and they are most active between 0900 and 1300 h in Nevada. Lizards in the Phrynosomatidae family have small home range sizes, usually smaller than 1.2 acres (0.5 hectare) (often much less) and rarely larger than 2.5 acres (1 hectare) (NatureServe 2007).

Diet

The diet of both the adult and juvenile zebra-tailed lizard includes grasshoppers, beetles, caterpillars, spiders, other lizards, and occasionally plants (NatureServe 2007, Stebbins 2003).

Migration

This is primarily a sedentary species. Phyrnosomatid lizards have small home range sizes, usually less than 0.5 hectares (NatureServe 2007).

1.9.4.6 Threats Warranting Protection

No major threats have been identified for the zebra-tailed lizard with the exception of localized habitat loss and degradation (NatureServe 2007). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Locally, the species has been detrimentally affected by habitat destruction and degradation as a result of conversion of land to human uses (e.g., agriculture, residential and commercial development (NatureServe 2007, UDWR 2005). All of these habitat alterations occur within the VRCMA Boundary.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

None of these activities are known to significantly impact the zebra-tailed lizard.

Disease or Predation

This species is preyed upon by carnivorous lizards, snakes, birds and probably mammalian predators (Zeiner et al. 1988).

The Inadequacy of Existing Regulatory Mechanisms

Although it is a species of special concern in Utah, the zebra-tailed lizard receives no other federal or state protection.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

No other significant threats to populations of this species are known.

1.9.4.7 Conservation

There are few known conservation measures are proposed that are meant to directly protect the zebra-tailed lizard. This species is a Watch List species under the Clark County MSHCP, which affords no protection for the species (RECON 2000). Watch List species are those for which adequate information is not available to assess population range, current status, or conservation potential or that are not considered to be at risk during the planning horizon of the MSHCP (RECON 2000). In Arizona, no conservation actions occur for this species (AGFD 2007b).

1.9.4.8 Species Status

Rangewide

Populations of this species are thought to be stable. Total abundance of the species is unknown but thought to exceed 100,000 individuals (NatureServe 2007).

VRCMA Boundary

The status of the zebra-tailed lizard within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.9.5 Desert Iguana

Scientific Name: *Dipsosaurus dorsalis*

1.9.5.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Listed as a sensitive species by the state of Utah (UDWR 2006).
- Global heritage rank is G5 (NatureServe 2007).
- Nevada heritage rank is S3 (NatureServe 2007).
- Arizona heritage rank is S5 (NatureServe 2007).

1.9.5.2 General Description

The desert iguana is a light colored, large lizard (ten to 16 inches in length [25.4 to 40.6 centimeters]) that has a long tail and a low crest of keeled scales down the back (SDNHM 2007a, Enature 2005). The head is relatively small with a short snout and large ear openings. The body is light cream in color with brown and gray dorsal bands extending down the iguana's back to the tail. Breeding adults may exhibit pink on the sides of the belly (Enature 2005). This species is typically inactive during cold weather (NatureServe 2007). On hot, sunny days, the desert iguana is more tolerant of high temperatures; therefore, it remains active in the heat, more so than other iguana species.

1.9.5.3 Distribution

Historic Distribution

The historic distribution of this species includes southern Nevada to extreme southwestern Utah along the Virgin River in the vicinity of Beaver Dam Wash, through western and central Arizona to northern Sonora to northeastern Baja California and all of southern Baja California (but not most of the Vizcaino Desert) to east of the Sierra Nevada and Coast ranges in southern California (NatureServe 2007, Stebbins 2003).

Current Distribution

The desert iguana's range extends from southern Nevada to extreme southwestern Utah along the Virgin River in the vicinity of Beaver Dam Wash (it may not occur in this location anymore), through western and central Arizona to northern Sonora to northeastern Baja California and all of southern Baja California (but not most of the Vizcaino Desert) to east of the Sierra Nevada and Coast ranges in southern California (NatureServe 2007, Stebbins 2003). This species also occurs on many islands in the Gulf of California and on Magdalena and Santa Margarita islands along the Pacific coast of Baja California. The range in the United States coincides closely with that of the creosote bush.

Within the VRCMA Boundary, this species is known to occur in the southwest corner of Washington County, Utah, and Clark and Lincoln Counties, Utah (UDWR 2005, NDOW 2006).

1.9.5.4 Habitat

The desert iguana is found in various desert scrub, grassland, and riparian woodland vegetative communities that contain substrates that consist of hummocks of loose sand and patches of firm ground with scattered rocks (Stebbins 2003). This species inhabits valley flats; toe slopes, bottoms, and swales; gently sloping ridges and hills; nearly level plateau or terrace land feature types (Stebbins 2003). In the north, the desert iguana is typically found in creosote bush desert with hummocks of loose sand and patches of firm ground with scattered rocks, whereas in the south they may occur in subtropical scrub habitats (NatureServe 2007). Suitable elevations range from below sea level in desert sinks to plateaus and hills that extend to 1,520 meters (Stebbins 2003). These lizards seek shelter in rodent burrows or rock crevices, and they may climb into bushes. (NatureServe 2007)

1.9.5.5 Life History

Reproductive Biology

This species reaches reproductive age in 31 to 33 months (NatureServe 2007). The desert iguana breeds from April through May or July and lays clutches of three to eight eggs from June to August (Stebbins 2003, Behler and King 1979).

Diet

The desert iguana is primarily herbivorous and consumes fresh leaves, buds, and flowers of the creosote bush and other plants (Stebbins 2003, NatureServe 2007). Secondarily, this species consumes insects, carrion, and its own fecal pellets.

Migration

This species does not migrate over a large area or even locally. Individuals tend to remain close to the hatching site (usually within 130 feet [40 meters]) (NatureServe 2007). In California, the home range for this species was found to average approximately 6,458 square feet (600 square meters) amongst males and was smaller for females.

1.9.5.6 Threats Warranting Protection

Declines in desert iguana populations are attributed primarily to habitat loss and fragmentation (UDWR 2005). This population is sometimes subject to illegal collection. A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Localized population declines have occurred in areas that are undergoing habitat conversion (NatureServe 2007). In some areas, desert iguana habitat has been lost due to human conversion to other uses such as agriculture, commercial and residential development, and roadway construction (UDWR 2005). Agricultural practices and improper grazing practices have resulted in the trampling of habitat and food competition between grazers and desert iguanas. Populations along busy highways presumably have been reduced as a result of road mortality; however, roadway mortality only affects a relatively small portion of the overall range (NatureServe 2007).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

This species is sometimes subject to illegal collection for the pet trade (UDWR 2005). Commercial collection occurs within Nevada. Additional monitoring and assessment of the rate of collection and the associated population impacts need to be completed to fully assess this risk (NDOW 2006).

Disease or Predation

Neither disease nor predation have been identified as a threat to the desert iguana’s population

The Inadequacy of Existing Regulatory Mechanisms

The inadequacy of existing regulatory mechanisms has not been identified as a threat to the desert iguana’s population.

Other Natural or Manmade Factors Affecting the Species’ Continued Existence

No other natural or manmade factors have been identified as affecting the desert iguana’s continued existence.

1.9.5.7 Conservation

This species is included in the Clark County MSHCP (RECON 2000).

1.9.5.8 Species Status

Rangewide

Little is known about population abundance, the relationship between habitat abundance and populations, and the impact of collection on the population for this species (NDOW 2006, UDWR 2005). While total population abundance in unknown, it is likely to exceed 100,000 (NatureServe 2007). This species is very common in northeastern Baja California and in creosote bush desert habitats in southeastern California and southwestern Arizona. Over its entire range, the population is stable (±10 percent population fluctuation) in the short term and relatively stable (±25 percent population fluctuation) in the long term.

VRCMA Boundary

The status of the desert iguana within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.9.6 Desert Night Lizard

Scientific Name: *Xantusia vigilis*

1.9.6.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended

Other Protections

- Evaluation species (High Priority) for the Clark County MSHCP (RECON 2000).
- Listed as a sensitive species by the State of Utah (UDWR 2006a).
- BLM sensitive species in Utah (BLM 2003a).
- Global heritage rank is G5 (NatureServe 2007).
- Nevada heritage rank is S4 (Nature Serve 2007).
- Arizona heritage rank is S4 (Nature Serve 2007).

1.9.6.2 General Description

The desert night lizard is an extremely secretive species that is inactive during periods of cold temperatures or extreme heat (NatureServe 2007, UDWR 2005). The average body length is 1.5 to 2.75 inches (3.8 to seven centimeters) (UDWR 2005). This slim lizard has an olive, gray, or brown body with black speckle markings along the back. Some individuals may also have a stripe that is light in color with black edging that runs from the eye to the shoulder.

1.9.6.3 Distribution

Historic Distribution

The historic range of this species is unknown.

Current Distribution

The desert night lizard's range extends throughout the Mojave Desert, ranging from the eastern side of the southern California coastal ranges to southern Nevada to southern Utah to most of Baja California and southwestern Sonora (Stebbins 2003, NatureServe 2007).

Within the VRCMA Boundary, this species occurs in the southwestern part of Washington County, Utah (UDWR 2005), Mohave County (Brennan 2006), and Clark and Lincoln counties, Nevada (Stebbins 2003, as cited in NatureServe 2007).

1.9.6.4 Habitat

The desert night lizard inhabits arid and semi-arid granite outcroppings and rocky areas among fallen leaves, agave and yucca trunks, cacti, other large plants, rocks, or vegetative debris in woodlands, shrub steppe, pinyon-juniper, and desert scrub vegetative habitats (AGFD 2003, Csuti and Crist 1998, NatureServe 2007, UDWR 2005). This species can be found in elevations ranging from sea level to 9,285 feet (2,830 meters) (Stebbins 2003).

1.9.6.5 Life History

Reproductive Biology

The female desert night lizard reachs sexual maturity at age three (UDWR 2005). The breeding season extends from May through June; after which, females give birth to one to three young between May and October (AGFD 2003l, NatureServe 2007, UDWR 2005, NDOW 2006). Males and females of this species become territorial during breeding season.

Diet

The desert night lizard is an insectivore, primarily consuming termites, ants, beetles, flies, spiders, moths, caterpillars, and ticks (AGFD 2003j).

Migration

This species is a non-migrant (NatureServe 2007). The desert night lizard is inactive in cold temperatures and extreme heat, but may be active at night during the summer. Despite sedentary habits, it seems unlikely that locations separated by less than a few kilometers of suitable habitat would represent independent occurrences over the long term (NatureServe 2007).

1.9.6.6 Threats Warranting Protection

Declines in desert night lizard populations are primarily attributed to habitat loss. In addition to habitat loss, some commercial collection may pose a threat to local populations. A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

General habitat loss presents a threat to the desert night lizard population (NDOW 2006). The species likely is declining at a local level where its habitat has been degraded or eliminated by municipal, commercial, and residential development (NatureServe 2007, UDWR 2005). Further monitoring is needed to determine the impact of habitat degradation on local populations (NatureServe 2007).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

The desert night lizard is potentially subject to illegal commercial collection (UDWR 2005, NDOW 2006). Researchers need to monitor collection rates and determine the impacts of collection on local populations to better understand the magnitude of this issue (NDOW 2006).

Disease or Predation

Neither disease nor predation has been identified as a threat to the desert night lizard's population.

The Inadequacy of Existing Regulatory Mechanisms

The inadequacy of existing regulatory mechanisms has not been identified as a threat to the desert night lizard's population.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

No other natural or manmade factors have been identified as affecting the desert night lizard's continued existence.

1.9.6.7 Conservation

This species is currently included in the Clark County MSHCP (RECON 2000).

1.9.6.8 Species Status

Rangewide

The population status of this species and the associated management needs are largely unknown for this species (NDOW 2006, UDWR 2005). While the population status is unknown, the population is probably between 10,000 and 100,000 (NatureServe 2007). Over its entire range, the population is stable (±10 percent population fluctuation) in the short term and relatively stable (±25 percent population fluctuation) in the long term. Research needs to focus on generating population estimates (NDOW 2006, UDWR 2005). Also, researchers need to monitor collection rates and determine the impacts of collection on local populations. This information is necessary to implement any adaptive management regime to maintain population viability.

VRCMA Boundary

The status of the desert night lizard within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.9.7 Desert Tortoise

Scientific Name: *Gopherus agassizii*

1.9.7.1 Protection Warranted

Endangered Species Act

- August 4, 1989: Populations north and west of the lower Colorado River in Arizona and Utah (excluding the Beaver Dam slope population) listed as endangered under an emergency rule, without critical habitat (54 CFR 32326–32331).
- April 2, 1990: Entire Mojave population west of the lower Colorado River in California and Nevada, and north of the lower Colorado River in Arizona and Utah, including the Beaver Dam slope, listed as threatened (55 CFR 12178–12191).
- February 8, 1994: Critical habitat designated (59 CFR 5820–5866).
- June 28, 1994: Final Recovery Plan approved (USFWS 1994a).

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Classified as threatened in Nevada under NAC 503.080 (Reptiles: Classification).
- Global heritage rank is G4 (NatureServe 2007).
- Nevada heritage rank is S2S3 (NatureServe 2007).
- Arizona heritage rank is S4 (NatureServe 2007).

1.9.7.2 General Description

The desert tortoise is a large, herbivorous reptile found in portions of California, Arizona, Nevada, and Utah. It also occurs in Sonora and Sinaloa, Mexico. The Mojave population of desert tortoise includes those animals living north and west of the Colorado River in the Mojave Desert of California, Nevada, Arizona, southwestern Utah, and in the Sonoran Desert in California. The desert tortoise reaches eight to 15 inches (20.3

to 38.1 centimeters) in carapace length. Adults have a domed carapace and relatively flat, unhinged plastron. Shell color is brownish, with yellow to tan scute centers. The forelimbs are flattened and adapted for digging and burrowing. Optimal habitat has been characterized as creosote bush scrub (*Larrea tridentata*) in which precipitation ranges from two to eight inches (5 to 20.3 centimeters), where a diversity of perennial plants is relatively high, and production of ephemerals is high (Luckenbach 1982, Turner and Brown 1982). Soils must be friable enough for digging of burrows, but firm enough so that burrows do not collapse. The desert tortoise occurs from below sea level to an elevation of 7,300 feet (2,225.0 meters), but the most favorable habitat occurs at elevations of approximately 1,000 to 3,000 feet (304.8 to 914.4 meters) (Luckenbach 1982).

1.9.7.3 Distribution

Historic Distribution

The historic distribution of the Mojave population of the desert tortoise includes California, southern Nevada, northwestern Arizona, and southwestern Utah (USFWS 2000a).

Current Distribution

The distribution of the Mojave population of the desert tortoise includes California, southern Nevada, northwestern Arizona, and southwestern Utah. The current distribution is the same is the historic range; however, populations are fragmented and declining (USFWS 2000a).

1.9.7.4 Habitat

The desert tortoise is most commonly found within the desert scrub vegetation, primarily in creosote bush scrub. In addition, they occur in succulent scrub, cheesebush scrub, blackbrush scrub, hopsage scrub, shadscale scrub, microphyll woodland, Mojave saltbush-allscale scrub, and scrub-steppe vegetation types of the desert and semidesert grassland complex (USFWS 1994a). Within these vegetation types, the desert tortoise potentially can survive and reproduce where their basic habitat requirements are met. These requirements include a sufficient amount and quality of forage species; shelter sites for protection from predators and environmental extremes; suitable substrates for burrowing, nesting, and over wintering; various plants for shelter; and adequate area for movement, dispersal, and gene flow. Throughout most of the Mojave Region, desert tortoise occur most commonly on gently sloping terrain where soils include sandy-gravel and scattered shrubs, and where there is abundant inter-shrub space for growth of herbaceous plants. Throughout their range; however, desert tortoise can be found in steeper, rockier areas.

1.9.7.5 Life History

Reproductive Biology

The desert tortoise possesses a combination of life history and reproductive characteristics that affect the ability of populations to survive external threats. Desert tortoise grow slowly, require 15 to 20 years to reach sexual maturity, and have low reproductive rates during a long period of reproductive potential (Turner et al. 1984, Bury 1987, Tracy et al. 2004). In the Eastern Mojave Desert, the desert tortoise mates in the fall (following nesting) and also in the spring (prior to nesting) (Rostal et al. 1994). During the winter, the species hibernates (Ronning, C., pers. comm.). At Yucca Mountain, Nye County, Nevada (Northeastern Mojave Recovery Unit), Mueller et al. (1998) estimated that the mean age of first reproduction was 19 to 20 years; clutch size (one to 10 eggs) and annual fecundity (0 to 16 eggs) were related to female size but annual clutch frequency (0 to 2) was not. Further, Mueller suggested that body condition during July to October may determine the number of eggs a desert tortoise can produce the following spring. The number of eggs that a female desert tortoise can produce in a season is dependent on a variety of factors including environment, habitat, availability of forage and drinking water, and physiological condition (Henen 1997, McLuckie and Fridell 2002).

Diet

The desert tortoise eats a wide variety of herbaceous vegetation, particularly grasses and the flowers of annual plants (Berry 1974, Luckenbach 1982). Tortoise are well adapted to living in a highly variable and often harsh environment. In adverse conditions, they retreat to burrows or caves, at which time they reduce their metabolism and loss of water, and consume very little food. Adult desert tortoise lose water at such a slow rate that they can survive for more than a year without access to free water of any kind. The desert tortoise apparently tolerates large imbalances in their water and energy budgets (Nagy and Medica 1986). This ability enables them to survive lean years and exploit resources that are only periodically available. During years of average or better than average precipitation and forage production, desert tortoise can balance their water budgets and have a positive energy balance, providing opportunity for growth and reproduction (Nagy and Medica 1986). All the mechanisms by which desert tortoise maintain their energy and water balance in the face of stochastic availability of resources are still not clear, but the desert tortoise seems to be flexible in their mechanisms of energy and water gain and in their expenditures of these resources (Wallis et al. 1992).

Migration

The size of desert tortoise home ranges varies with respect to location and year. Females have long-term home ranges that are approximately half that of the average male, which range from 25 to 200 acres (10.1 to 80.9 hectares) (Berry 1986). Over its lifetime, each desert tortoise may require more than 1.5 square miles (3.9 square kilometers) of habitat and may make forays of more than seven miles (11.3 kilometers) at a time (Berry 1986). In drought years, the ability of the desert tortoise to drink while surface water is available following rains may be crucial for desert tortoise survival. During droughts, the desert tortoise forages over larger areas, increasing the likelihood of encounters with sources of injury or mortality including humans and other predators.

The desert tortoise is most active during the spring and early summer, when annual plants are most common. Additional activity occurs during warmer fall months and occasionally after summer rainstorms. Desert tortoise spend the remainder of the year in burrows, escaping the extreme conditions of the desert. In Nevada and Arizona, desert tortoise are considered to be active from approximately March 15 through October 15.

Genetics and Morphology

Based on mitochondrial DNA (mtDNA) restriction-fragment polymorphisms, Lamb et al. (1989) described three major genetic units. One unit is found in the Colorado and Mojave deserts and a second in the Sonoran Desert from west-central Arizona to central Sonora. The third major unit is found in southern Sonora and Sinaloa, south of the Yaqui River.

Morphological variation coincides reasonably well with the mtDNA genotypes found north of Mexico. There are three distinct shell phenotypes in the United States: 1) the California phenotype from California and southwestern Nevada; 2) the Sonoran Desert phenotype from Arizona south and east of the Colorado River, and 3) the Beaver Dam Slope phenotype from extreme southwestern Utah and Arizona north of the Grand Canyon (Weinstein and Berry 1987). The California and Sonoran Desert phenotypes correspond to the Mojave region and Sonoran Desert mtDNA genotypes, respectively. Thus, based on genetic and morphological criteria, desert tortoise are divided into at least two well-differentiated entities, one in the Sonoran Desert in Arizona and one in the Mojave region. A third may exist in Sonora and Sinaloa, Mexico.

1.9.7.6 Threats Warranting Protection

Threats to the desert tortoise include factors such as loss of habitat from construction projects such as roads, housing and energy developments, and conversion of native habitat to agriculture. Grazing and off-highway vehicle activities not only degrade tortoise habitat but also may collapse burrows, killing any tortoises present. Also threatening the desert tortoise's continuing existence are illegal collection by humans for pets or consumption, predation on juvenile desert tortoise by common ravens, coyote, kit foxes and other mammals, and collisions with vehicles on paved and unpaved roads. A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

LAND USE CHANGE

Habitat is deteriorating and has been lost in many parts of the tortoise's range due to an accelerating rate of human uses of the desert. Loss of habitat from a variety of human land uses has occurred throughout the Mojave Desert and is particularly acute all over the western Mojave, the Las Vegas area, and the St. George area in Utah. Urbanization in the western Mojave has grown significantly in recent years, especially near the communities of Lancaster, Palmdale, Victorville, Ridgecrest, and Barstow. Other permanent human land uses that have an adverse impact on tortoises and their habitat include agricultural land conversion, construction of roads, some military activities, energy and mineral development, waste disposal areas and other land use. Grazing and off-highway vehicle (OHV) activity have further degraded habitat.

INVASIVE PLANTS

Nonnative plant species such as red brome (*Bromus rubens*), filaree (*Erodium cicutarium*), and split grass (*Schismus arabicus*) have been introduced as result of grazing and have become widely established in the Mojave Desert. Land managers and field scientists identified 116 species of alien plants in the Mojave and Colorado Deserts (Brooks and Esque 2002). The proliferation of non-native plant species has also contributed to an increase in fire frequency in desert tortoise habitat by providing sufficient fuel to carry fires, especially in the intershrub spaces that are mostly devoid of native vegetation (USFWS 1994a, Brooks 1998, Brown and Minnich 1986). Indeed, over 500,000 acres (202,342.8 hectares) of desert lands burned in the Mojave Desert in the 1980s. Changes in plant communities caused by alien plants and recurrent fire may negatively affect desert tortoise by altering habitat structure and species composition of their food plants (Brooks and Esque 2002).

Proportional increases in non-native plant species may also contribute to the incidence of tortoise disease. The desert tortoise has been found to prefer native vegetation over aliens (Jennings 1993). Alien annual plants in desert tortoise critical habitat in the western Mojave Desert were found to compose greater than 60 percent of the annual biomass (Brooks 1998). The reduction in quantity and quality of forage may stress tortoises and make them more susceptible to drought- and disease-related mortality (Jacobson et al. 1991, Brown et al. 1994).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Desert tortoises have long been a popular pet in the southwest. It is not known to what extent collecting has reduced wild populations, but it has continued to be a concern across all states in the region. Vandalism, including shooting and crushing of tortoises under vehicles, has also been documented.

Disease or Predation

Disease is a natural phenomenon in wild populations of animals, and can contribute to population declines by increasing mortality and reducing reproduction. However the effects of disease may be enhanced by natural and/or anthropogenic changes in habitat. Changing ecological condition as a result of natural events or human-caused activities may stress individuals and result in a more severe clinical expression of Upper Respiratory Tract Disease (URTD) (Brown et al. 2002). Additionally, URTD appears to be a complex, multi-factorial disease interacting with other stressors to affect desert tortoise (Brown et al. 2002, Tracy et al. 2004). For example, the disease occurs mostly in relatively dense desert tortoise populations, as mycoplasmal infections are dependent upon higher densities of the host (Tracy et al. 2004). Malnutrition has also been associated with several disease outbreaks in turtles (Borysenko and Lewis 1979). What is currently known with certainty about disease in the desert tortoise relates entirely to individual desert tortoises and not populations; however, virtually nothing is known about the demographic consequences of disease (Tracy et al. 2004).

Predation of young tortoise by ravens is a local and potentially growing threat to the species. In recent years, raven predation on juvenile desert tortoise has been documented in several locations and tortoises in certain smaller size classes could not be found. Recruitment of young tortoise into the adult population probably has been significantly reduced in these localities. For example, at the Desert Tortoise Natural Area, a protected area of 21,320 acres (8,627.9 hectares) in the western Mojave Desert in California, tortoise eggs are still being laid and hatched, as shown by the presence of very small tortoises. However, raven predation seems to have severely curtailed the abundance of young tortoises (BLM et al. 1989, as cited in USFWS 1994).

The Inadequacy of Existing Regulatory Mechanisms

The inadequacy of existing regulatory mechanisms is not a threat to the desert tortoise.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

An ancillary effect of continued declines in a species' numbers and loss of habitat is the fragmentation of remaining populations. Long-term survival of these isolated pockets will be aggravated by normal random fluctuations in the population or the environment and catastrophic events that could lead to extirpation. Of particular concern with the tortoise is the continued drought that has affected most of its Mojave range over the past several years. The resulting physiological stress caused by poor nutrition can be accentuated by other perturbations in the environment, such as the increased presence of predators, fire, OHVs, and competition for existing forage. The synergistic effects of these disturbances could result in the complete inability of both individual animals and isolated groups to return to and maintain population levels that are viable on a long-term basis (Tracy et al. 2004).

1.9.7.7 Conservation

On August 4, 1989, the USFWS published an emergency rule listing the Mojave population of the desert tortoise as endangered (54 CFR 42270). On April 2, 1990, the USFWS determined the Mojave population of the desert tortoise to be threatened (55 CFR 12178). Reasons for the determination included significant population declines, loss of habitat from construction projects such as roads, housing and energy developments, and conversion of native habitat to agriculture. Grazing and OHV activity have degraded additional habitat. Also cited as threatening the desert tortoise's continuing existence was the illegal collection by humans for pets or consumption, URTD, predation on juvenile desert tortoise by common ravens and kit foxes, fire, and collisions with vehicles on paved and unpaved roads.

The desert tortoise is covered under the Clark County MSHCP, in which the goal is to maintain stable or increasing populations. The Clark County MSHCP outlines threats to the tortoise in Clark County, as well as existing and proposed conservation actions for this species (RECON 2000).

Recovery Units

There are six recovery units designated for desert tortoise: Northern Colorado, Eastern Colorado, Upper Virgin River, Northeastern Mojave, Eastern Mojave, and Western Mojave. Only the Northeastern and Eastern Mojave Recovery Units are located in Nevada.

Northeastern Mojave Recovery Unit

The Northeastern Mojave Recovery Unit occurs primarily in Nevada, but it also extends into California along the Ivanpah Valley and into extreme southwestern Utah and northwestern Arizona. Vegetation within this unit is characterized by creosote bush scrub, big galleta-scrub steppe, desert needlegrass scrub-steppe, and blackbrush scrub (in higher elevations). Topography is varied, with flats, valleys, alluvial fans, washes, and rocky slopes. Much of the northern portion of the Northeastern Mojave Recovery Unit is characterized as basin and range, with elevations from 2,500 to 12,000 feet (762 to 3,658 meters). The desert tortoise typically eats summer and winter annuals, cacti, and perennial grasses. The desert tortoise in this recovery unit, the northern portion of which represents the northernmost distribution of the species, are typically found in low densities (about 10 to 20 adults per square mile).

A kernel analysis was conducted in 2003-2004 for the desert tortoise (Tracy et al. 2004) as part of the assessment of the 1994 Desert Tortoise Recovery Plan. The analyses revealed several areas in which the kernel estimations for live desert tortoise and carcasses did not overlap. The pattern of non-overlapping kernels that is of greatest concern is those in which there were large areas where the kernels encompassed carcasses but not live animals. These regions represent areas within DWMAs where there were likely recent die-offs or declines in desert tortoise populations. The kernel analysis indicated large areas in the Piute-Eldorado Valley, where there were carcasses but no live desert tortoise. For this entire area in 2001, 103 miles (165 kilometers) of transects were walked, and a total of six live and 15 dead desert tortoise observed, resulting in a live encounter rate of 0.06 desert tortoise per mile of transect for this area. This encounter rate was among the lowest that year for any of the areas sampled in the range of the Mojave desert tortoise (Tracy et al. 2004).

Critical Habitat

On February 8, 1994, the USFWS designated approximately 6.45 million acres (2.61 million hectares) of critical habitat for the Mojave population of desert tortoise in portions of California (4.75 million acres [1.92 million hectares]), Nevada (1.22 million acres [493,716.5 hectares]), Arizona (339 thousand acres [137,188.4 hectares]), and Utah (129 thousand acres [52,204.4 hectares]) (59 CFR 5820-5846, also see corrections in 59 CFR 9032-9036), which became effective on March 10, 1994. Desert tortoise critical habitat was designated by the USFWS to identify the key biological and physical needs of the desert tortoise and key areas for recovery, and focuses conservation actions on those areas. Desert tortoise critical habitat is composed of specific geographic areas that contain the primary constituent elements of critical habitat, consisting of the biological and physical attributes essential to the species' conservation within those areas, such as space, food, water, nutrition, cover, shelter, reproductive sites, and special habitats. The specific primary constituent elements of desert tortoise critical habitat are:

- Sufficient space to support viable populations within each of the six recovery units, and to provide for movement, dispersal, and gene flow;
- Sufficient quality and quantity of forage species and the proper soil conditions to provide for the growth of these species;
- Suitable substrates for burrowing, nesting, and overwintering; burrows, caliche caves, and other shelter sites; and
- Sufficient vegetation for shelter from temperature extremes and predators and habitat protected from disturbance and human-caused mortality.

Critical habitat units (CHUs) were based on recommendations for DWMAs outlined in the Draft Recovery Plan for the Desert Tortoise (Mojave Population) (USFWS 1993). These DWMAs are also identified as "desert tortoise ACECs" by BLM. Because the critical habitat boundaries were drawn to optimize reserve design, the CHU may contain both "suitable" and "unsuitable" habitat. Suitable habitat can be generally defined as areas that provide the primary constituent elements.

The Desert Tortoise Recovery Plan recommends establishment of 14 Desert Wildlife Management Areas (DWMAs) throughout the recovery units (USFWS 1994). Within each DWMA, the Recovery Plan recommends implementation of reserve-level protection of desert tortoise populations and habitat, while maintaining and protecting other sensitive species and ecosystem functions. The DWMAs have been designated by the BLM through development or modification of their land use plans in Arizona, Nevada, Utah, and parts of California.

In Nevada, BLM's Las Vegas, Ely, and Battle Mountain field offices manage desert tortoise habitat; 941,800 acres (381,132.9 hectares) of desert tortoise habitat were designated as ACECs by the Las Vegas and Ely field offices. BLM regulations (43 CFR 1610) define an ACEC as an area "within the public lands where special management attention is required (when such areas are developed or used or where no development is required) to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards." Management direction for ACECs reduces or eliminates certain resource uses and activities identified in the Desert Tortoise (Mojave Population) Recovery Plan as incompatible with desert tortoise recovery (Morse et al. 2003). The regulation of activities within critical habitat through ESA Section 7 consultation is based on recommendations in the Desert Tortoise Recovery Plan (USFWS 1994b).

1.9.7.8 Species Status

Rangewide

In 1998, the Desert Tortoise Management Oversight Group identified line distance sampling as the appropriate method to determine rangewide desert tortoise population densities and trends. Monitoring of populations using this method is underway across the range of the desert tortoise. Rangewide desert tortoise population monitoring began in 2001 and is conducted annually.

The survey results from the data collected as part of the rangewide desert tortoise population monitoring indicate that desert tortoise populations have declined both in numbers of desert tortoise found during surveys and in densities of live desert tortoise at most sites, since the plots were first established 20 to 30 years ago (Berry et al. 2002). Declines of 50 to 96 percent have occurred regardless of initial desert tortoise densities. Increases in the occurrence of shell-skeletal remains have been found to correspond with declines in numbers and densities of live desert tortoise with the exception of certain plots where poaching has been documented (Berry 2003).

Results of desert tortoise surveys at three survey plots in Arizona indicate that all three sites have experienced significant die-offs. Six live desert tortoise were located in a 2001 survey of the Beaver Dam Slope Exclosure Plot (Walker and Woodman 2002). Three had definitive signs of URTD, and two of those also had lesions indicative of cutaneous dyskeratosis. Previous surveys of this plot detected 31 live desert tortoise in 1996, 20 live desert tortoise in 1989, and 19 live desert tortoise in 1980. The 2001 survey report indicated the likelihood that there is no longer a reproductively viable population of desert tortoise on this study plot. Thirty-seven (37) live desert tortoise were located in a 2002 survey of the Littlefield Plot (Young et al. 2002). None had definitive signs of URTD. Twenty-three (23) desert tortoise had lesions indicative of cutaneous dyskeratosis. Previous surveys of this plot detected 80 live desert tortoise in 1998 and 46 live desert tortoise in 1993. The survey report indicated that the site might be in the middle of a die-off due to the high number of carcasses found since the site was last surveyed in 1998. Nine (9) live desert tortoise were located during the mark phase of a 2003 survey of the Virgin Slope Plot (Goodlett and Woodman 2003). The surveyors determined that the confidence intervals of the population estimate would be excessively wide and not lead to an accurate population estimate, so the recapture phase was not conducted. One desert tortoise had definitive signs of URTD. Seven (7) desert tortoise had lesions indicative of cutaneous dyskeratosis. Previous surveys of this plot detected 41 live desert tortoise in 1997 and 15 live desert tortoise in 1992. The survey report indicated that the site might be at the end of a die-off that began around 1996-1997.

The Western Mojave has experienced marked population declines as indicated in the Recovery Plan and continues today. Spatial analyses of the Western Mojave show areas with increased probabilities of encountering dead rather than live animals, areas where kernel estimates for carcasses exist in the absence of live animals, and extensive regions where there are clusters of carcasses where there are no clusters of live animals. Collectively, these analyses point generally toward the same areas within the Western Mojave, namely the northern portion of the Fremont-Kramer DWMA and the northwestern part of the Superior–Cronese DWMA. Together these independent analyses, based on different combinations of data, all suggest the same conclusion for the Western Mojave. Data are not currently available with sufficient detail for most of the range of the desert tortoise with the exception of the Western Mojave (Tracy et al. 2004).

Declines in desert tortoise abundance appear to correspond with increased incidence of disease in desert tortoise populations. The Goffs permanent study plot in Ivanpah Valley, California, suffered 92 to 96 percent decreases in desert tortoise density between 1994 and 2000 (Berry 2003). The high prevalence of disease in Goffs tortoise likely contributed to this decline (Christopher et al. 2003). Upper respiratory tract disease has not yet been detected at permanent study plots in the Sonoran Desert of California, but is prevalent at study plots across the rest of the species' range (Berry 2003) and has been shown to be a contributing factor in population declines in the Western Mojave Desert (Brown et al. 1999, Christopher et al. 2003). High mortality rates at permanent study plots in the Northeastern and Eastern Mojave and Sonoran deserts appear to be associated with incidence of shell diseases in tortoises (Jacobson et al. 1994). Low levels of shell diseases were detected in many populations when the plots were first established, but were found to increase during the 1980s and 1990s (Jacobson et al. 1994, Christopher et al. 2003). A herpes virus has recently been discovered in desert tortoise, but little is known about its effects on desert tortoise populations at this time (Berry et al. 2002).

The kernel analysis of the Eastern Colorado Recovery Unit shows that the distributions of the living desert tortoise and carcasses overlap for most of the region. The Chuckwalla Bench study plot occurs outside the study area, which creates a problem in evaluating what may be occurring in that area of the recovery unit. However, the few transects walked in that portion of the DWMA yielded no observations of live or dead desert tortoise. This illustrates the Service's concern for drawing conclusions from areas represented by too few study plots and leaves them with guarded concern for this region. The percentage of transects with live animals was relatively high for most DWMAs within the Eastern Colorado Recovery Unit. In addition, the ratio of carcasses to live animals was low within this recovery unit relative to others.

Northeastern Mojave Recovery Unit

Maintaining tortoise populations within the individual recovery units will ensure that future evolutionary processes will not be overly constrained in the future (USFWS 1994a). The VRCMA Boundary is located within the Northeastern Mojave Recovery Unit (USFWS 1994a). Topography within the Northeastern Mojave Recovery Unit is varied, with flats, valleys, alluvial fans, washes, and rocky slopes; much of the northern portion of the unit is characterized as basin and range. Creosote bush scrub, big galleta-scrub steppe, desert needlegrass scrub-steppe, and blackbrush scrub (in higher elevations of tortoise habitat) characterizes the vegetation of tortoise habitat within the recovery unit. The northern portion of the Northeastern Mojave Recovery Unit is where the tortoise reaches its northernmost extent in the distribution of the species, and where tortoises are typically found in low densities (about ten to 20 adults per square mile) (USFWS 2005a).

The Northeastern Mojave Recovery Unit includes four critical habitat units, of which two are located partially within Lincoln County: the Mormon Mesa CHU, and the Beaver Dam Slope CHU. The Mormon Mesa CHU is located in both Lincoln and Clark counties, and in total encompasses 427,900 acres (173,165.0 hectares) (USFWS 1994b). The portion of the Mormon Mesa CHU located in Lincoln County is 133,911 acres (54,191.9 hectares) (31 percent of the Mormon Mesa CHU). The Beaver Dam Slope CHU is located in Nevada, Utah, and Arizona, and in total encompasses 204,629 acres (82,810.4 hectares). The portion of the Beaver Dam Slope CHU located in Lincoln County is 87,400 acres (35,369.5 hectares) (43 percent of the Beaver Dam Slope CHU) (USFWS 1994b).

VRCMA Boundary

Within the VRCMA Boundary, 38 observances of the desert tortoise have been recorded. These occurrences are distributed throughout appropriate habitat within the VRCMA Boundary (NNHP 2006, AGFD 2007d).

Portions of the watershed contain critical habitat for the desert tortoise. The Northeastern Mojave Recovery Unit includes four critical habitat units, of which two are located partially within the VRCMA Boundary: the Mormon Mesa CHU, and the Beaver Dam Slope CHU. The Mormon Mesa CHU is located in both Lincoln and Clark counties, and in total encompasses 427,900 acres (173,165.0 hectares) (USFWS 1994b). The Beaver Dam Slope CHU is located in Nevada, Utah, and Arizona, and in total encompasses 204,629 acres (82,810.4 hectares) (USFWS 1994b).

1.9.8 Great Basin Collared Lizard

Scientific Name: *Crotaphytus insularis bicinctores*

1.9.8.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S4 (NatureServe 2007).
- Arizona heritage rank of S3? (NatureServe 2007).

1.9.8.2 General Description

The Great Basin collared lizard is a medium-sized lizard 4.25 inches (10.8 centimeters) from snout to vent. The tail is often twice the length of the body. The species has a robust body with a large head and narrow neck with two black collar bands separated by a white band. It has large rear legs and a long thick tail. Collar markings are separated at dorsal midline by no more than 12 pale scales. The scales are small and granular. The anterior collar completely encircles the neck on males. Coloration is gray-brown with soft-edged, yellow-orange crossbands; the ventral coloration is a light cream. The limbs and feet are tinted with yellow-orange and the back is usually marked with white to cream colored dots. This pattern reverses on the tail and hind limbs, becoming gray-brown dots on a light background. The tail is taller than it is wide, except in males where they are somewhat flattened side-to-side. In addition, males have a pale stripe running down the top of the tail with well-developed alternating wide crossbands, dark blue-gray to black patches on the throat and groin, and enlarged postanal scales. Females lack the tail stripe, are duller in color, and have orange bars on their sides when gravid. Juveniles are similar to adults, but juvenile banding is more distinct (AGFD 2007c).

1.9.8.3 Distribution

Historic Distribution

The Great Basin collared lizard is found from eastern and southeastern California, through most of Nevada, in extreme southeast Oregon and southern Idaho, western Utah, and northwestern and western Arizona. Isolated populations can be found in eastern Idaho and Utah (AGFD 2007c).

Current Distribution

The current distribution is the same as the historic distribution (NatureServe 2007).

1.9.8.4 Habitat

The Great Basin collared lizard is found in Mojave desert scrub, salt desert scrub, mesquite (*Prosopis* spp.) and catclaw (*Acacia greggii*) dominated areas, desert riparian, shrubby and pinyon-juniper habitats in rocky terrain: arroyos, hill slopes, washes with sparse vegetative cover, up to 7,500 feet (2,280 meters) in elevation (RECON 2000).

1.9.8.5 Life History

Reproductive Biology

Overall, the species breeds in the spring and lays a clutch of three to seven eggs in the summer. In Arizona, eggs are laid in June or July, hatching in October. In Utah, this species has been found to lay eggs in June (AGFD 2007c). Other members of the same genus lay one or two clutches of eggs/year (NatureServe 2007). Neonates have been observed in August in eastern Oregon. In southern populations some females mature in one year. This species hybridizes with eastern collared lizard (*Crotaphytus collaris*) where their ranges overlap (AGFD 2007c).

Diet

The Great Basin collared lizard feeds on other lizards, small snakes, arthropods, berries and leaves and flowers of plants (RECON 2000, AGFD 2007c).

Migration

The Great Basin collared lizard is a sedentary species (NatureServe 2007).

1.9.8.6 Threats Warranting Protection

The Great Basin collared lizard is considered a secure species with stable population levels (NatureServe 2007). The primary threat to localized populations of the Great Basin collared lizard is unauthorized collection (WAPT 2006).

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to the Great Basin collared lizard within the VRCMA Boundary include habitat modification and degradation, as well as commercial and recreational collecting (WAPT 2006, RECON 2000). Construction and heavy use of roads and trails can cause habitat fragmentation (RECON 2000).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Collection of this species for commercial or recreational purposes may cause localized population declines (WAPT 2006).

Disease or Predation

Predators probably include coachwhips (*Masticophis* spp.) and various birds and mammals. The young are taken by loggerhead shrikes (*Lanius ludovicianus*) in appropriate habitat (AGFD 2007c).

The Inadequacy of Existing Regulatory Mechanisms

This species has not been included on the threatened and endangered species list under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Collisions with vehicular traffic can cause injury and mortality to the Great Basin collared lizard (RECON 2000).

1.9.8.7 Conservation

The Great Basin collared lizard is monitored by the NDOW statewide reptile network (WAPT 2006).

1.9.8.8 Species Status

Rangewide

Populations of the Great Basin collared lizard appear to be stable (NatureServe 2007).

VRCMA Boundary

The status of the Great Basin collared lizard within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.9.9 Glossy Snake

Scientific Name: *Arizona elegans*

1.9.9.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- BLM sensitive species in Nevada (BLM 2003a).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S4 (NatureServe 2007).
- Arizona heritage rank of S5 (NatureServe 2007).

1.9.9.2 General Description

The glossy snake has glossy scales and varies in color from light brown to pink with brown or gray blotches on its back and sides with black edges. The underside of the snake is pale and unmarked. The adult glossy snake ranges from 26 to 70 inches (66 to 178 centimeters). Their average length is three to four feet (0.9 to 1.2 meters) (Californiaherps.com 2007).

This species is active at night, and burrows and remains underground during the daytime (Californiaherps.com 2007).

1.9.9.3 Distribution

Historic Distribution

The glossy snake is a permanent resident of California, Arizona, Nevada, New Mexico, Texas, Colorado, Oklahoma, Kansas and Nebraska (NatureServe 2007).

Current Distribution

There appears to be no difference between the historic and current distribution of this species.

1.9.9.4 Habitat

This species can be found in varied habitats. Degenhardt et al. (1996), Hammerson (1999), Grismer (2002) and Stebbins (2003) indicate that habitat for this species includes barren to sparse shrubby desert, sagebrush flats, grassland, sandhills, coastal scrub, chaparral slopes, and sometimes oak-hickory woodland, generally in open areas with sandy or loamy soil, though rocks may be present (as cited by NatureServe 2007). The glossy snake may be found up to 7,000 feet (2,134 meters) (RECON 2000).

1.9.9.5 Life History

Reproductive Biology

The glossy snake lays eggs in summer (clutch of two to 23 eggs, averaging eight per clutch) (NatureServe 2007). The eggs hatch in late summer and early fall. While not all adult females are reproductive every year, it is thought that they reproduce biennially at most (NatureServe 2007).

Diet

The diet of the glossy snake consists mostly of sleeping diurnal lizards, but will eat small snakes, small birds, and mammals (Californiaherps.com 2007)

Migration

This species is a non-migrant (NatureServe 2007)

1.9.9.6 Threats Warranting Protection

There are no species specific threats related to the glossy snake (RECON 2000), however threats to the habitat in which it lives may have an effect upon this species. These habitat threats include: 1) reduction of populations of flora and fauna resulting from commercial collection, 2) habitat modification and degradation and wildlife mortality from competitive OHV races, 3) habitat fragmentation by urban/rural development, 4) reduction of wildlife populations through highway mortality, and 5) habitat fragmentation by roads and trails.

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to the glossy snake include habitat modification, degradation, and fragmentation (RECON 2000).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

While the glossy snake is not specifically mentioned, commercial collection may lead to a reduction of populations of fauna in Clark County (RECON 2000).

Disease or Predation

The glossy snake is a likely prey item for larger predators such as owls, coyotes or other snakes.

The Inadequacy of Existing Regulatory Mechanisms

No federal or state protection focuses on this species, however within Clark County (RECON 2000) measures regarding commercial collection and roads should provide adequate protection.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

There are no other natural or manmade factors affecting the species' continued existence.

1.9.9.7 Conservation

General ecosystem level conservation actions for Mojave desert scrub, salt desert scrub and lizard and snakes include environmental education programs, livestock, wild horse and burro management, OHV management, road and trail consolidation, utility corridor consolidation and habitat protection for the desert tortoise (Clark County 2000).

1.9.9.8 Species Status

Rangewide

The glossy snake is considered to be a common species, with an unknown population, but is estimated to exceed 100,000 individuals (NatureServe 2007).

VRCMA Boundary

The status of the glossy snake within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.9.10 Large-spotted Leopard Lizard

Scientific Name: *Gambelia wislizenii wislizenii*

1.9.10.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Global heritage rank of G5 (NatureServe 2007).
- Nevada heritage rank of S4 (NatureServe 2007).
- Arizona heritage rank of S5 (NatureServe 2007).

1.9.10.2 General Description

The large-spotted leopard lizard is 3.25 to 5.75 inches (8.1 to 14.4 centimeters) in length. It is a large, robust lizard with a round body and a large, distinct head with a long snout. On its light dorsum are dark spots. Its throat has streaks of gray and the lining of the mouth and throat are purplish black (USGS 2003).

Males are smaller than females and have femoral pores. During the breeding season, females turn reddish on the sides, tail, and neck (USGS 2003).

The juvenile has more distinct crossbars and spots than the adult, and the dorsum is often rust colored (USGS 2003).

1.9.10.3 Distribution

Historic Distribution

The range of this species is the western U.S. (Arizona, California, Colorado, Idaho, New Mexico, Nevada, Oregon, Texas, and Utah) to northeastern Baja California and north central mainland Mexico, including Isla Tiburon in the Gulf of California (Stebbins 2003, as cited in NatureServe 2007).

Current Distribution

The current distribution of the large-spotted leopard lizard is the same as the historic distribution.

1.9.10.4 Habitat

The large-spotted leopard lizard's habitat includes desert and semidesert areas that include shrubs or other low plants, especially where abundant rodent burrows are located (Stebbins 2003, as cited in NatureServe 2007). This species uses hardpan, gravely, or sandy open ground where vegetation is sparse or in small clumps below 6,000 feet (1,830 meters) (RECON 2000).

1.9.10.5 Life History

Reproductive Biology

Eggs are laid in burrows (NatureServe 2007). One clutch of one to 11 eggs is laid in May or June (Collins 2007). UDWR reports that the number and size of clutches, as well as when eggs are laid depends upon the geographic location (2007b).

Diet

This species eats insects, small lizards, and some plant materials in the daytime (RECON 2000).

Migration

This species is non-migratory (NatureServe 2007).

1.9.10.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat loss and degradation from agriculture and commercial and residential development, along with invasion of exotic herbaceous plants, are threats to the large-spotted leopard lizard (NatureServe 2007). Habitat fragmentation from roads and trails is also a threat (RECON 2000).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Commercial collection is a threat to the large-spotted leopard lizard (RECON 2000).

Disease or Predation

Disease and predation are not known to be threats to this species.

The Inadequacy of Existing Regulatory Mechanisms

No federal or state protection exists specifically for the large-spotted leopard lizard.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Highway mortality is a threat to this species (RECON 2000).

1.9.10.7 Conservation

As a Covered species for the Clark County MSHCP, conservation actions specific to this species have been identified and are being implemented in Clark County, Nevada (RECON 2000).

1.9.10.8 Species Status

Rangewide

Population trends are stable, but probably declining at a low rate as a result of ongoing habitat loss and degradation (NatureServe 2007).

VRCMA Boundary

The status of the large-spotted leopard lizard within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.9.11 Mojave Green Rattlesnake

Scientific Name: *Crotalus scutulatus scutulatus*

1.9.11.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Listed as a sensitive species by the State of Utah (UDWR 2006).
- Global heritage rank is G5 (NatureServe 2007).
- Nevada heritage rank is S4 (NatureServe 2007).
- Arizona heritage rank is S5 (NatureServe 2007).

1.9.11.2 General Description

The mojave green rattlesnake extends 24 to 51 inches (61 to 129.5 centimeters) in length (Stebbins 2003). The coloring of this snake is similar to a diamondback, with a body color ranging from yellowish-tan to light brown and dark diamond shaped markings extending along the entire length of the back. The tail of this species contains white and black bands. Light facial stripes run from in front of the eye to behind the eye, which contrast with the more darkly colored head (Stebbins 2003).

This species is nearly exclusively active at night, morning, and late afternoon (NatureServe 2007). This species is nocturnal in the summer months and commonly active in both the morning and late afternoon in the spring and fall (NatureServe 2007).

1.9.11.3 Distribution

Historic Distribution

The historic distribution of this species is unknown.

Current Distribution

The current range of the Mojave green rattlesnake extends from southern Nevada and southwestern Utah to the southern edge of the Mexican plateau in Puebla and adjacent Veracruz and from the western edge of the Mojave Desert in California to western Texas (Stebbins 2003, NatureServe 2007).

1.9.11.4 Habitat

The Mojave green rattlesnake inhabits valley flats; toe slopes, bottoms, and swales; gently sloping ridges and hills; and nearly level plateau or terraces that range in elevation from sea level to nearly 2,530 m (Stebbins 2003, Csuti and Crist 1998, NatureServe 2007). This species is primarily found in low desert scrub or barren desert, but can also be found in various other desert scrub, grassland, and riparian woodland vegetative communities (Csuti and Crist 1998, Stebbins 2003, UDWR 2005). In the United States, vegetation in most occupied areas include creosotebush, palo verde, mesquite, or cacti (UDWR 2005). Species refuges include animal burrows, spaces under or among rocks, or similar sites (NatureServe 2007). In the spring, the Mojave green rattlesnake commonly coils under a small tree or shrub in early morning (NatureServe 2007).

1.9.11.5 Life History

Reproductive Biology

The female Mojave green rattlesnake gives birth to up to 17 offspring between July to September (Stebbins 2003, NatureServe 2007).

Diet

The Mojave green rattlesnake primarily consumes small mammals (including kangaroo rats, mice, ground squirrels, rabbits, and hares), lizards, snakes, birds, and bird eggs (Stebbins 2003, NatureServe 2007). This species sometimes eats other snakes and spadefoot toads (NatureServe 2007).

Migration

This species does not migrate long distances or locally (NatureServe 2007).

1.9.11.6 Threats Warranting Protection

Declines in Mojave green rattlesnake populations are primarily attributed to habitat loss. In addition to habitat loss, some commercial collection may pose a threat to populations. A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

This species experiences habitat destruction and fragmentation from municipal and utility development (UDWR 2005).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

This species does experience some pressure from collection for human use (UDWR 2005).

Disease or Predation

Neither disease nor predation has been identified as a threat to the Mojave green rattlesnake’s population.

The Inadequacy of Existing Regulatory Mechanisms

The inadequacy of existing regulatory mechanisms has not been identified as a threat to the Mojave green rattlesnake’s population.

Other Natural or Manmade Factors Affecting the Species’ Continued Existence

No other natural or manmade factors have been identified as affecting the Mojave green rattlesnake’s continued existence.

1.9.11.7 Conservation

There are no known conservation measures in place for this species.

1.9.11.8 Species Status

Rangewide

The Mojave green rattlesnake population size and trends are unknown (UDWR 2005). This species is common in suitable habitat; therefore, the population is presumed to exceed 100,000 (NatureServe 2007). Over its entire range, the population is stable (±10 percent population fluctuation) in the short term and relatively stable (±25 percent population fluctuation) in the long term.

VRCMA Boundary

The status of the Mojave green rattlesnake within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.9.12 Sidewinder

Scientific Name: *Crotalus cerastes*

1.9.12.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Listed as a sensitive species by the State of Utah (UDWR 2006a).
- Global heritage rank is G5 (NatureServe 2007).
- Nevada heritage rank is S4 (NatureServe 2007).
- Arizona heritage rank is S5 (NatureServe 2007).

1.9.12.2 General Description

The sidewinder is a primarily nocturnal rattlesnake species (NatureServe 2007). This species is inactive in cold and hot temperatures and exhibits diurnal activity during the spring and fall. The sidewinder rarely reaches 24 inches (61 centimeters) in length (SDNHM 2007b). This species has a pale tan and pink body color with small, dark, square-shaped blotches that extend down the back. A horn-like protrusion extends over the eye, which is a unique feature. A dark stripe extends from the sidewinder mouth corner to the outer corner of the eye. The sidewinder has a specially adapted locomotion style to enable the species to efficiently move over soft sand.

1.9.12.3 Distribution

Historic Distribution

This species' historic range is unknown.

Current Distribution

The current sidewinder range extends from southeastern California to southern Nevada to southwest Utah into northeast Baja California to northwest Sonora and Isla Tiburon (Stebbins 2003).

1.9.12.4 Habitat

This species is found in sand hummocks topped with desert plants; windswept flats; barren dunes; hardpan; and rocky hillsides that contain sandy soil types and desert dune, scrub, and riparian woodland vegetative community types primarily containing creosotebush or mesquite (Csuti and Crist 1998, Stebbins 2003, UDWR 2005). In the Mojave Desert, snakes concentrate near washes where mammal burrows are common, though in other areas this snake has been found to be more common where vegetation is sparse (NatureServe 2007). During the daytime inactive period, individuals retreat into underground burrows of rodents or tortoises and under bushes. The elevation of the sidewinder ranges from below sea level in desert sinks to nearly 6,000 feet (1,830 meters) (Stebbins 2003), but a majority of individuals are located below 3,940 feet (1,200 meters) (NatureServe 2007).

1.9.12.5 Life History

Reproductive Biology

Sidewinder mating occurs in the spring and fall (NatureServe 2007). Females are viviparous and give birth to five to 18 young in July through November (Stebbins 2003, NatureServe 2007). The maximum lifespan is approximately 10 years (NatureServe 2007).

Diet

The sidewinder primarily consumes pocket mice, kangaroo rats, gophers, lizards, and occasionally bird nestlings (Stebbins 2003, NatureServe 2007).

Migration

This species migrates locally, but not over long distances (NatureServe 2007). During monitoring, the sidewinder traveled an average distance of 115 feet (35 meters) per day on 32 percent of the days monitored during their April to October active season (NatureServe 2007).

1.9.12.6 Threats Warranting Protection

Declines in sidewinder populations are attributed to habitat loss and fragmentation, and human disturbance. A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat fragmentation, destruction, and urban development all likely impact sidewinder populations (UDWR 2005).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

The threat of over-utilization is unknown.

Disease or Predation

Members of this population are likely taken by carnivorous animals (NatureServe 2007).

The Inadequacy of Existing Regulatory Mechanisms

The inadequacy of existing regulatory mechanisms has not been identified as a threat to the sidewinder's population.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

This species is often killed by roadway vehicles (NatureServe 2007). Further, human recreation often disturbs this species (UDWR 2005).

1.9.12.7 Conservation

There are no known conservation measures for this species.

1.9.12.8 Species Status

Rangewide

The population abundance for the sidewinder is unknown (UDWR 2005). This species is common in suitable habitat; therefore, the population is presumed to exceed 100,000 (NatureServe 2007). Over its entire range, the population is stable (±10 percent population fluctuation) in the short term and relatively stable (±25 percent population fluctuation) in the long term. Research needs to be completed to determine current populations and trends to enable adaptive management actions (UDWR 2005).

VRCMA Boundary

The status of the sidewinder within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.9.13 Sonoran Lyre Snake

Scientific Name: *Trimorphodon biscutatus lambda*

1.9.13.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Global heritage rank of G5T5 (NatureServe 2007).
- Arizona heritage rank of S5 (NatureServe 2007).
- Nevada heritage rank of S4 (NatureServe 2007).

1.9.13.2 General Description

The Sonoran lyre snake is a slender snake with a broad head that is well-differentiated from its slim neck. Color ranges from light brown to gray with darker brown or gray saddle shaped blotches with light centers on back; smaller dark blotches on sides and belly scales. A lyre-shaped marking is present on top of the head. The pupils are vertical. The underside is off-white or yellowish with dark spots. The anal plate is usually divided (Behler and King 1979). The lyre snake has large rear-fangs and is mildly venomous, but considered harmless to humans (Californiaherps.com 2007). This species is very secretive, mostly active at night, and will hiss and vibrate its rattle-less tail when annoyed.

1.9.13.3 Distribution

Historic Distribution

The Sonoran lyre snake is endemic to the Sonoran and eastern Mojave deserts in California, Nevada, Arizona, Utah, New Mexico and into northern Mexico (Californiaherps.com 2007).

Current Distribution

The current distribution is the same as the historic distribution (Californiaherps.com 2007).

1.9.13.4 Habitat

Habitat is predominately rocky areas of lowlands, canyons, mesas, and lower mountain slopes, including desert grassland, desert scrub, chaparral, pinyon-juniper and oak woodland, open coniferous forest, thornscrub, and thornforest. It is usually found in rocky upland situations and is found much less often in lowland desert that is lacking rocks (Stebbins 2003, as cited in NatureServe 2007). In daytime, individuals retreat to crevices or similar refuges. It can achieve lengths around 47.2 inches (120 centimeters) (Californiaherps.com 2007).

1.9.13.5 Life History

Reproductive Biology

Very little is known about Sonoran lyre snake reproduction. The lyre snake lays a clutch of about six to 20 eggs. One clutch was laid in a lab and required 79 days to incubate (Californiaherps.com 2007).

Diet

The diet of the Sonoran lyre snake is likely similar to other lyre snakes and consists primarily of lizards and sometimes small mammals, including bats, nestling birds and other snakes (Scott and McDiarmid 1984; 1992, as cited in NatureServe 2007).

Migration

Migration is not applicable for this species.

1.9.13.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Primary threats to the Sonoran lyre snake include habitat degradation and disturbance from human activities including development, roads, trails and off-highway vehicle use.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

In some areas, excessive collection for the pet trade has likely caused a reduction in abundance (NatureServe 2007).

Disease or Predation

The lyre snake is likely eaten by kingsnakes and other ophiophagous snakes, avian predators (roadrunners and owls) and mammalian predators. Nothing is known about disease, competition, or parasites (NatureServe 2007).

The Inadequacy of Existing Regulatory Mechanisms

The Sonoran lyre snake is not protected by state or federal laws.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

No other factors are known to affect the Sonoran lyre snake.

1.9.13.7 Conservation

The Sonoran lyre snake is covered in the Clark County MSHCP, which includes conservation actions to offset effects from covered activities (RECON 2000).

1.9.13.8 Species Status

Rangewide

Mostly stable throughout its range, the Sonoran lyre snake is vulnerable to human development and recreation use, as well as commercial collecting for the pet trade.

VRCMA Boundary

The status of the Sonoran lyre snake within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.9.14 Southern Desert Horned Lizard

Scientific Name: *Phrynosoma platyrhinos calidiarum*

1.9.14.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Evaluation species (High Priority) for the Clark County MSHCP (RECON 2000).
- Global heritage rank of G5T5 (NatureServe 2007).
- Arizona heritage rank of S5 (NatureServe 2007).

1.9.14.2 General Description

The southern desert horned lizard is a medium-sized, flat-bodied lizard with a wide, oval-shaped body and scattered enlarged pointed scales on the upper body and tail. The snout is blunt, and horns extend from the back of the head. On the sides of the body is one row of fringe scales (Californiaherps.com 2007). This species ranges from 2.5 to 3.75 inches (6.4 to 9.5 centimeters) in length from snout to vent (Stebbins 2003, as cited in Californiaherps.com 2007).

The color can be reddish, tan, dark gay, beige, brown, or even black, in areas with dark lava. The background coloring typically matches the local soil and rocks. The back of the body is marked with wavy dark blotches and two large, dark blotches mark the neck (Californiaherps.com 2007).

Females are larger than males. They have postanal scales, femoral pores, and a tail base that is wider. Juveniles are similar in appearance to adults (Californiaherps.com 2007).

1.9.14.3 Distribution

Historic Distribution

This subspecies occurs in the Colorado and Mojave deserts in California. Near the Nevada border, it intergrades with *P. p. platyrhinos* in the White-Inyo mountains (Macey and Pappenfuss 1991, as cited in Californiaherps.com 2007). It also occurs along the eastern side of Baja California, the eastern portion of Arizona, the extreme southern portion of Nevada, and the extreme southeast portion of Utah (Californiaherps.com 2007).

Current Distribution

The current distribution is the same as the historic distribution.

1.9.14.4 Habitat

This species occurs from sea level to 6,500 feet. (1,980 meters) (Stebbins 2003, as cited in Californiaherps.com 2007). It occupies arid lands such as sandy flats, the edges of sand dunes, alluvial fans, and dry washes. Plants with which the southern desert horned lizard is associated include creosotebush, saltbush, cacti, and other small shrubs (Californiaherps.com 2007).

1.9.14.5 Life History

Reproductive Biology

This species mates from April to May. During June and July, one to two clutches of two to 16 eggs are laid. Hatchlings typically appear from August to mid-September (Californiaherps.com 2007).

Diet

The diet of the southern desert horned lizard is primarily ants, as well as other small invertebrates and berries (Californiaherps.com 2007).

Migration

This species is not known to migrate.

1.9.14.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to the habitat of the southern desert horned lizard are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization is not known to be a threat for the southern desert horned lizard. However, this species is collected for use as pets (Californiaherps.com 2007).

Disease or Predation

These are not known to be threats for the southern desert horned lizard.

The Inadequacy of Existing Regulatory Mechanisms

This species is not listed as a threatened or endangered species list under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

No other factors are known to be threats for this species.

1.9.14.7 Conservation

The southern desert horned lizard is an Evaluation species of high priority in the Clark County MSHCP, which includes conservation actions to offset effects from covered activities (RECON 2000).

1.9.14.8 Species Status

Rangewide

Population trends are unknown (NatureServe 2007).

VRCMA Boundary

The status of the southern desert horned lizard within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.9.15 Southern Plateau Lizard

Scientific Name: *Sceloporus undulatus tristichus*

1.9.15.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Evaluation species (Low Priority) for the Clark County MSHCP (RECON 2000).
- Global heritage rank of G5T5 (NatureServe 2007).

1.9.15.2 General Description

The southern plateau lizard is a relatively small lizard (up to 3.1 inches [8 centimeters] from snout to vent) that is gray-brown to golden-brown in color. It has scales that are pointed, keeled, and overlapping. Males have two large, bright blue patches on their belly, which are typically edged with dark gray or black. Blue blotches also occur on the underside of the throat, one on each side. Females have faint or no belly patches. Gravid females can have an orange or yellow color on their back (Discover Life 2000).

1.9.15.3 Distribution

Historic Distribution

The southern plateau lizard is known to occur in New Mexico, Arizona, and southeastern Nevada (Leache and Reeder 2002, Kay and Bradley 1968). The eastern fence lizard, of which it is a subspecies, is widespread through the southern portion of the United States, including all of the southeast, southwest, Texas, and as far north as southern Ohio, South Dakota, and New Jersey (Leache and Reeder 2002).

Current Distribution

The current distribution is the same as the historic distribution.

1.9.15.4 Habitat

This species occurs in desert scrub, grassland, and conifer forest. It is present in low valleys, grassy plains, bajadas, foothills, rocky canyons, and forested slopes. The southern plateau lizard uses relatively open, sunlit areas for basking (Discover Life 2007).

1.9.15.5 Life History

Reproductive Biology

This species begins mating during spring. Mating continues into early summer. In late spring and summer, one to four clutches of eggs, ranging in size from one to ten eggs, are laid. Hatchlings emerge in June through September (Discover Life 2007).

Diet

The southern plateau lizard feeds on termites, ants, beetles, grasshoppers, flies, larvae, wasps, spiders, snails, and small lizards. It sits still and waits for its prey to wander nearby (Discover Life 2007).

Migration

This species is not known to migrate.

1.9.15.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to the habitat of the southern plateau lizard are unknown.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization is not known to be a threat for the southern plateau lizard.

Disease or Predation

These are not known to be threats for the southern plateau lizard.

The Inadequacy of Existing Regulatory Mechanisms

This species is not listed as a threatened or endangered species list under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

No other factors are known to be threats for this species.

1.9.15.7 Conservation

The southern plateau lizard is an Evaluation species of low priority in the Clark County MSHCP, which includes conservation actions to offset effects from covered activities (RECON 2000).

1.9.15.8 Species Status

Rangewide

Population trends are unknown (NatureServe 2007).

VRCMA Boundary

The status of the southern plateau lizard within the VRCMA Boundary is unknown, although potential habitat does occur there. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006). Specimens were collected from the Virgin Mountains of Nevada in 1966 (Kay and Bradley 1968).

1.9.16 Speckled Rattlesnake

Scientific Name: *Crotalus mitchellii*

1.9.16.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Global heritage rank is G5 (NatureServe 2007).
- Nevada heritage rank is S4 (NatureServe 2007).
- Arizona heritage rank is S5 (NatureServe 2007).

1.9.16.2 General Description

The adult speckled rattlesnake is typically 24 to 30 inches (61.0 to 76.2 centimeters) in length. The species' color varies, but matches the colors of rocks and soil in its habitat – orange or pink (SDNHM 2007c).

The speckled rattlesnake hibernates during cold winter months (November to March). It often hibernates in dens with other rattlesnakes (UDWR 2006b).

1.9.16.3 Distribution

Historical Distribution

The speckled rattlesnake occurs throughout the deserts of the southwestern United States and Baja California (Stebbins 2003). In the United States, its range encompasses southern California, southern Nevada, and western Arizona (Stebbins 2003).

Current Distribution

The current distribution of speckled rattlesnake is the same as the historic distribution (NatureServe 2007).

1.9.16.4 Habitat

Range-wide, this species occurs from sea level to 8,000 feet (2,438.4 meters) in elevation, in primarily rocky terrain on outcrops and boulders, but also in loose soil and sand (Stebbins 2003). In Clark County, this species is found in pinyon-juniper, sagebrush, Mojave Desert scrub, and blackbrush habitats (Clark County 2006a).

1.9.16.5 Life History

Reproductive Biology

During late summer or early fall, females birth four to eight live young (UDWR 2006b).

Diet

The speckled rattlesnake eats lizards, birds, and small mammals (UDWR 2006b).

Migration

This species does not migrate (NatureServe 2007).

1.9.16.6 Threats Warranting Protection

Threats to the speckled rattlesnake within the VRCMA Boundary include: habitat fragmentation from roads, trails, and urban and rural development; mortality from vehicular traffic on highways and unimproved roads; loss from collection by commercial collectors and hobbyists; and habitat modification and degradation due to concentrated recreation use (e.g., OHV events, equestrian trail rides, and parking for these events) (UDWR 2005). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat modification and fragmentation from roads, development, and recreation use are threats to the speckled rattlesnake (UDWR 2005).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Collection by hobbyists and commercial collectors threatens speckled rattlesnake populations (Clark County 2006a).

Disease or Predation

This threat is unknown for the speckled rattlesnake.

The Inadequacy of Existing Regulatory Mechanisms

This threat is unknown for the speckled rattlesnake.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

This threat is unknown for the speckled rattlesnake.

1.9.16.7 Conservation

No conservation activities are known for this species (SDNHM 2007c).

1.9.16.8 Species Status

Rangewide

The rangewide population size of the speckled rattlesnake likely exceeds 100,000 (NatureServe 2007).

VRCMA Boundary

The status of the speckled rattlesnake within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.9.17 Western Chuckwalla

Scientific Name: *Sauromalus obesus obesus*

1.9.17.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- BLM sensitive species in Arizona (BLM 2005).
- Global heritage rank is G5 (NatureServe 2007).
- Nevada heritage rank is S3 (NatureServe 2007).
- Arizona heritage rank is S4 (NatureServe 2007).

1.9.17.2 General Description

The western chuckwalla is a large, dark-bodied lizard. Adults have a total length of 11.0 to 16.5 inches (28 to 42 centimeters) (AGFD 2005m) and weigh up to two pounds (90 grams). It has loose folds of skin on its neck and side. It tail has a blunt tip and broad base. Its dorsum has small scales, while a rostral scale is absent. Young are cross-branded with brown and gray-brown on body and tail. The population within the VRCMA Boundary is tricolored with a black head and limbs, a yellowish-white tail, and orange saddles on its torso (AGFD 2005m).

1.9.17.3 Distribution

Historic Distribution

The historic distribution is unknown. It is expected that the historic range was similar to the current range.

Current Distribution

The chuckwalla occurs throughout the deserts of the southwestern U.S., western Mexico, and eastern Baja California (Stebbins 2003). In the U.S., this subspecies' range encompasses southeastern California, southern Nevada, western Arizona, and extreme southern Utah (Stebbins 2003; Hiatt and Boone 2004).

1.9.17.4 Habitat

The chuckwalla is herbivorous and typically found on rocky slopes and open flats in the vicinity of rock outcrops where creosote bush is present (NatureServe 2007). In Clark County, this species is found within Mojave Desert scrub, salt desert scrub, and mesquite/catclaw in areas with rocky cover or boulder outcrops where individuals can seek shelter in rock crevices (Clark County 2006a). Within the Spring Mountains NRA, therefore, it would be expected to be found within the Sonora Mojave Creosote bush-white Bursage Desert Scrub/Mixed Salt Desert Scrub and the Inter-Mountain Basins Semi-Desert Shrub Steppe, where it would be located specifically adjacent to and within rocky areas. Specific habitat and distribution information on the NRA has not been documented. Hiatt and Boone (2004) state, "In Clark County, Nevada, this species occurs on virtually all undisturbed rocky hillsides up to about 4,920 feet (1,500 meters) in elevation."

1.9.17.5 Life History

Reproductive Biology

Mating of the chuckwalla occurs from May to June. The chuckwalla lays one clutch of five to 16 eggs from June to August; the eggs are laid underground. Clutch size increases with the female body size. Females may only lay eggs every second year (AGFD 2005l).

Diet

Primarily herbivorous, it browses on leaves, buds, flowers, and fruit. They eat a variety of annuals, some perennials, and occasionally insects. Based on a recent study (Kwiatkowski and Sullivan 2002) in the Phoenix, Arizona area (Phoenix, Santan, and South mountains), the chuckwalla was observed feeding on eight perennial plant species, all of which exhibited a relatively patchy distribution. These included yellow palo verde (*Cercidium microphyllum*), desert globemallow (*Sphaeralcea ambigua*), American threefold (*Trixis californica*), desert sunflower (*Viguiera deltoidea*), ocotillo (*Fouquieria splendens*), desert lavender (*Hyptis emoryi*), and wolfberry (*Lycium* sp.). According to the researchers, no feedings were observed of the most abundant plant species that were found throughout the study sites (i.e., *Ambrosia deltoidea* and *Encelia farinosa*), suggesting that the chuckwalla is selective about what they consume (AGFD 2005l).

Migration

This species does not migrate (NatureServe 2007).

1.9.17.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to habitat and range include habitat fragmentation and habitat degradation (Clark County 2006a). The species is found primarily on rocky flats and outcrops, therefore, it is vulnerable to habitat fragmentation and mortality caused by roads and trails (Clark County 2006a).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization is not known to be a threat for this species.

Disease or Predation

It is unknown whether this is a threat to the chuckwalla.

The Inadequacy of Existing Regulatory Mechanisms

It is unknown whether this is a threat to the chuckwalla.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Other threats to the chuckwalla within Clark County include: indiscriminate recreational shooting, illegal collection (a major problem as this is a popular reptile for collection), and habitat degradation from OHV activities and destructive collection methods (Clark County 2006a).

1.9.17.7 Conservation

The western chuckwalla has been designated as a Covered species for the Clark County MSHCP (RECON 2000).

1.9.17.8 Species Status

Rangewide

Population status is unknown. Populations are decreasing due to pet trade demand (AGFD 2005m).

VRCMA Boundary

The status of the western chuckwalla within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.9.18 Western Leaf-nosed Snake

Scientific Name: *Phyllorhynchus decurtatus*

1.9.18.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Global heritage rank of G4 (NatureServe 2007).
- Nevada heritage rank of S4 (NatureServe 2007).
- Arizona heritage rank of S5 (NatureServe 2007).

1.9.18.2 General Description

The western leaf-nosed snake gained its name in reference to the rostral scale over the nose, which is enlarged and raised above the other scales. The scale looks like a leaf folded over the nose. These snakes are small, ranging in size from 12 to 20 inches (30 to 51 centimeters) in length. They are pale and the predominant colors are tan, pink or grayish with brown blotches along the back from the base of the head to the tail. The underside is white and unmarked (Californiaherps.com 2007).

The western leaf-nosed snake is active at night, and utilize their rostral scale to burrow through the sand in search of prey (Californiaherps.com 2007).

1.9.18.3 Distribution

Historic Distribution

The western leaf-nosed snake ranges from southern California, southern Nevada, southwestern Utah, central and western Arizona, and south into Baja California (Grismer 2002, as cited by NatureServe 2007).

Current Distribution

There appears to be no difference between the historic and current distribution of this species.

1.9.18.4 Habitat

This species can be found from below sea level up to about 4,000 feet (1,200 meters) and inhabits sandy or gravelly deserts – open flats, washes, alluvial fans, foothills. (Californiaherps.com 2007). In Clark County the western leaf-nosed snake is probably widespread (RECON 2000).

1.9.18.5 Life History

Reproductive Biology

Little is known of the reproductive biology of this species. However, in Stebbins (1985) reported that a clutch of two to four eggs is laid during June and July, and Goldberg (1996) recorded oviductal eggs in early to mid-July in Arizona (as cited by NatureServe 2007).

Diet

Both the adult and juvenile western leaf-nosed snake are carnivorious (NatureServe 2007). The primary prey items consist of small lizards (banded geckos) and lizard eggs (Californiaherps.com 2007).

Migration

This species is a non-migrant (NatureServe 2007).

1.9.18.6 Threats Warranting Protection

There are no species-specific threats related to the western leaf-nosed snake (RECON 2000), however threats to the habitat in which it lives may have an effect upon this species. These habitat threats include: reduction of populations of flora and fauna resulting from commercial collection, habitat modification and degradation and wildlife mortality from competitive OHV races, habitat fragmentation by urban/rural development, reduction of wildlife populations through highway mortality, and habitat fragmentation by roads and trails. A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA is described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to the western leaf-nosed snake include habitat modification, degradation, and fragmentation (RECON 2000).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

While the western leaf-nosed snake is not specifically mentioned, commercial collection may lead to a reduction of populations of fauna in Clark County (RECON 2000).

Disease or Predation

The western leaf-nosed snake is a likely prey item for larger predators such as owls, coyotes or other snakes.

The Inadequacy of Existing Regulatory Mechanisms

No management focuses on this species; however, within Clark County (RECON 2000) measures regarding commercial collection and roads should provide adequate.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

There are no other natural or manmade factors affecting the species continued existence.

1.9.18.7 Conservation

General ecosystem level conservation actions for Mojave desert scrub habitat, salt desert scrub habitat, and lizard and snakes which apply to the western leaf-nosed snake in Clark County, Nevada, include environmental education programs, livestock, wild horse and burro management, OHV management, road and trail consolidation, utility corridor consolidation and habitat protection for the desert tortoise (RECON 2000).

1.9.18.8 Species Status

Rangewide

The western leaf-nosed snake is considered a common species. The population is estimated to exceed 100,000 individuals (NatureServe 2007).

VRCMA Boundary

The status of the western leaf-nosed snake within the VRCMA Boundary is unknown, although potential habitat is present. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

1.9.19 Western Red-tailed Skink

Scientific Name: *Eumeces gilberti rubricaudatus*

1.9.19.1 Protection Warranted

Endangered Species Act

- Not listed or proposed as threatened or endangered, or a candidate for listing, under the Endangered Species Act of 1973, as amended.

Other Protections

- Covered species for the Clark County MSHCP (RECON 2000).
- Global heritage rank of G5T4Q (NatureServe 2007).
- Nevada heritage rank of S2S3 (NatureServe 2007).
- Arizona heritage rank of S3S4 (NatureServe 2007).

1.9.19.2 General Description

The western red-tailed skink is large with a heavy body, small head, thick neck, and small legs. It has a smooth, shiny body with cycloid scales. The tongue is forked and protrudes frequently. The long tail (up to two times the body length) easily detaches. It is 2.5 to 4.5 inches (6.3 to 11.4 centimeters) from snout to vent (Californiaherps.com 2007).

Adults are uniformly olive or light brown in color, with dark edging around the scales. Sometimes there is the appearance of faded light and dark stripes. These stripes fade with age. Older adults can develop an orange color (Californiaherps.com 2007).

Young have distinct light and dark stripes and a pink tail. The dark stripe on a young skinks' sides typically only extends to near the base of the tail (Californiaherps.com 2007).

1.9.19.3 Distribution

Historic Distribution

In California, this species occurs in the foothills and mid-elevations of the southern Sierra Nevada and South Coast ranges. Its range extends south into Baja California. Isolated populations occur east of the Sierra Nevadas, in montane locations in southern Nevada (Californiaherps.com 2007, RECON 2000).

Current Distribution

The current distribution is the same as the historic distribution (NatureServe 2007).

1.9.19.4 Habitat

Pinyon-juniper and riparian habitats, including canyon bottoms near water, are the most commonly used habitats of the western red-tailed skink (RECON 2000). The species prefers habitats where moisture is nearby (Californiaherps.com 2007). It also occurs in higher elevation habitats, including mixed conifer forest, sagebrush, blackbrush, mesquite/catclaw, desert riparian habitat in rocky areas, or where logs or leaf cover are proximate to permanent or intermittent streams (RECON 2000).

1.9.19.5 Life History

Reproductive Biology

A clutch of three to nine eggs is laid each summer (Californiaherps.com 2007).

Diet

This species feeds primarily on insects, spiders, and other invertebrates (RECON 2000, Californiaherps.com 2007).

Migration

This species is not known to migrate.

1.9.19.6 Threats Warranting Protection

A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats to the western red-tailed skink include habitat degradation from mining extraction, wood removal, and fire suppression and fuels management (RECON 2000).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Commercial collection is a threat to the western red-tailed skink (RECON 2000).

Disease or Predation

These are not known to be threats for the western red-tailed skink.

The Inadequacy of Existing Regulatory Mechanisms

This species is not listed as a threatened or endangered species list under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

No other factors are known to be threats for this species.

1.9.19.7 Conservation

The western red-tailed skink is a Covered species in the Clark County MSHCP, which includes conservation actions to offset effects from covered activities (RECON 2000).

1.9.19.8 Species Status

Rangewide

Population trends are unknown (RECON 2000).

VRCMA Boundary

The status of the western red-tailed skink within the VRCMA Boundary is unknown, although potential habitat does occur there. No occurrences have been recorded within the VRCMA Boundary by the Nevada Natural Heritage Program (NNHP 2006).

Chapter 2: Existing Information and Data Gaps

This chapter reviews existing information available for environmental conditions, special status species, and human use issues within the VRCMA Boundary. Existing information is described, and data gaps where information is insufficient in quality and/or quantity are identified.

The purpose of this chapter is to identify information that is lacking and how potential information deficiencies may influence the development of a conservation management assessment for the VRCMA Boundary. Specific areas where adequate information is not available are referred to as data gaps. Data gaps identified in this chapter are specific to the level of detail needed for development of this conservation management assessment.

Overall, data gaps for the Virgin River Conservation Management Assessment can be grouped into the following categories:

- Limited information on environmental attributes (e.g., coarseness of available GIS layers for species habitat modeling),
- Limited or no information on distribution of species (about 80% of the species),
- Limited or no information on life history of species (about 30% of the species),
- Limited or no information on habitat of species (about 20% of the species),
- Limited or no information on threats to species (about 50% of the species),
- Limited or no information on species protection and management (about 30% of the species), and
- Limited information on human use issues (e.g., lack of information on recreational use in the VRCMA Boundary and gaps on assessing effects on species without monitoring and/or knowledge of species' habitat and life history).

2.1 EXISTING ENVIRONMENT

Table 2-1 summarizes the existing information and data gaps associated with environmental attributes in the VRCMA Boundary.

Environmental attributes are often used in deriving expert-based, non-statistical species-habitat models and data-derived, statistical species-habitat models to assess potential habitat. Environmental attributes that can be used to develop species-habitat models include information such as elevation, vegetation, and soil type. Table 2-1 also lists environmental information useful for development of species-habitat models and notes whether the available information in the VRCMA Boundary is adequate for their development.

How useful the various data types are for creating species-habitat models can depend on the scale of the dataset (detailed or coarse) and whether the data are available for the full project area in a seamless extent. In the VRCMA Boundary, vegetation datasets available from the Southwestern Regional Gap Analysis Project (SWReGAP) are seamless for the area, but are derived from 30-meter satellite imagery and are therefore considered relatively coarse. This imagery does not differentiate vegetation types that occur in areas smaller than a 900 m^2 block. As a result, the level of accuracy of the species-habitat models derived using this dataset will be lower than if a more detailed vegetation dataset were available for the entire VRCMA Boundary. Available soils data are either coarse or not uniform, which limits the accuracy of the models as well. For the more detailed soil data, joining the various soil surveys into a single GIS layer for the entire VRCMA Boundary is difficult due to different soil type names and the potential for non-matching edges between any two digital soil surveys. Appendix A lists all known available land cover type descriptions for the VRCMA Boundary that would be useful to this conservation management assessment.

Table 2-1 Existing Information for Environmental Conditions in the VRCMA Boundary

Topic	Existing Information	Data Gaps	Suitable Information Available for Species Habitat Modeling
Natural Environment			
Climate	Climate data for specific locations are available from Oregon Climate Service, Western Regional Climate Center, National Weather Service, also Community Environmental Monitoring Program Network (25 stations in southern Nevada and southwestern Utah), KUTV2 weatherNET in Salt Lake City, Nevada Department of Transportation (NDOT) Road Weather Information System, Clark County ALERT Weather Station Network (25 stations operated by Clark County Regional Flood Control District). PRISM modeling is also available, which interpolates precipitation and temperature patterns across the landscape.	None for this level of assessment	Climate data are generally not used for species-habitat modeling.
Other Wildlife	Nevada Department of Wildlife (NDOW) and Arizona Game and Fish Department (AGFD) each have a wildlife action plan for the state. A Partners in Flight plan (priority bird species) is available for each state as well. NDOW offers an interactive map on its website for locations and distribution of big horn sheep, elk, mule deer, pronghorn antelope, and sage grouse. Only bighorn sheep occurs in the VRCMA Boundary. UDWR also offers an interactive map of game species' distributions; of the species included, only mule deer occurs in the VRCMA Boundary. AGFD does not offer such an interactive map, although distribution data of game species are available by contacting them. Wildlife fact sheets are available from NDOW.	None for this level of assessment	Yes.
Vegetation/Land Cover	Information on vegetation that uniformly covers the VRCMA Boundary is available from the National Land Cover Database (NLCD) (2001, 30 meter raster data) and the Southwestern Regional Gap Analysis Project (SWReGAP) (1999-2001, these data are not intended to be used at scales larger than 1:100,000). For the SWReGAP, land cover imagery has been classified into ecological systems. Vegetation GIS layers are also available from GIS clearinghouses for each state; however, these may not be consistent with each other in terms of vegetation types. These GIS datasets are derived from LANDSAT satellite imagery at coarse scales.	None for this level of assessment	Coarse scale of vegetation GIS layers may be insufficient to accurately map potential habitat of species at the scale of the VRCMA Boundary as these layers, including the SWReGAP data, were created at coarser scales.
Geology	Information on surficial geology available from SWReGAP, which covers the entire VRCMA Boundary. Bedrock geology maps are also available for each state.	None for this level of assessment	Yes.
Soils	SSURGO soil data are available from NRCS's website for the entire VRCMA Boundary. Multiple soil surveys have been completed within the watershed, which results in different map unit names identified for similar or the same soil types. The U.S. General Soils Map (STATSGO), a more generalized soil layer, offers a uniform soil GIS layer for the VRCMA Boundary, but at a coarser scale.	None for this level of assessment	There may be difficulty in edge-matching multiple SSURGO surveys. STATSGO data are too general for this purpose.
Elevation	The National Elevation Dataset (NED) provides a seamless digital elevation model (DEM) at the 1:24,000 scale. Contours can be derived from this dataset and are also available as digital line graphs from USGS 1:24,000 topographic maps.	None	Yes.
Human Environment			
Existing Land and Resource Management	SWReGAP land ownership GIS layer and parcel-level GIS data from Clark County, City of Mesquite, and Mohave County	None for this level of assessment	Not applicable.
Land Use Designations	Available from City of Mesquite Land Use Element, Land Use Plan for Northeast Clark County, General Plan for Mohave County, Resource Management Plans for the BLM's Arizona Strip and Las Vegas Field Offices, Lake Mead General Management Plan and General Management Plan Amendment	None for this level of assessment	Not applicable.

2.2 SPECIAL STATUS SPECIES

2.2.1 Identification of Species Included in the Virgin River Conservation Management Assessment

A list of special status species (Table 2-2) occurring in the VRCMA Boundary for inclusion in this conservation management assessment was derived using established lists developed by the Clark County Multiple Species Habitat Conservation Plan (Covered, Evaluation, and Watch List taxa) and Nevada Natural Heritage Program (at-risk and watch list taxa for Clark County, Nevada). If the range of the species on either of these lists was included the VRCMA Boundary and potential habitat for the species occurred within the VRCMA Boundary, then the species was added to the special status species list for this conservation management assessment. In total, 108 species are addressed in this document, including 72 wildlife species (1 amphibian, 28 birds, 24 mammals, and 19 reptiles) and 36 plants.

In Table 2-2, several status and protection levels are identified for each species (i.e., federal ESA, critical habitat, state of Nevada, state of Arizona, BLM sensitive species, and global and state ranks). For federally-listed species, critical habitat may or may not be identified. Critical habitat is defined as "(1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation (NMFS 2007)." State and global conservation rankings are defined according to NatureServe (NatureServe 2007a).

Table 2-2 Special Status Species Addressed in the Virgin River Conservation Management Assessment

Species			Status and Protection Levels					
Taxon	Common Name	Scientific Name	Federal ESA[a]	Critical Habitat	State of Nevada[b]	State of Arizona[c]	BLM Sensitive Species	Global and State Ranking[d]
amphibian	Pacific tree frog	*Hyla regilla*						G5/S2 (AZ), S5 (NV)
bird	American peregrine falcon	*Falco peregrinus anatum*			Yes	WSC	Yes	G4T4/S4(AZ), S2 (NV)
bird	bald eagle	*Haliaeetus leucocephalus*			Yes			G5/S2S3, S4N (AZ), S1B, S3N (NV)
bird	Bendire's thrasher	*Toxostoma bendirei*					Yes	G4/S4 (AZ), S1 (AZ)
bird	black-chinned sparrow	*Spizella atrogularis*			Yes			G5/S5 (AZ), S3B (NV)
bird	blue grosbeak	*Guiraca caerulea*						G5/S5 (AZ), S3B (NV)
bird	Brewer's sparrow	*Spizella breweri*			Yes			G5/S5 (AZ), S4B (NV)
bird	cactus wren	*Campylorhynchus brunneicapillus*						G5/S5 (AZ), S4 (NV)
bird	crissal thrasher	*Toxostoma crissale*			Yes		Yes	G5/S5 (AZ), S3 (NV)
bird	ferruginous hawk	*Buteo regalis*			Yes		Yes	G4/S3 (NV)
bird	flammulated owl	*Otus flammeolus*			Yes		Yes	G4/S4?B (NV)
bird	golden eagle	*Aquila chrysaetos*			Yes		Yes	G5/S4 (AZ), S4 (NV)
bird	gray vireo	*Vireo vicinior*			Yes		Yes	G4/S4 (AZ), S3B (NV)
bird	Le Conte's thrasher	*Toxostoma lecontei*			Yes		Yes	G3/S3 (AZ), S2 (NV)
bird	loggerhead shrike	*Lanius ludovicianus*			Yes		Yes	G4/S4 (AZ), S4 (NV)
bird	long-eared owl	*Asio otus*			Yes		Yes	G4/S2B, S3S4N (AZ), S4 (NV)
bird	Lucy's warbler	*Vermivora luciae*			Yes		Yes	G5/S5 (AZ), S2S3B (NV)
bird	northern goshawk	*Accipiter gentilis*						G5/ S3 (AZ), S2 (NV)
bird	northern saw-whet owl	*Aegolius acadicus*						G5/ S4 (AZ), S4 (NV)
bird	phainopepla	*Phainopepla nitens*			Yes		Yes	G5/S2B (NV)
bird	pinyon jay	*Gymnorhinus cyanocephalus*			Yes		Yes	G5/S5 (AZ), S3S4 (NV)
bird	prairie falcon	*Falco mexicanus*			Yes		Yes	G5/S4 (AZ), S4 (NV)
bird	Scott's oriole	*Icterus parisorum*						G5/S5 (AZ), S4B (NV)
bird	summer tanager	*Piranga rubra*						G5/S4 (AZ), S2B (NV)

Table 2-2 Special Status Species Addressed in the Virgin River Conservation Management Assessment

Species			Status and Protection Levels					
Taxon	Common Name	Scientific Name	Federal ESA[a]	Critical Habitat	State of Nevada[b]	State of Arizona[c]	BLM Sensitive Species	Global and State Ranking[d]
bird	vesper sparrow	*Pooecetes gramineus*					Yes	G5/S5 (AZ), S4B (NV)
bird	western bluebird	*Sialia mexicana*						G5/S5 (AZ), S3 (NV)
bird	western burrowing owl	*Athene cunicularia*			Yes		Yes (AZ and NV)	G4T4/S3B (NV)
bird	western screech owl	*Otus kennicotti*						G5/S5 (AZ), S4 (NV)
bird	yellow-breasted chat	*Icteria virens*			Yes		Yes	G5/S4 (AZ), S3B (NV)
mammal	Allen's big-eared bat	*Idionycteris phyllotis*					Yes (AZ and NV)	G2G3/S2S3 (AZ), S1 (NV)
mammal	big free-tailed bat	*Nyctinomops macrotis*					Yes (AZ and NV)	G5/S3(AZ), S1N (NV)
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*			Yes		Yes	G5/S3S4 (AZ), S3S4 (NV)
mammal	California leaf-nosed bat	*Macrotus californicus*				WSC	Yes	G4/S3(AZ), S2 (NV)
mammal	California myotis	*Myotis californicus*					Yes	G5/S3B (NV)
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*					Yes	G4T4/S3S4(AZ), S4 (NV)
mammal	desert kangaroo rat	*Dipodomys deserti*						G5/S5(AZ), S2S3 (NV)
mammal	desert pocket mouse	*Chaetodipus penicillatus*						G5/S5 (AZ), S1S2 (NV)
mammal	fringed myotis	*Myotis thysanodes*					Yes (AZ and NV)	G4G5/S2B (NV)
mammal	greater western mastiff bat	*Eumops perotis californicus*					Yes	T4G5/S1 (NV)
mammal	hoary bat	*Lasiurus cinereus*					Yes	G5/S4 (AZ), S3 (NV)
mammal	kit fox	*Vulpes macrotis*						G4/S4(AZ), S3 (NV)
mammal	little brown myotis	*Myotis lucifugus*					Yes	G5/S1S2 (NV)
mammal	long-eared myotis	*Myotis evotis*			Yes		Yes (AZ and NV)	G5/S3S4 (AZ), S4 (NV)
mammal	long-legged myotis	*Myotis volans*					Yes (AZ and NV)	G5/S3S4 (AZ), S4 (NV)
mammal	Merriam's shrew	*Sorex merriami*						G5/S3(AZ), S3 (NV)
mammal	pallid bat	*Antrozous pallidus*			Yes		NC	G5/S4S5 (AZ), S3 (NV)
mammal	silver-haired bat	*Lasionycteris noctivagans*					Yes	G5/S3S4 (AZ), S3 (NV)
mammal	spotted bat	*Euderma maculatum*			Yes		Yes	G4/S1S2 (AZ), S2 (NV)
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*					Yes	G4/S3B (NV)
mammal	western pipistrelle	*Pipistrellus hesperus*					Yes	G5/S5 (AZ), S4 (NV)
mammal	western small-footed myotis	*Myotis ciliolabrum*					Yes	G5/S3B (NV)
mammal	western red bat	*Lasiurus blossevillii*			Yes		Yes	G5/S2 (AZ), S1 (NV)
mammal	Yuma myotis	*Myotis yumanensis*						G5/S3S4 (AZ)
plant	alpine stinking lomatium	*Lomatium graveolens* var. *alpinum*						G5?T3?/S2S3 (NV)
plant	Antelope Canyon goldenbush	*Ericameria cervina*						G3?/S1(NV)
plant	Aven Nelson's phacelia	*Phacelia anelsonii*						G2G3/S1S2 (NV)
plant	barrel cactus	*Ferocactus acanthoides* var. *lecontei*			CY	SR		G5T4?Q/ S3 (AZ), NV (S4)
plant	Beaver Dam scurf pea	*Pediomelum castoreum*						G3/S1 (AZ)
plant	catchfly gentian	*Eustoma exaltatum*					Yes	G4G5/SNR (AZ), S1 (NV)
plant	chalk liveforever	*Dudleya pulverulenta*						G4G5/SNR (AZ), S3(NV)
plant	Clark Mountain agave	*Agave utahensis* var. *nevadensis*						G4T3Q/S3 (NV)
plant	Clarke phacelia	*Phacelia filiae*					Yes	G2/S2 (NV)

Table 2-2 Special Status Species Addressed in the Virgin River Conservation Management Assessment

Species			Status and Protection Levels					
Taxon	Common Name	Scientific Name	Federal ESA[a]	Critical Habitat	State of Nevada[b]	State of Arizona[c]	BLM Sensitive Species	Global and State Ranking[d]
plant	Clokey fleabane	*Erigeron clokeyi*						G4G5/S4 (NV)
plant	Clokey pincushion	*Coryphantha vivipara* ssp. *rosea*						G3/S3 (AZ), S3 (NV)
plant	crossidium moss	*Crossidium seriatum*						G2/S2 (NV)
plant	dune linanthus	*Linanthus arenicola*						G3G4/S3 (NV)
plant	dune sunflower	*Helianthus deserticola*						
plant	fissidens sublimbatus	*Fissidens sublimbatus*						G2G4
plant	forked (Pahrump Valley) buckwheat	*Eriogonum bifurcatum*						G2/S2 (NV)
plant	Las Vegas bearpoppy	*Arctomecon californica*			CE	SR	Yes	G3/ S2 (AZ,) S3 (NV)
plant	Las Vegas buckwheat	*Eriogonum corymbosum nilesii*	C	none			Yes	G5T2T3/S2 (NV)
plant	Littlefield milkvetch	*Astragalus preussii* var. *laxiflorus*						G4T2T3/S1 (AZ), S1S2 (NV)
plant	Mokiak milkvetch	*Astragalus mokiacensis*					Yes	G2G3Q/S1S2 (NV)
plant	Nevada didymodon	*Didymodon nevadensis*					Yes	G2G3/S1 (NV)
plant	Nevada willowherb	*Epilobium nevadense*					Yes	G2/S2 (NV)
plant	Nye milkvetch	*Astragalus nyensis*						G3/S3 (NV)
plant	rayless tansy aster	*Machaeranthera grindelioides* var. *depressa*						G5T3T4, S3 (NV), S1 (AZ)
plant	rock phacelia	*Phacelia petrosa*					Yes	G3G4/SNR (AZ), S2 (NV)
plant	rosy twotone beardtongue	*Penstemon bicolor* ssp. *roseus*					Yes	G3T3Q/S2 (AZ), S3 (NV)
plant	Shockley rockcress	*Arabis shockleyi*						G3/S3 (NV)
plant	silverleaf sunray	*Enceliopsis argophylla*					Yes (AZ and NV)	G2G3/S2 (AZ), S1? (NV)
plant	splachnobryum obtusum	*Splachnobryum obtusum*						G5
plant	sticky buckwheat	*Eriogonum viscidulum*			CE		Yes	G2/S2 (AZ), S2(NV)
plant	sticky ringstem	*Anulocaulis leisolenus*					Yes	G4/S3 (AZ), S2 (NV)
plant	straw milkvetch	*Astragalus lentiginosus* var. *stramineus*						T2T3G5/S1S2 (NV)
plant	syntrichia princeps	*Syntrichia princeps*						
plant	threecorner milkvetch	*Astragalus geyeri* var. *triquetrus*			CE		Yes (AZ and NV)	G4T2T3/S2S3(NV)
plant	trichostomum moss	*Trichostomum sweetii*						G2?/S1 (NV)
plant	white bearpoppy	*Arctomecon merriamii*					Yes	G3/S3 (NV)
reptile	banded gecko	*Coleonyx variegatus*						G5/S5 (AZ), S4 (NV)
reptile	banded Gila monster	*Heloderma suspectum cinctum*			Yes		Yes (AZ and NV)	G4T4/S4(AZ), S2 (NV)
reptile	California (common) king snake	*Lampropeltis getulus californiae*						G5T5/S5 (AZ), S4 (NV)
reptile	common zebra-tailed lizard	*Callisaurus draconoides*						G5/S5 (AZ), S5 (NV)
reptile	desert iguana	*Dipsosaurus dorsalis*						G5/S5 (AZ), S3 (NV)
reptile	desert night lizard	*Xantusia vigilis*						G5/S4(AZ), S4(NV)
reptile	Mojave desert tortoise	*Gopherus agassizii* (Mojave Population)	LT	Yes	Yes	WSC	Yes	G4T3Q/S2 (AZ) S2S3 (NV)
reptile	glossy snake	*Arizona elegans*						G5/S5 (AZ), S4 (NV)
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*						G5/S3? (AZ), S4 (NV)
reptile	large-spotted leopard lizard	*Gambelia wislizenii wislizenii*						G5/AZ (S5), NV (S4)
reptile	Mojave green rattlesnake	*Crotalus scutulatus scutulatus*						G5/S5(AZ), S4(NV)
reptile	sidewinder	*Crotalus cerastes*						G5/S5(AZ), S4(NV)

Table 2-2 Special Status Species Addressed in the Virgin River Conservation Management Assessment

Species			Status and Protection Levels					
Taxon	Common Name	Scientific Name	Federal ESA[a]	Critical Habitat	State of Nevada[b]	State of Arizona[c]	BLM Sensitive Species	Global and State Ranking[d]
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*						G5T5/S5 (AZ), S4 (NV)
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*						G5T5/S5 (AZ)
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*						G5T5
reptile	speckled rattlesnake	*Crotalus mitchellii*						G5/S5(AZ), S4(NV)
reptile	western chuckwalla	*Sauromalus obesus*					Yes (AZ and NV)	G5/S4(AZ), S3(NV)
reptile	western leaf-nosed snake	*Phyllorhynchus decurtatus*						G5/S5 (AZ), S4 (NV)
reptile	western red-tailed skink	*Eumeces gilberti rubricaudatus*						G5T4Q/S3S4 (AZ), S2S3 (NV)

[a]LE = Federally endangered, LT = Federally threatened, C = candidate species
[b]CE=critically endangered, CY = Protected as a cactus, yucca, or Christmas tree (N.R.S. 527.060-.120)
[c]WSC = wildlife species of concern, Arizona Native Plant Law: HS = highly safeguarded, no collection allowed; SR = salvage restricted: collection only with permit
[d]G= global rank, T = infraspecific taxon rank, S = state rank, 1 = critically imperiled, 2 = imperiled, 3 = vulnerable, 4 = apparently secure, 5 = secure (Nature Serve 2007)

2.2.2 Analysis of Existing Information and Identification of Data Gaps

In this section, status, distribution, habitat, life history, and threats are evaluated. Data gaps are identified. Once data gaps are identified, they can be assessed to determine whether or not additional information is needed for immediate or long-term implementation of the VRCMA. Short-term and long-term needs have also been identified to determine how best to fill in the data gaps. In Appendix C, data gaps are listed for each species, and short-term and long-term tasks for obtaining the necessary information to fill in these data gaps are described. Data gaps were identified if after reviewing available literature, data gaps were identified in the literature or the literature sources did not provide a particular set of information (i.e., known threats to a particular species).

2.2.3 Special Species Status

Of those species considered in this conservation management assessment (36 plants, 19 reptiles, 1 amphibian, 28 birds, and 24 mammals), only one species, desert tortoise, is federally listed under ESA. This species is listed as threatened and critical habitat has been designated. Of the 108 species considered in this conservation management assessment, 14 are considered critically imperiled (according to the states' Natural Heritage programs) within Clark County, Nevada.

2.2.4 Population Status and Distribution

Species are located in various areas of the VRCMA Boundary. Their distribution depends upon vegetation, elevation, and other characteristics.

2.2.4.1 Existing Information

Information about population status and distribution can be obtained from the following documents:

- Southwestern Regional GAP analysis wildlife-habitat models for vertebrate species (SWReGAP 2005);
- Desert Tortoise (Mojave Population) Recovery Plan (USFWS 1994);
- Element occurrence data (point data) for the Nevada portion of the VRCMA Boundary from Nevada Natural Heritage Program (NNHP 2006); and
- NatureServe Explorer website, which identifies which watersheds species may occur in (NatureServe 2007b).

2.2.4.2 Data Gaps

Surveys and knowledge about the extent and status of species within the VRCMA Boundary are either lacking or incomplete for the majority of species (about 80% of the species). As a result, the distributions of these species are not well understood. The desert tortoise has more available information and is a better studied species, likely due to its federal status under ESA and designation of critical habitat.

Overall populations are reported as declining for desert tortoise and loggerhead shrike; all other species have unknown population trends or, for three bat species, winter populations are not well understood.

2.2.5 Habitat

Habitats in the VRCMA Boundary can vary greatly in vegetation, elevation, and soils. Vegetation communities include Mojave desert scrub (most common), desert washes, mesquite/catclaw forest, oak woodlands, pinyon juniper, and high elevation evergreen forests.

2.2.5.1 Existing Information

Information about habitat can be obtained from the following documents:

- Southwestern Regional GAP analysis wildlife-habitat models for vertebrate species (SWReGAP 2005),
- Desert Tortoise (Mojave Population) Recovery Plan (USFWS 1994);
- Nevada Rare Plant Atlas (NNHP 2001), for plant species; and
- Arizona Game and Fish Department fact sheets for individual species (AGFD 2007).

2.2.5.2 Data Gaps

Overall, general habitat characteristics for species are known, except for straw milkvetch, about which no habitat characteristics are available. Roost sites for bats such as Townsend's big eared bat are also not well understood.

2.2.6 Life History

2.2.6.1 Existing Information

Information about life history can be obtained from the following documents:

- Desert Tortoise (Mojave Population) Recovery Plan (USFWS 1994);
- Nevada Rare Plant Atlas (NNHP 2001), for plant species; and
- Arizona Game and Fish Department fact sheets for individual species (AGFD 2008).

2.2.6.2 Data Gaps

Life histories are generally well understood for the majority of wildlife species in this category. Limited information was available about a particular aspect of life history for birds, mammals and plants. No life history information is available for two plant species (straw milkvetch and syntrichia princeps).

2.2.7 Ongoing Species Protection and Management

2.2.7.1 Existing Information

Information on management activities can be found in the following documents:

- Clark County Multiple Species Habitat Conservation Plan (RECON 2000);
- Desert Tortoise (Mojave Population) Recovery Plan (USFWS 1994);
- NDOW Wildlife Action Plan (2006); and

- AGFD Arizona's Comprehensive Wildlife Conservation Strategy: 2005-2015 (2006).

2.2.7.2 Data Gaps

For non-federally listed species not addressed in the Clark County MSHCP or the states' wildlife action plans, species protection and management activities are unknown.

2.2.8 Threats

2.2.8.1 Existing Information

Information about threats can be obtained from the following documents:

- Listing documents for desert tortoise (55 FR 12178 12191),
- Desert Tortoise (Mojave Population) Recovery Plan (USFWS 1994),
- NDOW Wildlife Action Plan (2006),
- AGFD Arizona's Comprehensive Wildlife Conservation Strategy: 2005-2015 (2006), and
- Arizona Game and Fish Department fact sheets for individual species (AGFD 2008).

2.2.8.2 Data Gaps

Data gaps for threats to species within the VRCMA Boundary include:

- Threats to 27 species of plants, Bendire's thrasher, western screech owl, ferruginous hawk, northern goshawk, desert pocket mouse, and Brazilian free-tailed;
- Threats to blue grosbeak south of the United States; and
- Unknown responses to collection pressure for the large-spotted leopard lizard.

2.3 HUMAN USE ISSUES

This section identifies potential conflicts between human use and special status species in the VRCMA Boundary. In this section, a determination of whether sufficient information exists to be able to fully analyze the effects these conflicts can have on special status species is made, and data gaps where sufficient information is not available are identified.

2.3.1 Hunting

Hunting for game birds and mammals occurs within the VRCMA Boundary, as allowed (permitted) by NDOW and AGFD. Hunting could adversely affect other wildlife through stress from noise and increased human occurrences in isolated habitats. Special status species addressed in this VRCMA would be too small to be mistaken for large game mammals. Special status bird species included in this conservation management assessment do not include species similar in appearance to geese, ducks, or other game birds; therefore, they are unlikely to be affected by game bird hunting in the VRCMA Boundary.

2.3.1.1 Data Gaps

- Studies of stress from noise and hunting on species within the VRCMA Boundary are not available. Such studies are available for other species in other areas, however, and inferences can be made.

2.3.2 Development

Development pressures in the VRCMA Boundary are primarily focused around the city of Mesquite, which is adjacent to both sides of the Lower Virgin River. No development is occurring within the floodplain within the city of Mesquite.

Development activities could result in direct loss of habitat, habitat fragmentation, and increased road mortality for species. The extent of development can be readily mapped using parcel maps, aerial photographs, and/or satellite imagery.

2.3.2.1 Data Gaps

- Unless appropriate monitoring is in place prior to development activities, an assessment of effects on species is not possible.
- For species about which distribution, habitat, and/or life history is lacking, appropriate monitoring may be unable to be identified and assessments of effect may not be possible.
- Knowledge of effects from road mortality is not available for all species.

2.3.3 Agriculture and Grazing

Agricultural lands, although not natural habitats, can provide habitats for some species, including the burrowing owl. Depending upon tilling and mowing cycles, species may or may not be affected by agricultural practices. Agricultural practices for an area can generally be obtained through discussion with the Natural Resource Conservation Service (NRCS).

2.3.3.1 Data Gaps

- Water quality monitoring for contaminants potentially from agricultural areas, such as chemical pesticides and fertilizers is a data gap.
- For species about which distribution, habitat, and/or life history is lacking, appropriate monitoring may be unable to be identified and assessments of effect may not be possible.
- Knowledge of agricultural practices and their effects on particular life history traits of special status species is unknown.

2.3.4 Recreation

Recreation occurs along the Lower Virgin River through use of nearby trails. The potential for conflict is likely to be low from passive recreation activities such as bird watching and hiking. The potential for conflict from motorized recreation may be high, depending upon the species.

Passive recreation and motorized recreation are human activities that have the potential to be in conflict with special status species. Current recreation levels and locations within the entire VRCMA Boundary are unknown.

2.3.4.1 Data Gaps

- Current recreation levels and locations within the entire VRCMA Boundary are unknown. This is a data gap in that it limits the ability to accurately assess the potential for conflict between species and nonmotorized and motorized recreationists.
- For species about which distribution, habitat, and/or life history is lacking, assessments of effect may not be possible.

2.3.5 Roads

Roads can serve as barriers to dispersal and/or fragment habitat for many species. Mortality from roads can also occur. No current data on road mortality exist within the VRCMA Boundary, but this could be estimated from road mortality numbers in other areas. This type of data may not exist for all species in which road mortality is a known threat.

2.3.5.1 Data Gaps

- For species about which distribution, habitat, and/or life history is lacking, assessments of effect may not be possible.

2.3.6 Mining

Mining, primarily for sand and gravel, occurs on dry wash and other areas of the VRCMA Boundary. For species, mining for sand and gravel can affect habitat for several species, such as plants dependent upon sandy soils. Abandoned mine activities can affect bat species.

2.3.6.1 Data Gaps

- Unless appropriate monitoring (e.g., monitoring turbidity, sediment discharge, changes in flow levels) is in place prior to development activities, an assessment of effects on species may not be possible.
- For species about which distribution, habitat, and/or life history is lacking, appropriate monitoring may not be able to be developed and assessments of effect may not be possible.
- It is unknown whether bat species use abandoned mines in the VRCMA Boundary.

Chapter 3: Conservation Objectives

3.1 INTRODUCTION

This chapter establishes conservation goals and objectives for the Virgin River Conservation Management Assessment. General objectives, which apply to all habitats in the VRCMA Boundary, are presented in Section 3.2. To develop objectives necessary to address effects from human activities in the VRCMA Boundary, an effects analysis on hunting, development, recreation, agriculture and grazing, roads, and mining was conducted. The analysis of these specific actions is presented in Section 3.3. Following this analysis are specific objectives by habitat type for these human activities in Section 3.4. The VRCMA Boundary encompasses lands in both Clark County, Nevada and a small portion of Arizona. Only the conservation objectives defined for Nevada lands are the responsibility of Clark County under the VRCMA. Conservation objectives defined for lands in Arizona are suggested here.

Both the general and activity-specific objectives have been used to develop conservation actions, which are presented in the next chapter, Chapter 4: Conservation Actions. Some conservation actions developed are not specific to effects of human activities in the VRCMA Boundary, but rather, are concerned with overall viability of special status species' populations.

For the purposes of conducting the effects analysis and developing objectives, the 42 Southwestern Regional GAP Ecological System types present in the VRCMA Boundary were grouped into simplified habitats for how the 42 Ecological System types were grouped). These simplified habitats are as follows:

- Cliffs and canyon
- Low vegetation desert
- Forest/woodland
- Shrubland
- Scrub
- Agriculture
- Developed

Table 3-1 presents the extent and percentage of each of these simplified habitat types. Because special status species occur within modified habitats (agriculture and developed) within the VRCMA Boundary, these habitats, in addition to unmodified habitats, have been included in this document. Developing conservation objectives and actions that address management of these habitats will assist in protecting the special status species that, in part, use these habitats.

3.2 GENERAL OBJECTIVES OF THE VIRGIN RIVER CONSERVATION MANAGEMENT ASSESSMENT

The purpose of identifying conservation objectives is to identify general objectives from which to derive conservation actions to put into practice. Overall objectives for this Virgin River Conservation Management Assessment include:

- **Objective 1:** Promoting efforts in the VRCMA Boundary that will lead to the recovery and delisting of federally threatened and endangered species that occur or have the potential to occur in the VRCMA Boundary (See Table 2-2 in Chapter 2: Existing Information and Data Gaps).

Table 3-1 Acres of Each Ecological System Occurring within the VRCMA Boundary (USGS 2004)

Simplified Habitat Type	SWReGAP Land Cover Type	Nevada Portion (acres)	Arizona Portion (acres)	All Lands in VRCMA Boundary (acres)
Agriculture	Agriculture	814.6	181.3	995.9
Cliffs and Canyon	Colorado Plateau Mixed Bedrock Canyon and Tableland	27.6	0	27.6
	North American Warm Desert Bedrock Cliff and Outcrop	1,940.80	103.8	2,044.50
Developed	Developed, Medium - High Intensity	381.8	292.9	674.8
	Developed, Open Space - Low Intensity	2,062.20	234.7	2,296.90
Forest/Woodland	Great Basin Pinyon-Juniper Woodland	8,151.40	0	8,166.00
	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	1.4	0	1.4
	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	10	0	10
	Rocky Mountain Ponderosa Pine Woodland	853.7	0	853.7
Low Vegetation Desert	North American Warm Desert Badland	498	42.3	540.3
	North American Warm Desert Pavement	659.8	5.6	665.4
	North American Warm Desert Playa	4.9	0	4.9
	North American Warm Desert Wash	1,070.10	832	1,902.10
Riparian [a]	Invasive Southwest Riparian Woodland and Shrubland	429	145	574
	North American Arid West Emergent Marsh[a]	23.9	0	23.9
	North American Warm Desert Riparian Mesquite Bosque[a]	217.3	0	217.3
	North American Warm Desert Riparian Woodland and Shrubland[a]	15.3	0	15.3
Scrub	Mojave Mid-Elevation Mixed Desert Scrub	4.3	0	4.3
	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	24,995.00	6,953.10	31,948.10
	Sonora-Mojave Mixed Salt Desert Scrub	26.9	67.5	94.3
Shrubland	Colorado Plateau Blackbrush-Mormon-tea Shrubland	19.9	0	19.9
	Inter-Mountain Basins Big Sagebrush Shrubland	7	0	7
	Mogollon Chaparral	579.2	0	580.1
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	210.8	0	210.8
Aquatic [a]	Open Water[a]	97.9	2.3	100.3
Grand Total		43,102.30	8,860.60	51,978.40

[a] Aquatic and riparian habitats are included in this table, but are not analyzed in this VRCMA

- **Objective 2:** Promoting efforts in the VRCMA Boundary that will lead to the conservation of species protected under Nevada Revised Statutes that occur or have the potential to occur in the VRCMA Boundary (see Table 2-2 in Chapter 2: Existing Information and Data Gaps).
- **Objective 3:** Promoting efforts in the VRCMA Boundary that will lead to the conservation of other species not mentioned above included on the NNHP At-risk and Watch List species list and/or included as Covered, Evaluation, or Watch List species in the Clark County MSHCP that occur or have the potential to occur in the VRCMA Boundary (see Table 2-2 in Chapter 2: Existing Information and Data Gaps).
- **Objective 4:** Eliminating gaps in knowledge related to life history, habitat needs, and threats for special status species that occur or have the potential to occur in the VRCMA Boundary (See Chapter 2: Existing Information and Data Gap Collection and Appendix C: Final Data Screening Level Assessment Summary).

3.3 EFFECTS ANALYSIS

3.3.1 Summary of Effects on Special Status Species

Effects of human activities on special status species affect different species in different manners. However, effects fall into general categories that can be summarized by activity. Table 3-2 presents these general effects by activity for the VRCMA Boundary. Appendix D includes detailed tables of effects for each species, by activity and habitat type.

Table 3-2 Summary of Effects from Human Activities on Special Status Species in the VRCMA Boundary

	Direct Effects						Indirect Effects							
Activity	Mortality	Injury	Habitat Loss	Habitat Alteration	Human Disturbance	Pesticide/Herbicide	Loss of Prey	Predation/Competition	Habitat Fragmentation	Dispersal Barriers	Pesticide/Herbicide	Invasive Vegetation	Brood Parasitism	Collection
Hunting	▪	▪	▪	▪	▪		▪	▪	▪					
Development	▪	▪	▪	▪	▪	▪	▪	▪	▪			▪		
Agriculture and Grazing	▪	▪	▪	▪		▪	▪					▪	▪	
Recreation	▪	▪		▪	▪							▪		▪
Roads	▪	▪	▪	▪	▪	▪			▪	▪				
Mining			▪	▪			▪		▪					

3.3.2 Hunting

3.3.2.1 Activity Description

In the VRCMA Boundary, hunting is permitted by NDOW and AGFD. Hunting methods vary greatly with the type of animal being hunted. Rifles, shotguns and archery equipment are all used for hunting large game animals and shotguns are generally used for hunting birds of any type. Falconers will use birds of prey to hunt game birds as well. Regulations require hunters to obtain proof of hunter education and the appropriate licenses, permits, and stamps, which vary by state and the species hunted. These include a hunting license, duck stamp, upland game bird stamp and big game tag. Species that may be hunted within the VRCMA Boundary include doves, grouse, ring-necked pheasant, quail, wild turkey, rabbits, black-tailed deer and mountain lion (AGFD 2007a, NDOW 2007).

Hunting seasons vary greatly by the type of animal being hunted and by state. The time period and duration of a hunting season often changes annually, reflecting the population of the hunted species and local conditions. Some species, such as waterfowl, may have a season of several months while less common species may have a season as short as one day (NDOW 2007).

There are few data available regarding historical trends of hunting use in this area. With an increase in human development and population growth in the area, it is likely that hunting in the VRCMA Boundary is more substantial than in the past.

The amount of area required for hunting activities varies greatly with the species being hunted. A hunt for mourning doves may utilize several acres, while hunters searching for big game species such as mountain lions may have to cover several miles.

Land managed by the BLM, NPS, states, and private owners comprise the majority of land along the Lower Virgin River.

Hunting can potentially occur throughout the VRCMA Boundary, although it is not allowed in some areas of Lake Mead National Recreation Area (LMNRA 2007) and within cities. The landowners within the VRCMA Boundary are the BLM (35,154 acres in Nevada, 6,580 acres in Arizona), state agencies (1,058 acres in Nevada, 615 acres in Arizona), private landowners (5,055 acres in Nevada, 1,683 acres in Arizona), USFS (23,644 acres) and the Lake Mead NRA (1,661 acres in Nevada only).

Generally, hunting in this area is done for recreation by private citizens. Game birds and mammals are hunted in upland areas throughout the VRCMA Boundary. Hunting is not likely to occur in developed and urbanized areas.

Figures 3-1a, 3-1b, and 3-1c demonstrate where hunting is allowed within the VRCMA Boundary.

3.3.2.2 Potential Effects of Hunting

Cliffs and Canyon

Cliffs and canyon habitat types are characterized by steep, rocky areas of considerable size. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

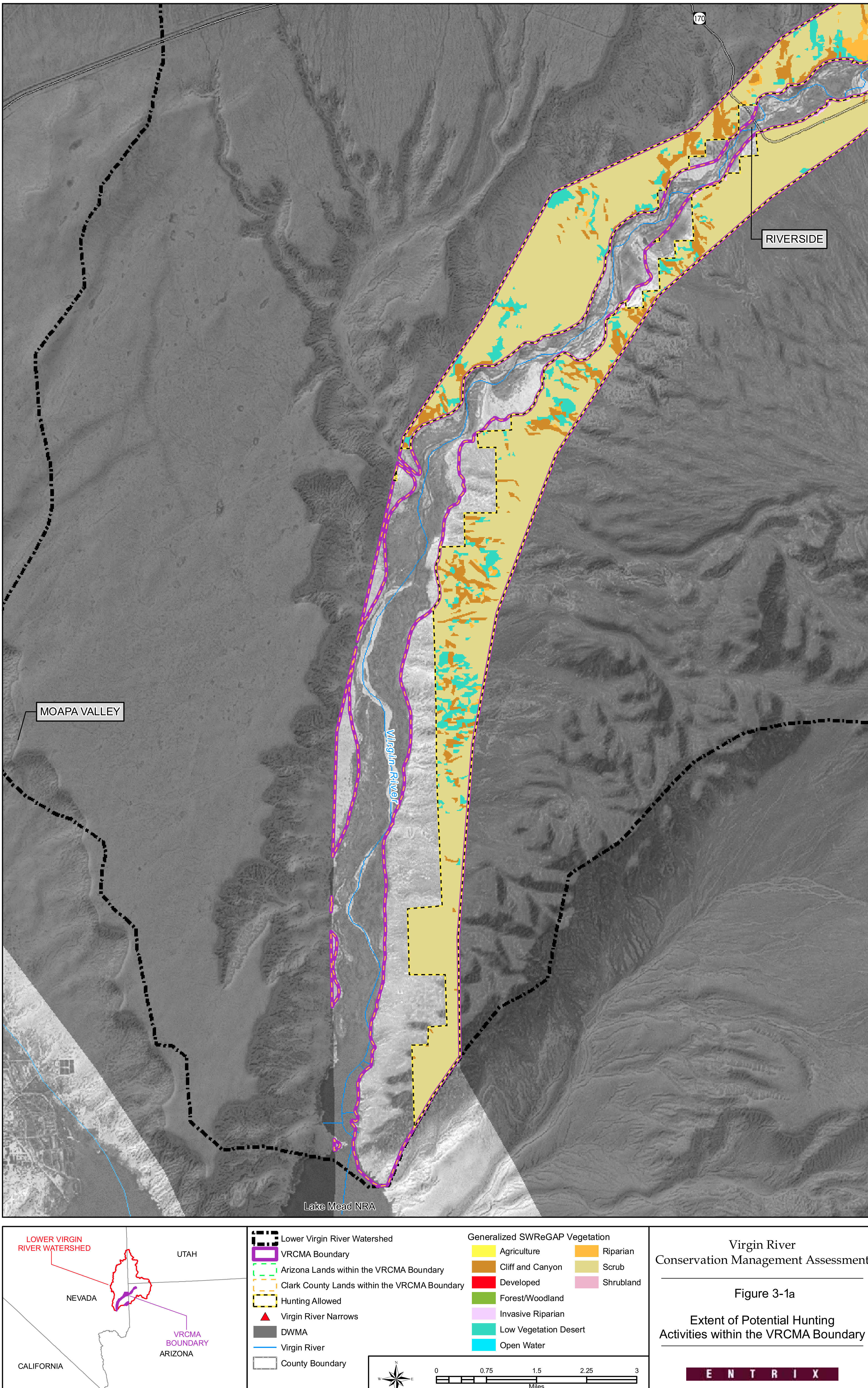
This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary (Figures 3-1a, 3-1b, and 3-1c). Hunting has the potential to occur in 1,798 acres of cliffs and canyon habitat in Nevada and 93 acres of cliffs and canyon habitat in Arizona within the VRCMA Boundary.

DIRECT EFFECTS

The most common methods of hunting, such as using archery equipment or a shotgun, do not cause significant damage to cliffs and canyon habitat on a large scale. These activities do not require removal of vegetation or alteration of the physical habitat. Individual episodes of hunting are often brief (i.e., a few hours to a few days). Hunting trips for large mammals can last longer, at times up to two weeks for bighorn sheep (AGFD 2007a). However, taking all hunting activities cumulatively, effects may be more substantial. Cliffs and canyon habitat types are, by nature, difficult to access and are not optimal habitat for many game species, although some large game species such as desert bighorn sheep and mountain lions are found in this habitat (NDOW 2007). Trampling vegetation can injure or kill protected plants and reptiles, and the possibility of accidentally shooting or catching protected species is a possibility. Repeated disturbance can cause animals to vacate suitable habitat and potentially cause reproductive failure. Hunting will likely continue as long as it is permitted by NDOW and AGFD. It is difficult to predict if hunting activity will increase or decrease within the VRCMA Boundary in future years.

Wildlife colliding with vehicular traffic associated with hunting activities is possible, to some degree, for almost all species listed in this assessment. Reptiles, amphibians and small mammals are the most vulnerable, while most birds can evade cars more easily. It is unlikely that vehicular collisions associated with hunting activities alone could have a significant impact to most of these species.

Plants are vulnerable to injury and direct mortality by trampling or being crushed by vehicles, especially in off-road areas (AGFD 2004). The possibility of a particular plant species being trampled by foot traffic may depend on its size, morphology, and specific habitat requirements. Larger shrubs are less likely to be trampled than small herbaceous plants. High-use areas, such as established campgrounds, trails, or parking areas used to access hunting spots are likely to have localized degradation of special-status plant habitat caused by trampling and deposits of litter. In these areas, effects on plants may be long-term. In areas that receive little human activity, effects should be brief.

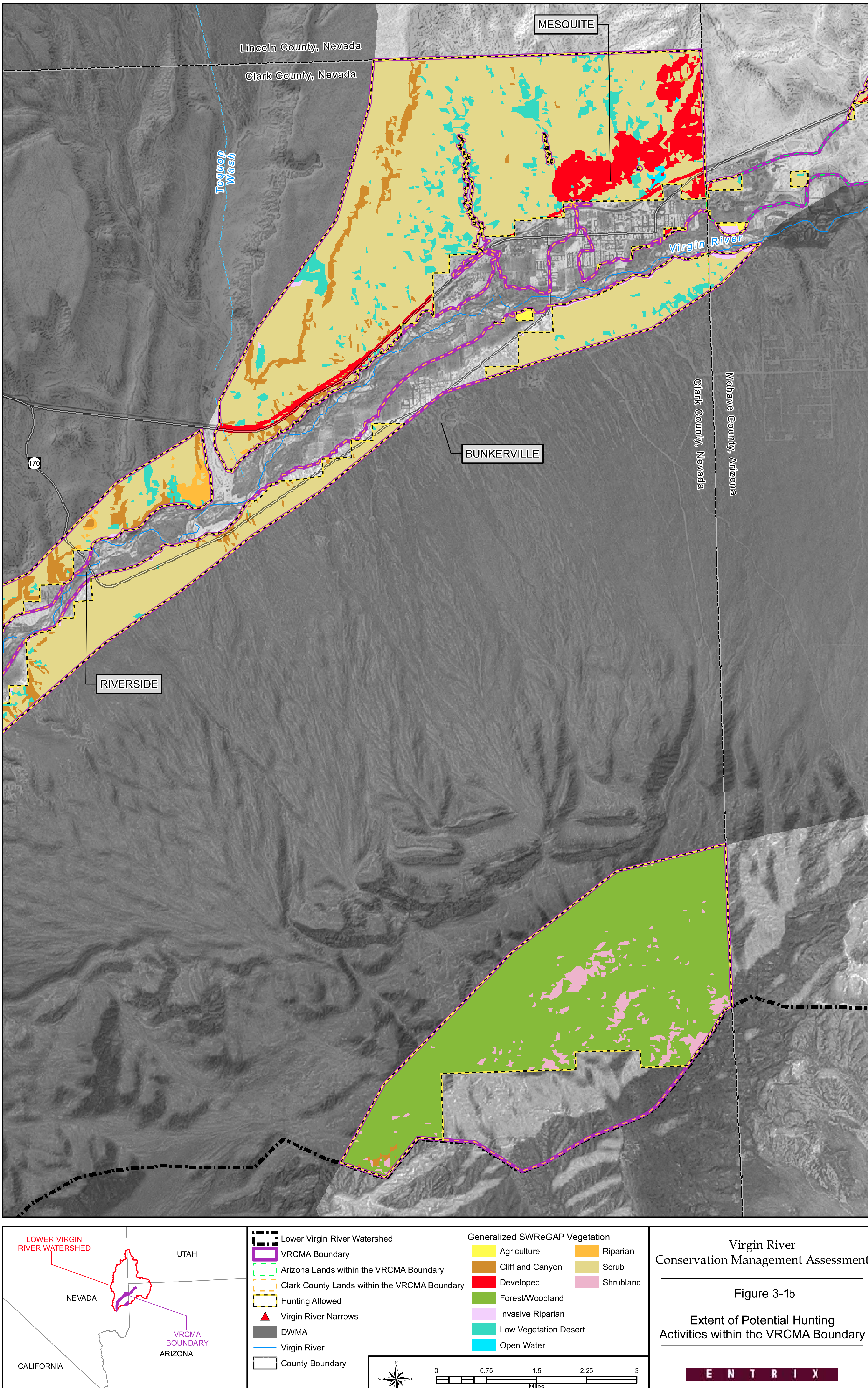


Virgin River
Conservation Management Assessment

Figure 3-1a

Extent of Potential Hunting Activities within the VRCMA Boundary

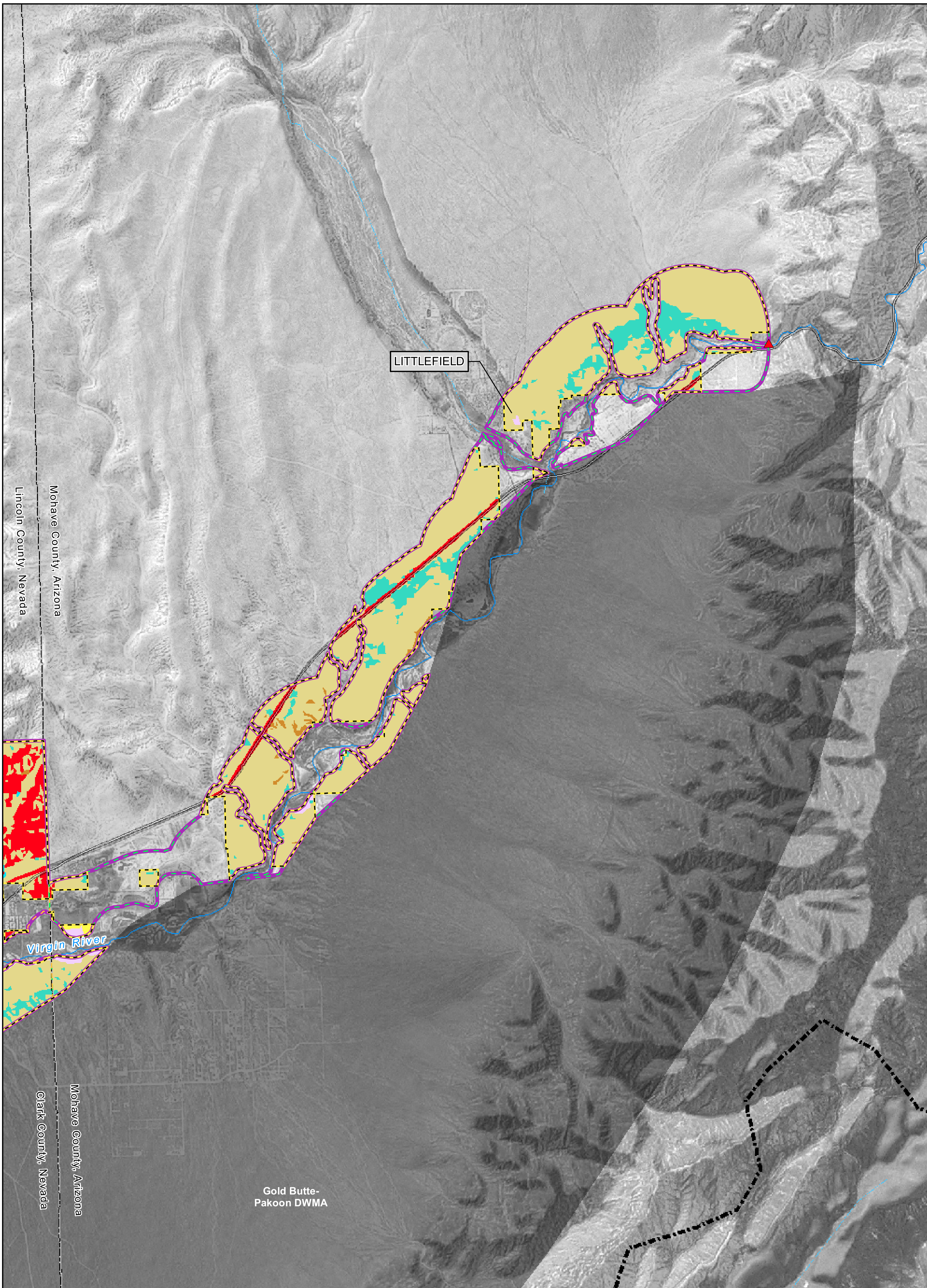
ENTRIX

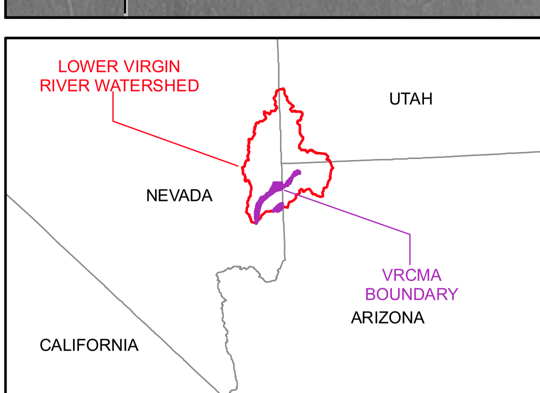


Virgin River
Conservation Management Assessment

Figure 3-1b

Extent of Potential Hunting Activities within the VRCMA Boundary





Lower Virgin River Watershed
VRCMA Boundary
Arizona Lands within the VRCMA Boundary
Clark County Lands within the VRCMA Boundary
Hunting Allowed
Virgin River Narrows
DWMA
Virgin River
County Boundary

Generalized SWReGAP Vegetation

Agriculture	Riparian
Cliff and Canyon	Scrub
Developed	Shrubland
Forest/Woodland	
Invasive Riparian	
Low Vegetation Desert	
Open Water	

0 0.75 1.5 2.25 3
Miles

Virgin River
Conservation Management Assessment

Figure 3-1c

Extent of Potential Hunting
Activities within the VRCMA Boundary

E N T R I X

Reptiles are vulnerable to trampling, as well. Although it is not likely that they would suffer injury or mortality by foot traffic, reptiles are susceptible to being crushed by vehicles. As a venomous species and therefore potentially dangerous to humans, the speckled rattlesnake may be more vulnerable to injury and mortality than other reptiles. Hunters encountering this species may react aggressively in self-defense if surprised by a rattlesnake underfoot. High-use areas, such as established campgrounds, trails, and parking areas used to access hunting spots, are likely to have degraded reptile habitat caused by trampling and deposits of litter. While human disturbance is likely to occur in habitat for these species, it would most likely not affect them significantly.

Collection efforts, both legal and illegal, can threaten many reptile populations, including western chuckwalla, Great Basin collared lizard, and southern desert horned lizard.

Peregrine falcons, golden eagle, and ferruginous hawks occur in this habitat. They are historically subject to both accidental and intentional shooting (QPWCM 1998, NatureServe 2007), and are potentially subject to direct mortality or injury. Shooting these species is illegal in Nevada and Arizona, but may occur. These species, particularly ferruginous hawks, are sensitive to human disturbance around nest sites (NatureServe 2007), and continuous disturbance may result in nest abandonment. Disturbance can occur as a result of discharging firearms or simply by the presence of humans near a nest. Elevated mercury levels have also been found in golden eagles, as a result of hunting activities (NMPIF 2007). Other bird species that occur in this habitat would be unlikely to be adversely affected by hunting activities, aside from disturbances from human presence in the area.

Kit fox and desert bighorn sheep are subject to regulated hunting in the Nevada and Arizona portions of the VRCMA Boundary (AGFD 2007a, NDOW 2007). Hunting and trapping of kit fox and desert bighorn sheep may result in direct mortality and injury, and these species are subject to human disturbance. Hunting squirrels and rabbits may reduce available prey, although kit fox will take other species as well.

Several bat species may occupy cliffs and canyon habitat types within the VRCMA Boundary. These include big free-tailed bat, California leaf-nosed bat, California myotis, greater western mastiff bat, little brown myotis, western small-footed myotis, Yuma myotis, fringed myotis, Brazilian free-tailed bat, hoary bat, pallid bat, western pipistrelle, silver-haired bat, spotted bat and Townsend's big-eared bat. Species that roost in these areas are very susceptible to human disturbance and may abandon roosts. Disturbance at a maternity roost may result in reproductive failure in the colony. Species that hibernate may be disturbed and awakened, which may cause more stress and greater use of energy stores than normal. Loud noises, such as gunshots, near roosts may disorient bats and negatively affect reproduction (AGFD 2001a). For some species, such as Townsend's big-eared bat, human disturbance at roosts has been the primary factor in population declines in some areas (AGFD 2003a). Disorientation, resulting from disturbance at a roost, may cause individuals to collide with canyon walls or other bats resulting in injury or mortality, either directly from the collision or from susceptibility to the elements and predators, if a bat is rendered flightless.

Hunters in this habitat are most likely to affect wildlife negatively by causing disturbance and trampling. Kit fox and desert bighorn sheep are the only species that are likely to suffer from direct mortality as a result of hunting activities. Habitat loss and degradation is possible for some plants, but overall not expected to be significant. However, ephemeral species and plants with a low number of populations, such as threecorner milkvetch, may be more vulnerable to these impacts.

INDIRECT EFFECTS

Potential indirect effects to plants and some wildlife from hunting activities in cliffs and canyon habitat in the VRCMA Boundary are habitat fragmentation and loss of prey. Loss of prey is not likely to be a significant effect, however, and habitat fragmentation would only occur with frequent and heavy use of areas by hunters. Plants, reptiles and amphibians would be most susceptible to this.

To some extent, almost all wildlife species besides large apex predators are vulnerable to predation when encountering human disturbance, as they may be distracted or flee to areas outside their normal territories, which they may not know well (Frid and Dill 2002).

Significant habitat degradation can result in habitat fragmentation for special-status plants in areas that receive high use by hunters and anglers. Habitat degradation can be significant for particularly rare plants, or species with patchy or small distributions, such as threecorner milkvetch (AGFD 2004, AGFD 2006).

Hunting can result in the loss of prey for peregrine falcon, ferruginous hawk and kit fox. Doves, and occasionally other upland gamebirds, are taken by peregrine falcons. Ferruginous hawks and kit fox both may prey on squirrels and rabbits, which are hunted. However, it is unlikely hunting would significantly reduce the prey base of these species.

Low Vegetation Desert

Low vegetation desert habitat consists of dry, arid areas with drought-tolerant vegetation. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary (Figures 3-1a, 3-1b, and 3-1c). This activity has the potential to occur in 1,964 acres of low vegetation desert habitat in Nevada and 773 acres of low vegetation desert habitat in Arizona within the VRCMA Boundary.

DIRECT EFFECTS

The most common methods of hunting, such as using archery equipment or a shotgun, do not cause significant damage to low vegetation desert habitat on a large scale. These activities do not require removal of vegetation or alteration of the physical habitat. Individual episodes of hunting are often brief (i.e., a few hours to a few days). Hunting trips for large mammals can last longer. However, taking all hunting activities cumulatively, effects may be more substantial. As with cliffs and canyon habitat, hunting activities in these habitats are primarily big game species such as black-tailed deer and upland game birds, such as Gambel's quail. Trampling vegetation can injure or kill protected plants and reptiles, and the possibility of accidentally shooting or catching protected species becomes more likely. Repeated disturbance can cause animals to vacate suitable habitat and potentially cause reproductive failure. Hunting will likely continue as long as it is permitted by NDOW and AGFD. It is difficult to predict if hunting activity will increase or decrease within the VRCMA Boundary in future years.

Wildlife colliding with vehicular traffic associated with hunting activities is possible, to some degree, for almost all species listed in this report. Reptiles, amphibians and small mammals are the most vulnerable, while most birds can evade cars more easily. It is unlikely that vehicular collisions associated with hunting activities alone could have a significant impact to most of these species.

Plants are vulnerable to injury and direct mortality by trampling or being crushed by vehicles, especially in off-road areas (AGFD 2004). High-use areas, such as established campgrounds, trails, or parking areas used to access hunting spots, are likely to have localized degradation of special-status plant habitat caused by trampling and deposits of litter. In these areas, effects on plants may be long-term. In areas that receive little human activity, effects should be brief.

The federally threatened desert tortoise is present in low vegetation desert habitat. Due to its sluggish nature, the tortoise is vulnerable to a variety of negative impacts that may result from hunting activities, including human disturbance, illegal collecting, illegal shooting, predation and injury by dogs associated with hunters, and collisions with vehicles and OHVs (USFWS 1994).

Western banded gecko, Great Basin collared lizard, southern plateau lizard, glossy snake, and zebra-tailed lizard are at risk of mortality from vehicular traffic. These species are somewhat vulnerable to trampling due to foot traffic, which can cause injury or mortality, but this is relatively unlikely. High-use areas, such as established campgrounds, trails, and parking areas used to access hunting spots, are likely to have degraded reptile habitat caused by trampling and deposits of litter. While human disturbance is likely to occur in habitat for these species, it would most likely not affect them significantly.

Peregrine falcons, prairie falcons, and ferruginous hawks occur in this habitat. They are historically subject to both accidental and intentional shooting (QPWCM 1998, NatureServe 2007), and are potentially subject to direct mortality or injury. Shooting these species is illegal in Nevada and Arizona, but may still occur. These species are also sensitive to human disturbance around nest sites, particularly ferruginous hawks (NatureServe 2007). Disturbance can occur because of discharging firearms or simply the presence of humans near a nest.

All three species may also experience the loss of prey through hunting, but it is unlikely that enough prey would be lost to affect these species significantly.

Western burrowing owls are subject to mortality or injury by vehicle collisions in these habitats as they are primarily ground-dwellers. Their burrows may also be collapsed by off-road vehicles, trapping or crushing any birds that may be inside. Human disturbance is also possible, but not likely to be significant, as this species is tolerant of human activity. Repeated disturbance can potentially result in a nest being abandoned, however. Dogs associated with hunters may cause significantly more stress to this species than interactions with humans.

Phainopepla, Lucy’s warbler, and other bird species in this habitat can be disturbed by human activity. Disturbance near a nest may cause significant stress to birds, and repeated disturbance may cause birds to abandon a nest. Human disturbance of birds away from nest sites is not likely to cause a significant negative effect.

Kit fox and desert bighorn sheep are subject to regulated hunting in the Nevada and Arizona portions of the VRCMA Boundary (AGFD 2007a, NDOW 2007). Hunting and trapping of kit fox and desert bighorn sheep may result in direct mortality and injury, and these species are subject to human disturbance. Hunting squirrels and rabbits may reduce available prey, although kit fox will take other species as well.

Desert kangaroo rat may be subject to direct mortality or injury from commercial collection and collision with cars that are used in hunting activities.

Several bat species, including western pipistrelle, and spotted bat may occupy low vegetation desert habitat within the VRCMA Boundary. Species that roost in these areas are very susceptible to human disturbance and may abandon roosts. Disturbance at a maternity roost may result in reproductive failure in the colony. Species that hibernate may be disturbed and awakened, which may cause more stress and use of energy stores than normal. Loud noises, such as gunshots near roosts, may disorient bats and negatively affect reproduction (AGFD 2001a). Disorientation, resulting from disturbance at a roost, may cause individuals to collide with solid objects or other bats resulting in injury or mortality, either directly from the collision or from susceptibility to the elements and predators, if a bat is rendered flightless.

INDIRECT EFFECTS

Potential indirect effects to plants and some wildlife from hunting activities in developed habitats in the VRCMA Boundary are habitat fragmentation and loss of prey. Loss of prey is not likely to be a significant effect, however, and habitat fragmentation would only occur with frequent and heavy use of areas by hunters and anglers. Plants, reptiles and amphibians would be most susceptible to this.

To some extent, almost all wildlife species besides large apex predators are vulnerable to predation when encountering human disturbance, as they may be distracted or flee to areas outside their normal territories, which they may not know well (Frid and Dill 2002).

Significant habitat degradation can result in habitat fragmentation for special-status plants in areas that receive high use by hunters and anglers. Habitat degradation can be significant for particularly rare plants, or species with patchy or small distributions.

Young Mojave desert tortoises are frequently preyed upon by ravens (USFWS 1994). Ravens have adapted well to human presence and may feed on any edible matter left behind by hunters and anglers using the area. This may encourage more ravens to use the area as a food source, and, thus, increase the probability of predation of desert tortoises.

When kept away from a nest by human disturbance, phainopepla is vulnerable to brood parasitism by brown-headed cowbirds. This often results in reproductive failure in the host species.

Forest/Woodland

Forests and woodlands are characterized by trees and shrubs; these habitats are in areas that receive enough moisture to support trees. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not open to all land within this habitat (Figures 3-1a, 3-1b, and 3-1c). This activity has the potential to occur in 6,776 acres of forest/woodland habitat within Nevada and zero acres of forest/woodland habitat in Arizona within the VRCMA Boundary.

DIRECT EFFECTS

The most common methods of hunting, such as using archery equipment or a shotgun, do not cause significant damage to woodland habitat on a large scale. These activities do not require removal of vegetation or alteration of the physical habitat. Individual episodes of hunting are often brief (i.e., a few hours to a few days). Hunting trips for large mammals can last longer. However, taking all hunting activities cumulatively, effects may be more substantial. Hunting activities in these habitats are primarily big game species such as black-tailed deer and upland game birds, such as wild turkey and Gambel's quail (AGFD 2007a). Trampling vegetation can injure or kill protected plants and reptiles, and the possibility of accidentally shooting or catching protected species becomes more likely. Repeated disturbance can cause animals to vacate suitable habitat and potentially cause reproductive failure. Hunting will likely continue as long as it is permitted by AGFD and NDOW. It is difficult to predict whether hunting activity will increase or decrease within the VRCMA Boundary in future years.

Wildlife colliding with vehicular traffic associated with hunting activities is possible, to some degree, for almost all species listed in this report. Reptiles, amphibians and small mammals are the most vulnerable, while most birds can evade cars more easily. It is unlikely that vehicular collisions associated with hunting activities alone could have a significant impact to most of these species.

Plants are vulnerable to injury and direct mortality by trampling or being crushed by vehicles, especially in off-road areas (AGFD 2004). The possibility of a particular species of plant being trampled by foot traffic may depend on its size, morphology and specific habitat requirements. Larger shrubs are less likely to be trampled than small herbaceous plants. High-use areas, such as established campgrounds, trails, or parking areas used to access hunting spots, are likely to have localized degradation of special-status plant habitat caused by trampling and deposits of litter. In these areas, effects on plants may be long term. In areas that receive little human activity, effects should be brief.

The Pacific tree frog would not be expected to be adversely affected by hunting activities on a significant level since hunting and fishing activities do not generally disturb habitat on a significant scale. However, trampling may occur.

Reptiles such as California king snake and Sonoran lyre snake are vulnerable to trampling. Although it is not likely that reptiles would suffer injury or mortality by foot traffic, they are susceptible to being crushed by vehicles. The venomous speckled rattlesnake may be more vulnerable to injury and mortality. Hunters encountering this species may react aggressively in self-defense if surprised by a rattlesnake underfoot. High-use areas, such as established campgrounds, trails, and parking areas used to access hunting spots, are likely to have degraded reptile habitat caused by trampling and deposits of litter. While human disturbance is likely to occur in habitat for these species, it would most likely not affect them significantly.

Collection efforts, both legal and illegal, are a threat for many reptiles, including California king snake and Sonoran lyre snake. Northern goshawks, golden eagles, and peregrine falcons are all birds of prey found in woodlands. Disturbance by hunters near nests can cause significant stress to birds, and continuous disturbance may result in nest abandonment. Goshawks can become very agitated by humans near nests and may physically attack anyone approaching a nest too closely. Raptors, including peregrine falcons, are susceptible to being shot illegally (QPWCM 1998, NatureServe 2007).

While the presence of humans may disturb flammulated owls, thrashers, Lucy's warbler, and other special status bird species, it is unlikely that hunting activities would have significant negative impacts on this species. Illegal shootings would be unlikely.

Kit fox and desert bighorn sheep are subject to regulated hunting in the Nevada and Arizona portions of the VRCMA Boundary (AGFD 2007a, NDOW 2007). Hunting and trapping of kit fox and desert bighorn sheep may result in direct mortality and injury, and these species are subject to human disturbance.

Several bat species, including hoary bat, spotted bat, and Brazilian free-tailed bat, may occupy woodland habitats within the VRCMA Boundary. Species that roost in these areas are very susceptible to human disturbance and may abandon roosts. Disturbance at a maternity roost may result in reproductive failure in the colony. Species that hibernate may be disturbed and awakened, which may cause more stress and increased use of energy stores than normal. Loud noises, such as gunshots, near roosts may disorient bats and negatively impact reproduction (AGFD 2001a). Disorientation, resulting from disturbance at a roost, may cause individuals to collide with solid objects or other bats resulting in injury or mortality, either directly from the collision or from susceptibility to the elements and predators, if a bat is rendered flightless.

INDIRECT EFFECTS

Potential indirect effects to plants and some wildlife from hunting activities in developed habitats in the VRCMA Boundary are habitat fragmentation and loss of prey. Loss of prey is not likely to be a significant effect, however, and habitat fragmentation would only occur with frequent and heavy use of areas by hunters and anglers. Plants, reptiles and amphibians would be most susceptible to this.

To some extent, almost all wildlife species besides large apex predators are vulnerable to predation when encountering human disturbance, as they may be distracted or flee to areas outside their normal territories, which they may not know well (Frid and Dill 2002).

Habitat fragmentation can be a result of significant habitat degradation for special-status plants in areas that receive high use by hunters and anglers. Habitat degradation can be significant for particularly rare plants, or species with patchy or small distributions.

Phainopeplas are vulnerable to brood parasitism by brown-headed cowbirds (AGFD 2002b). If human disturbance causes an incubating bird to leave the nest, this may provide an opportunity for a cowbird to parasitize the nest. This often results in reproductive failure in the host species.

Peregrine falcons and northern goshawks both prey primarily on birds, including some species that may be taken by hunters. However, it is unlikely that hunting pressure would significantly impact the amount of prey available to peregrine falcons and goshawks.

Shrubland

Vegetation in these communities is dominated by shrubby and brushy plants, such as sage. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. This activity has the potential to occur in 552 acres of shrubland habitat within Nevada and zero acres of shrubland habitat within Arizona in the VRCMA Boundary.

DIRECT EFFECTS

The most common methods of hunting, such as using archery equipment or a shotgun, do not cause significant damage to shrubland habitat on a large scale. These activities do not require removal of vegetation or alteration of the physical habitat. Individual episodes of hunting are often brief (i.e., a few hours to a few days). Hunting trips for large mammals can last longer. However, taking all hunting activities cumulatively, effects may be more substantial. Hunting activities in these habitats are primarily big game species such as black-tailed deer and upland game birds, such as wild turkey and Gambel's quail (AGFD 2007a). Trampling vegetation can injure or kill protected plants and reptiles, and the possibility of accidentally shooting or catching protected species becomes more likely. Repeated disturbance can cause animals to vacate suitable habitat and potentially cause reproductive failure. Hunting will likely continue as long as it is permitted by AGFD and NDOW. It is difficult to predict if hunting activity will increase or decrease within the VRCMA Boundary in future years.

Wildlife colliding with vehicular traffic associated with hunting activities is possible, to some degree, for almost all species listed in this report. Reptiles, amphibians and small mammals are the most vulnerable, while most birds can evade cars more easily. It is unlikely that vehicular collisions associated with hunting activities alone could have a significant impact to most of these species.

Plants are vulnerable to injury and direct mortality by trampling or being crushed by vehicles, especially in off-road areas (AGFD 2004). The possibility of a particular species of plant being trampled by foot traffic may depend on its size, morphology and specific habitat requirements. Larger shrubs are less likely to be trampled than small herbaceous plants. High-use areas, such as established campgrounds, trails, or parking areas used to access hunting spots, are likely to have localized degradation of special-status plant habitat caused by trampling and deposits of litter. In these areas, effects on plants may be long-term. In areas that receive little human activity, effects should be brief. Habitat loss and degradation is possible for some plants, but overall not expected to be significant. However, ephemeral species and plants with a low number of populations such as threecorner milkvetch may be more vulnerable to these impacts.

Reptiles, such as California king snake, Sonoran lyre snake, and Great Basin collared lizard are vulnerable to trampling as well. Although it is not likely that they would suffer injury or mortality by foot traffic, reptiles are susceptible to being crushed by vehicles. The venomous speckled rattlesnake is potentially dangerous to humans and may be more vulnerable to injury and mortality than other reptiles. Hunters encountering this species may react aggressively in self-defense if surprised by a rattlesnake underfoot. High-use areas, such as established campgrounds, trails, and parking areas used to access hunting spots, are likely to have degraded reptile habitat caused by trampling and deposits of litter. While human disturbance is likely to occur in habitat for these species, it would most likely not affect them significantly.

Bald eagles, peregrine falcons, northern goshawks, golden eagles, ferruginous hawks, and western burrowing owls are all found in shrubland habitats. Peregrine falcons and ferruginous hawks historically have been subject to both accidental and intentional shooting (QPWCM 1998, NatureServe 2007), and are potentially subject to direct mortality or injury. Shooting these species is illegal in Nevada, but may potentially occur. Disturbance by hunters in the vicinity of nests can cause significant stress to birds. Continuous disturbance may result in nest abandonment. Goshawks can become very agitated by humans near nests and may physically attack anyone approaching a nest too closely. They are both also sensitive to human disturbance around nest sites, particularly ferruginous hawks (NatureServe 2007). Birds can be disturbed in the vicinity of a nest because of discharging firearms or simply by the presence of humans. Both species may also experience the loss of prey through hunting, but it is unlikely that enough prey would be lost that would significantly impact these species.

Although they are susceptible to human disturbance, bald eagles currently do not breed within the VRCMA Boundary. Significant impacts from human disturbance are not likely. However, bald eagles have suffered from being shot illegally, and this remains a possibility within the VRCMA Boundary (AGFD 2002a).

Western burrowing owls are subject to mortality or injury by vehicles in these habitats, as they are primarily ground-dwellers, making them susceptible to collisions with vehicles. Their burrows may also be collapsed by off-road vehicles, trapping or crushing any birds that may be inside. Human disturbance is also possible, but not likely to be significant, as this species is tolerant of human activity. Repeated disturbance can potentially result in a nest being abandoned, however. Dogs associated with hunters may cause significantly more stress than a person may.

Human disturbance may affect flammulated owls and other bird species such as crissal thrasher, pinyon jay, and vesper sparrow, but it is unlikely that hunting activities would have significant negative impacts on this species because of the infrequency of hunting activities in a given location in the VRCMA Boundary. Illegal shootings would be unlikely.

Desert bighorn sheep are subject to regulated hunting in the Nevada and Arizona portions of the VRCMA Boundary (AGFD 2007a, NDOW 2007). Hunting of desert bighorn sheep may result in direct mortality and injury, and this species is subject to human disturbance.

Desert pocket mouse may be subject to direct mortality and injury by collision with cars that are used in hunting activities. Human disturbance is not likely to affect this species significantly.

Several bat species, including pallid bat, Brazilian free-tailed bat, spotted bat, and hoary bat, may occupy shrubland habitat within the VRCMA Boundary. Species that roost in these areas are very susceptible to human disturbance and may abandon roosts. Disturbance at a maternity roost may result in reproductive failure in the colony. Species that hibernate may be disturbed and awakened, which may cause more stress and increased use of energy stores than normal. Loud noises, such as gunshots, in the vicinity of roosts may disorient bats and negatively impact reproduction (AGFD 2001a). Disorientation, resulting from disturbance at a roost, may cause individuals to collide with solid objects or other bats, resulting in injury or mortality, either directly from the collision or from susceptibility to the elements and predators, if a bat is rendered flightless.

Hunters and anglers in this habitat are most likely to affect wildlife negatively by causing disturbance and trampling.

INDIRECT EFFECTS

Potential indirect effects to plants and some wildlife from hunting activities in scrub habitat in the VRCMA Boundary are habitat fragmentation and loss of prey. Loss of prey is not likely to be a significant effect, however, and habitat fragmentation would only occur with frequent and heavy use of areas by hunters and anglers. Plants, reptiles and amphibians would be most susceptible to this.

To some extent, almost all wildlife species besides large apex predators are vulnerable to predation when encountering human disturbance. They may be distracted or flee to areas outside their normal territories, which they may not know well (Frid and Dill 2002).

Significant habitat degradation can result in habitat fragmentation for special-status plants in areas that receive high use by hunters and anglers. Habitat degradation can be significant for particularly rare plants, or species with patchy or small distributions.

Raptors present in shrubland habitats feed primarily on birds and small mammals, including some species that may be taken by hunters. However, it is unlikely that hunting pressure would significantly impact the amount of prey available to birds of prey present in the VRCMA Boundary.

Scrub

Scrub is the most dominant habitat type throughout the VRCMA Boundary; it is prevalent everywhere but the northern and southeastern reaches. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary (Figures 3-1a, 3-1b, and 3-1c). This activity has the potential to occur in 19,812 acres of scrub habitat in Nevada and 5,383 acres of scrub habitat in Arizona within the VRCMA Boundary.

DIRECT EFFECTS

The most common methods of hunting, such as using archery equipment or a shotgun, do not cause significant damage to scrub habitat on a large scale. These activities do not require removal of vegetation or alteration of the physical habitat. Individual episodes of hunting are often brief (i.e., a few hours to a few days). Hunting trips for large mammals can last longer. However, taking all hunting activities cumulatively, effects may be more substantial. Hunting activities in these habitats are primarily big game species such as pronghorn antelope and upland game birds, such as Gambel's quail (AGFD 2007a). Trampling vegetation can injure or kill protected plants and reptiles, and the possibility of accidentally shooting or catching protected species becomes more likely. Repeated disturbance can cause animals to vacate suitable habitat and potentially cause reproductive failure. Hunting will likely continue as long as it is permitted by NDOW and AGFD. It is difficult to predict whether hunting activity will increase or decrease within the VRCMA Boundary in future years.

Wildlife colliding with vehicular traffic associated with hunting activities is possible, to some degree, for almost all species listed in this assessment. Reptiles, amphibians and small mammals are the most vulnerable, while most birds can evade cars more easily. It is unlikely that vehicular collisions associated with hunting activities alone could have a significant impact to most of these species.

Plants in scrub habitat are vulnerable to injury and direct mortality by trampling or being crushed by vehicles, especially in off-road areas (AGFD 2004). The possibility of a particular species of plant being trampled by foot traffic may depend on its size, morphology and specific habitat requirements. Larger shrubs are less likely to be trampled than small herbaceous plants. A high-use area, such as an established campground, trail, or parking area used to access hunting spots, may have high levels of human activity and, thus, can cause localized degradation of special-status plant habitat through trampling and deposits of litter. In these areas, effects on plants may be long-term. In areas that receive little human activity, effects should be brief.

Reptiles, including Great Basin collared lizard, California king snake, and Mojave green rattlesnake, are vulnerable to trampling as well. Although it is not likely that they would suffer injury or mortality by foot traffic, they are susceptible to being crushed by vehicles. As they are venomous species and potentially dangerous to humans, banded Gila monsters, sidewinders, Mojave rattlesnakes, and speckled rattlesnakes may be more vulnerable to injury than mortality. Hunters encountering these species may react aggressively in self-defense if surprised by one of these species underfoot. High-use areas, such as established campgrounds, trails, and parking areas used to access hunting spots, are likely to have degraded reptile habitat caused by trampling and deposits of litter. While human disturbance is likely to occur in habitat for these species, it would most likely not affect them significantly.

The federally threatened desert tortoise is present in scrub habitats. Due to its sluggish nature, the tortoise is vulnerable to a variety of negative impacts that may potentially result from hunting activities, including human disturbance, illegal collecting, illegal shooting, predation and injury by dogs associated with hunters, and collisions with vehicles and OHVs (USFWS 1994).

Prairie falcon, golden eagle, and peregrine falcon can be found in scrub habitats. Disturbance by hunters in the vicinity of nests can cause significant stress to birds, and continuous disturbance may result in nest abandonment. Raptors, including peregrine falcons, are susceptible to being shot illegally (QPWCM 1998, NatureServe 2007).

Although they are susceptible to human disturbance, bald eagles currently do not breed within the VRCMA Boundary. Significant impacts by human disturbance are not likely. However, bald eagles have suffered from being shot illegally, and this remains a possibility within the VRCMA Boundary (AGFD 2002a).

Western burrowing owls are subject to mortality or injury by vehicles in these habitats. They are primarily ground-dwellers, which makes them susceptible to collisions with vehicles. Their burrows may also be collapsed by off-road vehicles, trapping or crushing any birds that may be inside. Human disturbance is also possible, but not likely to be significant; this species is relatively tolerant of human activity (Klute et al. 2003). Repeated disturbance can potentially result in a nest being abandoned, however. Dogs associated with hunters may cause significantly more stress than human disturbance.

Phainopeplas and other bird species, such as crissal thrasher, loggerhead shrike, and blue grosbeak, can be disturbed by human activity. Disturbance near a nest may cause significant stress to birds, and repeated disturbance may cause birds to abandon a nest. Human disturbance of birds away from nest sites is not likely to cause a significant negative effect.

Desert pocket mouse may be subject to direct mortality and injury by collision with cars that are used in hunting activities. Human disturbance is not likely to affect this species significantly.

A variety of bat species may occupy scrub habitats within the VRCMA Boundary, including pallid bat, spotted bat, Brazilian free-tailed bat, and western pipistrelle. Species that roost in these areas are very susceptible to human disturbance and may abandon roosts. Disturbance at a maternity roost may result in reproductive failure in the colony. Species that hibernate may be disturbed and awakened, which may cause more stress and use of energy stores than normal. Loud noises, such as gunshots, in the vicinity of roosts may disorient bats and negatively impact reproduction (AGFD 2001a). For some species, such as Townsend's big-eared bat, human disturbance at roosts has been the primary factor in population declines in some areas (AGFD 2003a). Disorientation, resulting from disturbance at a roost, may cause individuals to collide with canyon walls or other bats, resulting in injury or mortality, either directly from the collision or from susceptibility to the elements and predators, if a bat is rendered flightless.

INDIRECT EFFECTS

Potential indirect effects to plants and some wildlife from hunting activities in developed habitats in the VRCMA Boundary are habitat fragmentation and loss of prey. Loss of prey is not likely to be a significant effect, however, and habitat fragmentation would only occur with frequent and heavy use of areas by hunters and anglers. Plants, reptiles and amphibians would be most susceptible to this.

To some extent, almost all wildlife species besides large apex predators are vulnerable to predation when encountering human disturbance, as they may be distracted or flee to areas outside their normal territories, which they may not know well (Frid and Dill 2002).

Significant habitat degradation can result in habitat fragmentation for special-status plants in areas that receive high use by hunters and anglers. Habitat degradation can be significant for particularly rare plants, or species with patchy or small distributions, such as threecorner milkvetch (AGFD 2004, AGFD 2006).

Young Mojave desert tortoises are frequently predated upon by ravens (USFWS 1994). Ravens have adapted well to human presence and may feed on any edible matter left behind by hunters using the area. This may encourage more ravens to use the area as a food source, and, thus, increase the probability of predation of desert tortoises.

Raptors present in scrub habitats feed primarily on birds and small mammals, including some species that may be taken by hunters. However, it is unlikely that hunting pressure would significantly impact the amount of prey available to birds of prey present in the VRCMA Boundary.

When kept away from a nest by human disturbance, phainopepla, blue grosbeak, and gray vireo may be vulnerable to brood parasitism by brown-headed cowbirds. This often results in reproductive failure in the host species.

Agriculture

Agricultural areas comprise 815 acres in Nevada and 181 acres in Arizona within the VRCMA Boundary (see Table 3-1).

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary (Figures 3-1a, 3-1b, and 3-1c). This activity has the potential to occur in 37 acres of agriculture habitat in Nevada and 19 acres of agriculture habitat in Arizona within the VRCMA Boundary.

DIRECT EFFECTS

The most common methods of hunting, such as using archery equipment or a shotgun, do not cause significant damage to agricultural areas on a large scale. These activities do not require removal of vegetation or alteration of the physical habitat. Individual episodes of hunting are often brief (i.e., a few hours to a few days). Hunting trips for large mammals can last longer. However, taking all hunting activities cumulatively, effects may be more substantial. Hunting activities in these habitats are primarily big game species such as black-tailed deer and upland game birds, such as wild turkey and Gambel's quail (AGFD 2007a). Trampling vegetation can injure or kill protected plants and reptiles, and the possibility of accidentally shooting or catching protected species becomes more likely. Repeated disturbance can cause animals to vacate suitable habitat and potentially cause reproductive failure. Hunting in agricultural areas may not be as popular as hunting in other habitats within the VRCMA Boundary. Popular game species such as pronghorn and bighorn sheep are not present here. Hunting will likely continue as long as it is permitted by AGFD and NDOW. It is difficult to predict if hunting activity will increase or decrease within the VRCMA Boundary in future years.

Wildlife colliding with vehicular traffic associated with hunting activities is possible, to some degree, for almost all species listed in this report. Reptiles, such as the California king snake, are the most vulnerable, while most birds can evade cars more easily. It is unlikely that vehicular collisions associated with hunting activities alone could have a significant impact to most of these species.

Peregrine falcons, golden eagle, prairie falcon, and ferruginous hawks occur in agricultural areas. They are historically subject to both accidental and intentional shooting (QPWCM 1998, NatureServe 2007), and are potentially subject to direct mortality or injury. Shooting these species is illegal in all three states, but may occur. These species, particularly ferruginous hawks, are sensitive to human disturbance around nest sites, and continuous disturbance may result in nest abandonment. Disturbance can occur because of discharging firearms or simply the presence of humans in the vicinity of a nest. Elevated levels of lead have been found in golden eagles, which is a result of hunting activities (NMPIF 2007).

Although they are susceptible to human disturbance, bald eagles currently do not breed within the VRCMA Boundary; therefore, significant impacts from human disturbance are not likely. However, bald eagles have suffered from being shot illegally, and this remains a possibility within the VRCMA Boundary (AGFD 2002a).

Western burrowing owls are subject to mortality or injury by vehicles in these habitats, as they are primarily ground-dwellers, making them susceptible to collisions with vehicles. Their burrows may also be collapsed by off-road vehicles, trapping or crushing any birds that may be inside. Human disturbance is also possible, but not likely to be significant, as this species is tolerant of human activity. Repeated disturbance can potentially result in a nest being abandoned, however. Dogs associated with hunters may cause significantly more stress than human disturbance.

Human disturbance may affect other species such as blue grosbeak, loggerhead shrike, summer tanager, and phainopeplas, but it is unlikely that hunting activities would have significant negative impacts on these species, although disturbance near a nest may cause these species more stress. Illegal shootings would be unlikely.

Several bat species, including pallid bat, may occupy agricultural areas within the VRCMA Boundary. Species that roost in these areas are very susceptible to human disturbance and may abandon roosts. Disturbance at a maternity roost may result in reproductive failure in the colony. Species that hibernate may be disturbed and awakened, which may cause more stress and use of energy stores than normal. Loud noises, such as gunshots, in the vicinity of roosts may disorient bats and negatively impact reproduction (AGFD 2001a). Disorientation, resulting from disturbance at a roost, may cause individuals to collide with solid objects or other bats, resulting in injury or mortality, either directly from the collision or from susceptibility to the elements and predators, if a bat is rendered flightless.

INDIRECT EFFECTS

Potential indirect effects to plants and some wildlife from hunting activities in developed habitats in the VRCMA Boundary are habitat fragmentation and loss of prey. Loss of prey is not likely to be a significant effect, however, and habitat fragmentation would only occur with frequent and heavy use of areas by hunters and anglers. Plants, reptiles and amphibians would be most susceptible to this.

To some extent, almost all wildlife species besides large apex predators are vulnerable to predation when encountering human disturbance, as they may be distracted or flee to areas outside their normal territories, which they may not know well (Frid and Dill 2002).

Peregrine falcons, ferruginous hawks, prairie falcons, golden eagles, and bald eagles prey on species that may be taken by hunters. However, it is unlikely that hunting pressure would significantly impact the amount of prey available to these birds of prey.

When kept away from a nest by human disturbance, passerines such as phainopepla and blue grosbeak may be vulnerable to brood parasitism by brown-headed cowbirds. This often results in failure of the nest.

Developed

Developed habitat types are those that have been disturbed by human activity or otherwise developed. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary. The towns of Littlefield, Arizona and Mesquite, Nevada are the most developed areas within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. This activity has the potential to occur in 1,247 acres of developed habitat in Nevada and 220 acres of developed habitat in Arizona within the VRCMA Boundary (Figures 3-1a, 3-1b, and 3-1c).

DIRECT EFFECTS

The most common methods of hunting, such as using archery equipment or a shotgun, do not cause significant damage to developed habitat on a large scale. These activities do not require removal of vegetation or alteration of the physical habitat. Individual episodes of hunting are often brief (i.e., a few hours to a few days). Hunting trips for large mammals can last longer. However, taking all hunting activities cumulatively, effects may be more substantial. Hunting activities in these habitats are primarily big game species, such as black-tailed deer, and upland game birds, such as wild turkey and Gambel's quail (AGFD 2007a). Trampling vegetation can injure or kill protected plants and reptiles, and the possibility of accidentally shooting or catching protected species becomes more likely. Repeated disturbance can cause animals to vacate suitable habitat and potentially cause reproductive failure. Hunting will likely continue as long as it is permitted by UDWR, AGFD and NDOW. It is difficult to predict if hunting activity will increase or decrease within the VRCMA Boundary in future years.

Wildlife colliding with vehicular traffic associated with hunting activities is possible, to some degree, for almost all species listed in this report. Reptiles, amphibians and small mammals are the most vulnerable, while most birds can evade cars more easily. It is unlikely that vehicular collisions associated with hunting activities alone could have a significant impact to most of these species.

Peregrine falcon, prairie falcon, golden eagle, and ferruginous hawk occur in developed areas. They are historically subject to both accidental and intentional shooting (QPWCM 1998, NatureServe 2007) and are potentially subject to direct mortality or injury. Shooting these species is illegal in all three states, but may occur. Both species, particularly ferruginous hawks, are sensitive to human disturbance around nest sites (NatureServe 2007), and continuous disturbance may result in nest abandonment. Disturbance can occur because of discharging firearms or simply the presence of humans near a nest.

Although they are susceptible to human disturbance, bald eagles currently do not breed within the VRCMA Boundary. Significant impacts by human disturbance are not likely. However, bald eagles have suffered from being shot illegally, and this remains a possibility within the VRCMA Boundary (AGFD 2002a).

Western burrowing owls are subject to mortality or injury by vehicles in these habitats, as they are primarily ground-dwellers, making them susceptible to collisions with vehicles. Their burrows may also be collapsed by off-road vehicles, trapping or crushing any birds that may be inside. Human disturbance is also possible, but not likely to be significant, as this species is tolerant of human activity. Repeated disturbance can potentially result in a nest being abandoned, however. Dogs associated with hunters may cause significantly more stress than a human encounter.

Human disturbance may affect other species such as phainopepla, but it is unlikely that hunting activities would have significant negative impacts on these species because of the infrequency of hunting activities in a given location in the VRCMA Boundary. Although, disturbance near a nest may cause these species more stress. Illegal shootings would be unlikely.

Several bat species, including pallid bat, hoary bat, and Brazilian free-tailed bat may occupy developed habitats within the VRCMA Boundary. Species that roost in these areas are very susceptible to human disturbance and may abandon roosts. Disturbance at a maternity roost may result in reproductive failure in the colony. Species that hibernate may be disturbed and awakened, which may cause more stress and use of energy stores than normal. Loud noises, such as gunshots, near roosts may disorient bats and negatively affect reproduction (AGFD 2001a). Disorientation, resulting from disturbance at a roost, may cause individuals to collide with solid objects or other bats, resulting in injury or mortality, either directly from the collision or from susceptibility to the elements and predators, if a bat is rendered flightless.

INDIRECT EFFECTS

Potential indirect effects to plants and some wildlife from hunting activities in developed habitats in the VRCMA Boundary include habitat fragmentation and loss of prey. Loss of prey is not likely to be a significant effect, however, and habitat fragmentation would only occur with frequent and heavy use of areas by hunters and anglers. Plants, reptiles, and amphibians would be most susceptible to this.

To some extent, almost all wildlife species besides large apex predators are vulnerable to predation when encountering human disturbance. They may be distracted or flee to areas outside their normal territories, which they may not know well (Frid and Dill 2002).

Peregrine falcons, ferruginous hawks, and bald eagles prey on species that may be taken by hunters. However, it is unlikely that hunting pressure would significantly affect the amount of prey available to peregrine falcons and bald eagles.

When kept away from a nest by human disturbance, passerines, such as phainopepla, may be vulnerable to brood parasitism by brown-headed cowbirds. This often results in reproductive failure in the host species.

3.3.3 Development

3.3.3.1 Activity Description

Development activities include land improvement or construction involving land, buildings, or infrastructure. Urban development is the process of developing populated settlements. State and federal lands are not subject to city and county zoning guidelines.

Figures 3-2a, 3-2b, and 3-2c demonstrate where development exists or could occur within the VRCMA Boundary.

Development in the Nevada Portion of the VRCMA Boundary

In Clark County, the resident and visitor population has increased from 500,000 in 1980 to over 2,000,000 in 2006. Clark County is one of the fastest-growing areas in the country, with more than 5,000 people moving there each month. Clark County is the most populous of Nevada's 17 counties with 70 percent of the state's population.

The City of Mesquite has grown in size by approximately 15,000 people since 1970. Estimated population size by the year 2008 is 21,000. With the acquisition of additional acreage from BLM, a new industrial area is planned adjacent to I-15 for easy accessibility. Within the City of Mesquite, all areas within the floodplain are zoned so that development is not allowed to occur in the floodplain (City of Mesquite 2003). As of January 2008, 5,204 of 18,557 acres within the City of Mesquite are designated as parks and open space and not available for development (City of Mesquite 2007).

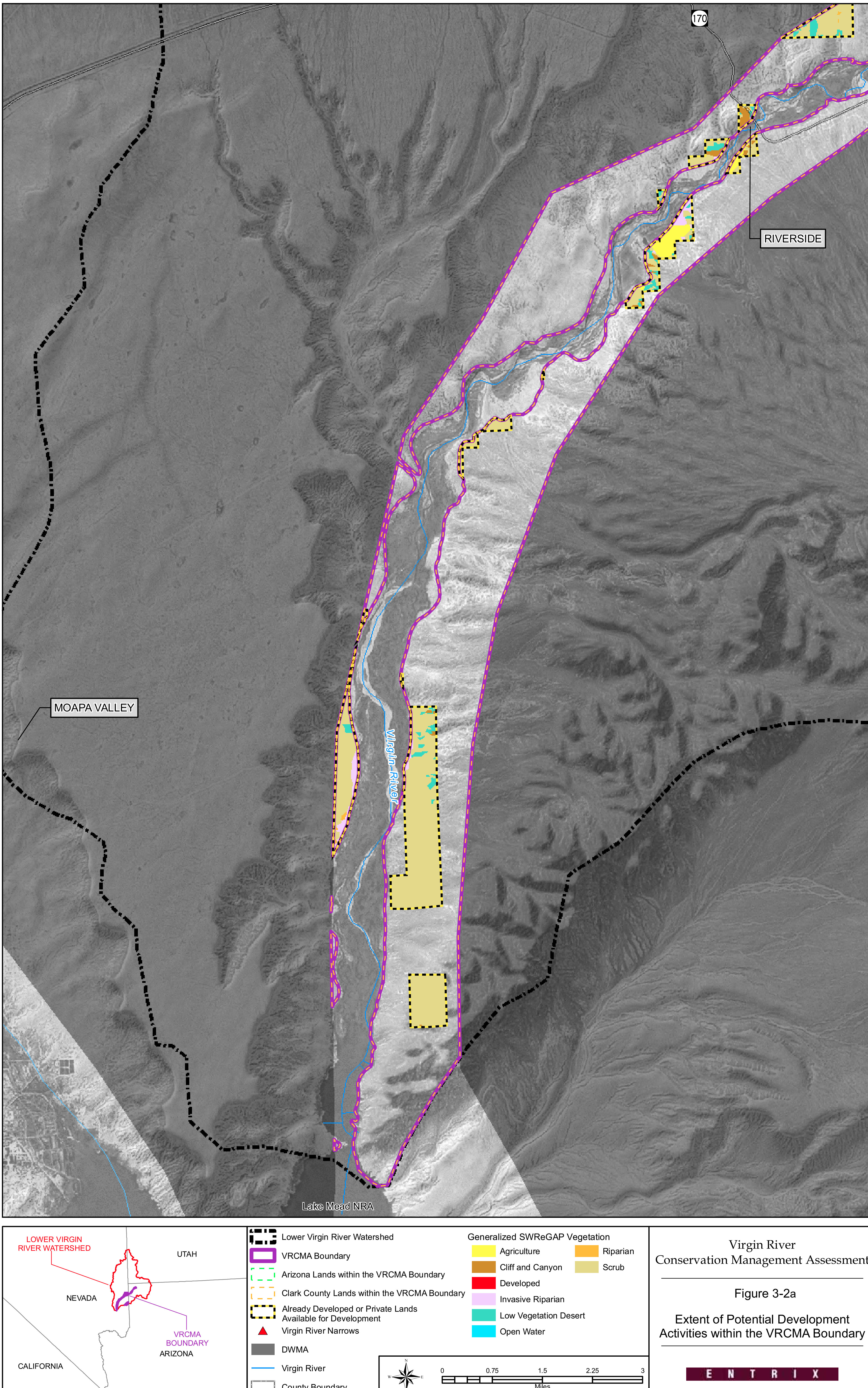
The increase in population size of Las Vegas and Mesquite has resulted in an increase in demand for water and energy supplies and increased use of public lands within driving distance of these urban and residential centers. It is anticipated that Las Vegas utilities will seek underground water supplies on public lands, including new water pipelines, electrical transmission lines, and new rights-of-way. Demands for new developed and dispersed recreation activities will need to be met through land disposals and improvements of existing public facilities (BLM 2005).

Development pressures in the VRCMA Boundary are primarily focused around the City of Mesquite, which is adjacent to both sides of the Lower Virgin River.

Development in the Arizona Portion of the VRCMA Boundary

Ongoing development activities and the potential for development in the Arizona portion of the VRCMA Boundary are limited. The USFS and BLM own 55.2 percent of the land in Mohave County, Arizona. Tribal lands compose 6.7 percent, the State of Arizona owns 6.6 percent, individuals or corporations own 17.2 percent, and other public lands comprise 14.3 percent of the land (Mohave County 2007).

The population of Mohave County has grown almost 25 percent from 2000 to now. Mohave County makes up over 13,000 square miles with 11.6 people per square mile (Mohave County 2007).

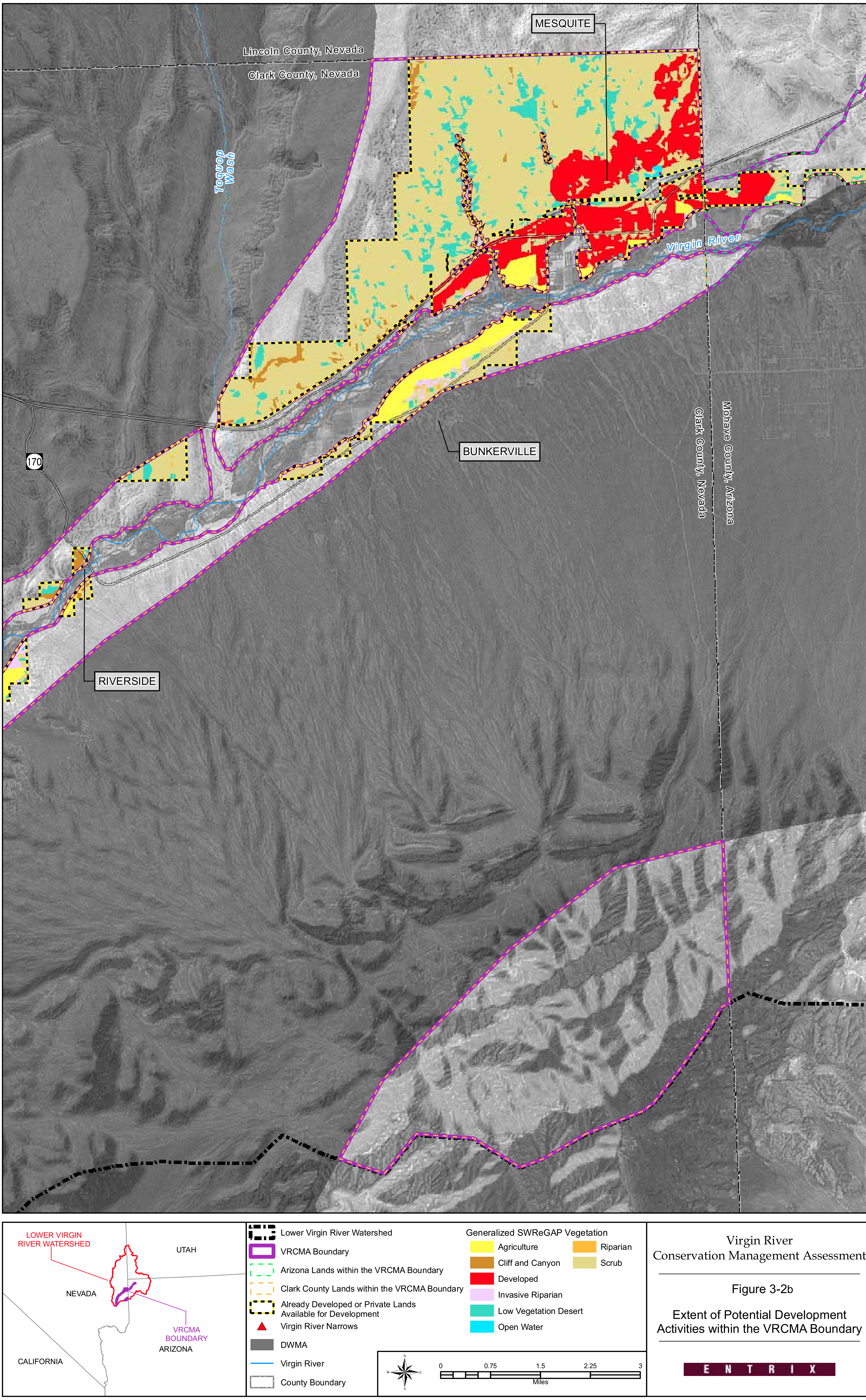


Virgin River
Conservation Management Assessment

Figure 3-2a

Extent of Potential Development Activities within the VRCMA Boundary

ENTRIX

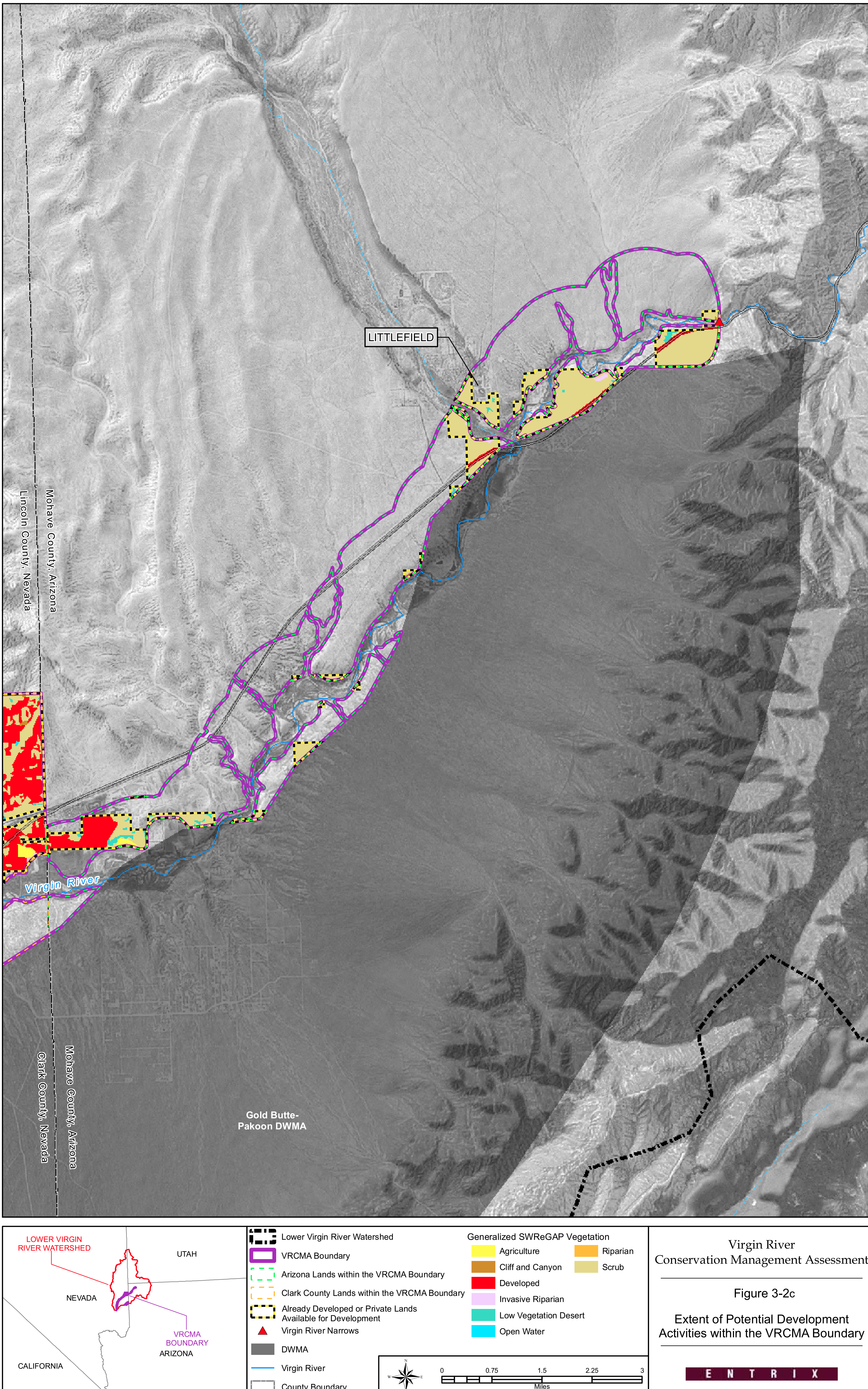


Virgin River
Conservation Management Assessment

Figure 3-2b

Extent of Potential Development Activities within the VRCMA Boundary

E N T R I X



Virgin River
Conservation Management Assessment

Figure 3-2c

Extent of Potential Development Activities within the VRCMA Boundary

ENTRIX

3.3.3.2 Potential Effects of Development

Cliffs and Canyon

Cliffs and canyon habitat types are characterized by steep, rocky areas of considerable size. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. This activity has the potential to occur in 353 acres of cliffs and canyon habitat within Nevada and zero acres of cliffs and canyon habitat within Arizona in the VRCMA Boundary (Figures 3-2a, 3-2b, and 3-2c).

DIRECT EFFECTS

Development activities currently do not occur in the cliffs and canyon habitat of the VRCMA Boundary. Cliffs and canyon habitat occurs on private lands within the VRCMA Boundary, which could allow for future development in these areas. However, given the isolation from existing roadways and utilities, steep topography, and lack of stability for buildings, it is unlikely that development would occur in these habitats. It is unlikely that any direct effects from development would occur to special status species in the cliffs and canyon habitat types.

INDIRECT EFFECTS

As described under direct effects, development activities do not currently occur in this habitat, nor would they be expected to in the future. Therefore, it is unlikely any indirect effects from development would occur to special status species in the VRCMA Boundary in the cliffs and canyon habitat types.

Low Vegetation Desert

Low vegetation desert habitat consists of dry, arid areas with drought-tolerant vegetation. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. This activity has the potential to occur in 1,136 acres of low vegetation desert habitat in Nevada and 60 acres of low vegetation desert habitat in Arizona within the VRCMA Boundary (Figures 3-2a, 3-2b, and 3-2c).

DIRECT EFFECTS

Private lands, where development has or could potentially occur in the VRCMA Boundary, are primarily along the Virgin River. Large tracts of private land exist surrounding the Lake Mead NRA lands at the mouth of the Virgin River; the City of Mesquite and nearby Bunkerville lands, including land newly annexed by the City of Mesquite; and lands surrounding the Littlefield, Arizona area.

Low vegetation desert habitat within private lands in the VRCMA Boundary occurs in the Mormon Mesa area, in newly annexed City of Mesquite lands, and around Bunkerville.

Development activities in these areas can result in habitat loss and alteration for plants and animals, injury and/or mortality of animal species, and direct loss of plant species. Habitat loss would be permanent, while habitat alteration may have a short-term or long-term effect, depending upon how habitat is altered. Injury, mortality, and plant loss would occur from the initial ground disturbance and clearing for construction activities.

Plant species would primarily be affected during the initial ground disturbance and from habitat loss and alteration. Because little is known about many of the plant species addressed in this document, the potential for other direct effects also exists.

Reptiles, including the desert night lizard, desert tortoise, and Great Basin collared lizard, would be directly affected by habitat loss and by the potential for direct mortality or injury during construction and ground-disturbing activities.

Bird species, including loggerhead shrike, Bendire's thrasher, and Le Conte's thrasher, would be affected by habitat loss and alteration and human disturbance of nesting and foraging habitats. Loss of habitat is one of the main threats to the persistence of western burrowing owl, as native habitats are converted to agriculture and development (Klute et al. 2003). However, western burrowing owls are known to use urban and semi-urban areas (CEC 2005, Klute et al. 2003), so they could potentially use some of the resulting habitat, after construction is completed and vegetation has regenerated. The potential for ferruginous hawks colliding with stationary objects in the area could increase, depending upon the type of development.

Kit fox and desert pocket mouse would primarily be affected by the loss of habitat. Habitat loss is considered the biggest threat to kit foxes. Other sources of mortality such as trapping, predator-control programs and predation by coyotes are not considered to have significant affects on most populations (Sillero-Zubiri et al. 2004).

Several bat species may occupy low vegetation desert habitat within the VRCMA Boundary. Species that roost in these areas are very susceptible to human disturbance and may abandon roosts. Disturbance at a maternity roost may result in reproductive failure in the colony. Species that hibernate may be disturbed and awakened, which may cause more stress and use of energy stores than normal. Loud noises, such as construction noises, in the vicinity of roosts may disorient bats and negatively impact reproduction (AGFD 2001a). Disorientation, resulting from disturbance at a roost, may cause individuals to collide with solid objects or other bats, resulting in injury or mortality, either directly from the collision or from susceptibility to the elements and predators, if a bat is rendered flightless.

INDIRECT EFFECTS

Development of low vegetation desert habitat within the VRCMA Boundary could result in a number of potential indirect effects: collisions with vehicles, introduction of invasive vegetation, OHV and other recreation use, side effects from use of potentially harmful pesticides and herbicides, alteration of the surrounding fire regime to reduce fire frequency and protect buildings, increased predation from domestic cats and dogs, habitat fragmentation, decline in permanent water sources from an increased water demand, loss of prey sources, and illegal collection.

Because of development in low vegetation desert habitat, an increase in the number of vehicles driving through the area is likely to cause injury or mortality to animal species. This could occur from the use of vehicles and heavy machinery during construction activities and from the use of personal vehicles by residents and visitors traveling to developed areas. These effects are described in detail in the Roads activity effects analysis section.

Plants are vulnerable to injury and direct mortality by trampling or being crushed by vehicles, especially in off-road areas (AGFD 2004). Ground disturbance for development activities would result in the potential for non-native vegetation to colonize the disturbed areas. This particularly affects native plant species. Habitat fragmentation may also affect some or all of the plant species addressed in this document, as it can separate populations from each other and prevent further expansion of populations.

Illegal collection of reptile species, such as desert night lizard, could occur because of an increased population in a localized area of the VRCMA Boundary. OHV use could also adversely affect desert tortoise, western banded gecko, and their habitats. Development would likely result in habitat fragmentation, impeding movement of desert tortoise and other reptiles through the developed area. Habitat fragmentation is a major contributor to population declines of the desert tortoise (Berry 1984, Berry and Burge 1984, Berry and Nicholson 1984).

Other indirect effects to desert tortoise include trash, domestic dogs, and increases in predators from human use and habitation. Trash disposal in the development area could adversely affect desert tortoises. Objects can become lodged in the gastrointestinal tract or entangle heads and legs, causing death (Burge 1989). The number of dogs could increase with an increase in human presence. Dog attacks or predation on desert tortoises has been identified by the USFWS as an emerging problem that warrants attention (Boarman 2002). Anticipated increases in human use and habitation of the development area may attract and concentrate predators such as ravens and coyotes, resulting in increased predation of desert tortoises.

Bird species can be adversely affected by predation from domestic cats and dogs (western burrowing owls), pesticide use for rodent control (western burrowing owl, potentially ferruginous hawk), habitat fragmentation (western burrowing owl), and changes in the fire regime to protect development areas (western burrowing owl). Loss of prey sources resulting from habitat loss or alteration can adversely affect all special status bird species in this habitat.

Yuma myotis can be indirectly affected by predation by domestic cats. The potential decline in water sources from increased surface and/or groundwater removal for an increased population need (depending upon the size of the development) could potentially affect the Yuma myotis, although the development in this habitat type would affect other habitat types (i.e., riparian).

Forest/Woodland

Forests and woodlands are characterized by trees and shrubs; these habitats are in areas that receive enough moisture to support trees. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. This activity has the potential to occur in zero acres of forest/woodland habitat within the VRCMA Boundary (Figures 3-2a, 3-2b, and 3-2c).

DIRECT EFFECTS

Because no acres of forest/woodland habitat within the VRCMA Boundary would be affected by this activity, no direct effects would occur.

INDIRECT EFFECTS

Because no acres of forest/woodland habitat within the VRCMA Boundary would be affected by this activity, no indirect effects would occur.

Shrubland

Vegetation in these communities is dominated by shrubby and brushy plants, such as sage. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. This activity has the potential to occur in zero acres of shrubland habitat within the VRCMA Boundary (Figures 3-2a, 3-2b, and 3-2c).

DIRECT EFFECTS

Because no acres of shrubland habitat within the VRCMA Boundary would be affected by this activity, no direct effects would occur.

INDIRECT EFFECTS

Because no acres of shrubland habitat within the VRCMA Boundary would be affected by this activity, no direct effects would occur.

Scrub

Scrub is the most dominant habitat type throughout the VRCMA Boundary; it is prevalent everywhere but the northern and southeastern reaches. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. This activity has the potential to occur in 10,647 acres of scrub habitat in Nevada and 1,288 acres of scrub habitat in Arizona within the VRCMA Boundary (Figures 3-2a, 3-2b, and 3-2c).

DIRECT EFFECTS

Private lands, where development has or could potentially occur in the VRCMA Boundary, are primarily along the Virgin River. Large tracts of private land exist surrounding the Lake Mead NRA lands at the mouth of the Virgin River; the City of Mesquite and nearby Bunkerville lands, including land newly annexed by the City of Mesquite; and lands surrounding the Littlefield, Arizona area.

Scrub habitat within private lands in the VRCMA Boundary occurs in the Mormon Mesa area, in newly annexed City of Mesquite lands, and around Bunkerville.

Development activities in these areas can result in habitat loss and alteration for plants and animals, injury and/or mortality of animal species, and direct loss of plant species. Habitat loss would be permanent, while habitat alteration may be a short-term or long-term effect, depending upon how habitat is altered. Injury, mortality, and plant loss would occur from the initial ground disturbance and clearing for construction activities.

Plant species would primarily be affected by direct loss from initial ground disturbance and from habitat loss and alteration. Because little is known about many of the plant species addressed in this document, the potential for other direct effects also exists.

Reptiles, including the desert night lizard, Great Basin collared lizard, banded Gila monster, sidewinder, desert tortoise, and Mojave rattlesnake, would be directly affected by habitat loss and conversion and by the potential for direct mortality or injury during construction and ground disturbance activities.

Bird species, including phainopepla, blue grosbeak, and Scott’s oriole, would be directly affected by habitat loss and alteration and human disturbance of nesting and foraging habitats. Loss of habitat is one of the main threats to the persistence of western burrowing owl, as native habitats are converted to agriculture and development (Klute et al. 2003). However, western burrowing owls are known to use urban and semi-urban areas (CEC 2005, Klute et al. 2003), so they could potentially use some of the resulting habitat, after construction is completed and vegetation has regenerated. The potential for ferruginous hawks to collide with stationary objects in the area could increase, depending upon the type of development.

Kit fox would primarily be affected by habitat conversion. Habitat loss is considered the biggest threat to this species. Other sources of mortality such as trapping, predator-control programs and predation by coyotes are not considered to have significant affects on most populations (Sillero-Zubiri et al. 2004).

Desert pocket mouse would be adversely affected by habitat loss and conversion. Bat species, including pallid bat and hoary bat, would be affected by habitat loss and conversion. Species that roost in these areas are very susceptible to human disturbance and may abandon roosts. Disturbance at a maternity roost may result in reproductive failure in the colony. Species that hibernate may be disturbed and awakened, which may cause more stress and use of energy stores than normal. Loud noises, such as construction noises, in the vicinity of roosts may disorient bats and negatively impact reproduction (AGFD 2001a). Disorientation, resulting from disturbance at a roost, may cause individuals to collide with solid objects or other bats, resulting in injury or mortality, either directly from the collision or from susceptibility to the elements and predators, if a bat is rendered flightless.

INDIRECT EFFECTS

Development of scrub habitat within the VRCMA Boundary could result in a number of potential indirect effects: collisions with vehicles, introduction of invasive vegetation, OHV and other recreation use, side effects from use of potentially harmful pesticides and herbicides, alteration of the surrounding fire regime to reduce fire frequency and protect buildings, increased predation from domestic cats and dogs, habitat fragmentation, decline in permanent water sources from an increased water demand, loss of prey sources, and illegal collection.

Because of development in scrub habitat, an increase in the number of vehicles driving through the area is likely to cause injury or mortality to animal species. This could occur from the use of vehicles and heavy machinery during construction activities and from the use of personal vehicles by residents and visitors traveling to developed areas. These effects are described in detail in the Roads activity effects analysis section.

Plants are vulnerable to injury and direct mortality by trampling or being crushed by vehicles, especially in off-road areas (AGFD 2004). Ground disturbance for development activities would result in the potential for non-native vegetation to colonize the disturbed areas. This particularly affects native plant species. Habitat fragmentation may also affect some or all of the plant species addressed in this document, as it can separate populations from each other and prevent further expansion of populations.

Collection of reptile species, such as desert night lizard and Mojave rattlesnake, could occur because of an increased population in a localized area of the VRCMA Boundary. This would likely reduce population numbers and alter population structure. OHV use could also adversely affect desert tortoise, western banded gecko, banded Gila monster, and their habitats through disturbance and habitat alteration. Habitat fragmentation from development likely would impede movement of desert tortoise and other reptiles through the area that is developed. Habitat fragmentation is a major contributor to population declines of the desert tortoise (Berry 1984, Berry and Burge 1984, Berry and Nicholson 1984).

Other indirect effects to desert tortoise include trash, domestic dogs, and increases in predators from human use and habitation. Trash disposal in developed areas could adversely affect desert tortoises. Objects can become lodged in the gastrointestinal tract or entangle heads and legs, causing death (Burge 1989). The number of dogs could increase with an increase in human presence. Dog attacks or predation on desert tortoises has been identified by the USFWS as an emerging problem that warrants attention (Boarman 2002). Anticipated increases in human use and habitation of the developed area may attract and concentrate predators such as ravens and coyotes, resulting in increased predation of desert tortoises. Bird species can be adversely affected by predation from domestic cats and dogs (western burrowing owl), pesticide use for rodent control (western burrowing owl, potentially ferruginous hawk), habitat fragmentation (western burrowing owl), declining groundwater levels (phainopepla), and changes in the fire regime to protect development areas (western burrowing owl). Loss of prey sources from habitat loss or alteration for those prey types can adversely affect all special status bird species in this habitat.

Bats can be indirectly affected by predation by domestic cats and loss of prey sources. The potential decline in water sources from increased surface and/or groundwater removal for an increased population need (depending upon the size of the development) could potentially affect the Yuma myotis, although development in this habitat type would affect other habitat types (i.e., riparian).

Agriculture

Agricultural areas, where the landscape is dominated by food grown for human consumption, comprise 815 acres in Nevada and 181 acres in Arizona within the VRCMA Boundary (see Table 3-1).

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. This activity has the potential to occur in 229 acres of agriculture habitat in Nevada and 25 acres of agriculture habitat in Arizona within the VRCMA Boundary (Figures 3-2a, 3-2b, and 3-2c).

DIRECT EFFECTS

The majority of agriculture habitat lies within the FEMA 100-year floodplain; however, there are some agricultural areas on private lands in the Bunkerville and Mesquite areas in Nevada and the Littlefield area in Arizona. These could be potentially developed in the future. Special status species that would be affected include certain reptile, bird, and bat species.

California king snake would be directly affected by habitat loss from development activities.

Bird species, including golden eagle, prairie falcon, loggerhead shrike, and western bluebird, would be directly affected by habitat loss and alteration and human disturbance of nesting and foraging habitats. Loss of habitat is one of the main threats to the persistence of western burrowing owl, as native habitats are converted to agriculture and development (Klute et al. 2003). However, western burrowing owls are known to use urban and semi-urban areas (CEC 2005, Klute et al. 2003), so they could potentially use some of the resulting habitat after construction is completed and vegetation has regenerated. The potential for ferruginous hawks to collide with stationary objects in the area could increase, depending upon the type of development.

Bat species, including pallid bat, would be affected by habitat loss and conversion. Species that roost in these areas are very susceptible to human disturbance and may abandon roosts. Disturbance at a maternity roost may result in reproductive failure in the colony. Species that hibernate may be disturbed and awakened, which may cause more stress and use of energy stores than normal. Loud noises, such as construction noises, in the vicinity of roosts may disorient bats and negatively impact reproduction (AGFD 2001a). Disorientation, resulting from disturbance at a roost, may cause individuals to collide with solid objects or other bats, resulting in injury or mortality, either directly from the collision or from susceptibility to the elements and predators, if a bat is rendered flightless.

INDIRECT EFFECTS

Because of development in agricultural habitats, an increase in the number of vehicles driving through the area may cause injury or mortality to plant and animal species. This could occur from the use of vehicles and heavy machinery during construction activities and from the use of personal vehicles by residents and visitors traveling to developed areas. These effects are described in detail in the Roads activity effects analysis section.

Bird species can be adversely affected by predation from domestic cats and dogs (western burrowing owls), pesticide use for rodent control (western burrowing owl, potentially ferruginous hawk), habitat fragmentation (western burrowing owl), and changes in the fire regime to protect development areas (western burrowing owl). Loss of prey sources from habitat loss or alteration for those prey types or from the use of pesticides can adversely affect special status bird species in this habitat.

Bat species can be indirectly affected by predation by domestic cats and loss of prey sources because of increased human activity and loss of habitat. The potential decline in water sources from increased surface and/or groundwater removal for an increased population need (depending upon the size of the development) could potentially affect the Yuma myotis, although the development in this habitat type would affect other habitat types (i.e., riparian).

Developed

Developed habitat types are those that have been disturbed by human activity or otherwise developed. The towns of Littlefield, Arizona and Mesquite, Nevada are the most developed areas within the VRCMA Boundary. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. This activity has the potential to occur in 2,206 acres of developed habitat in Nevada and 284 acres of developed habitat in Arizona within the VRCMA Boundary (Figures 3-2a, 3-2b, and 3-2c).

DIRECT EFFECTS

Developed habitat would likely be affected by development through increased infill development and a resulting increase in density of housing and buildings. Untended lots, open space, yards, and other pervious surfaces within a developed area would be converted to impervious surfaces such as parking lots, houses, and commercial buildings. For species that are dependent upon the disturbed habitats provided by low- and/or high-density habitat areas, this could result in habitat loss and/or alteration. The only special status species believed to use developed habitat are bird and bat species.

Bird species, including loggerhead shrike, would be directly affected by habitat loss and alteration and human disturbance of nesting and foraging habitats. Loss of habitat is one of the main threats to the persistence of western burrowing owl, as native habitats are converted to agriculture and development (Klute et al. 2003). However, western burrowing owl is known to use urban and semi-urban areas (CEC 2005, Klute et al. 2003), so it could potentially use some of the resulting habitat, after construction is completed and vegetation has regenerated.

Bat species, including pallid bat, hoary bat, and Brazilian free-tailed bat would be affected by habitat loss and conversion. Several bat species may occupy developed habitat within the VRCMA Boundary. Species that roost in these areas are very susceptible to human disturbance and may abandon roosts. Disturbance at a maternity roost may result in reproductive failure in the colony. Species that hibernate may be disturbed and awakened, which may cause more stress and use of energy stores than normal. Loud noises, such as construction noises, in the vicinity of roosts may disorient bats and negatively impact reproduction (AGFD 2001a). Disorientation, resulting from disturbance at a roost, may cause individuals to collide with solid objects or other bats, resulting in injury or mortality, either directly from the collision or from susceptibility to the elements and predators, if a bat is rendered flightless.

INDIRECT EFFECTS

Because of development in developed habitats, an increase in the number of vehicles driving through the area is likely to cause injury or mortality to animal species. This could occur from the use of vehicles and heavy machinery during construction activities and from the use of personal vehicles by residents and visitors traveling through developed areas. These effects are described in detail in the Roads activity effects analysis section.

Bird species can be adversely affected by predation from domestic cats and dogs (western burrowing owl), pesticide use for rodent control (western burrowing owl, potentially ferruginous hawk), habitat fragmentation (western burrowing owl), and changes in the fire regime to protect development areas (western burrowing owl). Loss of prey sources from habitat loss or alteration for those prey types can adversely affect all special status bird species in this habitat.

Because of development, bat species can be indirectly affected by predation by domestic cats and the loss of prey sources from reduced habitat.

3.3.4 Agriculture and Grazing

3.3.4.1 Activity Description

Agriculture

Agricultural practices have been occurring in the Lower Virgin River area since the Paiute Indians inhabited this area and continued when settlers made this their home in the late 1800s (Holt 1994). Hay and alfalfa are the primary harvestable crops (USDA 2007). Cattle are the only livestock within the project area according to the U.S. Department of Agriculture (2007). Within the project area, crop production and dairy farms occur primarily in the Bunkerville area, southwest of Mesquite, Nevada (USGS 2004).

The majority of crop production and dairy farms occur immediately around the Virgin River, within the 100-year floodplain, which is not addressed in this document. Additional agricultural operations occur outside of the floodplain in the Bunkerville and Mesquite, Nevada areas and in the Littlefield, Arizona area. Agricultural areas are identified in yellow on Figures 3-3a, 3-3b, and 3-3c. These activities occur on private lands on small farm operations. There are no industrial operations within the project area.

Hay and alfalfa are the primary harvestable crops produced within the project area. Growth and harvesting occurs throughout the year. Alfalfa is cut and harvested approximately every 30 days (Nevada Heritage Foundation 2007). These crops are grown in the vicinity of the Virgin River. Most of those acres are irrigated via return flow irrigation of the Virgin River. Additional activities associated with this action include clearing existing vegetation, plowing, fertilizing, and pesticide application.

Grazing

The VRCMA Boundary overlaps with portions of two BLM-managed grazing districts: the Las Vegas district in Nevada and the Arizona Strip district in Arizona. Livestock grazing occurs on allotments of BLM lands within the project area, as well as on state trust lands within Arizona and private lands. In 1968, all grazing allotments within Clark County, Nevada were designated as ephemeral rangelands. This policy was later applied to additional districts. Under this policy, grazing applications must be reviewed annually and may only be authorized when forage exists or climatic conditions indicate the probability of an ephemeral forage crop. The number of Animal Unit Months (AUMs) authorized for livestock grazing in the grazing allotments within these grazing districts is based on results from the current year's production studies in accordance with Ephemeral Range Rules. Because of this rule, some grazing allotments have been closed or reduced to protect the vegetation from over-grazing in years of low productivity (BLM 1998). Figures 3-3a, 3-3b, and 3-3c identify the extent of where grazing allotments allow grazing in the VRCMA Boundary and where agriculture currently exists in the VRCMA Boundary. Tables 3-3a, 3-3b, and 3-3c identify the acres of allotments that are available year-round, available seasonally, or closed, respectively.

In areas in which livestock grazing occurs, vegetation and climatic monitoring should continue. In years of abundant rainfall and other favorable climatic conditions, forage may be abundant and stocking rates can be high. However, in other years, forage may be lacking and stocking rates should be reduced. Only a small percentage of the vegetation in the non-irrigated areas is suitable for livestock grazing and continued use is dependent upon proper monitoring and management.

Table 3-3a Open Grazing Allotments within the VRCMA Boundary

Status	Grazing Allotment Name	Nevada (acres)	Arizona (acres)	Total within VRCMA Boundary (acres)
Open	Billy Goat Peak	489	0	489
	Flat Top Mesa	3,730	0	3,730
	Highwater Meander	920	0	920
	Lower Mormon Mesa	21	0	21
Totals		5,161	0	5,161

*Data obtained from resource management plans for each grazing district published by the Bureau of Land Management.

Table 3-3b Seasonal Grazing Allotments within the VRCMA Boundary

Status	Grazing Allotment Name	Nevada (acres)	Arizona (acres)	Total within VRCMA Boundary (acres)
Seasonal	Beaver Dam Slope	0	1,706	1,706
	Highway	0	624	624
	Littlefield Community	0	3,370	3,370
Totals		0	5,700	5,700

*Data obtained from resource management plans for each grazing district published by the Bureau of Land Management.

Table 3-3c Closed Grazing Allotments within the VRCMA Boundary

Status	Grazing Allotment Name	Nevada (acres)	Arizona (acres)	Total within VRCMA Boundary (acres)
Closed	Bunkerville	21,527	0	21,527
	Hen Springs	4,630	0	4,630
	Jack Rabbit	4,298	0	4,298
	Mesquite Community	2,017	0	2,017
	Pulsipher Wash	3,717	0	3,717
	Virgin River Bottom	339	0	339
	Private or State Lands	0	3,144	3,144
Totals		36,528	3,144	39.672

*Data obtained from resource management plans for each grazing district published by the Bureau of Land Management.

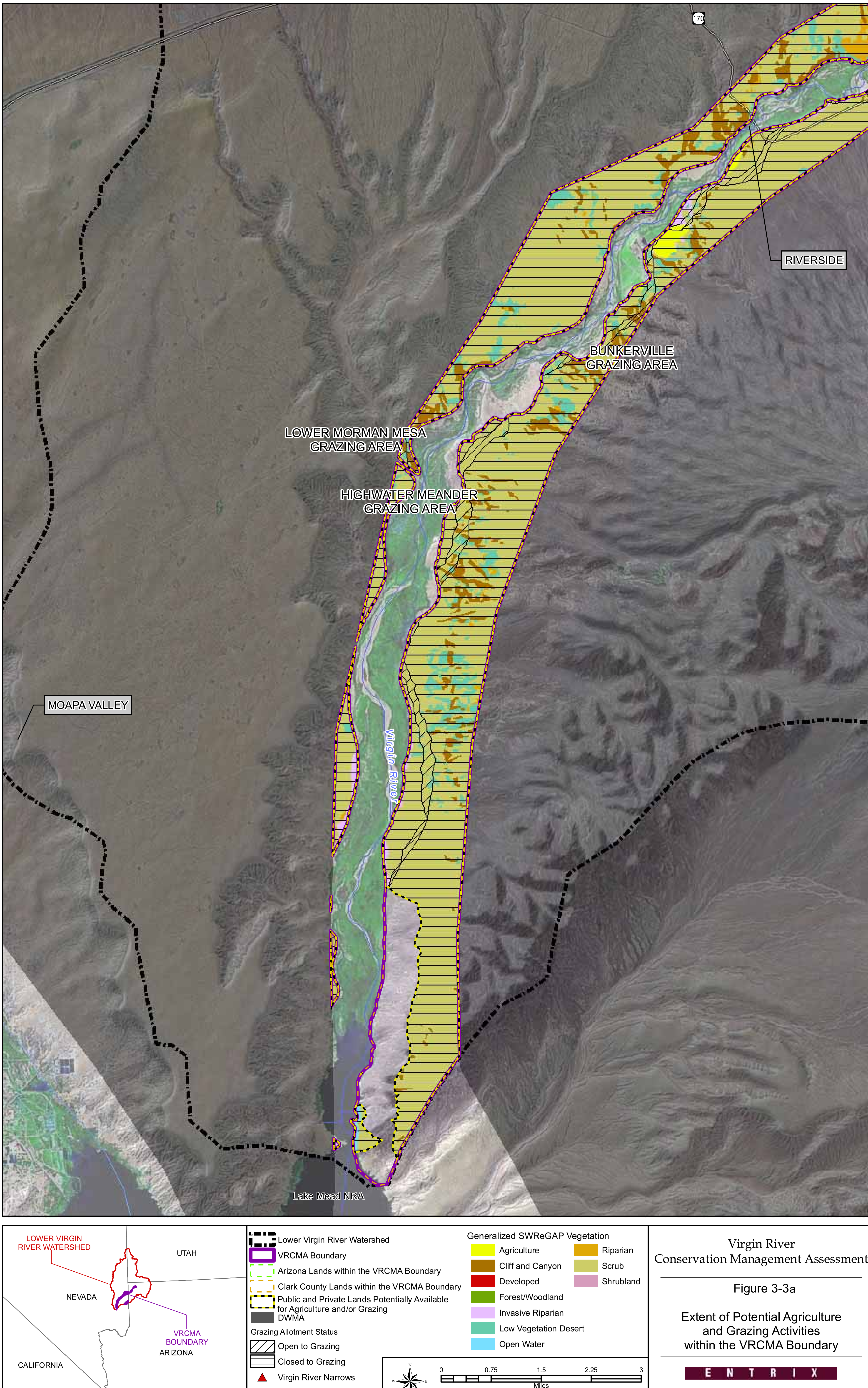
3.3.4.2 Potential Effects of Agriculture and Grazing

Cliffs and Canyon

Cliffs and canyon habitat types are characterized by steep, rocky areas of considerable size. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

Grazing is not currently open to the entire extent of this habitat within the VRCMA Boundary. This activity has the potential to occur in 371 acres of cliffs and canyon habitat in Nevada and less than one acre of cliffs and canyon habitat in Arizona within the VRCMA Boundary (Figures 3-3a, 3-3b, and 3-3c).

Agricultural activities would not occur within the cliffs and canyon habitat, as this habitat is primarily located on public lands. This habitat type is often on steep grades, which are not preferable locations for agricultural activities. For these reasons, only grazing has been analyzed for this habitat. Many grazing allotments on BLM lands include cliffs and canyon habitat, and livestock in the open allotments may use this habitat for grazing. All grazing allotments in Clark County, Nevada are closed, except for the Flat Top Mesa allotment, which is adjacent to Mesquite, Nevada (BLM 1998). All allotments within the Arizona portion of the VRCMA Boundary are available to grazing (BLM 2007a). Small areas of the Jack Rabbit and Lime Mountain allotments may be open for grazing (BLM 2005).

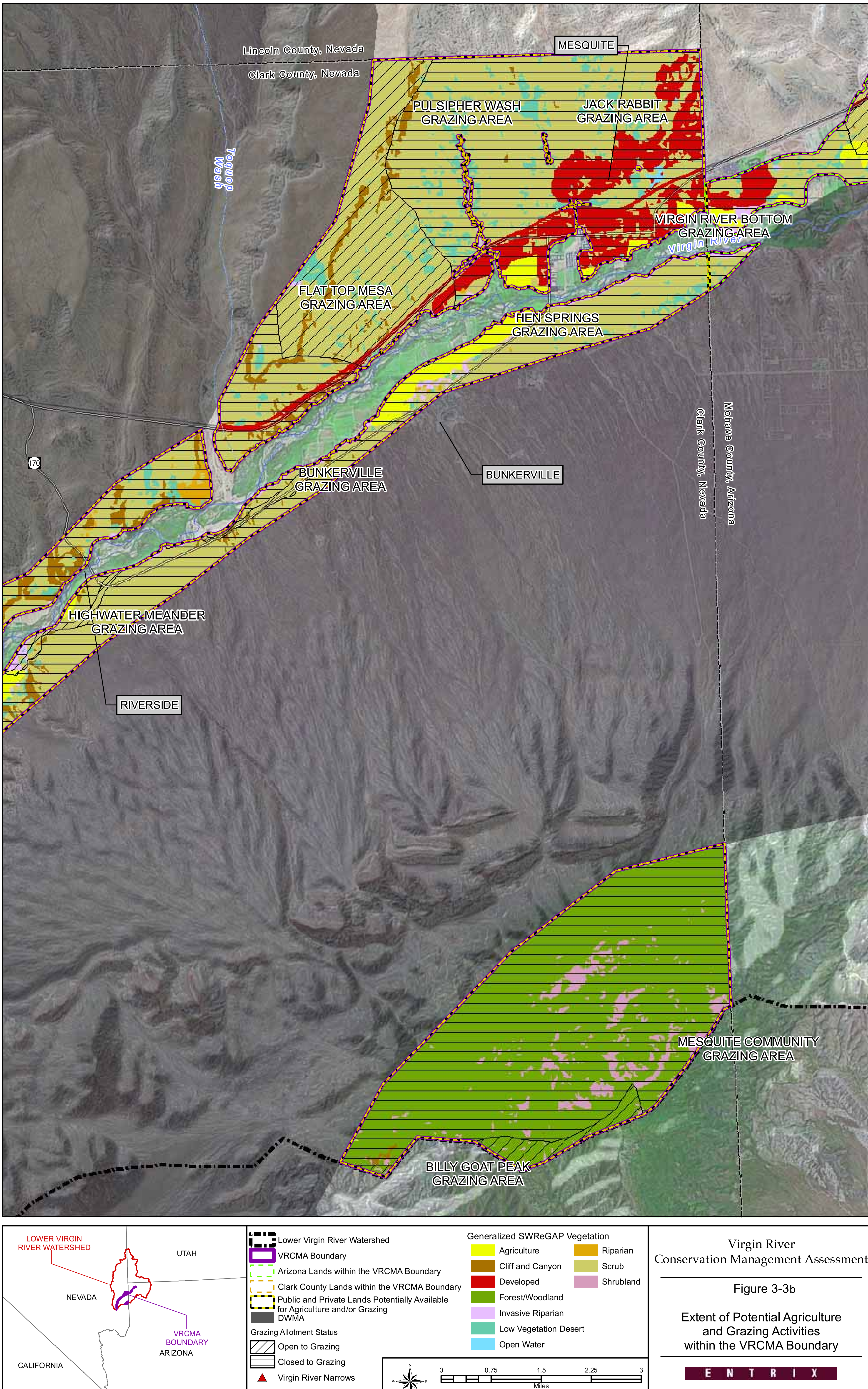


Virgin River
Conservation Management Assessment

Figure 3-3a

Extent of Potential Agriculture and Grazing Activities within the VRCMA Boundary

E N T R I X

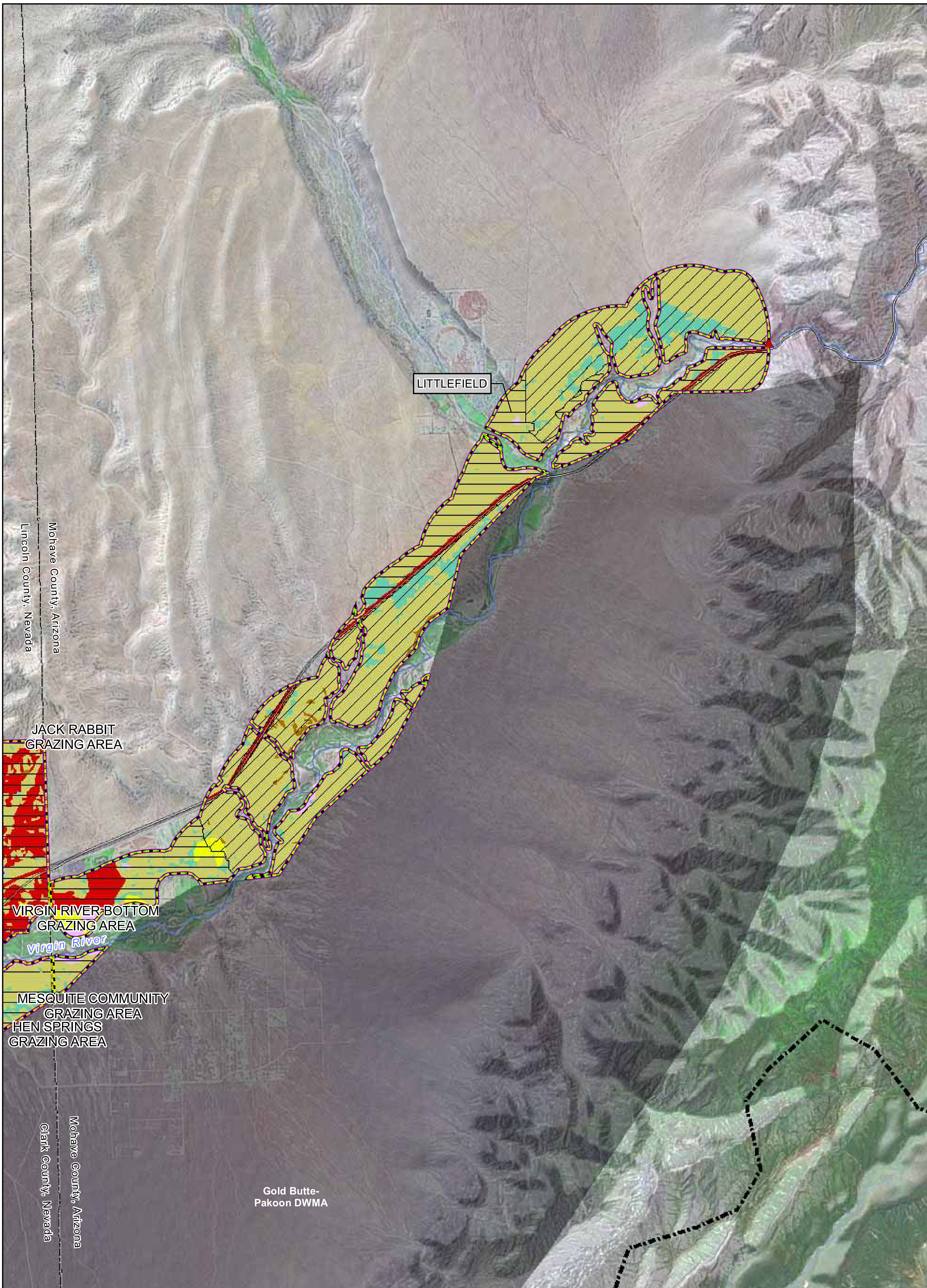


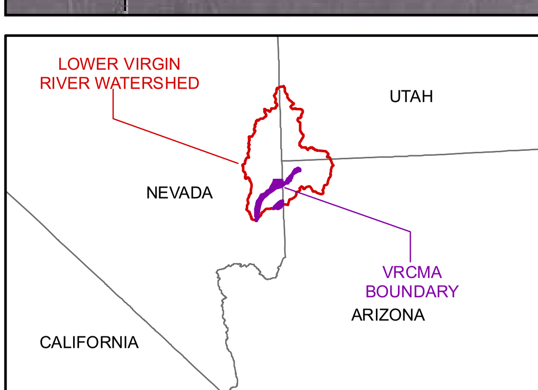
Virgin River
Conservation Management Assessment

Figure 3-3b

Extent of Potential Agriculture
and Grazing Activities
within the VRCMA Boundary

E N T R I X





Lower Virgin River Watershed
VRCMA Boundary
Arizona Lands within the VRCMA Boundary
Clark County Lands within the VRCMA Boundary
Public and Private Lands Potentially Available for Agriculture and/or Grazing
DWMA

Grazing Allotment Status
Open to Grazing
Closed to Grazing
Virgin River Narrows

Generalized SWReGAP Vegetation
Agriculture
Cliff and Canyon
Developed
Forest/Woodland
Invasive Riparian
Low Vegetation Desert
Open Water
Riparian
Scrub
Shrubland

0 0.75 1.5 2.25 3
Miles

Virgin River
Conservation Management Assessment

Figure 3-3c

Extent of Potential Agriculture and Grazing Activities within the VRCMA Boundary

ENTRIX

DIRECT EFFECTS

Grazing effects to special status plants can occur from trampling and alteration of vegetation communities. Specific information about the effect of grazing on special status plants is unknown. On Arizona Strip Field Office lands, none of the special status plants are preferred forage for livestock (BLM 2007a). While it is unknown whether this is true for other BLM and Forest Service lands that are grazed in the VRCMA Boundary, this may likely be the case.

Grazing activities can have significant detrimental effects to wildlife populations, although some species react positively to grazing activities. Negative effects associated with cattle grazing on arid lands can be seen in vegetative communities, faunal communities, and abiotic systems (Jones 2001). Decreases in native plant species diversity, cover, and density as a result of livestock grazing have been observed in a wide variety of arid ecosystems in the western U.S., including those of the Colorado Plateau of southern Utah. Moreover, these kinds of alterations to the vegetative community can in turn lead to significant effects on successional trajectories, the abiotic environment, and wildlife (Jones 2001).

Reptiles, such as desert night lizard, Great Basin collared lizard, and western chuckwalla, are vulnerable to habitat loss and alteration, which could result from overgrazing.

Peregrine falcons may be vulnerable to human disturbance associated with grazing activities, although effects would be minor unless this occurs in the vicinity of a nest site. Too much disturbance may cause nest abandonment. Pesticide use, primarily organochlorides such as DDT, has caused rangewide reproductive failure in peregrine falcons in North America and led to precipitous population declines before DDT was banned (Federal Register 1999). Populations have since recovered, but pesticides in the environment continue to be a threat for this species.

A number of threats associated with grazing are rodenticides, disturbance at nest sites, and habitat loss and degradation. These can all negatively affect ferruginous hawks, prairie falcons, and golden eagles in the VRCMA Boundary (AGFD 2001c). Other bird species such as Bendire’s thrasher, gray vireo, and western bluebird could be negatively affected by habitat loss and degradation and disturbance at nest sites.

The desert bighorn sheep is threatened by livestock grazing (DesertUSA 2008). Grazing can result in avoidance and alteration of suitable habitat.

Bats, such as silver-haired bat, and pallid bat, are threatened by livestock grazing (BLM 1999a). Altering habitat by grazing and/or agriculture can result in loss of prey or food sources found in that habitat, or more directly, destroy existing habitat that may provide habitat for roosting or nesting sites.

INDIRECT EFFECTS

Indirect effects of grazing can be a change in habitat structure and forage availability for other wildlife and increased competition with other native species for significantly reduced water, cover, and space (Donohue 1999, as cited in Jones 2001). Individually and cumulatively, these effects of grazing can significantly alter the habitat of native plants, which in turn alter habitat for wildlife.

Grazing aids in the expansion of invasive vegetative species, through ground disturbance and dispersal of seeds as animals move through areas that already contain invasive species. For example, grazing is noted as partially responsible for the expansion of tamarisk, an invasive species that alters riparian geomorphology and hydrology (Ohmart and Anderson 1982, as cited in Jones 2001). Livestock disperse seeds of invasive species in fur and dung, and reduce competition by native species (Fleischner 1994, as cited in Jones 2001) because the native plants, which are often more palatable, are more readily consumed. Alien plants often out compete native species and can have negative effects on native plants and native wildlife. Soil erosion caused by grazing can affect plant communities, as well.

The spotted bat is threatened by pesticide use on agricultural lands.

Because grazing can significantly alter habitats, associated activities can have substantial long-term effects on the environment in a wide variety of ways. Opening grazing allotments can potentially affect all wildlife and plant species that utilize these areas.

These indirect effects would apply to all special status species in cliffs and canyon habitat. There would be no additional specific indirect effects to individual species.

Low Vegetation Desert

Low vegetation desert habitat consists of dry, arid areas with drought-tolerant vegetation. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

Grazing is not currently open to the entire extent of this habitat within the VRCMA Boundary. This activity has the potential to occur in 301 acres of low vegetation desert habitat in Nevada and 27 acres in Arizona within the VRCMA Boundary (Figures 3-3a, 3-3b, and 3-3c).

Many grazing allotments on BLM lands include low vegetation desert habitat, and livestock in the open allotments may use this habitat for grazing. All grazing allotments in Clark County, Nevada are closed, except for the Flat Top Mesa allotment, which is adjacent to Mesquite, Nevada (BLM 1998). All allotments within the Arizona portion of the VRCMA Boundary are available to grazing, although the Beaver Dam Slope allotment is closed to spring grazing and others lie in wilderness areas (BLM 2007a). Small areas of the Jack Rabbit and Lime Mountain allotments may be open for grazing (BLM 2005).

Agriculture could potentially occur in this habitat if private lands were converted to agriculture.

DIRECT EFFECTS

Grazing activities can have significant detrimental effects to wildlife populations, although some species react positively to grazing activities. Negative effects associated with cattle grazing on arid lands can be seen in vegetative communities, faunal communities, and abiotic systems (Jones 2001). Decreases in native plant species diversity, cover, and density as a result of livestock grazing have been observed in a wide variety of arid ecosystems in the western U.S., including those of the Colorado Plateau of southern Utah. Moreover, these kinds of alterations to the vegetative community can in turn lead to significant effects on successional trajectories, the abiotic environment, and wildlife (Jones 2001). Conversion of land for agricultural use would likely result in loss of habitat and possibly direct mortality and/or injury for most plant and wildlife species. Conversion of this habitat to grazing would result in habitat alteration and the potential for trampling for plant and ground-dwelling wildlife species.

Reptiles, such as the western banded gecko and Great Basin collared lizard, are vulnerable to trampling by livestock, but potential habitat loss and degradation would have a much more significant effect (AGFD 2007b). Diverting water from natural sources to be made available for livestock can lower water tables and cause habitat loss in these areas. Impacts, such as the destruction, degradation, and fragmentation of habitat, may result from agricultural development and livestock grazing. In particular, this has had a significant negative effect on desert tortoise (USFWS 1994).

Peregrine and prairie falcons may be vulnerable to human disturbance associated with grazing and agricultural activities, although effects would be minor unless this occurs near a nest site. Too much disturbance may cause nest abandonment. Pesticide use, primarily organochlorides such as DDT, has caused rangewide reproductive failure in peregrine falcons in North America and led to precipitous population declines before DDT was banned (Federal Register 1999). Populations have since recovered, but pesticides in the environment continue to be a threat for this species.

A number of threats are associated with grazing and agriculture and include pesticides, disturbance at nest sites and habitat loss and degradation. These can all negatively affect ferruginous hawks in the VRCMA Boundary (AGFD 2001c). Overgrazing can result in the invasion of non-native plants and grasses that adversely affect Brewer’s sparrow habitat (Rottenberry et al. 1999).

Phainopeplas are subject to habitat loss and habitat degradation as a result of prolonged presence of livestock, which may feed on plants that are vegetation that phainopeplas would utilize. Other bird species, such as Bendire’s thrasher and loggerhead shrike, could be affected by disturbance and habitat loss either positively or negatively.

The desert bighorn sheep is threatened by livestock grazing (DesertUSA 2008). Grazing can result in avoidance and alteration of suitable habitat.

Bats, such as California leaf-nosed bat, spotted bat, and big free-tailed bat, are threatened by livestock grazing (BLM 1999a). Altering habitat by grazing can result in loss of prey or food sources found in that habitat, or more directly, destroy existing habitat that may provide habitat for roosting or nesting sites. Desert pocket mouse and desert kangaroo rat can also be affected by habitat alteration and conversion from grazing and agriculture activities.

Grazing and conversion of land to agriculture directly affects plants and wildlife by potentially causing direct mortality, habitat loss, habitat degradation, and poisoning from pesticides.

INDIRECT EFFECTS

Indirect effects of grazing can include a change in habitat structure and forage availability for wildlife and increased competition for significantly reduced water, cover, and space (Donohue 1999, as cited in Jones 2001). Individually and cumulatively, these effects of grazing can significantly alter the habitat of native plants, which in turn alter habitat for wildlife.

Grazing aids in the expansion of invasive vegetative species, through ground disturbance and dispersal of seeds as animals move through areas that already contain invasive species. For example, grazing is noted as partially responsible for the expansion of tamarisk, an invasive species that alters riparian geomorphology and hydrology (Ohmart and Anderson 1982, as cited in Jones 2001). Livestock disperse seeds of invasive species in fur and dung, and reduce competition by native species (Fleischner 1994, as cited in Jones 2001) because the native plants, which are often more palatable, are more readily consumed. Alien plants often out compete native species and can have negative effects on native plants and native wildlife. Soil erosion caused by grazing can affect plant communities, as well. Brown-headed cowbird, an obligate brood-parasite, is often found in association with grazing and agricultural habitats. This species has a negative effect on many passerine birds, such as phainopepla, by causing reproductive failure in the host species.

Conserving burrowing mammal colonies is of primary importance to sustaining western burrowing owls. They respond positively to grazing, but can lose nesting and roosting burrows from human efforts to control squirrels and prairie dogs with poison (BISON 2000, as cited in AGFD 2001c).

Pesticides used in agriculture can threaten bats, such as the western small-footed myotis, by reducing their prey source (AGFD 2001d).

Because grazing and agriculture can significantly alter habitats, these activities can have substantial long-term effects on the environment in a wide variety of ways. Conversion of areas to agriculture or opening grazing allotments can potentially affect all wildlife and plant species that utilize these areas.

Forest/Woodland

Forests and woodlands are characterized by trees and shrubs; these habitats are in areas that receive enough moisture to support trees. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

Grazing is not currently open to the entire extent of this habitat within the VRCMA Boundary. This activity has the potential to occur in 453 acres of forest/woodland habitat in Nevada and zero acres in Arizona within the VRCMA Boundary (Figures 3-3a, 3-3b, and 3-3c).

Some grazing allotments on BLM lands include forest/woodland habitat, and livestock in the open allotments may use this habitat for grazing. All grazing allotments in Clark County, Nevada are closed, except for the Flat Top Mesa allotment, which is adjacent to Mesquite, Nevada (BLM 1998). All allotments within the Arizona portion of the VRCMA Boundary are available to grazing, although the Beaver Dam Slope allotment is closed to spring grazing and others lie in wilderness areas (BLM 2007a). Small areas of the Jack Rabbit and Lime Mountain allotments may be open for grazing (BLM 2005).

DIRECT EFFECTS

Very little grazing activities are anticipated to occur in forest/woodland habitat, due to a lack of preferred forage for livestock and difficulty in movement through the habitat. Conversion to agriculture is expected to be unlikely, as these habitats occur on primarily public lands and are at an elevation that would remove the habitats from likely water sources and would provide less of a growing season for agricultural crops. Grazing activities could result in the following effects to special status species.

Plants can be significantly impacted by grazing activities in a wide range of ways. They may experience direct mortality or injury from being eaten or trampled. Plants may experience habitat degradation through livestock disturbing the ground and consuming surrounding vegetation.

Reptiles and amphibians, such as the Pacific tree frog, are vulnerable to trampling by livestock. Habitat loss and degradation pose a significant threat to species such as western banded gecko (AGFD 2007b). Diverting water from natural sources to be made available for livestock can lower water tables and cause habitat loss in these areas. Impacts, such as the destruction, degradation, and fragmentation of habitat, may result from agricultural development and livestock grazing. In particular, this has had a significant negative effect on desert tortoise (USFWS 1994).

Bird species, such as pinyon jay, gray vireo, and loggerhead shrike, could be affected by disturbance and habitat loss. Overgrazing can result in habitat degradation for the black-chinned sparrow (DeSante and George 1994), and in the invasion of non-native plants and grasses that adversely affect Brewer's sparrow habitat (Rottenberry et al. 1999).

The desert bighorn sheep is threatened by livestock grazing (DesertUSA 2008). Grazing can result in avoidance and alteration of suitable habitat. Agricultural activities can result in habitat loss, fragmentation, and degradation for Merriam's shrew (Van der Haegen et al. 2000).

Bats, such as the fringed myotis and hoary bat, are threatened by livestock grazing (AGFD 2003n). Altering habitat by grazing can result in loss of prey or food sources found in that habitat, or more directly, destroy existing habitat that may provide habitat for roosting or maternity sites.

Grazing and conversion of land to agriculture directly affects plants and wildlife by potentially causing direct mortality, habitat loss, habitat degradation, and poisoning from pesticides.

INDIRECT EFFECTS

Indirect effects of grazing can be a change in habitat structure and forage availability for wildlife and increased competition for significantly reduced water, cover, and space (Donohue 1999, as cited in Jones 2001). Individually and cumulatively, these effects of grazing can significantly alter the habitat of native plants, which in turn alter habitat for wildlife.

Grazing aids in the expansion of invasive vegetative species, through ground disturbance and dispersal of seeds as animals move through areas that already contain invasive species. For example, grazing is noted as partially responsible for the expansion of tamarisk, an invasive species that alters riparian geomorphology and hydrology (Ohmart and Anderson 1982, as cited in Jones 2001). Livestock disperse seeds of invasive species in fur and dung, and reduce competition by native species (Fleischner 1994, as cited in Jones 2001) because the native plants, which are often more palatable, are more readily consumed. Alien plants often out compete native species and can have negative effects on native plants and native wildlife. Soil erosion caused by grazing can affect plant communities, as well.

Insecticides can reduce prey for the insectivorous Merriam's shrew in and nearby agricultural lands (Azerrad 2004).

Pesticides used in agriculture can threaten bats, such as the western small-footed myotis, by reducing their prey source (AGFD 2001d).

Brown-headed cowbird, an obligate brood-parasite, is often found in association with grazing and agricultural habitats. This species has a negative effect on passerines by reducing reproductive success in the host species. Because grazing and agriculture can significantly alter habitats, these activities can have substantial long-term effects on the environment in a wide variety of ways. Conversion of areas to agriculture or opening grazing allotments can potentially affect all wildlife and plant species that utilize these areas.

Shrubland

Vegetation in shrubland communities is dominated by shrubby and brushy plants, such as sage. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

Grazing is not currently open to the entire extent of this habitat within the VRCMA Boundary. This activity has the potential to occur in 31 acres of shrubland habitat in Nevada and zero acres of shrubland habitat in Arizona within the VRCMA Boundary (Figures 3-3a, 3-3b, and 3-3c).

Many grazing allotments on BLM lands include shrubland habitat, and livestock in the open allotments may use this habitat for grazing. All grazing allotments in Clark County, Nevada are closed, except for the Flat Top Mesa allotment, which is adjacent to Mesquite, Nevada (BLM 1998). All allotments within the Arizona portion of the VRCMA Boundary are available to grazing (BLM 2007a). Small areas of the Jack Rabbit and Lime Mountain allotments may be open for grazing (BLM 2005).

Agriculture could potentially occur in this habitat if private lands were converted to agriculture.

DIRECT EFFECTS

Grazing activities can have significant detrimental effects to wildlife populations, although some species react positively to grazing activities. Negative effects associated with cattle grazing on arid lands can be seen in vegetative communities, faunal communities, and abiotic systems (Jones 2001). Decreases in native plant species diversity, cover, and density because of livestock grazing have been observed in a wide variety of arid ecosystems in the western U.S. Moreover, these kinds of alterations to the vegetative community can, in turn, lead to significant effects on successional trajectories, the abiotic environment, and wildlife (Jones 2001). Conversion of land for agricultural use may result in loss of habitat and possibly direct mortality for most plant and wildlife species.

Plants can be significantly impacted by grazing activities in a wide range of ways. They may experience direct mortality or injury from being eaten or trampled. Plants may experience habitat degradation through livestock disturbing the ground and consuming surrounding vegetation.

Reptiles, including southern plateau lizard and California king snake, are vulnerable to trampling by livestock. Additionally, habitat loss and degradation pose a significant threat to species such as western banded gecko (AGFD 2007b). Diverting water from natural sources to be made available for livestock can lower water tables and cause habitat loss in these areas. Impacts, such as the destruction, degradation, and fragmentation of habitat, may result from agricultural development and livestock grazing. In particular, this has had a significant negative effect on desert tortoise (USFWS 1994).

Direct effects to the desert tortoise from grazing can occur from mortality by crushing of animals or their burrows by livestock. However, Boarman (2002) reviewed literature regarding livestock crushing tortoises and found observations of trampling by cattle and sheep with little or no data for evaluation. An unpublished BLM study reviewed by Tracy (1996, as cited in Boarman 2002) found that sheep trampled 20 percent of juvenile decoy tortoises, while only trampling three percent of subadults and two percent of adults. No such studies have been conducted for cattle.

Prairie falcon and golden eagle may be vulnerable to human disturbance associated with grazing and agricultural activities, although effects would be minor unless this occurs in the vicinity of a nest site. Too much disturbance may cause nest abandonment. Other bird species, such as pinyon jay, gray vireo, and vesper sparrow, could be affected by disturbance and habitat loss.

Overgrazing can result in the invasion of non-native plants and grasses that adversely affect Brewer's sparrow habitat (Rottenberry et al. 1999). Conserving burrowing mammal colonies is of primary importance to sustaining western burrowing owls. They respond positively to grazing, but can lose nesting and roosting burrows from human efforts to control squirrels and prairie dogs with poison (BISON 2000, as cited in AGFD 2001c).

Bats, such as the fringed myotis and hoary bat, are threatened by livestock grazing (AGFD 2003b). Altering habitat by grazing can result in loss of prey or food sources found in that habitat, or more directly, destroy existing habitat that may provide habitat for roosting or nesting sites.

Some kangaroo mice populations have declined as a result of introduction of weedy grasses and extreme habitat alteration from cultivation (e.g., irrigation of dry sinks) (Hafner and Hafner 1983, as cited in NatureServe 2007), both of which can occur in conjunction with livestock grazing and other agricultural activities. This can negatively affect desert pocket mouse. Grazing may affect kit fox habitat by causing habitat loss and habitat degradation. Habitat loss is considered the biggest threat to this species. Other sources of mortality such as trapping, predator-control programs and predation by coyotes are not considered to have significant affects on most populations (Sillero-Zubiri et al. 2004). Agricultural activities can result in habitat loss, fragmentation, and degradation for Merriam's shrew (Van der Haegen et al. 2001).

Grazing and conversion of land to agriculture directly affects plants and wildlife by potentially causing direct mortality, habitat loss, habitat degradation, and poisoning from pesticides.

INDIRECT EFFECTS

Indirect effects of grazing can be a change in habitat structure and forage availability for wildlife and increased competition for significantly reduced water, cover, and space (Donohue 1999, as cited in Jones 2001). Individually and cumulatively, these effects of grazing can significantly alter the habitat of native plants, which in turn alter habitat for wildlife.

Grazing aids in the expansion of invasive vegetative species, through ground disturbance and dispersal of seeds as animals move through areas that already contain invasive species. For example, grazing is noted as partially responsible for the expansion of tamarisk, an invasive species that alters riparian geomorphology and hydrology (Ohmart and Anderson 1982, as cited in Jones 2001). Livestock disperse seeds of invasive species in fur and dung, and reduce competition by native species (Fleischner 1994, as cited in Jones 2001) because the native plants, which are often more palatable, are more readily consumed. Alien plants often out compete native species and can have negative effects on native plants and native wildlife. Soil erosion caused by grazing can affect plant communities, as well.

Desert tortoise is known to make use of agricultural fields in the Mojave Desert (Knight et al. 1993, Knowles et al. 1989, as cited in Boarman 2002). Agricultural activities can result in indirect effects to desert tortoise, through the drawdown of the water table, introduction of invasive plants along ditch corridors and in fallow fields, and possible introduction of toxic chemicals into desert tortoise habitats (Boarman 2002).

Grazing of livestock can have indirect effects to desert tortoise through alteration of habitat by soil compaction; changes in soil temperature; changing vegetation composition, including introduction of invasive plants into habitat; competition for food; and introduction of invasive plants into habitat (Boarman 2002).

Brown-headed cowbird, an obligate brood-parasite, is often found in association with grazing and agricultural habitats. This species has a negative effect on many passerine birds, such as phainopepla, by causing reproductive failure in the host species.

Overgrazing can result in habitat degradation for the black-chinned sparrow (DeSante and George 1994), and in the invasion of non-native plants and grasses that adversely affect Brewer's sparrow habitat (Rottenberry et al. 1999).

Insecticides can reduce prey for the insectivorous Merriam's shrew in and nearby agricultural lands (Azerrad 2004).

Pesticides used in agricultural pesticides can threaten bats, such as the western small-footed myotis and spotted bat, by reducing their prey source (AGFD 2001d).

Because grazing and agriculture can alter habitats, these activities can have substantial long-term effects on the environment in a wide variety of ways. Conversion of areas to agriculture or opening grazing allotments can potentially affect all wildlife and plant species that utilize these areas.

Scrub

Scrub is the most dominant habitat type throughout the VRCMA Boundary; it is prevalent everywhere but the northern and southeastern reaches. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

Grazing is not currently open to the entire extent of this habitat within the VRCMA Boundary. This activity has the potential to occur in 3,834 acres of scrub habitat in Nevada and 24,835 acres of scrub habitat in Arizona within the VRCMA Boundary (Figures 3-3a, 3-3b, and 3-3c).

Many grazing allotments on BLM lands include scrub habitat, and livestock in the open allotments may use this habitat for grazing. All grazing allotments in Clark County, Nevada are closed, except for the Flat Top Mesa allotment, which is adjacent to Mesquite, Nevada (BLM 1998). All allotments within the Arizona portion of the VRCMA Boundary are available to grazing (BLM 2007a). Small areas of the Jack Rabbit and Lime Mountain allotments may be open for grazing (BLM 2005).

Agriculture could potentially occur in this habitat if private lands were converted to agriculture.

DIRECT EFFECTS

Grazing activities can have significant detrimental effects to wildlife populations, although some species react positively to grazing activities. Negative effects associated with cattle grazing on arid lands can be seen in vegetative communities, faunal communities, and abiotic systems (Jones 2001). Decreases in native plant species diversity, cover, and density as a result of livestock grazing have been observed in a wide variety of arid ecosystems in the western U.S. Moreover, these kinds of alterations to the vegetative community can in turn lead to significant effects on successional trajectories, the abiotic environment, and wildlife (Jones 2001). Conversion of land for agricultural use may result in loss of habitat and possibly direct mortality for many plant and wildlife species.

Plants can be significantly impacted by grazing activities in a wide range of ways. They may experience direct mortality or injury from being eaten or trampled. Plants may experience habitat degradation through livestock disturbing the ground and consuming surrounding vegetation.

Reptiles, including Great Basin collared lizard and Sonoran lyre snake, are vulnerable to trampling by livestock. Additionally, habitat loss and degradation pose a significant threat to these species, such as western banded gecko (AGFD 2007b). Diverting water from natural sources to be made available for livestock can lower water tables and cause habitat loss in these areas. Impacts, such as the destruction, degradation, and fragmentation of habitat, may result from agricultural development and livestock grazing. In particular, this has had a significant negative effect on desert tortoise (USFWS 1994).

Peregrine falcons, prairie falcons, and golden eagle may be vulnerable to human disturbance associated with grazing and agricultural activities, although effects would be minor unless this occurs in the vicinity of a nest site. Too much disturbance may cause nest abandonment. Pesticide use, primarily organochlorides such as DDT, has caused rangewide reproductive failure in peregrine falcons in North America and led to precipitous population declines before DDT was banned (Federal Register 1999). Populations have since recovered, but pesticides in the environment continue to be a threat for this species. Overgrazing can result in the invasion of non-native plants and grasses that adversely affect Brewer’s sparrow habitat (Rottenberry et al. 1999).

Conversion of agricultural land into more developed and commercial areas has caused a decline in available habitat (AGFD 2001b).

Conserving burrowing mammal colonies is of primary importance to sustaining western burrowing owls. They respond positively to grazing, but can lose nesting and roosting burrows from human efforts to control squirrels and prairie dogs with poison (BISON 2000, as cited in AGFD 2001c).

Phainopeplas are subject to habitat loss and habitat degradation as a result of prolonged presence of livestock, which may feed on plants that are vegetation that phainopeplas would utilize. Other bird species such as blue grosbeak and loggerhead shrike also are subject to habitat loss and degradation.

Bats, such as fringed myotis, spotted bat, and pallid bat, are threatened by livestock grazing (AGFD 2003b). Altering habitat by grazing can result in loss of prey or food sources found in that habitat, or more directly, destroy existing habitat that may provide habitat for roosting or nesting sites.

Some kangaroo mice populations have declined as a result of introduction of weedy grasses and extreme habitat alteration from cultivation (e.g., irrigation of dry sinks) (Hafner and Hafner 1983, as cited in NatureServe 2007), both of which can occur in conjunction with livestock grazing and other agricultural activities. This can negatively affect desert pocket mouse. Grazing may affect kit fox habitat by causing habitat loss and habitat degradation. Habitat loss is considered the biggest threat to this species. Other sources of mortality such as trapping, predator-control programs and predation by coyotes are not considered to have significant affects on most populations (Sillero-Zubiri et al. 2004).

Grazing and conversion of land to agriculture directly affects plants and wildlife by potentially causing direct mortality, habitat loss, habitat degradation, and poisoning from pesticides.

INDIRECT EFFECTS

Indirect effects of grazing can include a change in habitat structure and forage availability for wildlife and increased competition for significantly reduced water, cover, and space (Donohue 1999, as cited in Jones 2001). Individually and cumulatively, these effects of grazing can significantly alter the habitat of native plants, which in turn alter habitat for wildlife.

Grazing aids in the expansion of invasive vegetative species, through ground disturbance and dispersal of seeds as animals move through areas that already contain invasive species. For example, grazing is noted as partially responsible for the expansion of tamarisk, an invasive species that alters riparian geomorphology and hydrology (Ohmart and Anderson 1982, as cited in Jones 2001). Livestock disperse seeds of invasive species in fur and dung, and reduce competition by native species (Fleischner 1994, as cited in Jones 2001) because the native plants, which are often more palatable, are more readily consumed. Alien plants often out compete native species and can have negative effects on native plants and native wildlife. Soil erosion caused by grazing can affect plant communities, as well. These effects can occur to any special status plant species present in riparian habitats.

Brown-headed cowbird, an obligate brood-parasite, is often found in association with grazing and agricultural habitats. This species has a negative effect on many passerine birds, such as phainopepla, by causing reproductive failure in the host species.

Pesticides used in agricultural pesticides can threaten bats, such as the western small-footed myotis, by reducing their prey source (AGFD 2001d).

Because grazing and agriculture can significantly alter habitats, these activities can have substantial long-term effects on the environment in a wide variety of ways. Conversion of areas to agriculture or opening grazing allotments can potentially affect all wildlife and plant species that utilize these areas.

Agriculture

Agricultural areas are where the landscape is dominated by food grown for human consumption. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

All allotments within the Arizona portion of the VRCMA Boundary are available to grazing, although some have seasonal restrictions and others lie in wilderness areas (BLM 2007a).

This activity has the potential to occur in 815 acres of agriculture habitat in Nevada and 181 acres of agriculture habitat in Arizona within the VRCMA Boundary (Figures 3-3a, 3-3b, and 3-3c).

DIRECT EFFECTS

Grazing activities can have significant detrimental effects to wildlife populations, although some species react positively to grazing activities. Negative effects associated with cattle grazing on arid lands can be seen in vegetative communities, faunal communities, and abiotic systems (Jones 2001). Decreases in native plant species diversity, cover, and density as a result of livestock grazing have been observed in a wide variety of arid ecosystems in the western U.S, including those of the Colorado Plateau of southern Utah. Moreover, these kinds of alterations to the vegetative community can in turn lead to significant effects on successional trajectories, the abiotic environment, and wildlife (Jones 2001). Increased agricultural activities in this habitat may result in loss of habitat and possibly direct mortality for most plant and wildlife species.

Agriculture and grazing activities within agriculture habitat could result in direct mortality to California king snake from trampling and/or mowing activities.

Peregrine falcons may be vulnerable to human disturbance associated with grazing and agricultural activities, although effects would be minor unless this occurs in the vicinity of a nest site. Too much disturbance may cause nest abandonment. Pesticide use, primarily organochlorides such as DDT, has caused rangewide reproductive failure in peregrine falcons in North America and led to precipitous population declines before DDT was banned (Federal Register 1999). Populations have since recovered, but pesticides in the environment continue to be a threat for this species. Bald eagles have experienced a similar reduction and increase in population as a result of pesticides, and pesticides in the environment are still a threat to these species (AGFD 2002a). Overgrazing can result in the invasion of non-native plants and grasses that adversely affect Brewer's sparrow habitat (Rottenberry et al. 1999).

A number of threats associated with grazing and agriculture are pesticides, disturbance at nest sites, and habitat loss and degradation. These can all negatively affect ferruginous hawks, golden eagles, and prairie falcons in the VRCMA Boundary (AGFD 2001b).

Conserving burrowing mammal colonies is of primary importance to sustaining western burrowing owls. They respond positively to grazing, but have a negative response (nest site loss) from human efforts to control squirrels and prairie dogs with poison (BISON 2000, as cited in AGFD 2001b).

Phainopeplas and other bird species are subject to habitat loss and habitat degradation as a result of prolonged presence of livestock, which may feed on plants that are vegetation that these species would utilize. Other bird species such as blue grosbeak, loggerhead shrike, and western bluebird could be affected by any further habitat loss and degradation within agriculture habitats from agriculture and grazing activities. None of these species nest on the ground and would be unlikely to be adversely affected by mowing activities.

Bats, such as the fringed myotis and pallid bat, are threatened by livestock grazing (AGFD 2003b). Altering habitat by grazing can result in loss of prey or food sources found in that habitat, or more directly, destroy existing habitat that may provide habitat for roosting or nesting sites. Grazing and conversion of land to agriculture directly affect plants and wildlife by potentially causing direct mortality, habitat loss, habitat degradation, and poisoning from pesticides.

INDIRECT EFFECTS

Indirect effects of grazing can be a change in habitat structure and forage availability for wildlife and increased competition for significantly reduced water, cover, and space (Donohue 1999, as cited in Jones 2001). Individually and cumulatively, these effects of grazing can significantly alter the habitat of native plants, which in turn alter habitat for wildlife.

Grazing aids in the expansion of invasive vegetative species, through ground disturbance and dispersal of seeds as animals move through areas that already contain invasive species. For example, grazing is noted as partially responsible for the expansion of tamarisk, an invasive species that alters riparian geomorphology and hydrology (Ohmart and Anderson 1982, as cited in Jones 2001). Livestock disperse seeds of invasive species in fur and dung, and reduce competition by native species (Fleischner 1994, as cited in Jones 2001) because the native plants, which are often more palatable, are more readily consumed. Alien plants often out compete native species and can have negative effects on native plants and native wildlife. Soil erosion caused by grazing can affect plant communities, as well.

Brown-headed cowbird, an obligate brood-parasite, is often found in association with grazing and agricultural habitats. This species has a negative effect on many passerine birds, such as phainopepla, by causing reproductive failure in the host species.

Pesticides used in agricultural pesticides can threaten bats, such as the western small-footed myotis, by reducing their prey source (AGFD 2001d).

Because grazing and agriculture can significantly alter habitats, these activities can have substantial long-term effects on the environment in a wide variety of ways. Conversion of areas to agriculture or opening grazing allotments can potentially affect all wildlife and plant species that utilize these areas.

Developed

Developed habitat types are those that have been disturbed by human activity or otherwise developed. The towns of Littlefield, Arizona and Mesquite, Nevada are the most developed areas within the VRCMA

Boundary. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity would not be expected to occur in developed habitat (Figures 3-3a, 3-3b, and 3-3c).

DIRECT EFFECTS

No direct effects to special status species in developed habitat would be expected, as grazing and agricultural activities would not occur in developed habitat.

INDIRECT EFFECTS

No indirect effects to special status species in developed habitat would be expected, as grazing and agricultural activities would not occur in developed habitat.

3.3.5 Recreation

3.3.5.1 Activity Description

Casual or dispersed recreation that occurs year-round includes activities such as hiking, backpacking, primitive and non-primitive camping, bird watching, wildlife watching, photography, automobile touring, picnicking, horseback riding, caving, geocaching, rock climbing, bouldering, hunting, and competitive and non-competitive off-road vehicle events. Organized competitive events that occur occasionally may include dog field trials, horse endurance rides, all-terrain bicycle events, model airplane fly-ins, and model rocketry launches. Figures 3-4a, 3-4b, and 3-4c highlight the extent of high-level and low-level recreation areas in the VRCMA Boundary and Figures 3-5a, 3-5b, and 3-5c identify land ownership within the VRCMA Boundary.

Recreation that occurs near the Lower Virgin River within the VRCMA Boundary includes hiking on nearby trails and hunting. The potential for conflict is likely to be low from passive recreation activities, such as bird watching and hiking. The potential for conflict from motorized recreation may be high, depending upon the species involved.

Passive recreation and motorized recreation are human activities that have the potential to be in conflict with special status species. Current recreation levels and locations within the entire VRCMA Boundary are unknown.

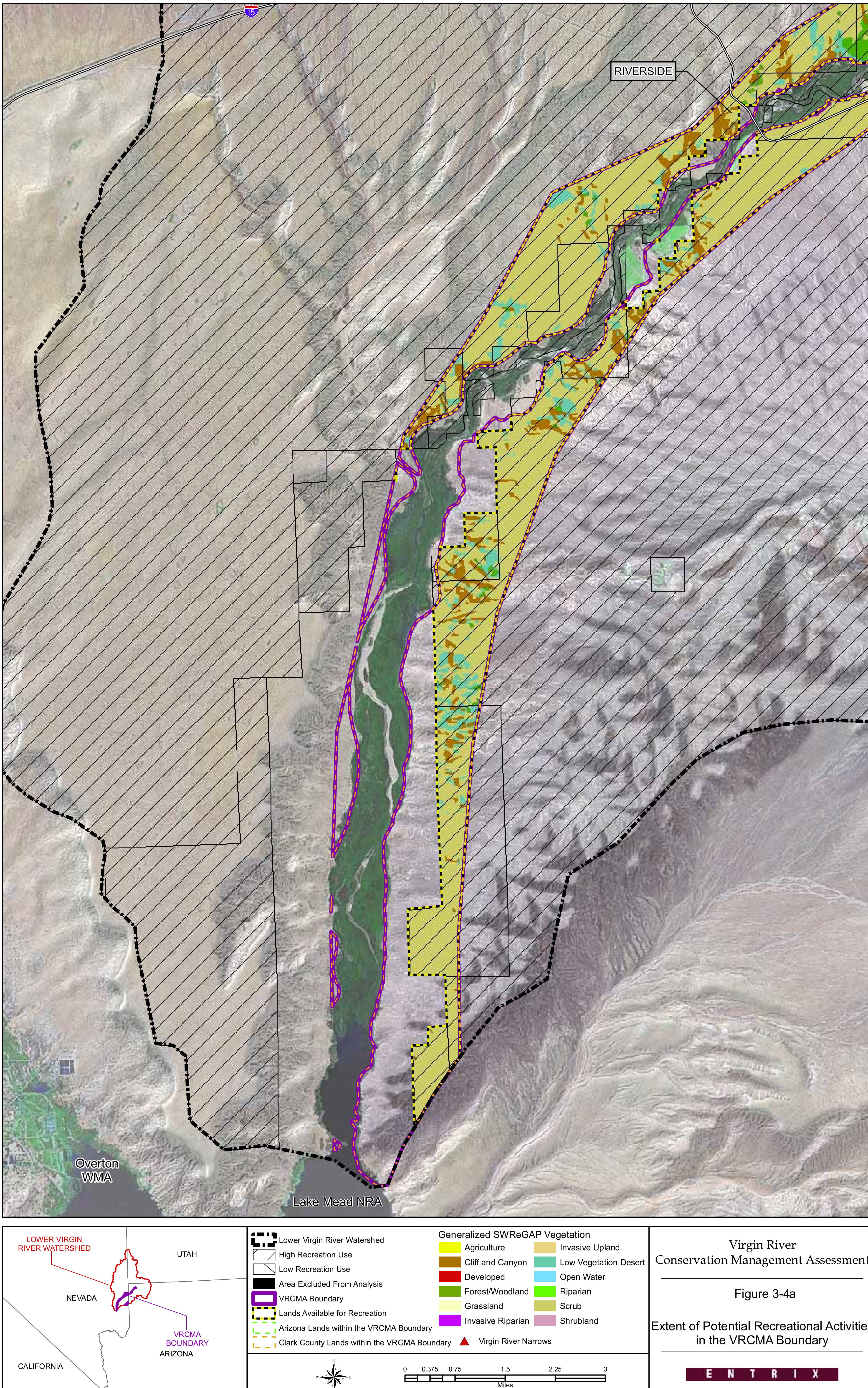
The landowners within the VRCMA Boundary are:

- BLM (35,154 acres in Nevada, 6,580 acres in Arizona),
- State agencies (1,058 acres in Nevada, 615 acres in Arizona),
- Private landowners (5,055 acres in Nevada, 1,683 acres in Arizona),
- USFS (23,644 acres), and
- Lake Mead NRA (1,661 acres in Nevada only).

Any public lands not designated as a Special Recreation Management Areas (SRMA) or as another designation are managed as Extensive Recreation Management Area (ERMA). ERMAs are “where recreation is unstructured and dispersed, minimal recreation-related investments are required, and minimal regulatory constraints are required” (BLM 2008).

SRMAs typically have a higher investment and level of management than what is required in most ERMAs. SRMAs have been designated by the BLM Arizona Strip Field Office for Virgin Ridge as a rock-climbing-oriented area (BLM 2007a). No other SRMAs have been designated within the VRCMA Boundary.

On BLM lands in the Nevada portion of the VRCMA Boundary, OHV use can occur on existing roads, trails, and washes within the BLM Las Vegas Field office managed public lands. OHV operators must comply with Nevada laws and regulations (BLM 1998). In designated areas, speed and non-speed events may occur (BLM 1998). In the Arizona portion of the VRCMA Boundary, OHV use is limited to designated roads and trails (BLM 2007a).

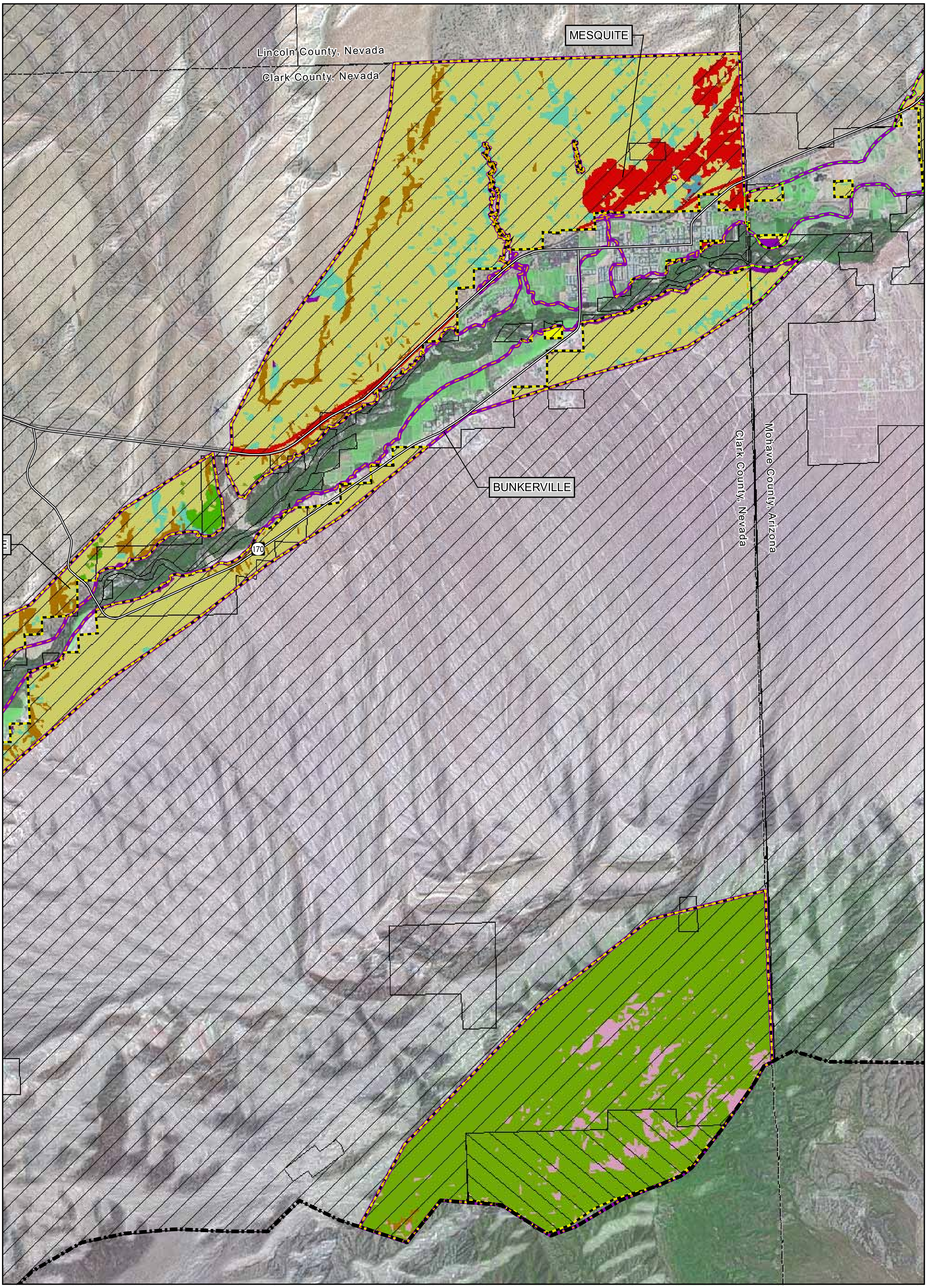


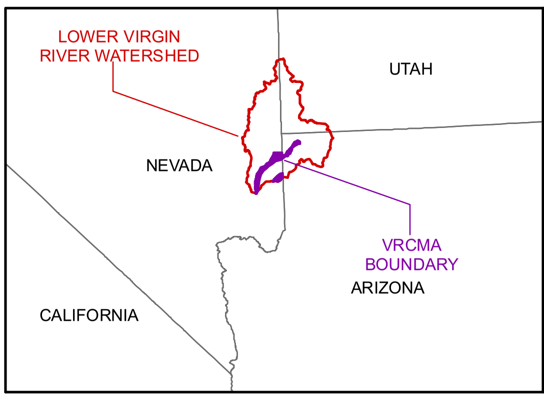
Virgin River
Conservation Management Assessment

Figure 3-4a

Extent of Potential Recreational Activities in the VRCMA Boundary

ENTRIX





Lower Virgin River Watershed
High Recreation Use
Low Recreation Use
Area Excluded From Analysis
VRCMA Boundary
Lands Available for Recreation
Arizona Lands within the VRCMA Boundary
Clark County Lands within the VRCMA Boundary

Generalized SWReGAP Vegetation

Agriculture
Cliff and Canyon
Developed
Forest/Woodland
Grassland
Invasive Riparian
Invasive Upland
Low Vegetation Desert
Open Water
Riparian
Scrub
Shrubland

Virgin River Narrows

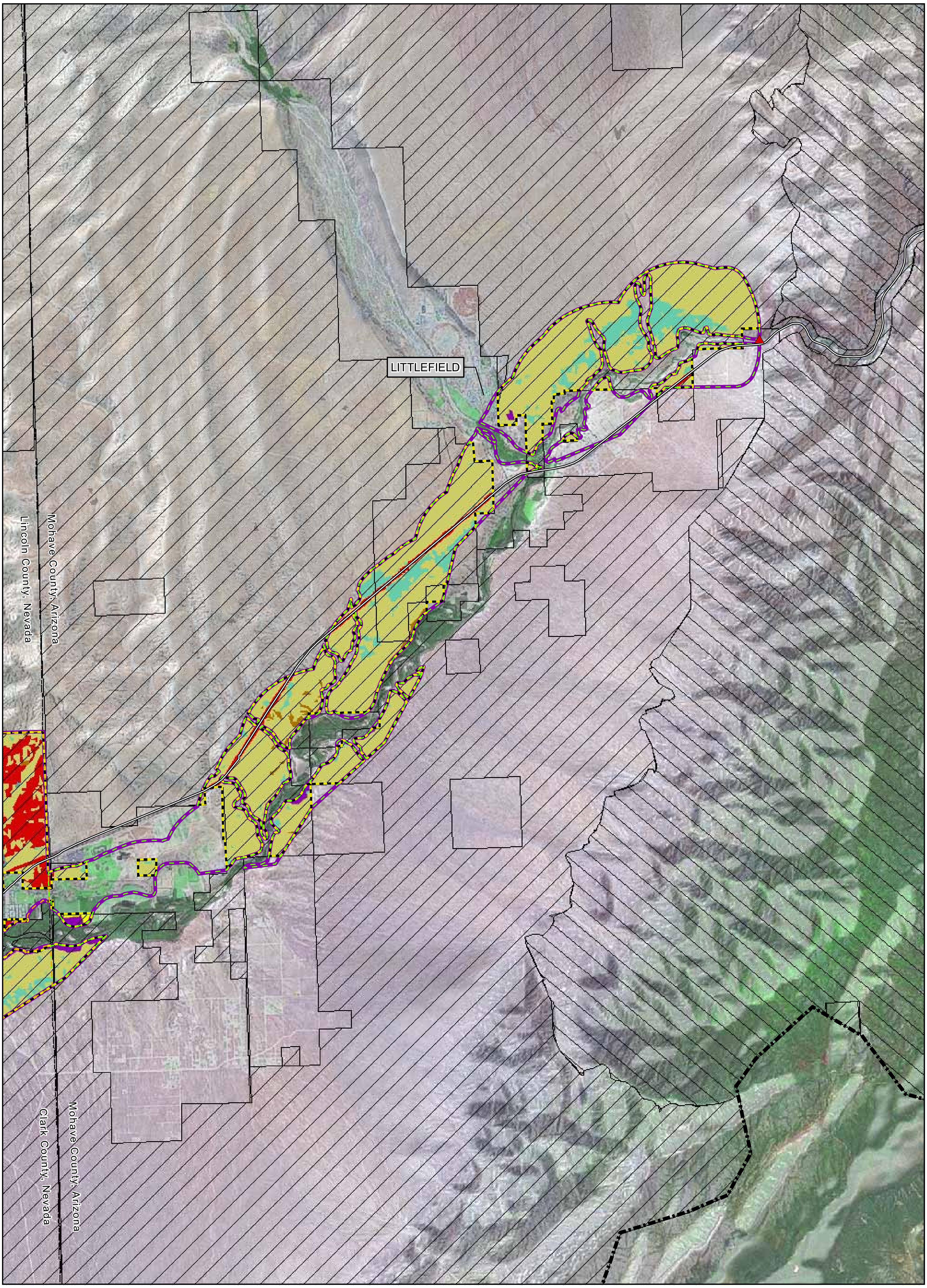
0 0.375 0.75 1.5 2.25 3
Miles

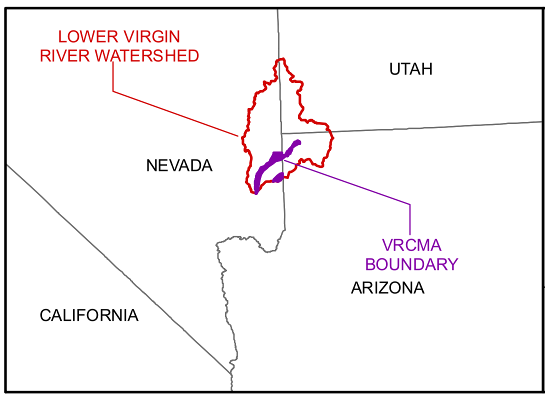
Virgin River
Conservation Management Assessment

Figure 3-4b

Extent of Potential Recreational Activities in the VRCMA Boundary

E N T R I X





Lower Virgin River Watershed
High Recreation Use
Low Recreation Use
Area Excluded From Analysis
VRCMA Boundary
Lands Available for Recreation
Arizona Lands within the VRCMA Boundary
Clark County Lands within the VRCMA Boundary

Generalized SWReGAP Vegetation

Agriculture
Cliff and Canyon
Developed
Forest/Woodland
Grassland
Invasive Riparian
Invasive Upland
Low Vegetation Desert
Open Water
Riparian
Scrub
Shrubland

Virgin River Narrows

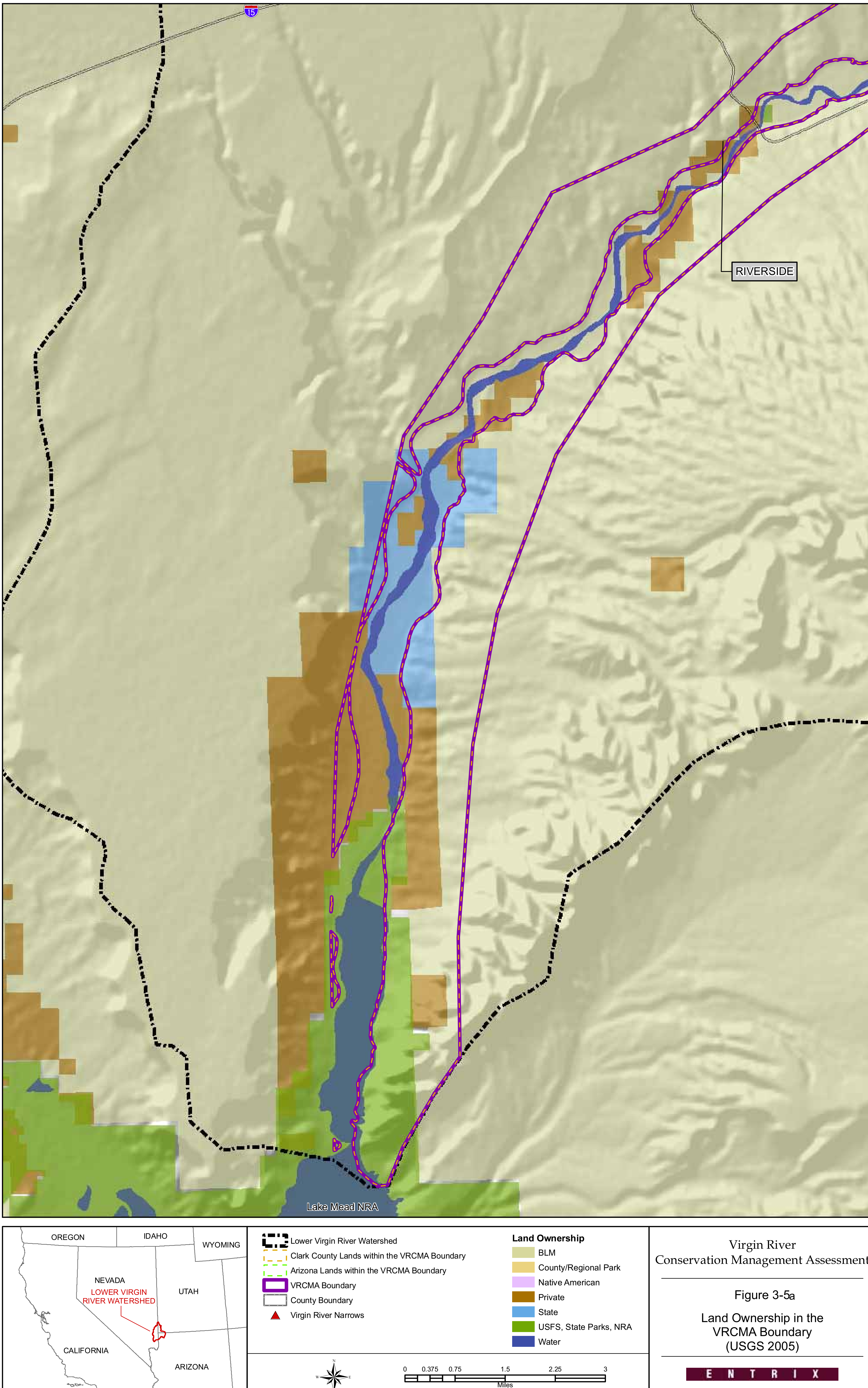
0 0.375 0.75 1.5 2.25 3
Miles

Virgin River
Conservation Management Assessment

Figure 3-4c

Extent of Potential Recreational Activities in the VRCMA Boundary

E N T R I X

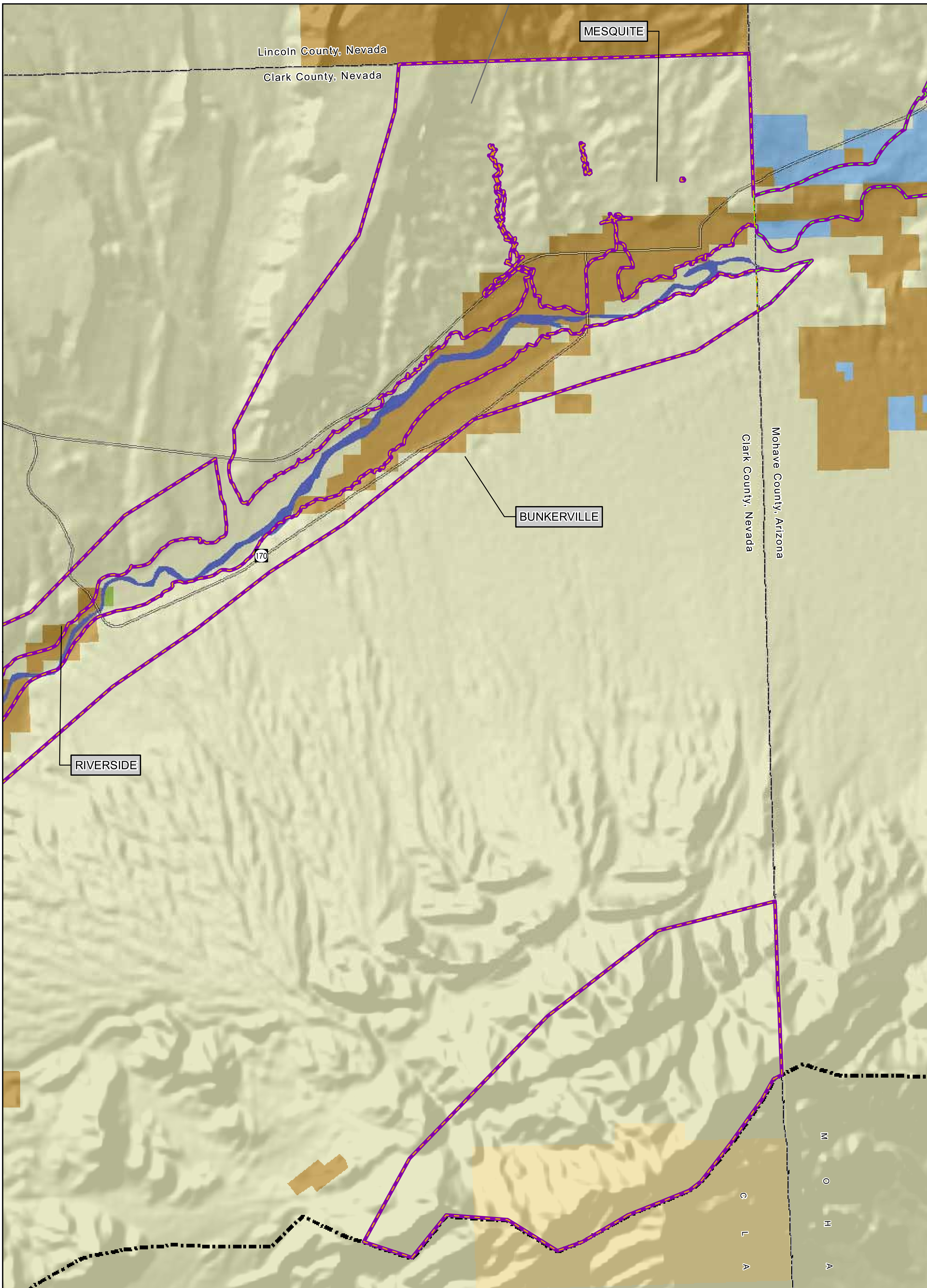


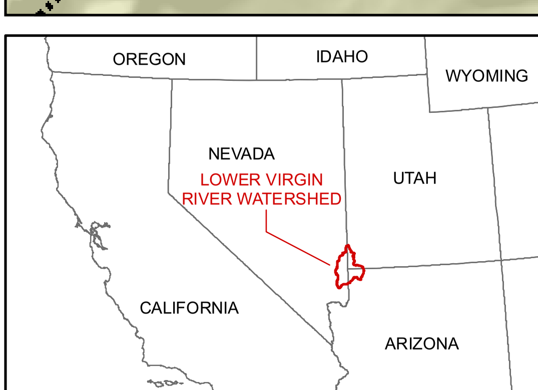
Virgin River
Conservation Management Assessment

Figure 3-5a

Land Ownership in the VRCMA Boundary (USGS 2005)

ENTRIX





Lower Virgin River Watershed
Clark County Lands within the VRCMA Boundary
Arizona Lands within the VRCMA Boundary
VRCMA Boundary
County Boundary
Virgin River Narrows

Land Ownership
BLM
County/Regional Park
Native American
Private
State
USFS, State Parks, NRA
Water

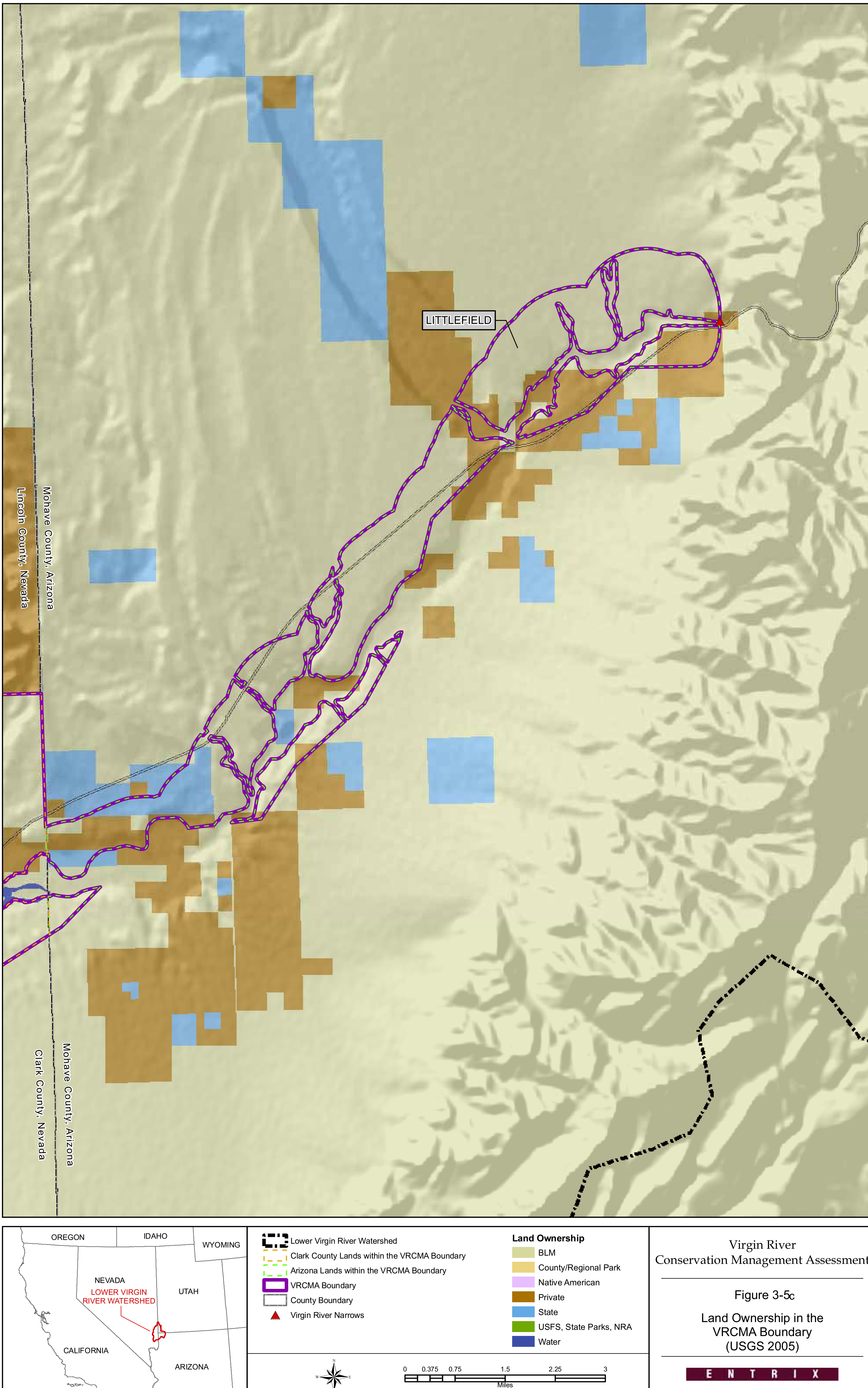
0 0.375 0.75 1.5 2.25 3
Miles

Virgin River
Conservation Management Assessment

Figure 3-5b

Land Ownership in the
VRCMA Boundary
(USGS 2005)

ENTRIX



Virgin River
Conservation Management Assessment

Figure 3-5c

Land Ownership in the VRCMA Boundary (USGS 2005)

ENTRIX

Portions of the Gold Butte ACEC occur within the VRCMA Boundary. This ACEC exists primarily for the protection of desert tortoise. In accordance with this purpose, OHV use is only allowed on designated roads and trails within ACECs in the area. OHV competitions are not being permitted within ACEC boundaries (BLM 1998).

Activities in the Nevada Portion of the VRCMA Boundary

BLM

Activities in the BLM portion of the VRCMA Boundary include caving, photography, automobile touring, backpacking, bird watching, hunting, primitive camping, hiking, rock climbing, and competitive and non-competitive off-road vehicle events. Water-based recreation is limited to a few desert streams and springs. Recreational areas within the Nevada portion of the VRCMA Boundary include mountains, dry lake playas, Joshua tree forests, sand dunes, sandstone bluffs, and riparian areas (BLM 1998).

STATE PARKS

Overton Wildlife Management Area (OWMA) lies in the lower extremes of the Moapa and Virgin River valleys where they flow into the north end of the Overton Arm of Lake Mead. OWMA is open year-round to visitors and is managed by the Nevada Department of Wildlife. Common recreational activities include wildlife observation, horseback riding, photography, hiking, educational activities, and hunting. Waterfowl hunting is the most popular activity and is allowed during waterfowl season every other day. Hunting for dove, quail, rabbit, and turkey is also popular (NDOW 2008).

MESQUITE

Mesquite, Nevada is located just 80 miles northeast of the Las Vegas Valley, which makes it a popular destination for golfing and other outdoor activities. The city of Mesquite has five golf courses, and six casinos, as well as shooting ranges, mountain bike trails, and nature tours (City of Mesquite 2003, LVCVA 2007). Existing parks within the city of Mesquite include six passive parks and seven action parks, and an additional ten passive and 12 action parks have been recently proposed (City of Mesquite 2008). Active parks are those that offer recreation and athletic activities such as football, soccer, and baseball. Passive parks are those that offer more passive activities such as senior activities, plays, and concerts (City of Mesquite 1994). With the City of Mesquite, 31 miles of trails currently exist and 72 miles are proposed (City of Mesquite 2008).

BUNKERVILLE

Around the unincorporated city of Bunkerville, the Bunkerville Trail is currently being planned. This trail will be a multi-use, non-equestrian, non-motorized trail that runs along State Route 170 for two to three miles (Clark County EPD 2008). The Bunkerville Secondary Trails Plan identifies an additional six trails that may be constructed in and surrounding Bunkerville (Clark County 2002). Two parks exist in the central area of Bunkerville (Clark County Department of Comprehensive Planning 2008).

NATIONAL PARK SERVICE

Lake Mead National Recreation Area (NRA) is located in Clark County, Nevada, and Mohave County, Arizona. The populations of Las Vegas, Laughlin, and Bullhead City have grown exponentially in the past ten years. In addition, population centers in Los Angeles, Phoenix, and Salt Lake City have led the nation in growth over recent years. This growth has influenced Lake Mead NRA in many ways, including increased visitation, pressure and development along the recreation boundaries, urban runoff and inflow from the Las Vegas Valley, and increased air pollution. The communities of Boulder City, Henderson, Las Vegas, Bullhead City, and Laughlin are developing up to recreation area boundaries. Housing developments and golf courses have been constructed adjacent to the recreation area boundary. There is the potential for future development along park boundaries, and it is anticipated that this trend will continue to increase. All forms of transportation have increased dramatically over the last ten years and are expected to increase in the future. All regional roads are operating at or near capacity, and major upgrades are underway for U.S. Highway 93, U.S. Highway 95, and Interstate 15. In addition, commercial air tours over Lake Mead National Recreation Area average 800 flights per day (NPS 2002).

Tourism is an important component of the region surrounding Lake Mead National Recreation Area, and much of the tourism revolves around the gaming industry. The recreation area provides a valuable resource to the area, contributing to the local economy through the sale and rental of boats and other water-related equipment, camping equipment, and other recreational equipment, as well as services and maintenance, hotels, restaurants, and travel-related services (NPS 2002).

Activities in the Arizona Portion of the VRCMA Boundary

Activities on the BLM's Arizona Strip lands include competitive events, vehicle exploring and sightseeing, backcountry aviation, and backpacking. OHV use is one of the most popular activities. Exploring or sightseeing is one of the highest use activities and can include touring by SUV, car, horse, small aircraft, walking, hiking, OHV, motorcycle, bicycle, or motor home. Wildlife viewing and hunting are popular in this area. Hunting activities are regulated by the Arizona Game and Fish Department. Other activities include visiting cultural sites, bird watching, viewing wildflowers, camping, hiking, backpacking, and climbing. Activities growing in popularity include flying radio-controlled aircraft, rock crawling, parasailing, and geocaching (BLM 2007a). There are two developed campgrounds and several areas with tables for picnicking or camping that are permanent in nature.

The Arizona Fish and Game Department manages wildlife resources, including regulation of hunting, fishing, and trapping activities (BLM 2007a).

3.3.5.2 Potential Effects of Recreation

Cliffs and Canyon

Cliffs and canyon habitat types are characterized by steep, rocky areas of considerable size. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. High levels of recreation have the potential to occur in 1,798 acres of cliffs and canyon habitat in Nevada and 93 acres of cliffs and canyon habitat in Arizona within the VRCMA Boundary. Low levels of recreation (i.e., wilderness areas) have the potential to occur in zero acres of cliffs and canyon habitat (Figures 3-4a, 3-4b, and 3-4c).

DIRECT EFFECTS

Types of recreation in this habitat are focused on rock climbing, rock scrambling, bouldering, caving, hiking, or the creation of roads, trails, and parking areas to access these sites. These recreation activities can lead to long-term effects such as erosion, soil compaction, and other environmental damage.

For plants confined to cliffs and canyon walls, human disturbance can lead to crushing or injury of plants. For some species, the destruction of the soil crust can be almost as damaging as crushing the plant itself. Vegetation loss and soil compaction in parking areas, near climbing areas, and on trails approaching recreation areas can occur. At the rims of cliffs, vegetation faces open exposure and is likely to be trampled by climbers reaching the top.

Effects on wildlife may include habituation to humans or avoidance of areas.

Reptiles such as the western chuckwalla, Great Basin collared lizard, desert night lizard, and speckled rattlesnake, could be affected by recreation activities in cliffs and canyon habitat that resulted in mortality from road or trail use by vehicles, OHVs, horses, habitat alteration, and human disturbance.

Campground development has proven to be both beneficial and detrimental for birds, depending on the species. Species associated with campgrounds and open canopy include tree nesters, while species that do not prefer open areas are usually ground nesters that need more vegetation cover (Knight et al. 1995).

Many cliff-dwelling animals such as raptors and bats construct nests in this type of habitat and human disturbance can cause nest or roost abandonment. Peregrine falcon and ferruginous hawk are disturbed by rock climbing.

Greater western mastiff bat is disturbed by rock climbing. Big free-tailed bat, spotted bat, California leaf-nosed bat, California myotis, hoary bat, pallid bat, silver-haired bat, and Townsend's big-eared bat are all highly sensitive to disturbance at roost sites. Fringed myotis, Brazilian free-tailed bat, California myotis, and Townsend's big-eared bat all roost in caves and are disturbed by recreational caving.

Kit fox could be affected by human presence in the area and would likely avoid areas where recreation occurred. Desert bighorn sheep are affected by OHV use and rock climbing (DesertUSA 2008).

These effects would be long term and are likely to continue and possibly increase as rock climbing and bouldering become more popular. These activities have a direct and detrimental effect on species and their habitats.

INDIRECT EFFECTS

Indirect effects from recreation can be significant and long-term, depending on the activity and the specific effect. Many activities are continuous and will persist over time, thereby causing more permanent damage to the environment and, subsequently, the species that inhabit the area.

Through the increase of humans in these formerly remote, hard-to-access areas, there can be an increase in litter or rock-climbing gear left behind, as well as pollution from improper human waste disposal.

The introduction of exotic plants through seeds on shoes or clothing can be damaging to native plant species. Areas that have OHV use may potentially experience erosion from vehicles. Intentional removal of vegetation along a climbing route can also occur. Dust deposition from recreation activities, including vehicle and OHV use, can reduce the ability of special status plant species, such as straw milkvetch, dune sunflower, Beaver Dam scurfpea, sticky buckwheat, and rosy twotone beardtongue, to photosynthesize, if these activities occur near special status plant populations.

As a result of recreation use of an area, illegal collection of reptiles could increase. This could result in localized, adverse effects to western chuckwalla, desert night lizard, and speckled rattlesnake. Humans are likely to bring their dogs on recreation excursions, leading to the potential for predation on reptiles.

Low Vegetation Desert

Low vegetation desert habitat consists of dry, arid areas with drought-tolerant vegetation. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. 1,964 acres of low vegetation desert habitat in Nevada and 773 acres of low vegetation desert habitat in Arizona within the VRCMA Boundary are potentially affected by high recreation activities, and zero acres of low vegetation desert habitat are potentially affected by low recreation activities (Figures 3-4a, 3-4b, and 3-4c).

DIRECT EFFECTS

Types of recreation in this habitat consist of hiking, backpacking, camping, picnicking, horseback riding, hunting, and OHV use or events, and the creation of roads, trails, and parking areas to access these sites. These recreation activities can lead to long-term effects such as erosion, soil compaction, and other environmental damage.

Human disturbance can lead to crushing or injury of plants. For some species, the destruction of the soil crust can be almost as damaging as crushing the plant itself. Vegetation loss and soil compaction in parking areas and on trails and dirt roads approaching recreation areas can occur. Vegetation cover can be reduced or species composition altered by intensive grazing from horses or pack animals used for extended camping trips (Knight et al. 1995).

Effects on wildlife may include habituation to humans or avoidance of areas. Major issues include habitat fragmentation due to the creation of roads or trails and habitat degradation due to overuse of the land. Human presence and disturbance can stress wildlife, leading to decreased productivity and consumption of necessary energy reserves needed for reproduction, feeding, or migration. Low level of recreational disturbance can eventually lead to canopy openings or a change in groundcover (Knight et al. 1995).

Human use can lead to illegal collection of reptiles, crushing of burrows for desert tortoise from vehicles, crushing of reptiles from vehicles, and destruction of habitat due to trail construction, equestrian trails, or other recreational use.

Vehicles and OHVs can crush burrows used by western burrowing owls, resulting in direct mortality, injury, and/or habitat loss. Human presence can cause nesting birds, such as long-billed curlew, to abandon the nest, resulting in mortality to eggs or fledglings (Knight et al. 1995). The development of recreational facilities and water impoundments (for swimming, fishing, etc.) may result in the loss of key breeding, foraging, and overwintering habitats for reptiles and amphibians (Joslin and Youmans 1999).

Campground development has proven to be both beneficial and detrimental for birds, depending on the species. Clearing vegetation can alter or destroy habitat for breeding birds, trash left by humans can attract predators and disturbance from human activity can disrupt breeding activities (Rosenberg et al. 2004). Some opportunistic species that are tolerant of human activity, such as cactus wren, may often be associated with campgrounds.

Desert bighorn sheep are affected by OHV use and rock climbing (DesertUSA 2008). Kit fox could be affected by human presence in the area and would likely avoid areas where recreation occurred. Human presence is not known to adversely affect desert pocket mouse. The western pipistrelle and spotted bat could be affected if humans disturb roost sites. Changes in habitat have a large impact on wildlife communities. Most habitat changes would be short-term effects, but in some cases, a long-term effect can be created if the alteration in habitat is permanent or creates habitat for other species that are better competitors for limiting resources.

INDIRECT EFFECTS

Indirect effects from recreation can be significant and long-term, depending on the activity and the specific effect. Many activities are continuous and will persist over time, thereby causing more permanent damage to the environment and, subsequently, the species that inhabit the area.

The introduction of exotic plants through seeds on shoes or clothing can be damaging to native plant species. Areas that have OHV use may potentially experience erosion from vehicles. Areas of OHV use have been documented to have adverse effects on shrubland populations (Knight et al. 1995).

Dust deposition from recreation activities, including vehicle and OHV use, can reduce the ability of special status plant species, such as straw milkvetch, dune sunflower, Beaver Dam scurfpea, sticky buckwheat, and rosy twotone beardtongue, to photosynthesize, if these activities occur near special status plant populations.

As a result of recreation use in an area, illegal collection of reptiles could increase. This could result in localized, adverse effects to western banded gecko, desert tortoise, and other special status reptile species. Humans are likely to bring dogs on hiking or camping ventures, leading to the potential for predation on reptiles.

Off Highway Vehicle use areas have been documented to have a decline in mammals and lizards.

Forest/Woodland

Forests and woodlands are characterized by trees and shrubs; these habitats are in areas that receive enough moisture to support trees. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. 6,776 acres of forest/woodland habitat within Nevada and zero acres of forest/woodland habitat within Arizona in the VRCMA Boundary are potentially affected by high recreation activities, and zero acres of forest/woodland habitat are potentially affected by low recreation activities (Figures 3-4a, 3-4b, and 3-4c).

DIRECT EFFECTS

Types of recreation in this habitat consist of hiking, backpacking, camping, picnicking, horseback riding, hunting, OHV use or events, and the creation of roads, trails, and parking areas to access these sites. These recreation activities can lead to long-term effects such as erosion, soil compaction, and other environmental damage.

Human disturbance can lead to crushing or injury of plants. For some species, the destruction of the soil crust can be almost as damaging as crushing the plant itself. Vegetation loss and soil compaction in parking areas and on trails and dirt roads approaching recreation areas can occur. Vegetation cover can be reduced or species composition altered by intensive grazing from horses or pack animals used for extended camping trips (Knight et al. 1995).

Human presence from recreation activities would be unlikely to affect the Pacific tree frog, although the potential for unintentional trampling would exist. The development of recreational facilities and water impoundments may result in the loss of key breeding, foraging, and overwintering habitats for reptiles and amphibians (Joslin and Youmans 1999).

Effects on wildlife may include habituation to humans or avoidance of areas. Major issues include habitat fragmentation due to the creation of roads or trails and habitat degradation due to overuse of the land. Human use can lead to destruction of habitat due to trail construction, equestrian trails, or other recreational use.

Human use can lead to illegal collection of reptiles, such as southern plateau lizard and California king snake; crushing of reptiles from vehicles; and destruction of habitat due to trail construction, equestrian trails, or other recreational use.

Human presence can cause nesting birds to abandon the nest, resulting in mortality to eggs or fledglings (Knight et al. 1995). Trail bikes and OHV use can result in habitat degradation for the black-chinned sparrow (Johnson and Cicero 1985).

Human presence and disturbance can stress wildlife, leading to decreased productivity and consumption of necessary energy reserves needed for reproduction, feeding, or migration. Low level of recreational disturbance can eventually lead to canopy openings or a change in groundcover (Knight et al. 1995).

Reduction in vegetation cover may reduce the availability of forage for herbivores (Knight et al. 1995).

Changes in habitat have a large impact on wildlife communities. Most habitat changes would be short-term effects, but in some cases, a long-term effect can be created if the alteration in habitat is permanent or creates habitat for other species that are better competitors for limiting resources.

When recreation occurs during peak breeding season, species like flammulated owls are directly affected by human disturbance. Removal of trees for creation of roads and trails also removes important habitat for birds and roosting bats. Human disturbance to roosting sites could affect the Brazilian free-tailed bat, hoary bat, and spotted bat.

INDIRECT EFFECTS

Indirect effects from recreation can be significant and long-term, depending on the activity and the specific effect. Many activities are continuous and will persist over time, thereby causing more permanent damage to the environment and, subsequently, the species that inhabit the area.

The introduction of exotic plants through seeds on shoes or clothing can be damaging to native plant species. Areas that have OHV use may potentially experience erosion from vehicles.

Dust deposition from recreation activities, including vehicle and OHV use, can reduce the ability of special status plant species, such as straw milkvetch, dune sunflower, Beaver Dam scurfpea, sticky buckwheat, and rosy twotone beardtongue, to photosynthesize, if these activities occur near special status plant populations. Areas with OHV use have been documented to have a decline in shrublands, mammals, and lizards. Campground development has proven to be both beneficial and detrimental for birds, depending on the species. Species associated with campgrounds and open canopy include tree nesters, while species that do not prefer open areas are usually ground nesters that need more vegetation cover. Mammals can increase in campground areas due to the increase in food left behind by recreationists (Knight et al. 1995).

Roads indirectly impact populations by creating migration barriers, destroying habitats, and increasing sedimentation and chemical contamination (Joslin and Youmans 1999). Sedimentation occurs when erosion results in elevated levels of sediment washing into a stream or other watercourse. Chemical contamination can occur as a result of leaking fluids or a large chemical spill from vehicles.

Human disturbance near recreation sites and facilities, as well as habitat conversion due to recreational facilities and sites, can affect the foraging and nesting behaviors of flammulated owls and northern goshawks.

Shrubland

Vegetation in shrubland communities is dominated by shrubby and brushy plants, such as sage. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. 552 acres of shrubland habitat in Nevada and zero acres of shrubland habitat in Arizona within the VRCMA Boundary are potentially affected by high recreation activities, and zero acres of shrubland habitat are potentially affected by low recreation activities (Figures 3-4a, 3-4b, and 3-4c).

DIRECT EFFECTS

Types of recreation in this habitat consist of hiking, backpacking, camping, picnicking, horseback riding, hunting, OHV use or events, and the creation of roads, trails, and parking areas to access these sites. These recreation activities can lead to long-term effects such as erosion, soil compaction, and other environmental damage.

Human disturbance can lead to crushing or injury of plants. For some species, the destruction of the soil crust can be almost as damaging as crushing the plant itself. Vegetation loss and soil compaction in parking areas and on trails and dirt roads approaching recreation areas can occur. Vegetation cover can be reduced or species composition altered by intensive grazing from horses or pack animals used for extended camping trips (Knight et al. 1995).

The development of recreational facilities and water impoundments may result in the loss of key breeding, foraging, and overwintering habitats for reptiles and amphibians (Joslin and Youmans 1999).

Effects on wildlife may include habituation to humans or avoidance of areas. Major issues include habitat fragmentation due to the creation of roads or trails and habitat degradation due to overuse of land. Human use can lead to illegal collection of reptiles, crushing of reptiles from vehicles, and destruction of habitat due to trail construction, equestrian trails, or other recreational use.

Human presence can cause nesting birds to abandon the nest, resulting in mortality to eggs or fledglings (Knight et al. 1995). Trail bikes and OHV use can result in habitat degradation for the black-chinned sparrow (Johnson and Cicero 1985).

Campground development has proven to be both beneficial and detrimental for birds, depending on the species. Species associated with campgrounds and open canopy include tree nesters, while species that do not prefer open areas are usually ground nesters that need more vegetation cover (Knight et al. 1995).

Human presence and disturbance can stress wildlife, leading to decreased productivity and consumption of necessary energy reserves needed for reproduction, feeding, or migration. Low level of recreational disturbance can eventually lead to canopy openings or a change in groundcover (Knight et al. 1995).

Desert pocket mouse could be adversely affected by habitat modifications. Kit fox and desert bighorn sheep could be affected by human presence in the area and would likely avoid areas where recreation occurred. Bat species such as Brazilian free-tailed bat, hoary bat, spotted bat, and pallid bat, could be adversely affected if roost sites were disturbed by humans and recreation activities. Desert bighorn sheep are affected by OHV use and rock climbing (DesertUSA 2008).

Changes in habitat have a large impact on wildlife communities. Most habitat changes would be short-term effects, but in some cases, a long-term effect can be created if the alteration in habitat is permanent or creates habitat for other species that are better competitors for limiting resources.

INDIRECT EFFECTS

Indirect effects from recreation can be significant and long-term, depending on the activity and the specific effect. Many activities are continuous and will persist over time, thereby causing more permanent damage to the environment and, subsequently, the species that inhabit the area.

The introduction of exotic plants through seeds on shoes or clothing can be damaging to native plant species. Areas that have OHV use may potentially experience erosion from vehicles.

Dust deposition from recreation activities, including vehicle and OHV use, can reduce the ability of special status plant species, such as straw milkvetch, dune sunflower, Beaver Dam scurfpea, sticky buckwheat, and rosy twotone beardtongue, to photosynthesize, if these activities occur near special status plant populations.

Trail construction and construction of other recreational facilities affects many of the reptiles in this habitat and can destroy vegetation cover for species like Schlesser pincushion. Shrubland species can decline in areas of OHV use.

As a result of recreation use in an area, illegal collection of reptiles could increase. This could result in localized, adverse effects to western banded gecko, desert night lizard, and other special status reptile species. Humans are likely to bring dogs on hiking or camping ventures, leading to the potential for predation on reptiles. Areas of OHV use have been documented to have a decline in lizard populations (Knight et al. 1995).

Scrub

Scrub is the most dominant habitat type throughout the VRCMA Boundary; it is prevalent everywhere but the northern and southeastern reaches. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. 19,812 acres of scrub habitat in Nevada and 5,383 acres in Arizona within the VRCMA Boundary are potentially affected by high recreation activities, and zero acres of scrub habitat are potentially affected by low recreation activities (Figures 3-4a, 3-4b, and 3-4c).

DIRECT EFFECTS

Types of recreation in this habitat consist of hiking, backpacking, camping, picnicking, horseback riding, hunting, OHV use or events, and the creation of roads, trails, and parking areas to access these sites. These recreation activities can lead to long-term effects such as erosion, soil compaction, and other environmental damage.

Human disturbance can lead to crushing or injury of plants. For some species, the destruction of the soil crust can be almost as damaging as crushing the plant itself. Vegetation loss and soil compaction in parking areas and on trails and dirt roads approaching recreation areas can occur. Vegetation cover can be reduced or species composition altered by intensive grazing from horses or pack animals used for extended camping trips (Knight et al. 1995).

Human use can lead to illegal collection of reptiles, crushing of burrows for desert tortoise from vehicles, crushing of reptiles from vehicles, and destruction of habitat due to trail construction, equestrian trails, or other recreational use. Areas where OHV and vehicle uses occur can disturb and harm desert tortoise. The development of recreational facilities and water impoundments may result in the loss of key breeding, foraging, and overwintering habitats for reptiles (Joslin and Youmans 1999).

Vehicles and OHVs can crush burrows used by western burrowing owls, resulting in direct mortality, injury, and/or habitat loss. Human presence can cause nesting birds to abandon the nest, resulting in mortality to eggs or fledglings (Knight et al. 1995).

Campground development has proven to be both beneficial and detrimental for birds, depending on the species. Species associated with campgrounds and open canopy include tree nesters, while species that do not prefer open areas are usually ground nesters that need more vegetation cover.

Human presence and disturbance can stress wildlife, leading to decreased productivity and consumption of necessary energy reserves needed for reproduction, feeding, or migration. Low level of recreational disturbance can eventually lead to canopy openings or a change in groundcover (Knight et al. 1995).

Bat species, such as pallid bat, spotted bat, and western pipistrelle, can be adversely affected if roost sites are disturbed. The desert pocket mouse could be adversely affected by habitat modifications.

Changes in habitat have a large impact on wildlife communities. Most habitat changes would be short-term effects, but in some cases, a long-term effect can be created if the alteration in habitat is permanent or creates habitat for other species that are better competitors for limiting resources.

INDIRECT EFFECTS

Indirect effects from recreation can be significant and long-term, depending on the activity and the specific effect. Many activities are continuous and will persist over time, thereby causing more permanent damage to the environment and, subsequently, the species that inhabit the area.

The introduction of exotic plants through seeds on shoes or clothing can be damaging to native plant species. Areas that have OHV use may potentially experience erosion from vehicles. Shrublands have been documented to decline in areas of OHV use (Knight et al. 1995).

Dust deposition from recreation activities, including vehicle and OHV use, can reduce the ability of special status plant species, such as straw milkvetch, dune sunflower, Beaver Dam scurfpea, sticky buckwheat, and rosy twotone beardtongue, to photosynthesize, if these activities occur near special status plant populations.

As a result of recreation use in an area, illegal collection of reptiles could increase. This could result in localized, adverse effects to western banded gecko, desert tortoise, and other special status reptile species. Humans are likely to bring dogs on hiking or camping ventures, leading to the potential for predation on reptiles.

Areas of OHV use have been documented to have a decline in mammals and lizards.

Agriculture

Agricultural areas, where the landscape is dominated by food grown for human consumption, comprise 815 acres in Nevada and 181 acres in Arizona within the VRCMA Boundary (Table 3-1).

Recreational activities are not likely to be prevalent on agricultural land (Figures 3-4a, 3-4b, and 3-4c).

Developed

Developed habitat types are those that have been disturbed by human activity or otherwise developed. The towns of Littlefield, Arizona and Mesquite, Nevada are the most developed areas within the VRCMA Boundary. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

Parks and recreation areas (acreage is unknown) in developed habitat are potentially affected by high recreation activities, and zero acres of developed habitat are potentially affected by low recreation activities (Figures 3-4a, 3-4b, and 3-4c).

DIRECT EFFECTS

Types of recreation in this habitat that have the potential to occur on parks and recreation areas within the developed habitat include hiking, picnicking, horseback riding, OHV use or events, and the creation of roads, trails, and parking areas to access these sites. These recreation activities can lead to long-term effects such as erosion, soil compaction, and other environmental damage. Human presence and disturbance can stress wildlife, leading to decreased productivity and consumption of necessary energy reserves needed for reproduction, feeding, or migration. However, species that utilize developed habitat are already likely acclimated to human presence.

Vehicles and OHVs can crush burrows used by western burrowing owls, resulting in direct mortality, injury, and/or habitat loss. Human presence can cause nesting birds to abandon the nest, resulting in mortality to eggs or fledglings (Knight et al. 1995). However, species that utilize developed habitat, such as loggerhead shrike, are already likely acclimated to human presence.

Bat species, such as the pallid bat, could be adversely affected if roost sites were disturbed from recreation activities.

Changes in habitat have a large impact on wildlife communities. Most habitat changes would be short-term effects, but in some cases, a long-term effect can be created if the alteration in habitat is permanent or creates habitat for other species that are better competitors for limiting resources.

INDIRECT EFFECTS

Indirect effects from recreation can be significant and long-term, depending on the activity and the specific effect. Many activities are continuous and will persist over time, thereby causing permanent damage to the environment and, subsequently, the species that inhabit the area.

The introduction of exotic plants through seeds on shoes or clothing can be damaging to native plant species. Areas that have OHV use may potentially experience erosion from vehicles.

Reptile species are vulnerable to habitat loss, habitat degradation, and direct mortality as a result of road construction and being crushed by moving vehicles on established roadways.

Birds of prey are vulnerable to human disturbance and mortality by colliding with vehicles as they hunt near roadways. Some species have a very low tolerance of human disturbance and will abandon their nests quickly, which could happen if a new roadway is being constructed. Peregrine falcons sometimes nest under bridges and can be impacted by bridge construction or maintenance activities (NatureServe 2007). Western burrowing owls may be at greater risk of vehicular collisions than other raptors, as they spend most of their time on the ground or close to it.

Bat species are vulnerable to disturbance and loss of roost sites from road construction and maintenance by losing roost sites under bridges, culverts, and natural environments (NCHRP 2002). A loss of a nursery or hibernacula can be a particularly significant impact on bats. Road construction can also be a source of disturbance.

3.3.6 Roads

3.3.6.1 Activity Description

Roads within the VRCMA Boundary are both paved and unpaved and carry varying degrees of vehicular traffic. Highways, such as Highway 15, can carry large volumes, while unpaved roads typically do not. Several bridges cross the Lower Virgin River. Roadwork may require the use of heavy machinery and/or water trucks for dust abatement. The activities associated with use, maintenance, and modification (paving/fencing) of roads include: motorized and mechanized vehicular traffic; grooming and grading of dirt roads; installation of gravel or pavement; installation of water bars, culverts, or other drainage features; installation of protective barriers, posts, or other barricades to limit proliferation of disturbance; installation and maintenance of signs, trailhead markers, cattle guards, retaining walls, fences, and gates; and development of turn-around points, vehicle pull-out sites, and staging areas. Construction and maintenance of roads may last a few hours, or could take months. Once completed, roads are often permanent fixtures of the landscape, although short segments and smaller, unpaved roads that receive little use may be decommissioned or become unmaintained.

The VRCMA Boundary does not contain a high density of roadways. Several roads crisscross the lands within VRCMA Boundary, such as Road 91 and 3454. Highway 15, a major highway, parallels the Virgin River for some distance in Nevada and Arizona. Smaller towns along Highway 15, such as Mesquite, Nevada and Littlefield, Arizona, also have networks of roads. New development is occurring in Mesquite, and thus, this area has a high potential for new roads.

Use and construction of roadways most likely does not vary significantly by season in this area. Inclement weather and snowy conditions at high elevation areas in winter may preclude potential road construction or block passage of traffic.

Roadways for vehicular traffic within the VRCMA Boundary have been present since the early 20th century and the rate of road construction increased as people acquired more cars. Construction of new roads is ongoing and will most likely occur at the edges of growing communities within the VRCMA Boundary. Widening existing roads that receive high volumes of traffic, such as Highway 15, may also occur.

Roads vary in width and can span up to 50 feet. Roads also vary in length, from short, unmaintained roads to longer stretches, such as length of Highway 15 that spans the center of the VRCMA Boundary.

Roadways within the VRCMA Boundary cross a matrix of land owned by BLM, private owners, and the two states. BLM oversees the vast majority of land within the VRCMA Boundary, but many small roads around

Mesquite and Littlefield are surrounded by private property. Other roads cross the area within the VRCMA Boundary and may potentially be constructed in many areas. The Nevada Department of Transportation (NDOT) and the Arizona Department of Transportation (ADOT) are responsible for the construction and maintenance of roadways within the VRCMA Boundary (ADOT 2007, NDOT 2007). A variety of private, commercial and government entities utilize these roadways. Roads assessed for effects here exist primarily in upland habitats and developed areas. Figures 3-6a, 3-6b, and 3-6c demonstrate the existing network of roads in the VRCMA Boundary and identify the area potentially affected by roads.

3.3.6.2 Potential Effects of Roads

Cliffs and Canyon

Cliffs and canyon habitat types are characterized by steep, rocky areas of considerable size. Cliffs and canyons occur in scattered locations throughout the VRCMA Boundary. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. Twenty-one (21) acres of cliffs and canyon habitat in Nevada and two acres of cliffs and canyon habitat in Arizona within the VRCMA Boundary are potentially affected by road activities (Figures 3-6a, 3-6b, and 3-6c).

DIRECT EFFECTS

Road construction could occur almost anywhere within the VRCMA Boundary. Because of this, all wildlife and plants that occupy this area can potentially lose habitat as a result. Species that occupy a narrow range of habitats are particularly vulnerable, and may be significantly affected, if road construction occurs where they are present. Road maintenance may also cause loss of habitat or mortality to special status species depending on the activity. Road construction can occur over brief or long periods of time, depending on the extent of work that may be done. Once a road is constructed, it usually becomes a permanent fixture of the landscape and will have long-term environmental effects. Road construction is likely to increase in all habitat types within the VRCMA Boundary. However, cliffs and canyon habitat types are potentially difficult to access and construct roads; therefore, there will likely not be rapid growth in these areas. Currently, there are few existing roads within cliffs and canyon habitat. Highway 15 passes through cliffs and canyon habitat. Several dirt roads go through the cliffs and canyon habitat in the western part of the VRCMA Boundary.

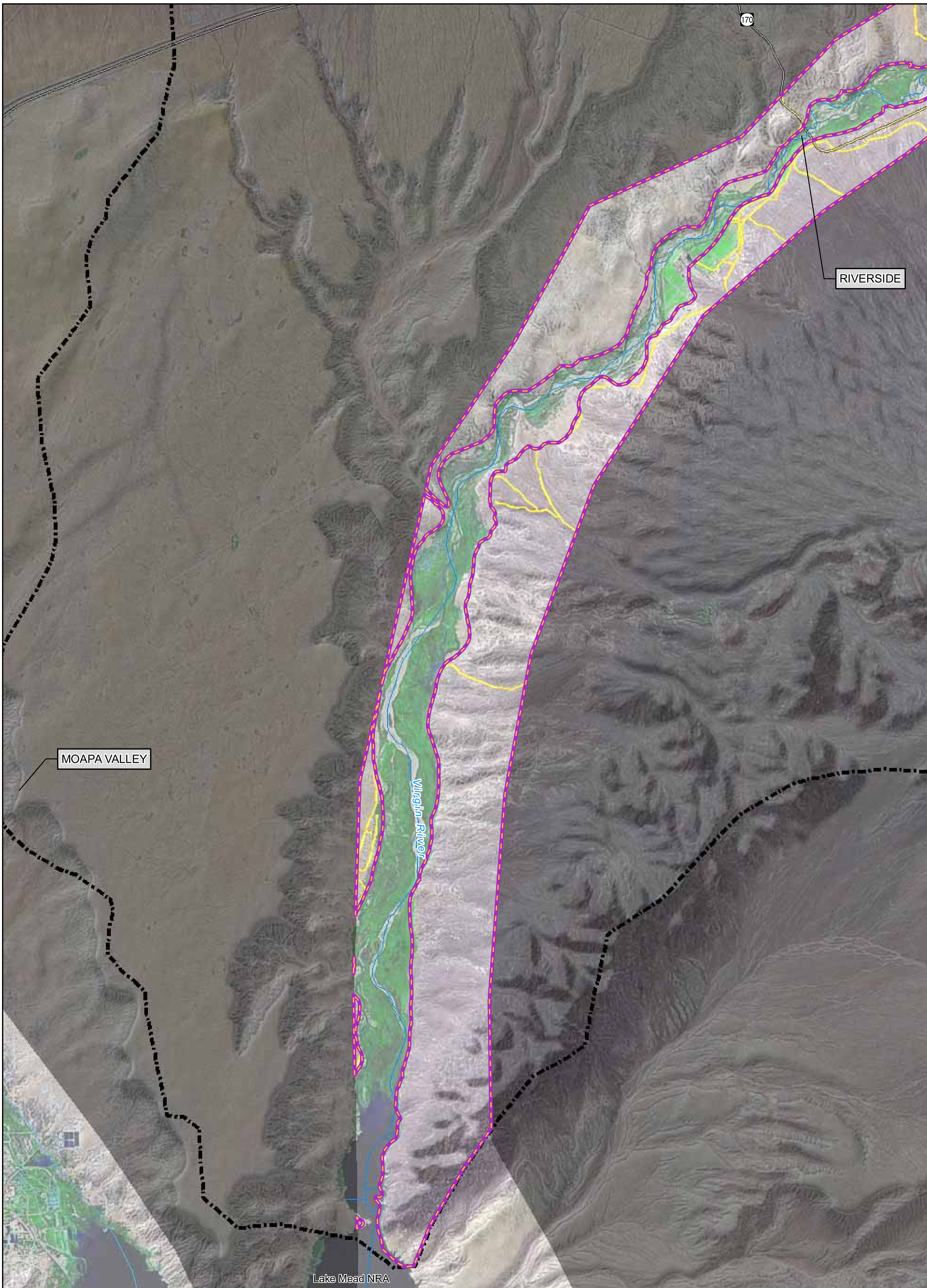
Normal traffic can be a source of disturbance to many species, although some species can regularly be found near roads with high amounts of traffic. Wildlife colliding with vehicular traffic is possible, to some degree, for almost all species being evaluated in this assessment (NCHRP 2002). Road construction and maintenance and vehicles using roads can have significant negative impacts on plant and wildlife populations (NCHRP 2002).

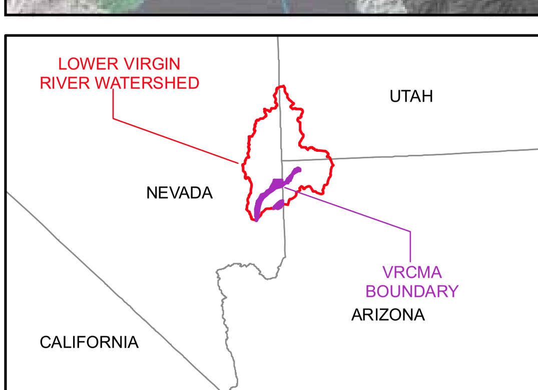
Plants are vulnerable to direct mortality, injury, habitat loss, and habitat degradation as the result of construction and maintenance of roads (NCHRP 2002). Litter, debris, and pollution from existing roadways may impact adjacent habitats, as well.

Reptile species are vulnerable to habitat loss, habitat degradation, and direct mortality as a result of road construction and being crushed by moving vehicles on established roadways.

Birds of prey, including prairie falcon and golden eagle, are vulnerable to human disturbance and mortality by colliding with vehicles as they hunt near roadways. Some species have a very low tolerance of human disturbance and will abandon their nests quickly, which could happen if a new roadway is being constructed. Peregrine falcons sometimes nest under bridges and can be impacted by bridge construction or maintenance activities (NatureServe 2007). Other bird species such as Bendire’s thrasher, pinyon jay, and western bluebird could lose habitat through road development activities.

Bat species are vulnerable to disturbance and loss of roost sites from road construction and maintenance by losing roost sites under bridges, culverts, and natural environments (NCHRP 2002). A loss of a nursery or hibernacula can be a particularly significant impact on bats. Road construction can also be a source of disturbance.





Lower Virgin River Watershed
VRCMA Boundary
Arizona Lands within the VRCMA Boundary
Clark County Lands within the VRCMA Boundary
Virgin River Narrows
DWMA
Lands Potentially Affected by Roads
Virgin River

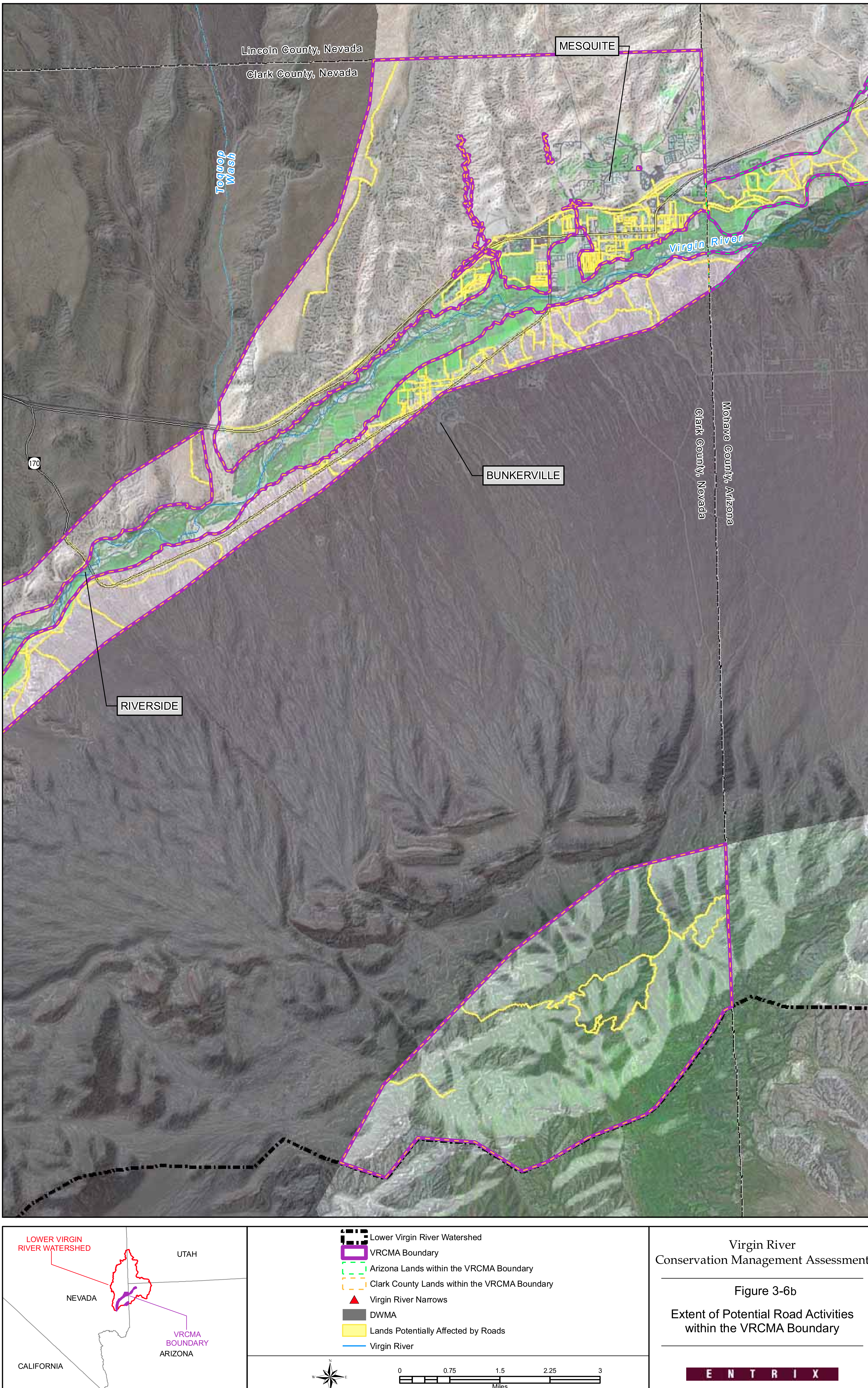
0 0.75 1.5 2.25 3
Miles

Virgin River
Conservation Management Assessment

Figure 3-6a

Extent of Potential Road Activities within the VRCMA Boundary

ENTRIX

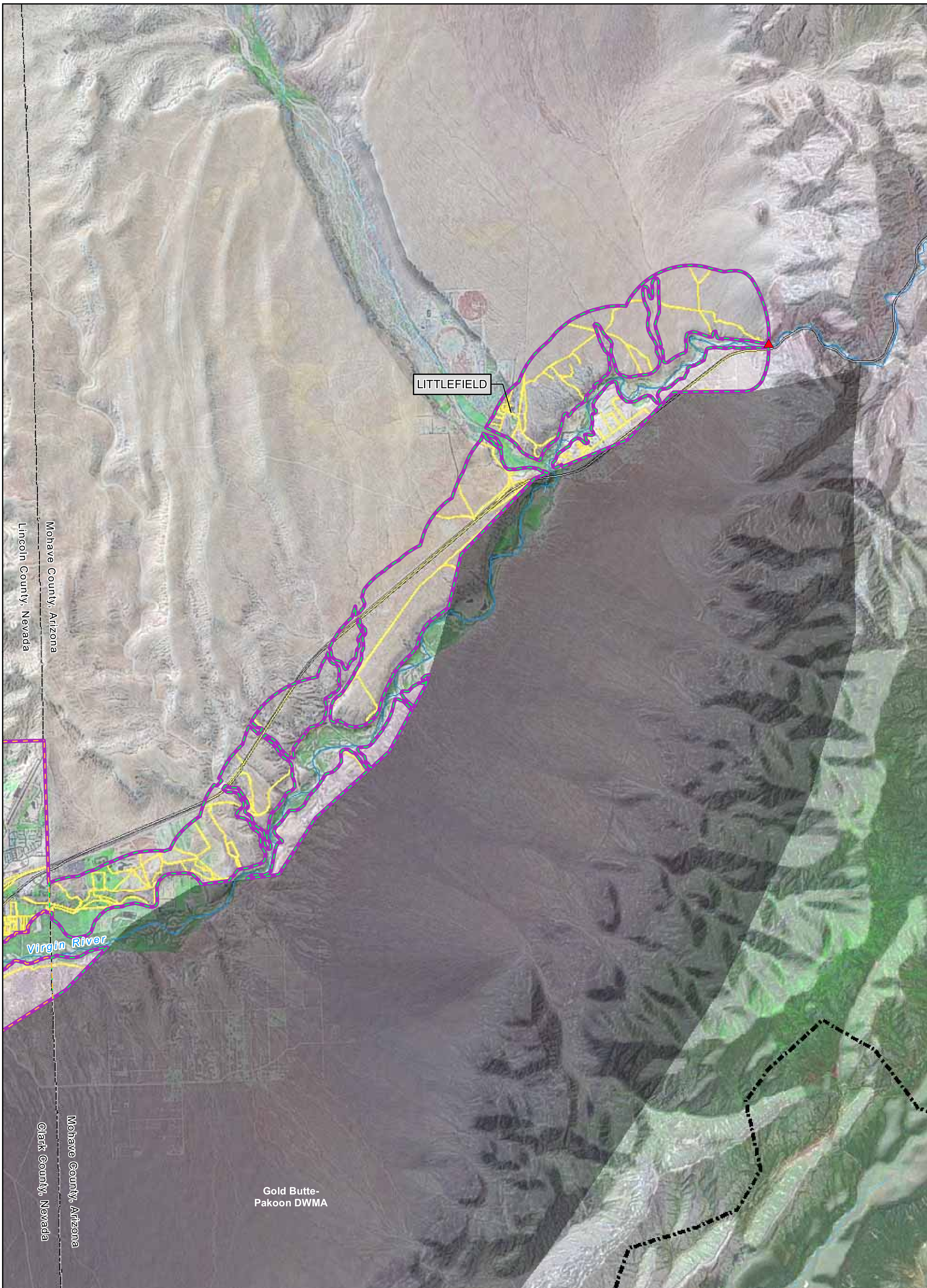


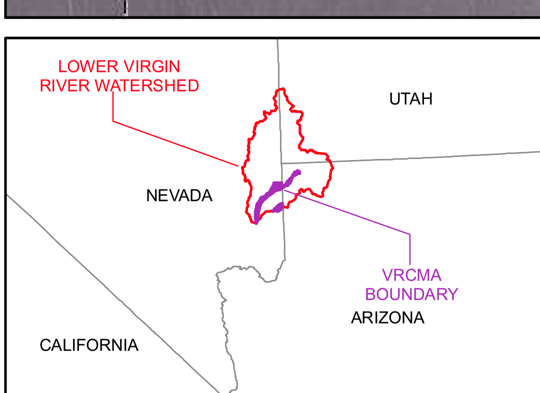
Virgin River
Conservation Management Assessment

Figure 3-6b

Extent of Potential Road Activities within the VRCMA Boundary

ENTRIX





Lower Virgin River Watershed
VRCMA Boundary
Arizona Lands within the VRCMA Boundary
Clark County Lands within the VRCMA Boundary
Virgin River Narrows
DWMA
Lands Potentially Affected by Roads
Virgin River

0 0.75 1.5 2.25 3
Miles

Virgin River
Conservation Management Assessment

Figure 3-6c

Extent of Potential Road Activities within the VRCMA Boundary

ENTRIX

Kit fox and desert bighorn sheep may be struck by moving vehicles during construction of roadways, and could suffer habitat loss and degradation as a result of road construction. Collisions with vehicles are a primary source of mortality in some areas (Sillero-Zubiri et al. 2004, DesertUSA 2008). Habitat loss is considered the biggest threat to this species. Other sources of mortality such as trapping, predator-control programs, and predation by coyotes are not considered to have significant effects on most populations (Sillero-Zubiri et al. 2004).

INDIRECT EFFECTS

Roads can serve as barriers for dispersal of some plants and terrestrial wildlife species, which cause habitat fragmentation (NCHRP 2002). This is particularly true for species at high risk of being injured or killed by traffic, such as invertebrates, reptiles, amphibians and ground-dwelling mammals. This can have long-term effects on wildlife populations. Erosion and changed patterns of hydrology can be a result of road construction (NCHRP 2002). A change in hydrology, in particular, can have significant effects on aquatic invertebrates and fish. However, the extent of these effects and what they will be is difficult to predict.

Roads are known to promote the spread and propagation of invasive weeds (Marcus et al. 1998). In forested areas, road construction opens up areas to increased light intensity, to which nonnative plant species may positively respond (McNab and Meeker 1987). Disturbed areas along the edges of roads create ideal conditions for nonnative plant species (Stapanian et al. 1998). Non-native plants, once established, may remain a significant part of the local flora even if there has been no disturbance for an extended amount of time (Zink et al. 1995). The effects of invasive weeds include increasing frequency of forest fires (Monsen 1994) and competitive exclusion of native plants (Randall and Rejmanek 1993), thus affecting cover and available forage and prey for wildlife. These effects all may have significant negative impacts on both native plants and wildlife.

These factors can make the indirect effects of existing roads and road construction potentially long-term and significant. However, it is difficult to determine the extent of environmental effects broadly and can only be accurately predicted when it is known where a new road would be situated and what plants and wildlife are found nearby.

Low Vegetation Desert

Low vegetation desert habitat consists of dry, arid areas with drought-tolerant vegetation. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

Road construction is not currently open to the entire extent of this habitat within the VRCMA Boundary. Thirty (30) acres of low vegetation desert habitat in Nevada and 51 acres of low vegetation desert habitat in Arizona within the VRCMA Boundary are potentially affected by road activities (Figures 3-6a, 3-6b, and 3-6c).

DIRECT EFFECTS

Road construction could occur almost anywhere within the VRCMA Boundary. Because of this, all wildlife and plants that occupy this area can potentially lose habitat. Species that occupy a narrow range of habitats are particularly vulnerable, and may be significantly affected, if road construction occurs where they are present. Road maintenance may also cause loss of habitat or mortality to special status species depending on the activity. Road construction can occur over brief or long periods of time, depending on the extent of work that may be done. Once a road is constructed, it usually becomes a permanent fixture of the landscape and will have long-term environmental effects. Road construction is likely to increase in all habitat types within the VRCMA Boundary, although there will not likely be rapid growth in areas distant from towns and cities. Currently, there are few existing roads within low vegetation desert habitat. Highway 15 passes through low vegetation habitats in the western part of the VRCMA Boundary.

Normal traffic can be a source of disturbance to many species, although some species can regularly be found near roads with high amounts of traffic. Wildlife colliding with vehicular traffic is possible, to some degree, for almost all species being evaluated in this report (NCHRP 2002). Roadway construction and simply maintaining and vehicles using roads can have significant negative impacts on plant and wildlife populations (NCHRP 2002).

Plants are vulnerable to direct mortality, injury, habitat loss, and habitat degradation as the result of construction and maintenance of roads (NCHRP 2002). Litter, debris, and pollution from existing roadways may impact adjacent habitats as well.

Reptile species are vulnerable to habitat loss, habitat degradation, and direct mortality as a result of road construction and being crushed by moving vehicles on established roadways. The federally endangered desert tortoise can be significantly impacted by habitat loss and degradation by road construction and regularly are killed or injured crossing roads or being hit by OHVs.

Birds of prey are vulnerable to human disturbance and mortality by colliding with vehicles as they hunt near roadways. Some species have a very low tolerance of human disturbance and will abandon their nests quickly, which could happen if a new roadway is being constructed. Peregrine falcons sometimes nest under bridges and can be impacted by bridge construction or maintenance activities (NatureServe 2007). Western burrowing owls may be at greater risk of vehicular collisions than other raptors, as they spend most of their time on the ground, or close to it. Other bird species, such as cactus wren and crissal thrasher could lose habitat from construction and maintenance activities and have the potential for mortality from collision with vehicles.

Desert kangaroo rat can be affected by roads through direct mortality and interruption of movement (Garland and Bradley 1984).

Bat species are vulnerable to disturbance and loss of roost sites from road construction and maintenance by losing roost sites under bridges, culverts, and natural environments (NCHRP 2002). A loss of a nursery or hibernacula can be a particularly significant impact on bats. Road construction can also be a source of disturbance.

Kit fox and desert bighorn sheep may be struck by moving vehicles during construction of roadways, and could suffer habitat loss and degradation as a result of road construction. Collisions with vehicles are a primary source of mortality in some areas (Sillero-Zubiri et al. 2004, DesertUSA 2008). Habitat loss is considered the biggest threat to this species. Other sources of mortality such as trapping, predator-control programs and predation by coyotes are not considered to have significant affects on most populations (Sillero-Zubiri et al. 2004).

INDIRECT EFFECTS

Roads can serve as barriers for dispersal of some plants and terrestrial wildlife species, which cause habitat fragmentation (NCHRP 2002). This is particularly true for species at high risk of being injured or killed by traffic, such as invertebrates, reptiles, amphibians and ground-dwelling mammals. This can have long-term effects on wildlife populations. Erosion and changed patterns of hydrology can be a result of road construction (NCHRP 2002). A change in hydrology, in particular, can have significant effects on aquatic invertebrates and fish. In the years to come, this may have substantial long-term effects or no discernible effects at all on plant and wildlife populations nearby. The extent of these effects and what they will be is difficult to predict.

Roads are known to promote the spread and propagation of invasive weeds (Marcus et al. 1998). In forested areas, road construction opens up areas to increased light intensity, to which nonnative plant species may positively respond (McNab and Meeker 1987). Disturbed areas along the edges of roads create ideal conditions for nonnative plant species (Stapanian et al. 1998). Non-native plants, once established, may remain a significant part of the local flora even if there has been no disturbance for an extended amount of time (Zink et al. 1995). The effects of invasive weeds include increasing frequency of forest fires (Monsen 1994), competitive exclusion of native plants (Randall and Rejmanek 1993), thus affecting cover and available forage and prey for wildlife. These effects all may have significant negative impacts on both native plants and wildlife.

These factors can make the indirect effects of existing roads and road construction potentially long-term and significant. However, it is difficult to determine the extent of environmental effects broadly, and can only be accurately predicted when it is known where a new road would be situated and what plants and wildlife are found nearby.

Forest/Woodland

Forests and woodlands are characterized by trees and shrubs; these habitats are in areas that receive enough moisture to support trees. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. One hundred fifty-four (154) acres of forest/woodland habitat in Nevada and zero acres of forest/woodland habitat in Arizona within the VRCMA Boundary are potentially affected by road activities (Figures 3-6a, 3-6b, and 3-6c).

DIRECT EFFECTS

Road construction could occur almost anywhere within the VRCMA Boundary. Because of this, all wildlife and plants that occupy this area can potentially lose habitat. Species that occupy a narrow range of habitats are particularly vulnerable and may be significantly affected if road construction occurs where they are present. Road maintenance may also cause loss of habitat or mortality to special status species depending on the activity. Road construction can occur over brief or long periods of time, depending on the extent of work that may be done. Once a road is constructed, it usually becomes a permanent fixture of the landscape and will have long-term environmental effects. Road construction is likely to increase in all habitat types within the VRCMA Boundary. Although, there will likely not be rapid growth in areas that are distant from towns and cities. Currently, there are few existing roads within woodland habitats.

Normal traffic can be a source of disturbance to many species, although some species can regularly be found near roads with high amounts of traffic. Wildlife colliding with vehicular traffic is possible, to some degree, for almost all species being evaluated in this assessment (NCHRP 2002). Roadway construction and simply maintaining and vehicles using roads can have significant negative impacts on plant and wildlife populations (NCHRP 2002).

Plants are vulnerable to direct mortality, injury, habitat loss, and habitat degradation as the result of construction and maintenance of roads (NCHRP 2002). Litter, debris, and pollution from existing roadways may impact adjacent habitats as well.

Reptile species are vulnerable to habitat loss, habitat degradation, and direct mortality as a result of road construction and being crushed by moving vehicles on established roadways. The federally endangered desert tortoise can be significantly impacted by habitat loss and degradation by road construction and regularly are killed or injured crossing roads or being hit by OHVs.

Birds of prey, such as golden eagle and western screech owl, are vulnerable to human disturbance and mortality by colliding with vehicles as they hunt near roadways. Some species have a very low tolerance of human disturbance and will abandon their nests quickly, which could happen if a new roadway is being constructed. Peregrine falcons sometimes nest under bridges and can be impacted by bridge construction or maintenance activities (NatureServe 2007). Other bird species, such as Lucy’s warbler and Scott’s oriole could lose habitat from construction and maintenance activities and have the potential for mortality from collision with vehicles.

Kit fox and desert bighorn sheep may be struck by moving vehicles during construction of roadways, and could suffer habitat loss and degradation as a result of road construction. Collisions with vehicles are a primary source of mortality in some areas (Sillero-Zubiri et al. 2004, DesertUSA 2008). Habitat loss is considered the biggest threat to this species. Other sources of mortality such as trapping, predator-control programs and predation by coyotes are not considered to have significant effects on most populations (Sillero-Zubiri et al. 2004).

Bat species are vulnerable to disturbance and loss of roost sites from road construction and maintenance by losing roost sites under bridges, culverts, and natural environments (NCHRP 2002). A loss of a nursery or hibernacula can be a particularly significant impact on bats. Road construction can also be a source of disturbance.

INDIRECT EFFECTS

Roads can serve as barriers for dispersal of some plants and terrestrial wildlife species, which cause habitat fragmentation (NCHRP 2002). This is particularly true for species at high risk of being injured or killed by traffic, such as invertebrates, reptiles, amphibians and ground-dwelling mammals. This can have long-term effects on wildlife populations. Erosion and changed patterns of hydrology can be a result of road construction (NCHRP 2002). A change in hydrology, in particular, can have significant effects on aquatic invertebrates and fish. In the years to come, this may have substantial long-term effects or no discernible effects at all on plant and wildlife populations nearby. The extent of these effects and what they will be is difficult to predict.

Roads are known to promote the spread and propagation of invasive weeds (Marcus et al. 1998). In forested areas, road construction opens up areas to increased light intensity, to which nonnative plant species may positively respond (McNab and Meeker 1987). Disturbed areas along the edges of roads create ideal conditions for nonnative plant species (Stapanian et al. 1998). Non-native plants, once established, may remain a significant part of the local flora even if there has been no disturbance for an extended amount of time (Zink et al. 1995). The effects of invasive weeds include increasing frequency of forest fires (Monsen 1994) and competitive exclusion of native plants (Randall and Rejmanek 1993), thus affecting cover and available forage and prey for wildlife. These effects all may have significant negative impacts on both native plants and wildlife.

These factors can make the indirect effects of existing roads and road construction potentially long-term and significant. However, it is difficult to determine the extent of environmental effects broadly, and can only be accurately predicted when it is known where a new road would be situated and what plants and wildlife are found nearby.

Shrubland

Vegetation in shrubland communities is dominated by shrubby and brushy plants, such as sage. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. Seven acres of shrubland habitat in Nevada and zero acres of shrubland habitat in Arizona within the VRCMA Boundary are potentially affected by road activities (Figures 3-6a, 3-6b, and 3-6c).

DIRECT EFFECTS

Road construction could occur almost anywhere within the VRCMA Boundary. Because of this, all wildlife and plants that occupy this area can potentially lose habitat. Species that occupy a narrow range of habitats are particularly vulnerable and may be significantly affected if road construction occurs where they are present. Road maintenance may also cause loss of habitat or mortality to special status species depending on the activity. Road construction can occur over brief or long periods of time, depending on the extent of work that may be done. Once a road is constructed, it usually becomes a permanent fixture of the landscape and will have long-term environmental effects. Road construction is likely to increase in all habitat types within the VRCMA Boundary, albeit very slowly in areas away from population centers. Since there will likely not be rapid growth in areas that are distant from existing towns and cities, it is unlikely the small amount of shrubland habitat within the VRCMA Boundary will be affected. Currently, there are few existing roads within shrubland habitats.

Normal traffic can be a source of disturbance to many species, although some species can regularly be found near roads with high amounts of traffic. Wildlife colliding with vehicular traffic is possible, to some degree, for almost all species being evaluated in this assessment (NCHRP 2002). Roadway construction and simply maintaining and vehicles using roads can have significant negative impacts on plant and wildlife populations (NCHRP 2002).

Plants are vulnerable to direct mortality, injury, habitat loss, and habitat degradation as the result of construction and maintenance of roads (NCHRP 2002). Litter, debris, and pollution from existing roadways may impact adjacent habitats as well.

Reptile species are vulnerable to habitat loss, habitat degradation, and direct mortality as a result of road construction and being crushed by moving vehicles on established roadways.

Birds of prey are vulnerable to human disturbance and mortality by colliding with vehicles as they hunt near roadways. Some species have a very low tolerance of human disturbance and will abandon their nests quickly, which could happen if a new roadway is being constructed. Peregrine falcons sometimes nest under bridges and can be impacted by bridge construction or maintenance activities (NatureServe 2007). Western burrowing owls may be at greater risk of vehicular collisions than other raptors, as they spend most of their time on the ground or close to it. Other bird species, such as pinyon jay and western bluebird, could lose habitat from construction and maintenance activities and have the potential for mortality from collision with vehicles.

Bat species are vulnerable to disturbance and loss of roost sites from road construction and maintenance by losing roost sites under bridges, culverts, and natural environments (NCHRP 2002). A loss of a nursery or hibernacula can be a particularly significant impact on bats. Road construction can also be a source of disturbance. Desert pocket mouse has the potential for direct mortality from vehicles.

Kit fox and desert bighorn sheep may be struck by moving vehicles during construction of roadways, and could suffer habitat loss and degradation as a result of road construction. Collisions with vehicles are a primary source of mortality in some areas (Sillero-Zubiri et al. 2004, DesertUSA 2008). Habitat loss is considered the biggest threat to this species. Other sources of mortality such as trapping, predator-control programs and predation by coyotes are not considered to have significant affects on most populations (Sillero-Zubiri et al. 2004).

INDIRECT EFFECTS

Roads can serve as barriers for dispersal of some plants and terrestrial wildlife species, which cause habitat fragmentation (NCHRP 2002). This is particularly true for species at high risk of being injured or killed by traffic, such as invertebrates, reptiles, amphibians and ground-dwelling mammals such as desert valley kangaroo mouse (NatureServe 2007). This can have long-term effects on wildlife populations. Erosion and changed patterns of hydrology can be a result of road construction (NCHRP 2002). A change in hydrology, in particular, can have significant effects on aquatic invertebrates and fish. However, the extent of these effects and what they will be is difficult to predict.

Roads are known to promote the spread and propagation of invasive weeds (Marcus et al. 1998). In forested areas, road construction opens up areas to increased light intensity, to which nonnative plant species may positively respond (McNab and Meeker 1987). Disturbed areas along the edges of roads create ideal conditions for nonnative plant species (Stapanian et al. 1998). Non-native plants, once established, may remain a significant part of the local flora even if there has been no disturbance for an extended amount of time (Zink et al. 1995). The effects of invasive weeds include increasing frequency of forest fires (Monsen 1994) and competitive exclusion of native plants (Randall and Rejmanek 1993), thus affecting cover and available forage and prey for wildlife. These effects all may have significant negative impacts on both native plants and wildlife.

These factors can make the indirect effects of existing roads and road construction potentially long-term and significant. However, it is difficult to determine the extent of environmental effects broadly, and can only be accurately predicted when it is known where a new road would be situated and what plants and wildlife are found nearby.

Scrub

Scrub is the most dominant habitat type throughout the VRCMA Boundary; it is prevalent everywhere but the northern and southeastern reaches. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. Six hundred thirty-three (633) acres of scrub habitat in Nevada and 412 acres of scrub habitat in Arizona within the VRCMA Boundary are potentially affected by road activities (Figures 3-6a, 3-6b, and 3-6c).

DIRECT EFFECTS

Road construction could occur almost anywhere within the VRCMA Boundary. Because of this, all wildlife and plants that occupy this area can potentially lose habitat. Species that occupy a narrow range of habitats are particularly vulnerable, and may be significantly affected, if road construction occurs where they are present.

Road maintenance may also cause loss of habitat or mortality to special status species depending on the activity. Road construction can occur over brief or long periods of time, depending on the extent of work that may be done. Once a road is constructed, it usually becomes a permanent fixture of the landscape and will have long-term environmental effects. Road construction is likely to increase in all habitat types within the VRCMA Boundary; although, there will likely not be rapid growth in areas that are distant from towns and cities. Scrub habitat is the most abundant in the VRCMA Boundary and contains the most roads outside of developed and agricultural areas, although it is not densely distributed. Numerous dirt roads are found in scrub habitats throughout the VRCMA Boundary. Highway 15 crosses through scrub habitats, and Highway 91 goes north from Littlefield through scrub habitat.

Normal traffic can be a source of disturbance to many species, although some species can regularly be found near roads with high amounts of traffic. Wildlife colliding with vehicular traffic is possible, to some degree, for almost all species being evaluated in this assessment (NCHRP 2002). Roadway construction, maintenance, and vehicles using roads can have significant negative impacts on plant and wildlife populations (NCHRP 2002).

Plants are vulnerable to direct mortality, injury, habitat loss, and habitat degradation as the result of construction and maintenance of roads (NCHRP 2002). Litter, debris, and pollution from existing roadways may impact adjacent habitats as well.

Reptile species are vulnerable to habitat loss, habitat degradation, and direct mortality as a result of road construction and being crushed by moving vehicles on established roadways. The federally threatened desert tortoise can be significantly impacted by habitat loss and degradation by road construction and regularly are killed or injured crossing roads or being hit by OHVs.

Birds of prey, including golden eagle and prairie falcon, are vulnerable to human disturbance and mortality by colliding with vehicles as they hunt near roadways. Some species have a very low tolerance of human disturbance and will abandon their nests quickly, which could happen if a new roadway is being constructed. Peregrine falcons sometimes nest under bridges and can be impacted by bridge construction or maintenance activities (NatureServe 2007). Western burrowing owls may be at greater risk of vehicular collisions than other raptors, as they spend most of their time on the ground, or close to it. Other bird species, such as Bendire's thrasher, blue grosbeak, and Scott's oriole, could lose habitat from construction and maintenance activities and have the potential for mortality from collision with vehicles.

Bat species are vulnerable to disturbance and loss of roost sites from road construction and maintenance by losing roost sites under bridges, culverts, and natural environments (NCHRP 2002). A loss of a nursery or hibernacula can be a particularly significant impact on bats. Road construction can also be a source of disturbance.

INDIRECT EFFECTS

Roads can serve as barriers for dispersal of some plants and terrestrial wildlife species, which cause habitat fragmentation (NCHRP 2002). This is particularly true for species at high risk of being injured or killed by traffic, such as reptiles, amphibians and ground-dwelling mammals. This can have long-term effects on wildlife populations. Erosion and changed patterns of hydrology can be a result of road construction (NCHRP 2002). A change in hydrology, in particular, can have significant effects on aquatic invertebrates and fish. However, the extent of these effects and what they will be is difficult to predict.

Roads are known to promote the spread and propagation of invasive weeds (Marcus et al. 1998). In forested areas, road construction opens up areas to increased light intensity, to which nonnative plant species may positively respond (McNab and Meeker 1987). Disturbed areas along the edges of roads create ideal conditions for nonnative plant species (Stapanian et al. 1998). Non-native plants, once established, may remain a significant part of the local flora even if there has been no disturbance for an extended amount of time (Zink et al. 1995). The effects of invasive weeds include increasing frequency of forest fires (Monsen 1994) and competitive exclusion of native plants (Randall and Rejmanek 1993), thus, affecting cover and available forage and prey for wildlife. These effects all may have significant negative impacts on both native plants and wildlife.

These factors can make the indirect effects of existing roads and road construction potentially long-term and significant. However, it is difficult to determine the extent of environmental effects broadly, and can only be accurately predicted when it is known where a new road would be situated and what plants and wildlife are found nearby.

Agriculture

Agricultural areas, where the landscape is dominated by food grown for human consumption. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. Eighty-two (82) acres of agriculture habitat in Nevada and 14 acres of agriculture habitat in Arizona within the VRCMA Boundary are potentially affected by road activities (Figures 3-6a, 3-6b, and 3-6c).

DIRECT EFFECTS

Road construction could occur almost anywhere within the VRCMA Boundary. Because of this, all wildlife and plants that occupy this area can potentially lose habitat. Species that occupy a narrow range of habitats are particularly vulnerable, and may be significantly affected, if road construction occurs where they are present. Road maintenance may also cause loss of habitat or mortality to special status species depending on the activity. Road construction can occur over brief or long periods of time, depending on the extent of work that may be done. Once a road is constructed, it usually becomes a permanent fixture of the landscape and will have long-term environmental effects. Road construction is likely to increase in all habitat types within the VRCMA Boundary; although, there will likely not be rapid growth in areas that are distant from towns and cities. Agricultural areas are located adjacent to the VRCMA Boundary from Mesquite westward, and a small area is located north of Littlefield. Roads may be built through agricultural areas, as they are located close to population centers and provide economic value. It is unlikely however that a significant amount of agricultural habitat will be destroyed, since they are located on private property.

Normal traffic can be a source of disturbance to many species, although some species can regularly be found near roads with high amounts of traffic. Wildlife colliding with vehicular traffic is possible, to some degree, for almost all species being evaluated in this report (NCHRP 2002). Roadway construction and simply maintaining and vehicles using roads can have significant negative impacts on plant and wildlife populations (NCHRP 2002).

Reptile species, such as the California king snake are vulnerable to habitat loss, habitat degradation, and direct mortality as a result of road construction and being crushed by moving vehicles on established roadways.

Birds of prey, including golden eagle and prairie falcon, are vulnerable to human disturbance and mortality by colliding with vehicles as they hunt near roadways. Some species have a very low tolerance of human disturbance and will abandon their nests quickly, which could happen if a new roadway is being constructed. Other bird species, such as blue grosbeak and summer tanager, could lose habitat from construction and maintenance activities and have the potential for mortality from collision with vehicles.

Bat species, such as the pallid bat, are vulnerable to disturbance and loss of roost sites from road construction and maintenance by losing roost sites under bridges, culverts, and natural environments (NCHRP 2002). A loss of a nursery or hibernacula can be a particularly significant impact on bats. Road construction can also be a source of disturbance.

INDIRECT EFFECTS

Roads can serve as barriers for dispersal of some plants and terrestrial wildlife species, which cause habitat fragmentation (NCHRP 2002). This is particularly true for species at high risk of being injured or killed by traffic, such as invertebrates, reptiles, amphibians and ground-dwelling mammals. This can have long-term effects on wildlife populations. Erosion and changed patterns of hydrology can be a result of road construction (NCHRP 2002). A change in hydrology, in particular, can have significant effects on aquatic invertebrates and fish. In the years to come, this may have substantial long-term effects or no discernible effects at all on plant and wildlife populations nearby. The extent of these effects and what they will be is difficult to predict.

Roads are known to promote the spread and propagation of invasive weeds (Marcus et al. 1998). In forested areas, road construction opens up areas to increased light intensity, to which nonnative plant species may positively respond (McNab and Meeker 1987). Disturbed areas along the edges of roads create ideal conditions for nonnative plant species (Stapanian et al. 1998). Non-native plants, once established, may remain a significant part of the local flora even if there has been no disturbance for an extended amount of time (Zink et al. 1995). The effects of invasive weeds include increasing frequency of forest fires (Monsen 1994) and competitive exclusion of native plants (Randall and Rejmanek 1993), thus affecting cover and available forage and prey for wildlife. These effects all may have significant negative impacts on both native plants and wildlife.

These factors can make the indirect effects of existing roads and road construction potentially long-term and significant. However, it is difficult to determine the extent of environmental effects broadly, and can only be accurately predicted when it is known where a new road would be situated and what plants and wildlife are found nearby.

Developed

Developed habitat types are those that have been disturbed by human activity or otherwise developed. The towns of Littlefield, Arizona and Mesquite, Nevada are the most developed areas within the VRCMA Boundary. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. Three hundred eight (380) acres of developed habitat in Nevada and 148 acres of developed habitat in Arizona within the VRCMA Boundary are potentially affected by road activities (Figures 3-6a, 3-6b, and 3-6c).

DIRECT EFFECTS

Road construction could occur almost anywhere within the VRCMA Boundary. Because of this, all wildlife and plants that occupy this area can potentially lose habitat. Species that occupy a narrow range of habitats are particularly vulnerable, and may be significantly affected, if road construction occurs where they are present. Road maintenance may also cause loss of habitat or mortality to special status species depending on the activity. Road construction can occur over brief or long periods of time, depending on the extent of work that may be done. Once a road is constructed, it usually becomes a permanent fixture of the landscape and will have long-term environmental effects. Road construction is likely to increase in all habitat types within the VRCMA Boundary; although, there will likely not be rapid growth in areas that are distant from towns and cities. Developed areas in the VRCMA Boundary are easily accessed by Highway 15 and are adjacent to Mesquite, Nevada, Littlefield, Arizona, and St. George, Utah. Road construction in developed areas is significantly more likely than other habitat types within the VRCMA Boundary.

Normal traffic can be a source of disturbance to many species, although some species can regularly be found near roads with high amounts of traffic. Wildlife colliding with vehicular traffic is possible, to some degree, for almost all species being evaluated in this assessment (NCHRP 2002). Roadway construction, maintenance, and vehicles using roads can have significant negative impacts on plant and wildlife populations (NCHRP 2002).

Birds of prey are vulnerable to human disturbance and mortality by colliding with vehicles as they hunt near roadways. Some species have a very low tolerance of human disturbance and will abandon their nests quickly, which could happen if a new roadway is being constructed. Peregrine falcons sometimes nest under bridges and can be impacted by bridge construction or maintenance activities (NatureServe 2007). Western burrowing owls may be at greater risk of vehicular collisions than other raptors, as they spend most of their time on the ground, or close to it. The loggerhead shrike also is at risk for vehicular collisions.

Bat species are vulnerable to disturbance and loss of roost sites from road construction and maintenance by losing roost sites under bridges, culverts, and natural environments (NCHRP 2002). A loss of a nursery or hibernacula can be a particularly significant impact on bats. Road construction can also be a source of disturbance.

INDIRECT EFFECTS

Roads can serve as barriers for dispersal of some plants and terrestrial wildlife species, which cause habitat fragmentation (NCHRP 2002). This is particularly true for species at high risk of being injured or killed by traffic, such as invertebrates, reptiles, amphibians and ground-dwelling mammals. This can have long-term effects on wildlife populations. Erosion and changed patterns of hydrology can be a result of road construction (NCHRP 2002). A change in hydrology, in particular, can have significant effects on aquatic invertebrates and fish. However, the extent of these effects and what they will be is difficult to predict.

Roads are known to promote the spread and propagation of invasive weeds (Marcus et al. 1998). In forested areas, road construction opens up areas to increased light intensity, to which nonnative plant species may positively respond (McNab and Meeker 1987). Disturbed areas along the edges of roads create ideal conditions for nonnative plant species (Stapanian et al. 1998). Non-native plants, once established, may remain a significant part of the local flora even if there has been no disturbance for an extended amount of time (Zink et al. 1995). The effects of invasive weeds include increasing frequency of forest fires (Monsen 1994) and competitive exclusion of native plants (Randall and Rejmanek 1993), thus affecting cover and available forage and prey for wildlife. These effects all may have significant negative impacts on both native plants and wildlife.

These factors can make the indirect effects of existing roads and road construction potentially long-term and significant. However, it is difficult to determine the extent of environmental effects broadly, and can only be accurately predicted when it is known where a new road would be situated and what plants and wildlife are found nearby.

When kept away from a nest by human disturbance, passerine birds, such as phainopepla, may be vulnerable to brood parasitism by brown-headed cowbirds. This often results in reproductive failure in the host species.

3.3.7 Mining

3.3.7.1 Activity Description

Mining occurs on various land base/ownership types including federal, state, and private lands. The BLM administers both mining claim records and mineral leases for federally owned minerals on public lands. Mining activities authorized on BLM land can be categorized into three major mineral resource types: locatable, leasable, and saleable minerals. The programs are based on the type of commodity that is sought and each program is subject to unique laws and regulations.

Most public lands administered by BLM are open to location of mining claims. Privately owned lands, trust lands, sovereign lands, national parks and monuments, as well as Indian and military reservations, are excluded from location of mining claims. Lands patented under the Stock Raising Homestead Act require a formal notification procedure to the surface owner(s) and BLM prior to entry (BLM 2007d).

No mining activities are allowed within wilderness or wilderness study areas (BLM 1998, 1999b).

The major federal law governing locatable minerals on public lands is the General Mining Law of 1872, as amended (30 U.S. Code 22-54). Regulations applicable to BLM's mineral materials program are found in Title 43 Code of Federal Regulations (CFR), Group 3600 (mineral materials disposal) and Part 3500 (leasing of solid minerals other than oil shale). Regulations governing contracts and permits for mineral materials are contained in Title 43 CFR, Subparts 3610 and 3620, respectively (BLM 2007d). The Surface Management regulations (Title 43 CFR 3809) authorize and permit mineral exploration, mining, and reclamation actions for locatable minerals. Occupancy of public lands in association with mining is governed by the regulations set forth in Title 43 CFR 3715, which was administered pursuant to the Surface Resources Act of 1955. BLM was given the authority to administer the mining laws and regulations by Congress in the Federal Land Policy and Management Act of 1976, as amended (FLPMA).

Development of saleable, leasable, and locatable mineral on BLM land within the VRCMA Boundary is subject to conditions set forth in the various resource management plans for Las Vegas and Arizona Strip field offices. Applicable laws include the Environmental Protection Act and the National Environmental Protection Act.

The Minerals Section of the Arizona State Land Department (ASLD) is responsible for mining/mineral activities on State Trust land. Its primary obligation is to maximize revenues for the Trust from the disposition and management of mineral commodities while considering the long-term best interest of the Trust. The right to explore for and produce mineral commodities on Arizona State Trust land is accomplished by a lease, sale, or permit depending on the given activity (ADMMR 2007).

Actions related to mineral resource development generally consist of exploration, mining, processing, and reclamation. Specific activities associated with exploration and mining include clearing vegetation; road building; excavating trenches, pits, and/or underground openings; drilling, crushing and screening of rock materials; and blasting hardrock. Activities may be underground or on the land surface, depending on type of mineral and the particular method of development. Activities involved in the processing, transport, and sale of minerals may include chemical/non-chemical processing of ore including washing of materials to remove contaminants, storing mine and mill rock products, and hauling finished product for sale. Use of local water (e.g., diversion of surface water, groundwater development) sources may be necessary for processing minerals. Development of wash ponds, treatment ponds, or water storage ponds may be necessary. Processing may also generate waste products that require special handling, isolation, or treatment. Hauling of materials can result in construction of new roads, road improvement, and increased traffic, noise, and emissions. Equipment may include bulldozers, loaders, water trucks, graders and screeners. Extracted material is often removed and hauled to a mill site using dump trucks and processed using rock screens and ore crushers.

Mining activity occurs year-round. Activities are generally long term in nature and result in irreversible modifications to the landscape. Activities are generally located in upland areas; however, if local water sources are utilized, activities can extend into riparian and aquatic areas. Reclamation activities can attempt to restore habitat values that had been otherwise removed or compromised. Reclamation actions can also include the neutralization of any process activities that have created human and/or wildlife health and safety issues. These actions result in ground disturbance, and, in general, plant and wildlife species will be removed or temporarily displaced until such activities cease and reclamation occurs.

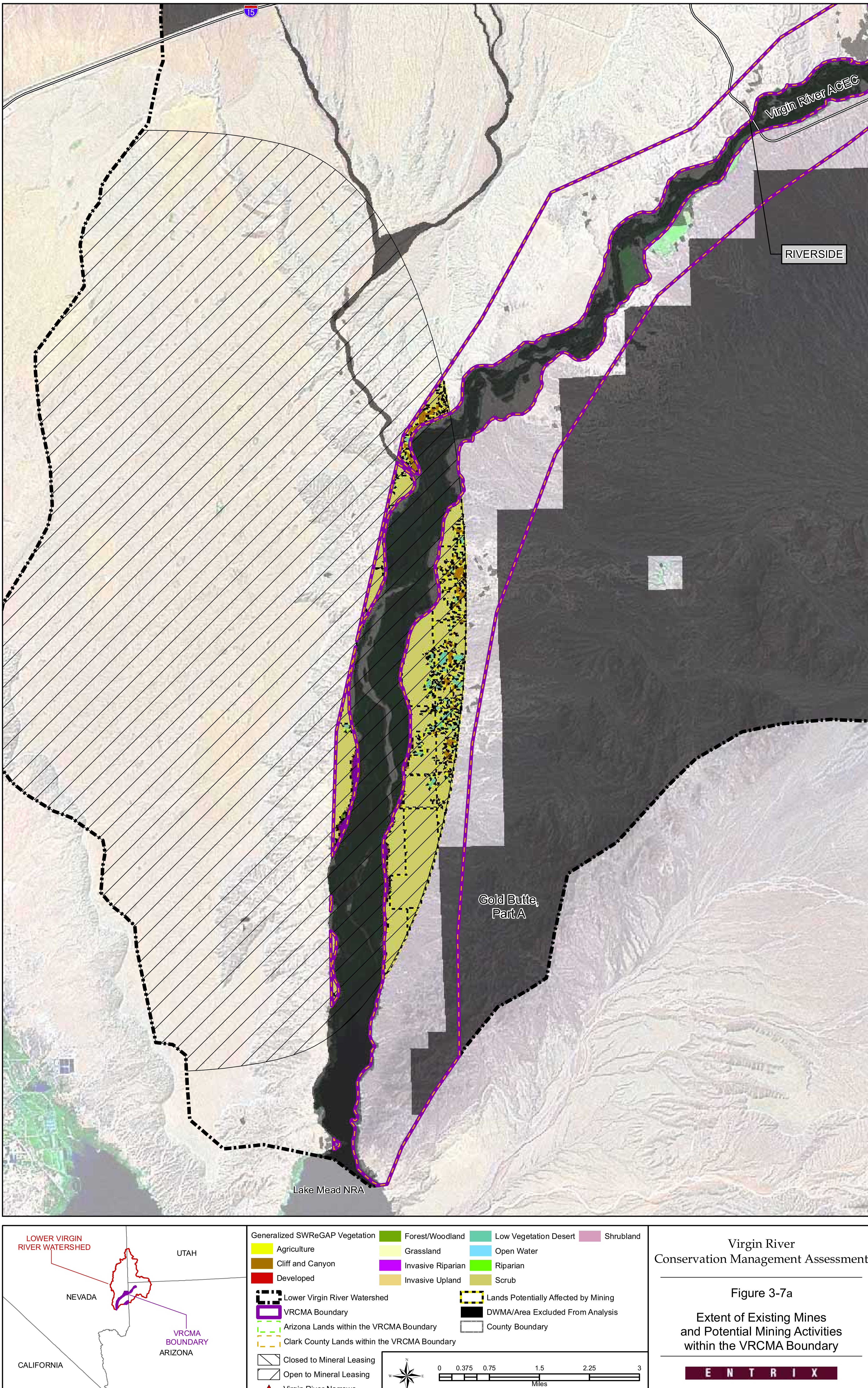
Solid and fluid mineral commodities within the VRCMA Boundary can be divided into three categories; locatable, leasable and saleable materials. Following is a description of each commodity type, and the location (i.e., action area) where mining for that material currently occurs.

Locatable Minerals

Locatable minerals generally include valuable mineral deposits such as precious and base metal ores (i.e., gold, silver, copper) as well as other industrial minerals such as pozzolan, gypsum, chemical grade or cement grade limestone, chemical grade silica sand and decorative stone. Uncommon varieties of sand, rock, cinders, pumice, clay, etc. are also considered locatable minerals. These minerals are regulated under the General Mining Law of 1872, and the Surface Use and Occupancy Act of 1955.

The Virgin Mountains in Nevada and Arizona have moderate potential for carbonate-hosted gold occurrence. Likewise, placer gold deposits reportedly occur along the lower western slope of the Beaver Dam and Virgin Mountains. Therefore, the alluvial material along the Virgin River shows a moderate potential for the occurrence of gold (BLM 2007d). Uranium occurrences are also known from the Virgin Mountains (BLM 2007c). Extensive deposits of gypsum and commercial quality feldspar occur in the Virgin Mountains (BLM 1998d). The Arizona Department of Mines and Mineral Resources (2002) reports gypsum located in northwest Mohave County, Arizona.

The Nevada Bureau of Mines and Geology does not currently report any major mines in the Nevada portion of the VRCMA Boundary (not including sand and gravel operations) (Driesner and Coyner 2007). Four mines occur on BLM lands in Clark County, Nevada within the Bunkerville (Copper King) Mining District (Figures 3-7a. 3-7b, and 3-7c). Two principal copper and precious metals mines, the Key West and Great Eastern, occur along the northwestern flank of the Virgin Mountains, outside of the VRCMA Boundary. The Great Eastern Mine is approximately 1,300 feet from the VRCMA Boundary. Silver Leaf and Santa Cruz Mines are mapped on the top of Virgin Peak Ridge within the VRCMA Boundary. Commodities such as copper, gold, silver, tungsten, nickel, platinum, palladium, cobalt, beryllium, mica, gypsum, uranium, and titanium are known to occur in the area. The Bunkerville District was discovered in 1901 and was active from 1901 to 1908 (Tingley 1998).

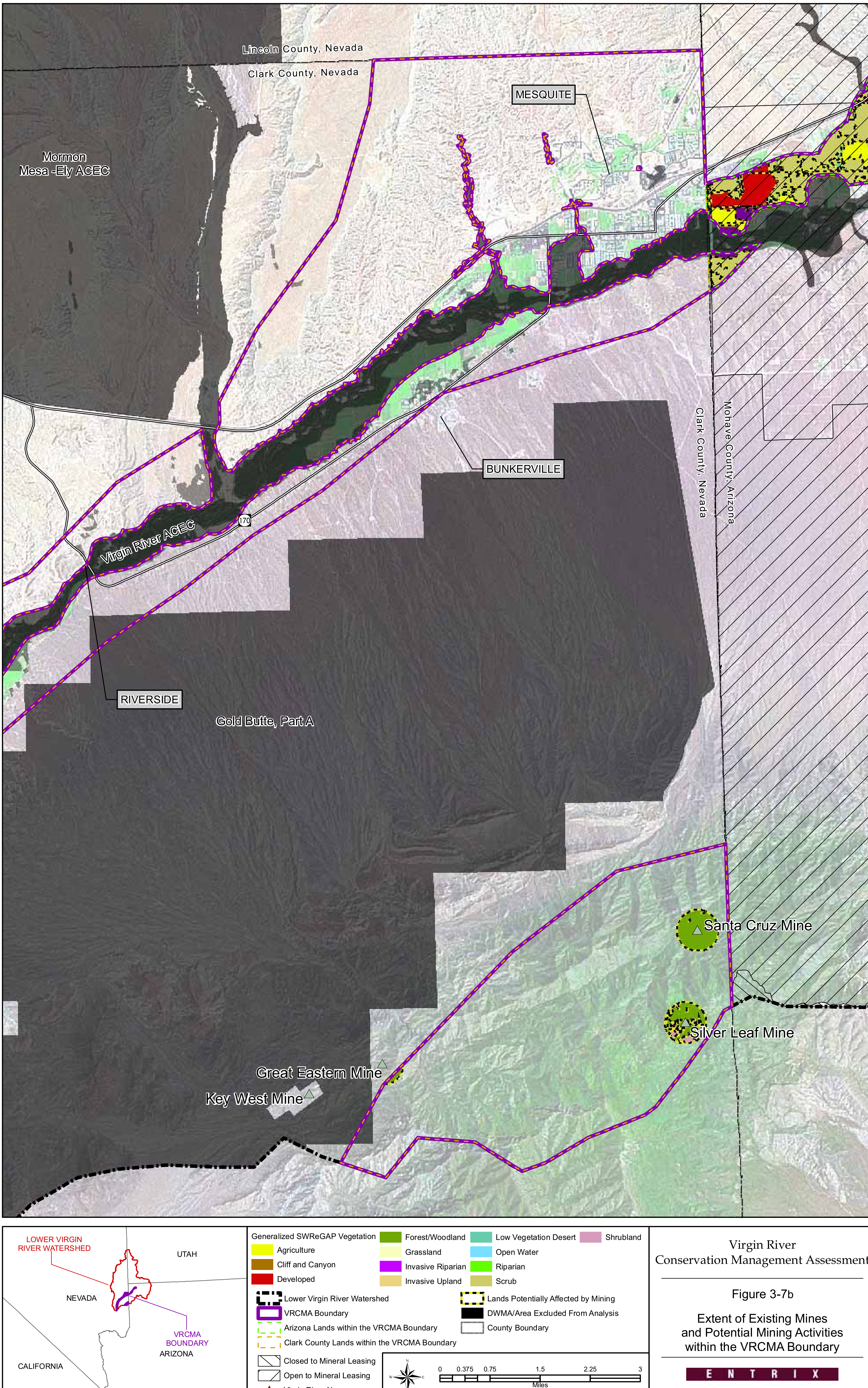


Virgin River
Conservation Management Assessment

Figure 3-7a

Extent of Existing Mines and Potential Mining Activities within the VRCMA Boundary

ENTRIX

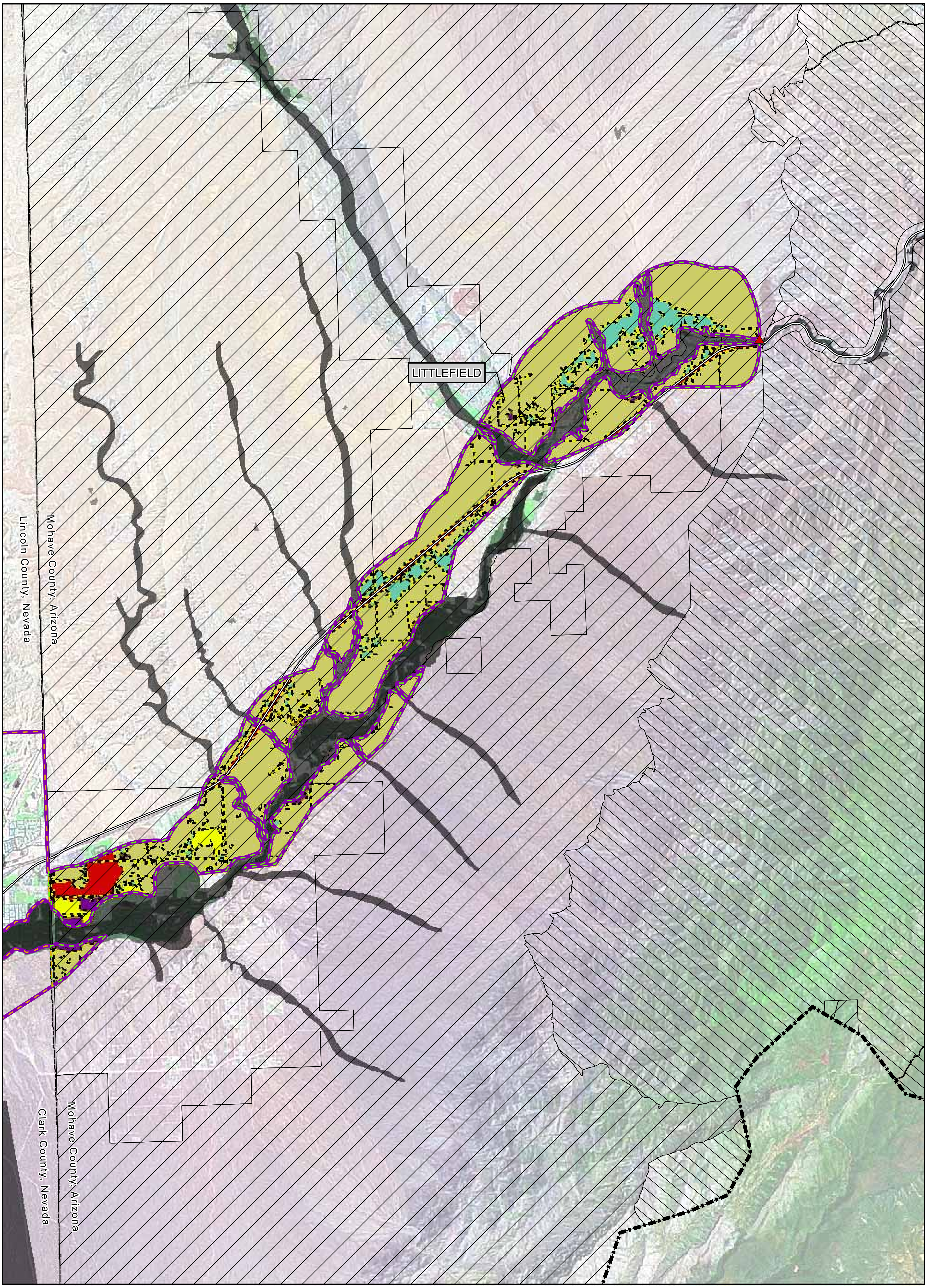


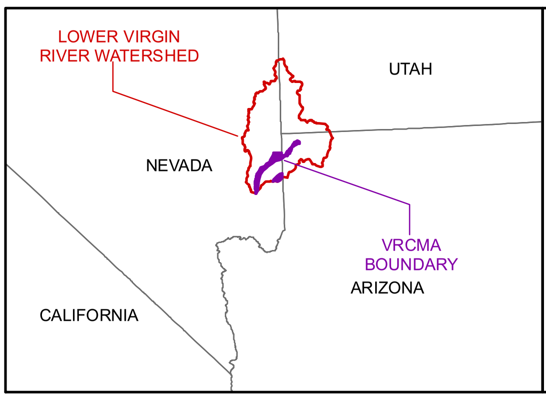
Virgin River
Conservation Management Assessment

Figure 3-7b

Extent of Existing Mines
and Potential Mining Activities
within the VRCMA Boundary

ENTRIX





Virgin River
Conservation Management Assessment

Figure 3-7c

Extent of Existing Mines and Potential Mining Activities within the VRCMA Boundary

ENTRIX

Leasable Minerals

Leasable minerals are those minerals leased to individuals for exploration and development, and include both solid and fluid mineral resources. Base and precious metals generally fall into the category of leasable materials. Leasable minerals include minerals such as coal, phosphate, sodium, potassium, oil, gas, chlorides, sulphates, carbonates, borates, silicates or nitrates of potassium and sodium, native asphalt, solid and semi-solid bitumen and bituminous rock, tar sands, oil shale, oil impregnated sands or other material in which oil can be recovered, and geothermal resources and associated byproducts.

Applicable regulations include Mineral Leasing Act of 1920, Mineral Leasing Act for Acquired Lands of 1947, and the Geothermal Stream Act of 1970. The regulations regarding leasable minerals are generally contained within Title 43 CFR, Parts 3000 thru 3500.

Leasable mineral areas include all types of terrain including valley floors. East of the Virgin River, in Clark County, Nevada, two active oil and gas leases are held by Mobil Oil Corp, Virgin River U.S.A. No. 1 and No. 1-A. Virgin River U.S.A. No. 1-A was drilled to a depth of 19,562 feet, and was an unsuccessful overthrust test (BLM 1998, Garside et al. 1988). Based on past drilling and field discovery history, future exploration is likely to be located on the valley floor adjacent to the mountain block.

No geothermal or solid mineral active claims occur within the VRCMA Boundary (BLM 2007c). The geothermal resources nearest to the VRCMA Boundary are located north of the VRCMA Boundary in Caliente Hot Springs in Lincoln County, Nevada and south of the VRCMA Boundary in Las Vegas Valley and west in Moapa, Clark County, Nevada.

Saleable Minerals

Saleable minerals or mineral materials generally include construction and landscaping materials including common varieties of sand, stone, gravel, cinders, pumice, pumicite, rock/boulders, and clay. Also included in this category are similar minerals used as aggregate, rip-rap, ballast, borrow, or fill.

Saleable minerals are regulated under the Mineral Material Act of 1947 and the Surface Use and Occupancy Act of 1955.

The development of mineral materials generally takes place in valleys, alluvial fans, and in the lower elevations of surrounding hills. The western slope of the Virgin Mountains represents good sources of sand and gravel. Gravel is also abundant along the Virgin River.

Active sand and gravel operations are located along the south bank of the Lower Virgin River near Bunkerville. No other historic or current mining operation along the Lower Virgin River is known (McLaurin et al. 2006).

Table 3-4 identifies the mines known to occur within the VRCMA Boundary in the Nevada and Arizona portions. Figures 3-7a, 3-7b, and 3-7c present the extent of potential mining and the location of existing mines.

Table 3-4 Mines Located in the VRCMA Boundary

Name	County/State	Quadrangle	Elevation (feet)	Mining District	Other Names
Santa Cruz Mine	Clark/Nevada	Hen Spring	5,282	Bunkerville	Talgo Mine, Teagle Mine
Silver Leaf Mine	Clark/Nevada	Hen Spring	7,020	Bunkerville	

Sources: Tingley 1998, TopoZone 2007, National Atlas data set.
*Assumed based on proximity to other mine sites

3.3.7.2 Potential Effects of Mining Activities

Cliffs and Canyon

Cliffs and canyon habitat types are characterized by steep, rocky areas of considerable size. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. Two hundred ninety (290) acres of cliffs and canyon habitat in Nevada and 103 acres of cliffs and canyon habitat within the VRCMA Boundary are potentially affected by mining activities, and 0 percent of existing mines occur in or adjacent to cliffs and canyon habitat (Figures 3-7a, 3-7b, and 3-7c).

Soil development is generally low and erosion potential is high. Mining activities within this cover type would likely be limited to exploration, excavation, and extraction of materials.

Steep slopes and rough terrain would preclude activities such as processing or storage, but direct mine development (e.g., rock blasting, excavation, grading) could take place. In addition, some development of roads would be necessary to reach the site.

DIRECT EFFECTS

Direct impacts to species can occur because of loss of habitat and habitat degradation associated with development of mines and associated infrastructure, as well as the transport of materials. Direct loss of habitat could occur when removing mineral material and/or regrading the landscape to allow for site access or mineral extraction. Injury or mortality to plant and animal species could occur because of rock blasting, crushing, grading, burial, etc.

Alteration and/or degradation of habitat, such as increased erosion and/or contamination of soil or water resources, could occur as a result of vegetation removal, development of infrastructure, and road building. Activities such as vegetation removal for excavation and/or development of infrastructure, and/or the storage or stockpiling of materials could result in the loss of foraging habitat and reduction of prey base for many animal species, especially birds (i.e., raptors), reptiles (i.e., snakes and lizards), and small mammals (i.e., bats and kit fox).

Reptile species are especially vulnerable to habitat loss, habitat degradation, and direct mortality as a result of mine development and road construction, and being crushed by moving vehicles on newly developed roadways.

Nesting and foraging habitat for birds could be impacted by mine development, storage, and transport activities. Removal of woody vegetation could affect nesting and roosting areas for bird species, while disturbance of rock outcrops may disturb roosting areas for bat species and birds, specifically peregrine falcon. Some species have a very low tolerance of human disturbance and will abandon their nests if disturbed by loud noise or other human activity. Birds of prey may collide with vehicles while hunting near roadways and other developed areas, resulting in injury or mortality to the birds.

Bat species, such as silver-haired bat and Brazilian free-tailed bat, located in the cliffs and canyon habitat can be affected by human disturbance of roosts outside of mine areas, from mine closures, and from mining activities. Disorientation, resulting from disturbance at a roost, may cause individuals to collide with solid objects or other bats, resulting in injury or mortality, either directly from the collision or from susceptibility to the elements and predators, if a bat is rendered flightless.

Desert bighorn sheep are also adversely affected by mining activities (DesertUSA 2008). Direct effects from mining activities could be considered long term, and would continue for the duration of the activity, or until best management practices were initiated.

INDIRECT EFFECTS

Mining activities could result in indirect effects related to habitat fragmentation, introduction of disease causing agents, and loss of food source or prey.

Plant species can be indirectly affected by mining activities if current or potential habitat is degraded or modified. Land-disturbing activities can result in erosion and sedimentation of habitats. Development of previously undisturbed areas can introduce exotic plant species, including noxious or invasive weeds, which increase competition for limiting resources, and in severe cases, can even modify existing microclimates.

Habitat fragmentation for ground dwelling animals could result from infrastructure development and road building. An increase in predation and competition would occur as a result of removal of vegetative cover and cover provided by rock outcrops. The spread of disease related to chemical contamination is not likely, as chemical processing is not likely to occur in these areas. Removal of vegetation could reduce habitat for invertebrate, bird, and small mammal populations, and thereby reduce the prey base.

Indirect effects from mining could be considered long term and would continue for the duration of the activity, until best management practices were initiated, or the site was remediated.

Low Vegetation Desert

Low vegetation desert habitat consists of dry, arid areas with drought-tolerant vegetation. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. 328 acres of low vegetation desert habitat in Nevada and 879 acres of low vegetation desert habitat in Arizona within the VRCMA Boundary are potentially affected by future mining activities. No existing mines occur in or adjacent to low vegetation desert habitat (Figures 3-7a, 3-7b, and 3-7c).

Mining actions in low vegetation desert habitat include exploration, processing, storage and transportation. Mining activities in low vegetation desert habitat would likely be limited to rocklands and pavement areas where processing areas or infrastructure could be constructed, or where material could be utilized. The probability for future exploration and expansion of mining activities is moderate, and could include sand and gravel mining in wash habitats. Mining of cinder basalt, lava, and tuff is probable in areas with volcanic soils. Storage and/or transport of material are likely in this habitat type, based on the gentle, flat topography common in these areas.

DIRECT EFFECTS

Direct impacts to species can occur as a result of loss of habitat and habitat degradation associated with development of mines and associated infrastructure, as well as the transport of materials. Direct loss of habitat could occur when removing mineral material and/or regrading the landscape to allow for site access or mineral extraction. Injury or mortality to plant and animal species could occur as a result of rock blasting, crushing, grading, burial, etc.

Alteration and/or degradation of habitat, such as increased erosion and/or contamination of soil or water resources, could occur as a result of vegetation removal, development of infrastructure, and road building. Activities such as vegetation removal for excavation, development of infrastructure, and/or the storage or stockpiling of materials could result in the loss of foraging habitat and reduction of prey base for many animal species, especially birds (i.e., raptors), reptiles (i.e., snakes and lizards), and small mammals (i.e., bats). Vegetation removal could result in the loss of cover, which could disrupt nesting for ground-nesting birds, such as western burrowing owl.

Plant species are vulnerable to direct mortality or injury, which could result from crushing or burial.

Reptile species, such as Great Basin collared lizard and desert tortoise, are especially vulnerable to habitat loss, habitat degradation, and direct mortality as a result of mine development and road construction, and being crushed by moving vehicles on newly developed roadways.

Nesting and foraging habitat for birds could be impacted by mine development, storage, and transport activities. Removal of woody vegetation could affect nesting and roosting areas for birds. Some species have a very low tolerance of human disturbance and will abandon their nests if disturbed by loud noise or other human activity. Birds of prey may collide with vehicles while hunting near roadways and other developed areas, resulting in injury or mortality to the birds.

Bat species located in this habitat can be affected by loss of roosting habitat from mine closures, and from disturbance from mining activities. Mines, when not in frequent use by humans, can serve as important sites for daytime roosting, breeding and as hibernacula. Disorientation, resulting from disturbance at a roost, may cause individuals to collide with solid objects or other bats, resulting in injury or mortality, either directly from the collision, from susceptibility to the elements and predators, or because it can no longer feed itself, if a bat is rendered flightless. Disturbance or closure of a mine can result in reproductive failure and a significant loss of habitat for some bat populations.

Development in areas with friable soil could affect denning activities for mammals, such as kit fox. Desert bighorn sheep are also adversely affected by mining activities (DesertUSA 2008).

Habitat alteration and/or degradation could occur as a result of vegetation removal, infrastructure development, and road building. Those activities may also increase erosion, cause soil or water contamination, and increase runoff into washes, all of which further degrade habitat. In addition, kit fox may be struck by moving vehicles on roadways. Direct effects from mining activities could be considered long term, and would continue for the duration of the activity, or until best management practices were initiated.

INDIRECT EFFECTS

Plant species can be indirectly affected by mining activities if current or potential habitat is degraded or modified. Land-disturbing activities can result in erosion and sedimentation of habitats. Development of previously undisturbed areas can introduce exotic plant species, including noxious or invasive weeds, which increase competition for limiting resources, and in severe cases, can even modify existing microclimates. Stockpiling materials and heavy equipment can spread invasive weed species.

Indirect impacts could include habitat fragmentation, disruption of predator-prey relationships, and disruptions to plant and animal life cycles. Habitat fragmentation can result from development of infrastructure and road building. Loss of vegetative cover in foraging areas may push species into smaller feeding zones, thereby increasing predation/competition. Loss of prey or other food sources could result from removal of vegetation, which subsequently could reduce invertebrate, bird, and small mammal populations. If processing of mineral resources occurs in these areas, diseases or various life-cycle interruptions could result from chemical contamination of soil and water.

When kept away from a nest by human disturbance, phainopepla is vulnerable to brood parasitism by brown-headed cowbirds. This often results in reproductive failure in the host species.

Indirect effects from mining could be considered long term, and would continue for the duration of the activity, or until best management practices were initiated, or the site was remediated.

Forest/Woodland

Forests and woodlands are characterized by trees and shrubs; these habitats are in areas that receive enough moisture to support trees. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. Zero (0) acres of forest/woodland habitat are potentially affected by current or future mining activities. In the VRCMA Boundary, two of three existing mines occur in or adjacent to forest/woodland habitat (Figures 3-7a, 3-7b, and 3-7c).

These areas are generally located in montane elevations where tree cover is dominated by conifers and broadleaves tree such as aspen. The understory is variable and generally composed of cold-deciduous shrublands and graminoid species. Soils are generally shallow. These communities are found in cooler north-facing slopes and more mesic sites.

Steep slopes and rough terrain would preclude activities such as processing or storage, but exploration and mineral extraction activities could occur in high elevation woodland areas. Some development of roads would be necessary to reach the site.

DIRECT EFFECTS

Direct impacts to species can occur as a result of loss of habitat and habitat degradation associated with development of mines and associated infrastructure, as well as the transport of materials. Direct loss of habitat could occur when removing mineral material and/or regrading the landscape to allow for site access or mineral extraction. Injury or mortality to plant and animal species could occur as a result of rock blasting, crushing, grading, burial, etc.

Alteration and/or degradation of habitat could occur as a result of vegetation removal and development of infrastructure, road building, increased erosion and/or contamination of soil or water resources. Activities such as vegetation removal for excavation and/or development of infrastructure could result in the loss of foraging habitat and reduction of prey base for all animal species, especially birds (raptors), reptiles (snakes and lizards) and small mammals (bats and kit fox).

Plant species are vulnerable to direct mortality or injury, which could result from crushing or burial.

Amphibian and reptile species are vulnerable to habitat loss, habitat degradation, and direct mortality as a result of mine development and road construction, and being crushed by moving vehicles on newly developed roadways. Amphibians, such as the Pacific tree frog, could be impacted by tree removal and subsequent changes in microclimate and soil moisture. Reptile species, such as desert night lizard, speckled rattlesnake, Sonoran lyre snake, and western banded gecko, could be crushed by moving vehicles or heavy equipment.

Nesting and foraging habitat for birds could be impacted by mine development, storage, and transport activities. Removal of woody vegetation could affect nesting and roosting areas for birds. Some species have a very low tolerance of human disturbance and will abandon their nests if disturbed by loud noise or other human activity. Birds of prey, such as golden eagle, may collide with vehicles while hunting near roadways and other developed areas, resulting in injury or mortality to the birds. Mining can degrade habitat for the black-chinned sparrow (Johnson and Cicero 1985).

Bat species located in this habitat can be affected by loss of roosting habitat from mine closures, and from disturbance from mining activities. Disorientation, resulting from disturbance at a roost, may cause individuals to collide with solid objects or other bats, resulting in injury or mortality, either directly from the collision or from susceptibility to the elements and predators, if a bat is rendered flightless. Desert bighorn sheep are also adversely affected by mining activities (DesertUSA 2008).

Direct effects from mining activities could be considered long term and would continue for the duration of the activity or until best management practices were initiated.

INDIRECT EFFECTS

Indirect impacts could include habitat fragmentation, disruption of predator-prey relationships, and disruptions to plant and animal life-cycles. Habitat fragmentation can result from development of infrastructure and road building. Loss of vegetative cover in foraging areas may push species into smaller feeding zones, thereby increasing predation/competition. Loss of prey or other food sources could result from removal of vegetation, which subsequently could reduce invertebrate, bird, and small mammal populations. If processing of mineral resources occurs in these areas, diseases or various life-cycle interruptions could result from chemical contamination of soil and water.

Plant species can be indirectly affected by mining activities if current or potential habitat is degraded or modified. Land-disturbing activities can result in erosion and sedimentation of habitats. Development of previously undisturbed areas can introduce exotic plant species, including noxious or invasive weeds, which increase competition for limiting resources, and in severe cases, can even modify existing microclimates.

Indirect effects from mining could be considered long term, and would continue for the duration of the activity, or until best management practices were initiated, or the site was remediated.

Shrubland

Vegetation in these communities is dominated by shrubby and brushy plants, such as sage. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. Zero acres of shrubland habitat are potentially affected by current or future mining activities. In the VRCMA Boundary, one of three existing mines occurs in or adjacent to shrubland habitat (Figures 3-7a, 3-7b, and 3-7c).

Based on past activities, there is a possibility for future mining in these areas, but the extent is not known. Mining activities in shrubland habitats could include excavation and mineral extraction, storage, and processing in relatively flat areas and material transport and road development.

DIRECT EFFECTS

Direct impacts to species can occur as a result of loss of habitat and habitat degradation associated with development of mines and associated infrastructure as well as the transport of materials. Direct loss of habitat could occur when removing mineral material and/or regrading the landscape to allow for site access or mineral extraction. Injury or mortality to plant and animal species could occur as a result of rock blasting, crushing, grading, burial, etc.

Localized removal of vegetation for excavation and/or development of infrastructure could have the potential to affect special status plant populations. If this were to occur, direct mortality, injury, and habitat loss would result.

Alteration and/or degradation of habitat could occur as a result of vegetation removal and development of infrastructure, road building, increased erosion and/or contamination of soil or water resources. Activities such as vegetation removal for excavation and/or development of infrastructure could result in the loss of foraging habitat and reduction of prey base for all animal species, especially birds (i.e., raptors), reptiles (i.e., snakes and lizards), and small mammals (i.e., bats and kit fox).

All reptile species, such as western banded gecko, could be affected by crushing from vehicles and destruction of habitat from new mining construction.

Bird species such as ferruginous hawk and prairie falcon can be affected by human disturbance. Western burrowing owl could be affected by vehicle trampling of burrows if vehicles are used off roads. Vehicle use could result in mortality for any of the special status bird species, although the extent of vehicle use would likely be limited in the mining areas. Mining can degrade habitat for the black-chinned sparrow (Johnson and Cicero 1985).

Desert pocket mouse could be adversely affected by habitat modifications. Kit fox could be affected by human presence in the area and would likely avoid areas where mining activities occurred. Vehicle use could result in mortality for these special status mammal species, although the extent of vehicle use would likely be limited in the mining areas.

Bat species located in this habitat can be affected by loss of roosting habitat from mine closures, and from disturbance from mining activities. Mines, when not in frequent use by humans, can serve as important sites for daytime roosting, breeding and as hibernacula. Disorientation, resulting from disturbance at a roost, may cause individuals to collide with solid objects or other bats, resulting in injury or mortality, either directly from the collision, from susceptibility to the elements and predators, or because it can no longer feed itself, if a bat is rendered flightless. Disturbance or closure of a mine can result in reproductive failure and a significant loss of habitat for some bat populations. Desert bighorn sheep are also adversely affected by mining activities (DesertUSA 2008).

Direct effects from mining activities could be considered long term and would continue for the duration of the activity or until best management practices were initiated.

INDIRECT EFFECTS

Plant species can be indirectly affected by mining activities if current or potential habitat is degraded or modified. Land-disturbing activities can result in erosion and sedimentation of habitats. Development of previously undisturbed areas can introduce exotic plant species, including noxious or invasive weeds, which increase competition for limiting resources, and in severe cases, can even modify existing microclimates.

Indirect impacts could include habitat fragmentation, disruption of predator-prey relationships, and disruptions to plant and animal life-cycles. Habitat fragmentation can result from development of infrastructure and road building. Loss of vegetative cover in foraging areas may push species into smaller feeding zones, thereby increasing predation/competition. Loss of prey or other food sources could result from removal of vegetation, which subsequently could reduce invertebrate, bird, and small mammal populations. If processing of mineral resources occurs in these areas, diseases or various life-cycle interruptions could result from chemical contamination of soil and water.

Indirect effects from mining could be considered long term and would continue for the duration of the activity, until best management practices were initiated, or the site was remediated.

Scrub

Scrub is the most dominant habitat type throughout the VRCMA Boundary; it is prevalent everywhere but the northern and southeastern reaches. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. Two thousand seven hundred seventy-six (2,776) acres of scrub habitat in Nevada and 7,015 acres of scrub habitat in Arizona within the VRCMA Boundary are potentially affected by mining activities (Figures 3-7a, 3-7b, and 3-7c). In the VRCMA Boundary, no existing mines occur in or adjacent to scrub habitat. Although no mining activities are currently located within the VRCMA Boundary, new mines may potentially be opened in this habitat.

DIRECT EFFECTS

Direct impacts to species can occur as a result of loss of habitat and habitat degradation associated with development of mines and associated infrastructure, as well as the transport of materials. Direct loss of habitat could occur when removing mineral material and/or regrading the landscape to allow for site access or mineral extraction. Injury or mortality to plant and animal species could occur as a result of rock blasting, crushing, grading, burial, etc.

Alteration and/or degradation of habitat could occur as a result of vegetation removal and development of infrastructure, road building, increased erosion and/or contamination of soil or water resources. Activities such as vegetation removal for excavation and/or development of infrastructure could result in the loss of foraging habitat and reduction of prey base for all animal species, especially birds (i.e., raptors), reptiles (i.e., snakes and lizards) and small mammals (i.e., bats).

Plant species are vulnerable to direct mortality or injury, which could result from crushing or burial.

Human use can lead to harm to desert tortoise, crushing of burrows for desert tortoise, and crushing of other reptiles from vehicles.

Vehicles can crush burrows used by western burrowing owls, resulting in direct mortality, injury, and/or habitat loss. Human presence can cause nesting birds to abandon the nest, resulting in mortality to eggs or fledglings (Knight et al. 1995).

Bird species such as prairie falcon can be affected by human disturbance. Western burrowing owl could be affected by vehicle trampling of burrows if vehicles are used off roads. Vehicle use could result in mortality for any of the special status bird species, although the extent of vehicle use would likely be limited in the mining areas.

Desert pocket mouse could be adversely affected by habitat modifications. Kit fox could be affected by human presence in the area and would likely avoid areas where recreation occurred. Vehicle use could result in mortality for these special status mammal species, although the extent of vehicle use would likely be limited in the mining areas.

Bat species located in this habitat can be affected by loss of roosting habitat from mine closures, and from disturbance from mining activities. Disorientation, resulting from disturbance at a roost, may cause individuals to collide with solid objects or other bats, resulting in injury or mortality, either directly from the collision or from susceptibility to the elements and predators, if a bat is rendered flightless.

Direct effects from mining activities could be considered long term, and would continue for the duration of the activity or until best management practices were initiated.

INDIRECT EFFECTS

Plant species can be indirectly affected by mining activities if current or potential habitat is degraded or modified. Land-disturbing activities can result in erosion and sedimentation of habitats. Development of previously undisturbed areas can introduce exotic plant species, including noxious or invasive weeds, which increase competition for limiting resources, and in severe cases, can even modify existing microclimates.

Indirect impacts could include habitat fragmentation, disruption of predator-prey relationships, and disruptions to plant and animal life-cycles. Habitat fragmentation can result from development of infrastructure and road building. Loss of vegetative cover in foraging areas may push species into smaller feeding zones, thereby increasing predation/competition. Loss of prey or other food sources could result from removal of vegetation, which subsequently could reduce invertebrate, bird, and small mammal populations. If processing of mineral resources occurs in these areas, diseases or various life-cycle interruptions could result from chemical contamination of soil and water.

Indirect effects from mining could be considered long term and would continue for the duration of the activity, until best management practices were initiated, or the site was remediated.

Agriculture

Agricultural areas, where the landscape is dominated by food grown for human consumption. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary. Zero (0) acre of agriculture habitat are potentially affected by mining activities. In the VRCMA Boundary, no existing mines occur in or adjacent to agriculture habitat (Figures 3-7a, 3-7b, and 3-7c).

DIRECT EFFECTS

Agricultural lands are not likely to be impacted by mining activities.

INDIRECT EFFECTS

Agricultural lands are not likely to be impacted by mining activities.

Developed

Developed habitat types are those that have been disturbed by human activity or otherwise developed. The towns of Littlefield, Arizona and Mesquite, Nevada are the most developed areas within the VRCMA Boundary. Table 3-1 identifies the specific habitat types and associated acreages that occur within the VRCMA Boundary.

This activity is not currently open to the entire extent of this habitat within the VRCMA Boundary (Figures 3-7a, 3-7b, and 3-7c). There is a high probability that mineral processing and/or storage may increase in developed areas. Similarly, transportation of these goods will increase as towns like Mesquite, Nevada expand and grow.

Mining activities, such as material processing and storage, as well as material transport currently occur in developed areas. Further development of mining in previously developed areas is not likely to reduce the habitat benefits of the area.

No acres of developed habitat are potentially affected by mining activities aside from mine processing plants and storage areas. No existing mines occur in or adjacent to developed habitat.

DIRECT EFFECTS

Mining activities in any habitat have the potential to cause injury or mortality to plant and animal species as a result of rock blasting, crushing, grading, burial, etc.

Mining operations could potentially increase the activity on a developed site, or modify the habitat values it provides. For example, an open, fallow field providing nesting for western burrowing owl or foraging habitat for peregrine falcon, bald eagle, and bat species (i.e., hoary bat, fringed myotis) could be modified by mining activities, such as mineral processing or material storage.

Direct effects from mining activities could be considered long term and would continue for the duration of the activity or until best management practices were initiated.

INDIRECT EFFECTS

No indirect effects from mining on special status species that occur in developed habitat would be expected.

3.4 SPECIFIC CONSERVATION OBJECTIVES FOR EFFECTS FROM HUMAN ACTIVITIES

This section includes specific conservation objectives by habitat type for effects from human activities. Simplified habitat types have been used to organize these conservation objectives, in order to direct conservation actions based upon habitat type and desired future conditions of each habitat type.

3.4.1 Cliffs and Canyon Habitat

Conservation objectives for offsetting effects from human activities in cliffs and canyon habitat are as follows.

- **Objective 5:** Offset potential effects of hunting on special status species.
  - 1,891 acres of cliffs and canyon habitat are potentially affected by hunting activities. 1,798 acres are in the Nevada portion and 93 acres are in the Arizona portion of the VRCMA Boundary.
- **Objective 6:** Offset potential effects of development on special status species.
  - 353 acres of cliffs and canyon habitat are potentially affected by development activities, although the feasibility of development in these areas is low. 345 acres are in the Nevada portion and eight acres are in the Arizona portion of the VRCMA Boundary.
- **Objective 7:** Offset potential effects from agriculture and grazing on special status species.
  - 371 acres of cliffs and canyon habitat are potentially affected by agriculture and year-round grazing activities in the Nevada portion of the VRCMA Boundary. 103 acres of cliffs and canyon habitat are potentially affected by agriculture and seasonal grazing activities in the Arizona portion of the VRCMA Boundary.
  - Development of actions to address trampling of desert tortoise would be a priority.
- **Objective 8:** Offset potential effects from recreation on special status species.
  - 1,891 acres of cliffs and canyon habitat are potentially affected by high recreation activities, and zero acres of cliffs and canyon habitat are potentially affected by low recreation activities. 1,798 acres are in the Nevada portion and 93 acres are in the Arizona portion of the VRCMA Boundary.
  - Development of actions to address effects on birds of prey and bats from human disturbance of nesting and roosting sites would be a priority.
- **Objective 9:** Offset potential effects from roads on special status species.
  - 23 acres of cliffs and canyon habitat are potentially affected by road activities. 20 acres are in the Nevada portion and three acres are in the Arizona portion of the VRCMA Boundary.
  - Development of actions to address effects on birds of prey and bats from human disturbance of nesting and roosting sites would be a priority.
- **Objective 10:** Offset potential effects from mining on special status species.
  - 393 acres of cliffs and canyon habitat are potentially affected by mining activities. In the VRCMA Boundary, no existing mines occur in or adjacent to cliffs and canyon habitat. 290 acres are in the Nevada portion and 103 acres are in the Arizona portion of the VRCMA Boundary.
  - Development of actions to address effects on birds of prey and bats from human disturbance of nesting and roosting sites would be a priority.

3.4.1.1 Desired Future Conditions

Cliffs and canyon habitat in the VRCMA Boundary should be of sufficient quality to promote the existence and maintenance of viable populations of native flora and fauna, particularly special status species associated with these habitats. Non-native vegetation and human activities would not threaten the existence or quality of these habitats.

3.4.2 Low Vegetation Desert Habitats

Conservation objectives for offsetting effects from human activities in low vegetation desert habitat are as follows.

- **Objective 5:** Offset potential effects from hunting on special status species.
  - 2,737 acres of low vegetation desert habitat are potentially affected by hunting activities. 1,964 acres of potentially affected low vegetation desert habitat occur in the Nevada portion and 773 acres of potentially affected low vegetation desert habitat occur in the Arizona portion of the VRCMA Boundary.
  - Measures should be developed to address effects to kit fox from regulated hunting.
- **Objective 6:** Offset potential effects from development on special status species.
  - 1,197 acres of low vegetation desert habitat are potentially affected by development activities, although the feasibility of development in these areas is low. 1,136 acres of potentially affected low vegetation desert habitat occur in the Nevada portion and 60 acres of low vegetation desert habitat occur in the Arizona portion of the VRCMA Boundary.
  - Development of actions to address habitat loss of desert tortoise, Las Vegas buckwheat, sticky buckwheat, and Las Vegas bearpoppy habitat would be a priority.
  - Development of actions to address effects of habitat loss on western burrowing owl habitat would be a priority.
- **Objective 7:** Offset potential effects from agriculture and grazing on special status species.
  - 301 acres of low vegetation desert habitat are potentially affected by agriculture and year-round grazing activities in the Nevada portion of the VRCMA Boundary. 692 acres of low vegetation desert habitat are potentially affected by agriculture and seasonal grazing activities in the Arizona portion of the VRCMA Boundary.
  - Development of actions to address effects of habitat loss on western burrowing owl habitat would be a priority.
- **Objective 8:** Offset potential effects from recreation on special status species.
  - 2,737 acres of low vegetation desert habitat are potentially affected by high recreation activities, and zero acres of low vegetation desert habitat are potentially affected by low recreation activities. 1,964 acres of potentially affected low vegetation desert habitat are in the Nevada portion and 773 acres of potentially affected low vegetation desert habitat are in the Arizona portion of the VRCMA Boundary.
- **Objective 9:** Offset potential effects from roads on special status species.
  - 81 acres of low vegetation desert habitat are potentially affected by road activities: 30 of these acres are within the Nevada portion and 51 acres are within the Arizona portion of the VRCMA Boundary.
  - Development of actions to address habitat loss of desert tortoise, Las Vegas buckwheat, sticky buckwheat, and Las Vegas bearpoppy habitat would be a priority.
- **Objective 10:** Offset potential effects from mining on special status species.
  - 1,207 acres of low vegetation desert habitat are potentially affected by mining activities: 328 of these acres occur in the Nevada portion and 879 of these acres occur in the Arizona portion within the VRCMA Boundary. In the VRCMA Boundary, less than one percent of existing mines occur in or adjacent to low vegetation desert habitat.

3.4.2.1 Desired Future Conditions

Low vegetation desert habitats in the VRCMA Boundary should be of sufficient quality to promote the existence and maintenance of viable populations of native flora and fauna, particularly special status species associated with these habitats. Non-native vegetation and human activities would not threaten the existence or quality of these habitats.

3.4.3 Forest/Woodland

Conservation objectives for offsetting effects from human activities in forest/woodland habitat are as follows.

- **Objective 5:** Offset potential effects from hunting on special status species.
  - 6,776 acres of forest/woodland habitat are potentially affected by hunting activities. All of these acres occur within the Nevada portion of the VRCMA Boundary.
- **Objective 6:** Offset potential effects from development on special status species.
  - Zero acres of forest/woodland habitat are potentially affected by development activities.
  - Development of actions to address effects on birds of prey, including peregrine falcon, and northern goshawk, and bats (i.e., Allen's big-eared bat, little brown myotis, western small-footed myotis, Yuma myotis, big free-tailed bat, California myotis, Townsend's big-eared bat, fringed myotis) from human disturbance of nesting and roosting sites would be a priority.
- **Objective 7:** Offset potential effects from agriculture and grazing on special status species.
  - 453 acres of forest/woodland habitat are potentially affected by agriculture and year-round grazing activities. All of these acres occur within the Nevada portion of the VRCMA Boundary and zero acres of forest/woodland habitat are potentially affected by agriculture and seasonal grazing activities.
- **Objective 8:** Offset potential effects from recreation on special status species.
  - 2,737 acres of forest/woodland habitat are potentially affected by high recreation activities, and zero acres of forest/woodland habitat are potentially affected by low recreation activities. All of these acres occur within the Nevada portion of the VRCMA Boundary.
  - Development of actions to address effects on birds of prey, including peregrine falcon, and northern goshawk, and bats (i.e., Allen's big-eared bat, little brown myotis, western small-footed myotis, Yuma myotis, big free-tailed bat, California myotis, Townsend's big-eared bat, fringed myotis) from human disturbance of nesting and roosting sites would be a priority.
- **Objective 9:** Offset potential effects from roads on special status species.
  - 154 acres of forest/woodland habitat are potentially affected by road activities. All of these acres occur within the Nevada portion of the VRCMA Boundary.
  - Development of actions to address effects on birds of prey, including peregrine falcon, and northern goshawk, and bats (i.e., Allen's big-eared bat, little brown myotis, western small-footed myotis, Yuma myotis, big free-tailed bat, California myotis, Townsend's big-eared bat, fringed myotis) from human disturbance of nesting and roosting sites would be a priority.
- **Objective 10:** Offset potential effects from mining on special status species.
  - Zero acres of forest/woodland habitat are potentially affected by current and future mining activities, and two of three existing mines occur in or adjacent to forest/woodland habitat. All of these acres occur within the Nevada portion of the VRCMA Boundary.
  - Development of actions to address effects on birds of prey, including peregrine falcon, and northern goshawk, and bats (i.e., Allen's big-eared bat, little brown myotis, western small-footed myotis, Yuma myotis, big free-tailed bat, California myotis, Townsend's big-eared bat, fringed myotis) from human disturbance of nesting and roosting sites would be a priority.

3.4.3.1 Desired Future Conditions

Forest/woodland habitat in the VRCMA Boundary should be of sufficient quality to promote the existence and maintenance of viable populations of native flora and fauna, particularly special status species associated with these habitats. Non-native vegetation and human activities would not threaten the existence or quality of these habitats.

3.4.4 Shrubland

Conservation objectives for offsetting effects from human activities in shrubland habitat are as follows:

- **Objective 5:** Offset potential effects from hunting on special status species.
  - 552 acres of shrubland habitat are potentially affected by hunting activities. All of these acres occur within the Nevada portion of the VRCMA Boundary.
- **Objective 6:** Offset potential effects from development on special status species.
  - Zero acres of shrubland habitat are potentially affected by development activities.
  - Development of actions to address effects on birds of prey, including ferruginous hawk and northern goshawk, and bats (i.e., western small-footed myotis, Yuma myotis, big free-tailed bat, California myotis, Townsend's big-eared bat) from human disturbance of nesting and roosting sites would be a priority.
- **Objective 7:** Offset potential effects from agriculture and grazing on special status species.
  - 31 acres of shrubland habitat are potentially affected by agriculture and year-round grazing activities. Zero acres of shrubland habitat are potentially affected by agriculture and seasonal grazing activities. All of these acres occur within the Nevada portion of the VRCMA Boundary.
- **Objective 8:** Offset potential effects from recreation on special status species.
  - 552 acres of shrubland habitat are potentially affected by high recreation activities, and zero acres of shrubland habitat are potentially affected by low recreation activities. All of these acres occur within the Nevada portion of the VRCMA Boundary.
  - Development of actions to address effects on birds of prey, including ferruginous hawk and northern goshawk, and bats (i.e., western small-footed myotis, Yuma myotis, big free-tailed bat, California myotis, Townsend's big-eared bat) from human disturbance of nesting and roosting sites would be a priority.
- **Objective 9:** Offset potential effects from roads on special status species.
  - 7 acres of shrubland habitat are potentially affected by road activities. All of these acres occur within the Nevada portion of the VRCMA Boundary.
  - Development of actions to address effects on birds of prey, including ferruginous hawk and northern goshawk, and bats (i.e., western small-footed myotis, Yuma myotis, big free-tailed bat, California myotis, Townsend's big-eared bat) from human disturbance of nesting and roosting sites would be a priority.
- **Objective 10:** Offset potential effects from mining on special status species.
  - Zero acres of shrubland habitat are potentially affected by current and future mining activities, and one of three percent of existing mines occur in or adjacent to shrubland habitat.
  - Development of actions to address effects on birds of prey, including ferruginous hawk and northern goshawk, and bats (i.e., western small-footed myotis, Yuma myotis, big free-tailed bat, California myotis, Townsend's big-eared bat) from human disturbance of nesting and roosting sites would be a priority.

3.4.4.1 Desired Future Conditions

Shrubland habitat in the VRCMA Boundary should be of sufficient quality to promote the existence and maintenance of viable populations of native flora and fauna, particularly special status species associated with these habitats. Non-native vegetation and human activities would not threaten the existence or quality of these habitats.

3.4.5 Scrub

Conservation objectives for offsetting effects from human activities in scrub habitat are as follows:

- **Objective 5:** Offset potential effects from hunting on special status species.
  - 25,192 acres of scrub habitat are potentially affected by hunting activities: 19,811 of these acres are within the Nevada portion and 5,383 acres of these acres are within the Arizona portion of the VRCMA Boundary.
- **Objective 6:** Offset potential effects from development on special status species.
  - 11,935 acres of scrub habitat are potentially affected by development activities: 10,647 of these acres are within the Nevada portion and 1,288 of these acres are within the Arizona portion of the VRCMA Boundary.
  - Development of actions to address habitat loss of desert tortoise, banded Gila monster, Las Vegas buckwheat, and threecorner milkvetch would be a priority.
  - Development of actions to address effects of habitat loss on western burrowing owl habitat would be a priority.
- **Objective 7:** Offset potential effects from agriculture and grazing on special status species
  - 3,834 acres of scrub habitat are potentially affected by agriculture and year-round grazing activities. All of these acres occur within the Nevada portion of the VRCMA Boundary. 4,834 acres of scrub habitat are potentially affected by agriculture and seasonal grazing activities. All of these acres occur within the Arizona portion of the VRCMA Boundary.
  - Development of actions to address trampling of desert tortoise, banded Gila monster, Las Vegas buckwheat, and threecorner milkvetch would be a priority.
- **Objective 8:** Offset potential effects from recreation on special status species.
  - 25,195 acres of scrub habitat are potentially affected by high recreation activities, and zero acres of scrub habitat are potentially affected by low recreation activities: 19,812 of these acres are within the Nevada portion and 5,383 of these acres are within the Arizona portion of the VRCMA Boundary.
- **Objective 9:** Offset potential effects from roads on special status species.
  - 1,045 acres of scrub habitat are potentially affected by road activities: 633 of these acres are within the Nevada portion and 412 of these acres are within the Arizona portion of the VRCMA Boundary.
  - Development of actions to address habitat loss of desert tortoise, banded Gila monster, Las Vegas buckwheat, and threecorner milkvetch would be a priority.
- **Objective 10:** Offset potential effects from mining on special status species.
  - 9,792 acres of scrub habitat are potentially affected by mining activities and no existing mines occur in or adjacent to scrub habitat: 2,776 of these acres are within the Nevada portion and 7,016 of these acres are within the Arizona portion of the VRCMA Boundary.

3.4.5.1 Desired Future Conditions

Scrub habitat in the VRCMA Boundary should be of sufficient quality to promote the existence and maintenance of viable populations of native flora and fauna, particularly special status species associated with these habitats. Non-native vegetation and human activities would not threaten the existence or quality of these habitats.

3.4.6 Agriculture

Conservation objectives for offsetting effects from human activities in agriculture habitat are as follows.

- **Objective 5:** Offset potential effects from hunting on special status species.
  - Zero acres of agriculture habitat are potentially affected by hunting activities.
- **Objective 6:** Offset potential effects from development on special status species.
  - 803 acres of agriculture habitat are potentially affected by development activities: 778 of these acres are within the Nevada portion and 25 of these acres are within the Arizona portion of the VRCMA Boundary.
  - Development of actions to address effects of habitat loss on western burrowing owl habitat would be a priority.
- **Objective 7:** Offset potential effects from agriculture and grazing on special status species.
  - 996 acres of agriculture habitat are potentially affected by agriculture and grazing activities: 814 of these acres are within the Nevada portion and 181 of these acres are within the Arizona portion of the VRCMA Boundary.
  - Development of actions to address effects of habitat loss on western burrowing owl habitat would be a priority.
- **Objective 8:** Offset potential effects from recreation on special status species.
  - Zero acres of agriculture habitat are potentially affected by high recreation activities, and zero acres of agriculture habitat are potentially affected by low recreation activities.
- **Objective 9:** Offset potential effects from roads on special status species.
  - 96 acres of agriculture habitat are potentially affected by road activities: 82 of these acres are within the Nevada portion and 13 of these acres are within the Arizona portion of the VRCMA Boundary.
  - Development of actions to address effects of habitat loss on western burrowing owl habitat would be a priority.
- **Objective 10:** Offset potential effects from mining on special status species.
  - Zero acres of agriculture habitat are potentially affected by mining activities, and zero percent of existing mines occur in or adjacent to agriculture habitat.

3.4.7 Developed

Conservation objectives for offsetting effects from human activities in developed habitats are as follows.

- **Objective 5:** Offset potential effects from hunting on special status species.
  - Zero acres of developed habitat are potentially affected by hunting activities.
- **Objective 6:** Offset potential effects from development on special status species.
  - 2,206 acres are developed within the Nevada portion and 284 acres are developed within the Arizona portion of the VRCMA Boundary.
  - Development of actions to address effects of habitat loss on western burrowing owl habitat would be a priority.
- **Objective 7:** Offset potential effects from agriculture and grazing on special status species.
  - Zero acres of developed habitat are potentially affected by agriculture and grazing activities.
- **Objective 8:** Offset potential effects from recreation on special status species.

  - Parks and recreation areas (acreage is unknown) in developed habitat are potentially affected by high recreation activities, and zero acres of developed habitat are potentially affected by low recreation activities.
  - Development of actions to address effects on birds of prey, including bald eagle, and bats from human disturbance of nesting and roosting sites would be a priority.
- **Objective 9:** Offset potential effects from roads on special status species.
  - 529 acres of developed habitat are potentially affected by road activities: 381 of these acres are within the Nevada portion and 148 of these acres are within the Arizona portion of the VRCMA Boundary.
  - Development of actions to address effects on birds of prey and bats from human disturbance of nesting and roosting sites would be a priority.
- **Objective 10:** Offset potential effects from mining on special status species.
  - Zero acres of developed habitat are potentially affected by mining activities, and no existing mines occur in or adjacent to developed habitat.
  - Development of actions to address effects on birds of prey, including bald eagle, and bats from human disturbance of nesting and roosting sites would be a priority.

3.4.7.1 Desired Future Conditions

Developed habitat in the VRCMA Boundary would be managed to avoid harming special status species directly or indirectly. Non-native vegetation and human activities would not threaten the existence or quality of these habitats.

Agriculture habitat in the VRCMA Boundary would be managed to avoid harming special status species directly or indirectly. Non-native vegetation and human activities would not threaten the existence or quality of these habitats.

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Chapter 4: Conservation Actions

4.1 INTRODUCTION

These conservation actions are a compilation of existing conservation actions taken from a variety of agency documents. Some of the documents that were reviewed are, of course, several years old (such as the MSHCP which was completed in 2000), and circumstances, may have changed for some species and habitats. Additionally, each agency is continuously working on conservation measures based on agency priorities and existing partnerships. To incorporate the most recent concerns of the natural resource agencies, the ranking of these conservation actions are further refined in chapter 5 by incorporating stakeholder input. To this end, ranks of conservation actions in chapter 4 are not identical to those in chapter 5. Modifications are made to the ranks of conservation actions in chapter 5 based upon new information or concerns such as restoration or recovery needs for particular species that may be provided by the natural resource agencies.

In development of the conservation actions, upland habitats across jurisdictional boundaries that were not already covered by the Desert Wildlife Management Area CMSs in the lower Virgin River were considered. Additionally, conservation actions were not developed for riparian and aquatic species; they are addressed under the VRHCRP.

4.1.1 Types of Conservation Actions

Conservation actions presented below have been grouped into the following categories based on seven general types (Clark County DCP 2007a):

- **Management Action (MA).** A management action regulates activities over which a land management or regulatory agency or office has control, such as development, recreation, agriculture, grazing, and road construction.
- **Protective Measure (PM).** A protective measure protects species' habitat through restricted use and other regulations and protects individual species through regulations for collection and other activities.
- **Restoration Effort (RE).** Restoration efforts are related to restoration and rehabilitation of degraded habitats.
- **Public Outreach, Partnership, and Education Actions (POE).** Public outreach, partnership, and education actions are those related to public involvement, partnership with other agencies and organizations, and education activities affecting the special status species addressed in this VRCMA.
- **Inventory and Monitoring Actions (IMA).** Inventory and monitoring actions are designed to obtain information about species and their habitats.
- **Applied Research Actions (ARA).** Applied research actions are those which lead to addressing specific research questions related to one or more special status species and/or associated habitats considered in this VRCMA.
- **Impact Mitigation (IM).** Impact mitigation actions are those which mitigate (e.g., offset) activities which may degrade or otherwise adversely affect special status species and/or their habitat within the VRCMA Boundary.

4.2 METHODOLOGY

4.2.1 Sources of Conservation Actions

Conservation actions appropriate for consideration in this VRCMA were collected from various conservation plans and biological assessments/opinions for activities in Clark County, Nevada and areas with similar habitat types and species. These conservation actions were compiled into a single table identifying the sources of each conservation action prior to the prioritization process.

Sources of conservation actions include the following:

- Clark County MSHCP (RECON 2000),
- Nevada Wildlife Action Plan (NDOW 2006),
- Nevada Partners in Flight Bird Conservation Plan (Neel 1999),
- Draft Las Vegas Field Office Biological Assessment (BLM 2007),
- Revised Nevada Bat Conservation Plan (Nevada Bat Working Group 2006),
- Arizona Bat Conservation Strategic Plan (AGFD 2003),
- Conservation Management Strategy for Gold Butte Desert Wildlife Management Area (Clark County DCP 2007a),
- Conservation Management Strategy for Mormon Mesa Desert Wildlife Management Area (Clark County DCP 2007b),
- A Conservation Management Strategy for Nine Rare Low Elevation Plants in Clark County Nevada (TNC 2007), and
- Desert Tortoise (Mojave Population) Recovery Plan (USFWS 1994).

4.2.2 Prioritization of Conservation Actions

Once conservation actions were compiled, they were prioritized based upon two factors: 1) a "Biological Ranking", a rank based upon which conservation action would provide the most benefit based on species and habitat and 2) a "Feasibility Ranking", a rank based upon the relative feasibility of performing the action.

4.2.2.1 Biological Ranking

To rank actions based on biological attributes, three factors were weighted equally:

- Affected Species Score,
- Species Benefit Score, and
- Habitat Benefit Score.

Affected Species Score

The affected species score is based upon two measures: 1) the number of species affected by a particular conservation action and 2) the average status rank of the combined group of species. A conservation action is ranked higher if it affects a greater number of species and if it affects species that are considered more imperiled.

NUMBER OF SPECIES AFFECTED

There are multiple species (N = 108) considered in this VRCMA and any single action may affect one or several of these species. Therefore, the total number of species affected by a particular action has been divided into five categories for convenience (Table 4-1). The highest-ranking category (category one) is the category in which 36 species or greater are affected by a conservation action. This cut-off point is based upon the taxon with the largest representation in the 108 species (plants, which includes 36 species in the VRCMA). By setting category "one" based on the taxon with the greatest number of species, any conservation action with the highest-ranking category (=1) will likely be affecting more than one taxon.

Table 4-1 Categories Used to Identify the Number of Species Affected by a Single Conservation Action					
Category	1 (most species)	2	2	4	5 (least species)
Number of Affected Species	36 + species	20 to 35 species	11 to 19 species	6 to 10 species	0 to 5 species
Categories range from 1, the highest score, which affects 36 or more species, to 5, the lowest, where 0 to 5 species are affected by a single VRCMA conservation action					

AVERAGE OF SPECIES STATUS RANK

The status rank used in the affected species score is the Nevada Natural Heritage Program rank for each species. This score ranges from S1 (critically imperiled), which receives a value of one to S5 (secure) which receives a value of five (Table 4-2).

Table 4-2 Categories Used to Identify Nevada Natural Heritage Program Ranks for VRCMA Conservation Actions					
Category	1 (most vulnerable)	2	2	4	5 (least vulnerable)
NNHP Rank	S1	S2	S3	S4	S5
Explanation of Rank	Critically Imperiled	Imperiled	Threatened	Apparently Secure	Secure
Categories range from 1, the highest score, which affects 36 or more species, to 5, the lowest, where 0 to 5 species are affected by a single VRCMA conservation action					

The two ranks (one based on number of affected species and one based on Nevada Heritage Program rank) are averaged for each single or suite of species affected by a conservation action to obtain the affected species score. This averaged score is between one and five.

Species Benefit Score

The species benefit score is a value between one and five that identifies the magnitude that a conservation action will benefit the species it affects. Table 4-3 identifies the five categories of scoring. A score of one indicates that the conservation action either fully removes an adverse effect from a threat or fully protects a species in a given area. A score of five indicates that the conservation action has no effect.

Table 4-3 Categories Used to Identify the Relative Benefit to a Species of a Particular VRCMA Conservation Action				
Rank 1 (most beneficial)	Rank 2	Rank 3	Rank 4	Rank 5 (least beneficial)
Fully removes threat or fully protects species	High effect	Medium effect	Low effect	No effect
Categories range from 1, the highest score, which affects 36 or more species, to 5, the lowest, where 0 to 5 species are affected by a single VRCMA conservation action				

Habitat Benefit Score

The habitat benefit score is a value between one and five that identifies the magnitude that a conservation action will benefit habitat(s) of species affected (see Table 4-4). A score of one indicates that the conservation action either fully removes an adverse effect from a threat or fully protects a habitat in a given area. A score of five indicates that the conservation action has no direct effect on habitat such as some species-specific inventory and monitoring actions.

Table 4-4 Categories Used to Identify the Relative Benefit to the Habitat of a Particular VRCMA Conservation Action				
Rank 1 (most beneficial)	Rank 2	Rank 3	Rank 4	Rank 5 (least beneficial)
Fully removes threat to habitat or fully protects habitat	High effect	Medium effect	Low effect	No effect
Categories range from 1, the highest score, which affects 36 or more species, to 5, the lowest, where 0 to 5 species are affected by a single VRCMA conservation action				

Calculation of Biological Ranking

The three scores (affected species, species benefit, and habitat benefit) were averaged to determine a priority rank between one and five for each conservation action. Thus, conservation actions that benefited a large number of highly imperiled species, provided high benefits to those species, and provided high benefits to those species' habitats are the actions that would receive the highest biological ranking of one. Alternatively, those conservation actions that benefited only one species with a stable (S4) to secure (S5) population in Nevada, provided little to no benefits to those species, and/or provided no benefits to habitat are those actions which would receive the lowest biological ranking of five.

4.2.2.2 Feasibility of Conservation Actions

Conservation actions were assessed based upon how feasible they are to implement. Feasibility was determined by three categories: cost, effort, and time. Table 4-5 identifies those categories and how rankings between one and five were calculated. Conservation actions with a rank of one are the most feasible (e.g., requiring relatively low amounts of funding, effort, and time), and conservation actions with a rank of five are the least feasible.

Table 4-5 Categories Used to Create the Feasibility Score for VRCMA Conservation Actions

Category	Rank 1 (most feasible)	Rank 2	Rank 3	Rank 4	Rank 5 (least feasible)
Cost	Under 10,000 dollars	10,000 to 100,000 dollars	100,000 to 500,000	500,000 to 1 million dollars	Greater than 1 million dollars
Effort	One person, part time	Multiple people, part time	One person, full time	Multiple people, part to full time	Multiple people, full time
Time	A one time effort	Less than one month	Up to a year to complete	Multiple years	Ongoing

Categories range from 1, the highest score, which refers to actions that are the most feasible based on cost, effort, and time, to 5, the least feasible.

4.2.3 Combined Priority and Feasibility Ranking

After biological-based priority and feasibility rankings were separately determined for each conservation action, these two scores were averaged to determine which conservation actions were high priority, based on biology and feasibility. This is the Calculated Ranking for each action.

4.3 CONSERVATION ACTIONS

The existing conservation actions that were identified and ranked for this assessment are presented according to conservation objectives one through ten (listed below) in Tables 4-6 through 4-13. In each table, conservation actions are ranked from the highest Calculated Ranking to the lowest and are sorted by the special status species affected by the actions. Unrounded numbers of the priority and feasibility rankings were used in determining the Calculated Ranking, even though only rounded numbers are presented in the tables. To better understand how the various conservation actions are distributed, the number of conservation actions are quantified with respect to various categories such as rank, conservation objectives, types of species, and management action type. Summary tables are provided.

The conservation objectives were originally defined in Chapter 3. The ten conservation objectives include the following:

GENERAL OBJECTIVES

- **Conservation Objective 1:** Promoting efforts in the VRCMA Boundary that will lead to the recovery and delisting of federally threatened and endangered species that occur or have the potential to occur in the VRCMA Boundary.

- **Conservation Objective 2:** Promoting efforts in the VRCMA Boundary that will lead to the conservation of species protected under Nevada Revised Statutes that occur or have the potential to occur in the VRCMA Boundary.
- **Conservation Objective 3:** Promoting efforts in the VRCMA Boundary that will lead to the conservation of other species not mentioned above included on the NNHP at risk and watch list species list and/or included as Covered, Evaluation, or Watch List species in the Clark County MSHCP that occur or have the potential to occur in the VRCMA Boundary.
- **Conservation Objective 4:** Eliminating gaps in knowledge related to life history, habitat needs, and threats for special status species that occur or have the potential to occur in the VRCMA Boundary.

SPECIFIC CONSERVATION OBJECTIVES

- **Conservation Objective 5:** Offset potential effects of hunting on special status species.
- **Conservation Objective 6:** Offset potential effects of development on special status species.
- **Conservation Objective 7:** Offset potential effects of agriculture and grazing on special status species.
- **Conservation Objective 8:** Offset potential effects of recreation on special status species.
- **Conservation Objective 9:** Offset potential effects of roads on special status species.
- **Conservation Objective 10:** Offset potential effects of mining on special status species.

In Chapter 3: Conservation Objectives, Conservation Objectives 5 through 10 are identified for each habitat type.

4.3.1 Conservation Objectives 1, 2, and 3

Presented below are conservation actions for the first three conservation objectives. These objectives are general and are related to conservation and protection of the special status species addressed in this document. They are combined into a single table (Table 4-6) because some conservation actions apply to more than one of these three objectives.

The Conservation Objectives 1, 2, and 3 are as follows:

- **Conservation Objective 1:** Promoting efforts in the VRCMA Boundary that will lead to the recovery and delisting of federally threatened and endangered species that occur or have the potential to occur in the VRCMA Boundary.
- **Conservation Objective 2:** Promoting efforts in the VRCMA Boundary that will lead to the conservation of species protected under Nevada Revised Statutes that occur or have the potential to occur in the VRCMA Boundary.
- **Conservation Objective 3:** Promoting efforts in the VRCMA Boundary that will lead to the conservation of other species not mentioned above included on the NNHP at risk and watch list species list and/or included as Covered, Evaluation, or Watch List species in the Clark County MSHCP that occur or have the potential to occur in the VRCMA Boundary.

Table 4-6 Conservation Actions Associated with Conservation Objectives 1, 2, and 3

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
2	Organize volunteers to conduct/assist with conservation actions where possible, within the VRCMA.	all plants	Public Outreach, Partnership, and Education Actions	3	2	CC MSHCP
2	Remove exotic plants and noxious weeds within the VRCMA.	all species	Public Outreach, Partnership, and Education Actions	3	2	CC MSHCP
2	Reduce impacts on species and habitat during incident control (e.g. limit helicopter landings to previously used areas)	all species	Protective Measure	3	1	Las Vegas Fire Management Plan
2	Protect and improve sensitive habitat such as nesting areas and migration routes.	all species	Restoration Effort	1	3	CMS - MMDWMA, CMS - GBDWMA
2	Do not permit introduction of new non-native species of fish or wildlife except for specific management actions under agency oversight.	all species	Management Action	2	2	CC MSHCP
2	Evaluate the need for area to protect nesting sites of sensitive species.	birds	Management Action	3	1	CC MSHCP

Table 4-6 Conservation Actions Associated with Conservation Objectives 1, 2, and 3

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
2	Conduct the following protective measures for western bluebird: 1) Preserve native existing old growth forest remnants. 2) Connect existing old-growth tracts by treating second-growth corridors to break self-perpetuating even-aged stand characteristics. 3) Promote timber harvest strategies that leave larger, older trees in an open-canopied array. Leave snags for cavity provision. 4) Thin second-growth stands with high stem densities "from the bottom up" where they occur adjacent to meadows; that is, thin smaller-diameter trees and leave well-spaced, larger-diameter trees, opening up a park-like interface with meadows.	western bluebird	Protective Measure	3	1	Nevada Partners in Flight Bird Conservation Plan (Neel 1999)
3	Wherever possible, select only locally native species for restoration, and where appropriate, use seed from the plant species of concern and endemic butterfly host plants.	all species	Restoration Effort	3	1	CC MSHCP
3	Develop and implement Fire Management Plan, including the identification of key susceptible habitat areas and species, develop and maintain a network of shaded fuelbreaks, and return management through prescribed fire to the VRCMA.	all species	Management Action	3	4	CC MSHCP
3	Use U.S. Department of Agriculture (USDA) Nevada Animal Damage Control Program to monitor and aid in control of feral cats and dogs, brown-headed cowbirds, ravens, and other predator species that may affect the special status species.	all species	Management Action	3	4	CC MSHCP BO
3	Protect large tracts of suitable habitat that are well dispersed throughout the range.	desert tortoise	Protective Measure	2	4	Nevada Wildlife Action Plan
3	For fuelwood management, implement the following actions. 1) Allow collection of snags only between the months of October and the end of February. 2) Prohibit or limit by permit requirements the collection of wood in key habitat areas; provide alternative areas for wood collecting. 3) Provide firewood for sale at campgrounds and other appropriate locations. 4) Prohibit peeling bark, disturbing or collecting plant litter, or dead or apparently dead plant parts, including yucca and cholla skeletons. 5) Retain a minimum of 5 snags per acre in late seral stages of the Pinyon/juniper, Mixed Conifer, and Bristlecone Pine Land Type Associations in all cases.	cavity nesters and raptors	Management Action	3	2	CC MSHCP

Table 4-6 Conservation Actions Associated with Conservation Objectives 1, 2, and 3

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
3	Educate all fire/support personnel on tortoises and habitat using protocols contained in the Las Vegas Fire Management Plan.	desert tortoise	Management Action	4	2	Las Vegas Fire Management Plan
3	Prohibit destructive collecting techniques such as breaking off rock flakes and rolling cap rocks to uncover lizards.	lizards	Protective Measure	4	2	CC MSHCP
3	Avoid cutting fuelwood, or cutting trees for salvage or sanitation within 0.5 mile of active or recently active flammulated owl or goshawk nest. Trees hazardous to public safety or extreme fire danger may be removed. Insect and disease treatments may occur within this area to control epidemic outbreaks.	northern goshawk and flammulated owl	Protective Measure	4	2	CC MSHCP
3	Use integrated weed management and best management practices when controlling exotic pests and disease outbreaks.	desert tortoise, banded gecko, banded Gila monster, California kingsnake, desert iguana, desert kangaroo rat, desert night lizard, desert pocket mouse, glossy snake, Great Basin collared lizard, Kit fox, large-spotted leopard lizard, Las Vegas bearpoppy, Mojave green rattlesnake, Pale Townsends big eared bat, sidewinder, Sonoran lyre snake, southern desert horned lizard, speckled rattlesnake, sticky buckwheat, western burrowing owl, western chuckwalla, western leaf-nosed snake, western long-nosed snake, western red-tailed skink, white bearpoppy, yellow twotone beardtongue.	Protective Measure	3	2	CMS - MMDWMA, CMS - GBDWMA
3	Conserve important bat roosting sites in cliffs, crevices, and talus habitat.	pallid bat, western mastiff bat, western pipistrelle, big free-tailed bat, Brazilian free-tailed bat	Protection Measure	3	3	Revised Nevada Bat Conservation Plan
3	Develop and implement additional plans to inventory and map problem areas of nonnative plants and monitor encroachment over time.	plants	Inventory and Monitoring Actions	3	3	CC MSHCP
3	Develop and implement additional plans to collect seed for endowment and cultivation of sensitive and rare plants	plants	Protective Measure	3	2	CC MSHCP
3	Proactively protect and manage for long-term viability of all populations of rare plants on Federal lands (IMAs, LIMAs, MUMAs, and UMAs as appropriate) in the VRCMA.	sticky ringstem, Las Vegas bearpoppy, white bearpoppy, sticky buckwheat, threecorner milkvetch, forked buckwheat	Management Action	2	3	A Conservation Management Strategy for Nine Low Elevation Rare Plants in Clark County, Nevada

Table 4-6 Conservation Actions Associated with Conservation Objectives 1, 2, and 3

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
3	If proposed actions will result in surface disturbance near a population of special status plants, remove soil with seed source and relocate to a potential habitat site and monitor over time.	white bearpoppy	Protective Measure	4	1	CC MSHCP
4	Maintain a healthy mix of coniferous forest/woodland foraging habitats across the VRCMA.	Allen's big-eared bat, silver-haired bat, western red bat, hoary Bat, California myotis, western small-footed Myotis, long-eared myotis, long-legged myotis, fringed myotis, western mastiff bat, little brown bat, big free-tailed bat, Yuma myotis	Protective Measure	3	4	Revised Nevada Bat Conservation Plan

4.3.2 Conservation Objective 4: Eliminating Gaps in Knowledge Related to Life History, Habitat Needs, and Threats for Special Status Species That Occur or Have the Potential to Occur in the VRCMA Boundary.

Presented below are conservation actions for Conservation Objective 4 (Table 4-7).

Table 4-7 Conservation Actions Associated with Conservation Objective 4

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
2	Investigate the basic ecology of obligate pollinators of target plant species to ensure complementarity of conservation recommendations and the location of protected areas, ensuring the inclusion of the pollinator's full habitat and food source requirements.	all plants	Applied Research Actions	3	2	CC MSHCP
2	Conduct risk analyses on high density areas. Identify important sites at risk.	prairie falcon	Inventory and Monitoring Actions	4	1	Nevada Partners in Flight Bird Conservation Plan
2	Develop plans to: 1) identify and protect abandoned mines as bat habitat and 2) conduct periodic monitoring for bats, emphasizing roost site and water source monitoring to document species occurrence, habitat suitability, and threats using methods described in the Nevada Bat Conservation Plan.	all bats	Inventory and Monitoring Actions	2	2	CMS - Mormon Mesa DWMA, CMS - Gold Butte DWMA
2	Evaluate the efficacy of present monitoring efforts; add monitoring stations as appropriate.	all species	Inventory and Monitoring Actions	3	1	Nevada Partners in Flight Bird Conservation Plan
3	Enlist the help of volunteer survey corps such as organized by the Great Basin Bird Observatory.	all birds	Public Outreach, Partnership, and Education Actions	4	1	Nevada Partners in Flight Bird Conservation Plan
3	Incorporate winter raptor surveys into Audubon Society winter field trips. Recruit volunteers to conduct periodic winter raptor surveys, both on established and new routes wherever needed.	all raptors	Inventory and Monitoring Actions	4	1	Nevada Partners in Flight Bird Conservation Plan
3	Develop detailed predictive models of species distribution within the VRCMA.	Great Basin collared lizard, desert night lizard	Inventory and Monitoring Actions	2	3	Nevada Wildlife Action Plan
3	Describe and quantify the effects of historic habitat changes and current land management practices within the VRCMA for bat species which are known to be there.	California leaf-nosed bat, greater western mastiff bat, big free-tailed bat, pallid bat, Townsend's big-eared bat, western red bat, silver-haired bat, hoary bat, western pipistrelle, California myotis, western small-footed myotis, fringed myotis, long-legged myotis, Yuma myotis	Inventory and Monitoring Actions	3	2	Arizona Bat Conservation Strategic Plan

Table 4-7 Conservation Actions Associated with Conservation Objective 4

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
3	Identify key resource requirements and limiting factors for bats within the VRCMA.	California leaf-nosed bat, greater western mastiff bat, big free-tailed bat, pallid bat, Townsend's big-eared bat, western red bat, silver-haired bat, hoary bat, western pipistrelle, California myotis, western small-footed myotis, fringed myotis, long-legged myotis, Yuma myotis	Inventory and Monitoring Actions	3	2	Arizona Bat Conservation Strategic Plan
3	Monitor the effects of land management practices, human disturbances, and artificial assistance on bats within the VRCMA.	California leaf-nosed bat, greater western mastiff bat, big free-tailed bat, pallid bat, Townsend's big-eared bat, western red bat, silver-haired bat, hoary bat, western pipistrelle, California myotis, western small-footed myotis, fringed myotis, long-legged myotis, Yuma myotis	Inventory and Monitoring Actions	3	2	Arizona Bat Conservation Strategic Plan
3	Validate occupied LeConte's Thrasher habitats and identify important population centers.	Le Conte's thrasher	Inventory and Monitoring Actions	4	1	Nevada Partners in Flight Bird Conservation Plan
3	Conserve identified population centers where populations are productive and contributing individuals to surrounding populations.	loggerhead shrike	Protective Measure	3	2	Nevada Partners in Flight Bird Conservation Plan
3	Isolate population declines by major habitat type.	loggerhead shrike	Inventory and Monitoring Actions	4	1	Nevada Partners in Flight Bird Conservation Plan
3	Evaluate Breeding Bird Atlas data for distribution and occurrence, Analyze data for changes in prairie falcon breeding densities and distribution of Scott's oriole. Note new high density areas if discovered.	all birds	Inventory and Monitoring Actions	4	1	Nevada Partners in Flight Bird Conservation Plan
3	Support and participate in Christmas Bird Counts and regularly analyze CBC data for trends.	resident and winter migrant birds	Public Outreach, Partnership, and Education Actions	4	1	Nevada Partners in Flight Bird Conservation Plan
3	Create a Burrowing Owl colony atlas that specifically delineates areas of breeding pair concentration.	burrowing owl	Inventory and Monitoring Actions	4	1	Nevada Partners in Flight Bird Conservation Plan
3	Obtain baseline data on desert tortoise densities in lands adjacent to the VRCMA.	desert tortoise	Inventory and Monitoring Actions	4	1	Desert Tortoise (Mojave Population) Recovery Plan
3	Perform GAP analyses to determine relative vulnerability of important LeConte's Thrasher population centers.	Le Conte's thrasher	Inventory and Monitoring Actions	4	1	Nevada Partners in Flight Bird Conservation Plan
3	Maintain positive liaison with practicing falconers regarding annual nest site information.	northern goshawk	Public Outreach, Partnership, and Education Actions	4	1	Nevada Partners in Flight Bird Conservation Plan

Table 4-7 Conservation Actions Associated with Conservation Objective 4

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
3	Delineate old growth stands and inventory Pinyon Jay presence in those stands.	pinyon jay	Inventory and Monitoring Actions	4	2	Nevada Partners in Flight Bird Conservation Plan
3	Identify Joshua tree habitats and perform risk analyses for these sites projected through the planning period.	Scott's oriole	Inventory and Monitoring Actions	4	1	Nevada Partners in Flight Bird Conservation Plan
3	Delineate and map occupied Vesper Sparrow habitat throughout the VRCMA.	vesper sparrow	Inventory and Monitoring Actions	4	1	Nevada Partners in Flight Bird Conservation Plan
3	Collect baseline data regarding the impacts of specific range land pesticide distributions on local Burrowing Owl nesting pairs.	burrowing owl	Applied Research Actions	4	2	Nevada Partners in Flight Bird Conservation Plan
3	Conduct population surveys and genetic studies of the desert pocket mouse in southern Nevada will be conducted.	desert pocket mouse	Inventory and Monitoring Actions	4	2	CC MSHCP BO
3	Use remote sensing and satellite imagery to track land use and establish a baseline for non-disturbed habitat within the VRCMA.	Desert tortoise, banded gecko, banded Gila monster, California kingsnake, desert iguana, desert kangaroo rat, desert night lizard, desert pocket mouse, glossy snake, Great Basin collared lizard, Kit fox, large-spotted leopard lizard, Las Vegas bearpoppy, Mojave green rattlesnake, Pale Townsend's big eared bat, sidewinder, Sonoran lyre snake, southern desert horned lizard, speckled rattlesnake, sticky buckwheat, western burrowing owl, western chuckwalla, western leaf-nosed snake, western red-tailed skink, white bearpoppy, yellow twotone beardtongue.	Inventory and Monitoring Actions	4	2	CMS - Mormon Mesa DWMA, CMS - Gold Butte DWMA
3	Encourage scout groups, conservation organizations, and civic clubs to build nest boxes and monitor breeding success.	flammulated owl	Public Outreach, Partnership, and Education Actions	4	1	Nevada Partners in Flight Bird Conservation Plan
3	Develop effective survey methods to determine status and distribution of this species within the VRCMA.	banded Gila monster	Inventory and Monitoring Actions	4	2	CCMSHCP & EIS APP B
3	Inventory and monitor caves, mines, and other natural and artificial roosts and habitats within the VRCMA that support, or once supported, important bat colonies and populations. Work cooperatively with interested groups to evaluate caves. The inventory process should document all unique biological, hydrological, geological, mineralogical, paleontological, educational, scientific, cultural, and/or recreational values.	California leaf-nosed bat, greater western mastiff bat, big free-tailed bat, pallid bat, Townsend's big-eared bat, western red bat, silver-haired bat, hoary bat, western pipistrelle, California myotis, western small-footed myotis, fringed myotis, long-legged myotis, Yuma myotis	Inventory and Monitoring Actions	3	2	Arizona Bat Conservation Strategic Plan, CMS - Mormon Mesa DWMA, CMS - Gold Butte DWMA

Table 4-7 Conservation Actions Associated with Conservation Objective 4

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
3	Undertake genetic studies related to management and conservation.	California leaf-nosed bat, greater western mastiff bat, big free-tailed bat, pallid bat, Townsend's big-eared bat, western red bat, silver-haired bat, hoary bat, western pipistrelle, California myotis, western small-footed myotis, fringed myotis, long-legged myotis, Yuma myotis	Inventory and Monitoring Actions	3	2	Arizona Bat Conservation Strategic Plan
3	Initiate research and monitoring activities to provide information on life history population status and trend, location of key concentrations, and conservation needs of cave and mine, cliff, crevice and talus, and structure roosting bats.	California leaf-nosed bat, greater western mastiff bat, big free-tailed bat, pallid bat, Townsend's big-eared bat, western red bat, silver-haired bat, hoary bat, western pipistrelle, California myotis, western small-footed myotis, fringed myotis, long-legged myotis, Yuma myotis, Allen's big-eared bat, Brazilian free-tailed bat, western yellow bat, big brown bat, long-eared myotis, little brown bat	Inventory and Monitoring Actions	2	3	Revised Nevada Bat Conservation Plan
3	Conduct a landscape analysis of projected pinyon-juniper treatment projects through the five-year planning period. Determine potential impacts on pinyon jay populations.	pinyon jay	Applied Research Actions	3	2	Nevada Partners in Flight Bird Conservation Plan
3	Coordinate an inventory of three-cornered milkvetch and sticky buckwheat within the VRCMA with other survey efforts on Federal lands.	Three-cornered milkvetch and sticky buckwheat	Inventory and Monitoring Actions	4	2	CC MSHCP
3	Determine management needs for the species.	desert night lizard, Sonoran lyre snake	Management Action	3	3	Nevada Wildlife Action Plan
3	Determine demographic parameters and conduct population viability analyses.	all species	Inventory and Monitoring Actions	4	2	Nevada Partners in Flight Bird Conservation Plan
3	Determine essential habitat needed for the continued existence of the southwestern bald eagle, including non-nesting habitat. Maintain suitable habitats and upgrade potential habitats. Protect potential and future bald eagle habitats by mapping these areas and making this information available for use in future fire suppression activities, both in and outside of bald eagle habitats.	bald eagle	Impact Mitigation	4	2	Nevada Partners in Flight Bird Conservation Plan
3	Determine the environmental requirements and life history of buffaloberry, as well as the species' recovery potential from fire and other perturbations.	blue grosbeak	Inventory and Monitoring Actions	4	2	Nevada Partners in Flight Bird Conservation Plan
3	Develop long-term hypothesis-based studies targeting management issues for recovery of desert tortoise populations.	desert tortoise	Applied Research Actions	3	3	CMS - Mormon Mesa DWMA, CMS - Gold Butte DWMA
3	Inventory pinyon stands by age class in the five priority areas.	pinyon jay	Inventory and Monitoring Actions	4	2	Nevada Partners in Flight Bird Conservation Plan

Table 4-7 Conservation Actions Associated with Conservation Objective 4

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
3	Conduct landscape analysis that delineates and classifies key foraging areas associated with the top priority sites. Promote the maintenance of Prairie Falcon habitat at a landscape scale.	prairie falcon	Applied Research Actions	4	2	Nevada Partners in Flight Bird Conservation Plan
3	Monitor parasite populations; implement parasite control program as appropriate.	all birds	Inventory and Monitoring Actions	4	3	CC MSHCP
3	Determine population trend and response to collection pressure within the VRCMA.	Great Basin collared lizard, long-nosed leopard lizard, desert iguana, desert horned lizard, chuckwalla, desert night lizard, Sonoran lyre snake	Inventory and Monitoring Actions	4	3	Nevada Wildlife Action Plan
3	Collect data on spatial variability of climate and productivity of vegetation throughout the VRCMA and correlate this information with population parameters (e.g., maximum sustainable population size).	desert tortoise	Applied Research Actions	4	3	Desert Tortoise (Mojave Population) Recovery Plan
3	Conduct appropriately designed, long-term research on the impacts of grazing, road density, barriers, human-use levels, restoration, augmentation, and translocation on desert tortoise population dynamics within the VRCMA.	desert tortoise	Applied Research Actions	3	4	Desert Tortoise (Mojave Population) Recovery Plan
3	Determine the range of suitable habitat parameters and, within that range, identify preferred habitat of nesting pairs by region, i.e., Sierra Nevada, Jarbidge, Snake Range, central ranges.	flammulated owl	Inventory and Monitoring Actions	4	2	Nevada Partners in Flight Bird Conservation Plan
3	Conduct nest occupancy checks every five years, prioritizing nest sites at risk and noting changes in human activity in the area.	prairie falcon	Inventory and Monitoring Actions	4	2	Nevada Partners in Flight Bird Conservation Plan
3	Research sources of mortality and their representation of the total mortality, including human effects, natural predation, diminishment of required resources, etc., within the VRCMA to better mitigate against tortoise deaths.	desert tortoise	Inventory and Monitoring Actions	4	2	Desert Tortoise (Mojave Population) Recovery Plan
3	Conduct research on reproductive behavior and physiology, focusing on requisites for successful reproduction within the VRCMA.	desert tortoise	Applied Research Actions	4	2	Desert Tortoise (Mojave Population) Recovery Plan
3	Initiate or enable other entities to initiate epidemiological studies of URTD and other diseases that affect the tortoise within the VRCMA.	desert tortoise	Inventory and Monitoring Actions	4	2	Desert Tortoise (Mojave Population) Recovery Plan
3	Initiate research necessary to monitor and guide recovery efforts.	desert tortoise	Applied Research Actions	3	3	Desert Tortoise (Mojave Population) Recovery Plan

Table 4-7 Conservation Actions Associated with Conservation Objective 4

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
4	Implement comprehensive monitoring program for all special status species in coordination with VRCMA. Evaluate inventory needs on an annual basis and coordinate on maintaining a digital inventory database. An inventory of rare flora and fauna should be completed on an annual basis within the VRCMA, with occurrence records submitted to the NNHP. Coordinate survey efforts between agencies and maintain survey data in a central database accessible to local biologists. Provide protocols, training, and survey tapes to all affected agency biologists and interested biological consultants.	all species	Inventory and Monitoring Actions	3	4	CMS - Mormon Mesa DWMA, CCMSHCP, Arizona Bat Conservation Strategic Plan, Nevada Wildlife Action Plan, Nevada Partners in Flight Bird Conservation Plan
4	Fund research to determine minimum viable population sizes in various habitat types, nutritional forage quantity and quality needs, the juvenile niche, nest microhabitat requirements, temperature-dependent sex determination as determined by field nest temperature cycles, mating systems in nature, and genetics.	desert tortoise	Applied Research Actions	3	4	Nevada Wildlife Action Plan
4	Develop a comprehensive model of desert tortoise demography within the VRCMA. Such a model should be based on at least 25 years of data. This time span represents one desert tortoise generation and is necessary to capture the effects of normal environmental variability on desert tortoise survival and reproduction. Research should be done in both high- and low-density areas.	desert tortoise	Applied Research Actions	4	4	Desert Tortoise (Mojave Population) Recovery Plan
4	Develop a relative abundance index, and a measurement of chuckwalla population repatriation, and a regional chuckwalla genetic history, and its relevance to viability of local populations will be developed.	western chuckwalla	Inventory and Monitoring Actions	4	3	CC MSHCP BO
4	Conduct long-term research on the nutritional and physiological ecology of various age-size classes of desert tortoises throughout the VRCMA.	desert tortoise	Applied Research Actions	4	3	Desert Tortoise (Mojave Population) Recovery Plan

4.3.3 Conservation Objective 5: Offset Potential Effects of Hunting on Special Status Species

Presented below are conservation actions for Conservation Objective 5 (Table 4-8).

Table 4-8 Conservation Actions Associated with Conservation Objective 5

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility	Source of Conservation Action
2	Support restrictions of hunting, collection (other than for scientific research), or harassment of conservation species.	all wildlife	Protective Measure	2	3	CC MSHCP
3	Use population demographic data to adjust collection limits.	Great Basin collared lizard, desert iguana, long-nosed leopard lizard, desert horned lizard	Management Action	3	2	Nevada Wildlife Action Plan
3	Develop and maintain cooperative partnerships with hunters and trappers to benefit ecosystem health.	all species	Public Outreach, Partnership, and Education Actions	3	2	CC MSHCP
3	Inform recreational shooters of conservation impacts of indiscriminate shooting.	all species	Public Outreach, Partnership, and Education Actions	2	3	CC MSHCP
3	Regulate hunting, trapping, and collection.	all wildlife	Management Action	3	2	CC MSHCP
3	Increase awareness of law enforcement and land management staff on the potential illegal collection of Gila Monsters, particularly in areas most accessible by collectors and suitable for the species.	banded Gila monster	Protective Measure	4	2	CCMSHCP & EIS APP B

4.3.4 Conservation Objective 6: Offset Potential Effects of Development on Special Status Species.

Presented below are conservation actions for Conservation Objective 6 (Table 4-9).

Table 4-9 Conservation Actions Associated with Conservation Objective 6

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
2	Construction above or near a cave, within the VRCMA, will be designed in a way to insure protection of the cave resources. Diversion of surface drainage into caves is prohibited.	all bats	Protective Measure	2	1	CC MSHCP
2	Where possible, maintain native vegetation around cave openings for a minimum distance of 100 yards within the VRCMA.	all bats	Impact Mitigation	3	1	CC MSHCP
2	Create or improve new open water resources for bats and other wildlife within the VRCMA.	all bats and wildlife	Restoration Effort	2	3	CC MSHCP
2	Coordinate with BLM to perform plant salvages prior to work in undisturbed habitat and/or when Covered plant species cannot be avoided, especially cactus and yucca species within the VRCMA.	all plants	Protective Measure	3	2	CC MSHCP
2	Work with the Nevada Power Company (and other utilities) to be sure that support towers and poles, within the VRCMA are "raptor-safe."	all raptors	Protective Measure	3	1	CC MSHCP
2	No non-biodegradable debris would be left on the ROW.	all species	Impact Mitigation	3	1	Informal and Formal Consultation on Proposed Construction of the Harry Allen to Mead 500kV Transmission Line, Clark County, Nevada
2	Use weed-free, native seed mixed if re-vegetation were required. No species on the state noxious weed list would be included in the revegetation seed mixes.	all species	Impact Mitigation	3	1	Informal and Formal Consultation on Proposed Construction of the Harry Allen to Mead 500kV Transmission Line, Clark County, Nevada
2	Minimize clearing of undergrowth during construction of new facilities.	all species	Impact Mitigation	3	1	CC MSHCP
2	If lands will be temporarily disturbed within the VRCMA, develop a reclamation plan.	all species	Restoration Effort	2	2	BO and Request for Concurrence on Effect Determination for Listed Species Associated with the Proposed Toquop Energy Project
2	VRCMA partners will ensure that restoration activities will occur based on prior agreements.	all species	Restoration Effort	2	2	Request to Append Red Rock Fire Station Utility Line
2	Site new facilities away from key populations and habitat areas; provide measures to avoid, minimize, or mitigate effects of these activities; and provide protection for populations and habitat areas not affected by existing facilities.	all species	Impact Mitigation	2	2	CC MSHCP

Table 4-9 Conservation Actions Associated with Conservation Objective 6

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
2	Using "best management practices" as identified by the State of Nevada, minimize contributions from both point and non-point sources of pollution (including salts) resulting from public land management actions. Where applicable, proposed management actions would comply with local, state, tribal and Federal air quality laws, regulations, and standards.	all species	Management Action	2	2	CC MSHCP
2	Instruct workers not to drive or park vehicles where catalytic converters can ignite dry vegetation and to exhibit care when smoking in natural areas. Fire protective mats or shields would be used during grinding or welding. Vehicles would carry water and shovels or fire extinguishers during times of high fire hazards.	all species	Protective Measure	3	1	Informal and Formal Consultation on Proposed Construction of the Harry Allen to Mead 500kV Transmission Line, Clark County, Nevada
2	Prior to the disposal of identified public lands, conduct analysis to determine their resource values, including the occurrence of Special Status Species and sensitive habitats such as riparian and aquatic habitats. Land disposal will be consistent with conservation of special status species unless there is an overriding public benefit.	all species	Management Action	3	1	CC MSHCP
2	Where feasible, proposals for saleable materials in essential habitats for special status species will be avoided.	all species	Protective Measure	3	1	CC MSHCP
2	Grading, blading, clearing or cutting of trees or other vegetation not permitted to accommodate vehicle access.	all species	Protective Measure	2	2	Las Vegas Fire Management Plan
2	Avoid construction of new paved roads in high elevation habitat areas.	all species	Impact Mitigation	2	2	CC MSHCP
2	Provide site-specific fencing and signage where needed.	all species	Impact Mitigation	2	2	CC MSHCP
2	Retrofit existing highways and design new highways for safe passage of wildlife.	all species	Impact Mitigation	2	2	CC MSHCP
2	Conduct pre-activity surveys for the species of concern prior to any actions that may affect them, and design projects to minimize or avoid adverse effects. Ensure that surveys consider unique habitat components of the species of concern (e.g., mud and puddles for butterflies).	all species	Inventory and Monitoring Actions	2	2	CC MSHCP
2	To the extent feasible, ensure that minimal impacts occur to resources during the planning stages for projects.	all species	Management Action	3	2	CC MSHCP
2	Prohibit dumping, refuse disposal, littering, and use of herbicides or biocides (except where used in habitat management and control of invasive species as part of an agency approved program).	all species	Protective Measure	2	3	File No. 1-5-94-F-283 BO on the Sale of Public Lands in Eldorado Valley (PL 85-339, as Amended)

Table 4-9 Conservation Actions Associated with Conservation Objective 6

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
2	Site new power lines in consolidated utility corridors adjacent to existing facilities; retrofit existing lines where appropriate.	all species	Impact Mitigation	3	2	CC MSHCP
2	Implement weed-control actions within the VRCMA.	all species	Impact Mitigation	2	2	BO Sempra Energy's Eldorado Valley Ext Project
2	All surface-disturbing activities within the range of any listed species shall be conducted in a manner that reduces, as much as possible, the potential for take of individuals of a listed species on the VRCMA.	all species	Protective Measure	2	2	Biological Opinion and Request for Concurrence with Effect Determination for Listed and Proposed Species Associated with the Kern River Gas Transmission Company Project in California, Nevada, Utah, and Wyoming, Docket No. CP01-422-000
2	To the maximum extent practicable, avoid construction and maintenance projects in habitats during sensitive times, such as breeding or nesting or overwintering (e.g., near bat hibernacula, mowing of potential butterfly habitat, or in rare plant habitat).	all species	Protective Measure	2	2	CC MSHCP
2	Only use existing material sites for development within the VRCMA. Prior to sampling/testing or excavating in material sites, a biologists will meet on-site with the USFWS to determine avoidance areas (undisturbed habitat) and develop appropriate minimization measures. (Expansion of existing materials sites or acquisition of new material sites which involves Federal lands or another Federal nexus shall be in compliance with Section 7 of the ESA.)	all species	Protective Measure	3	2	CC MSHCP
2	Inform the public of potential impacts of domestic animals on native species; design reserve areas so as to support populations of natural predators (coyote, bobcat, and mountain lion); increase law enforcement presence; increase interaction between land managers and animal damage control.	all species	Public Outreach, Partnership, and Education Actions	3	2	CC MSHCP
2	Prior to use of pesticides and other chemicals, determine potential impacts to the species of concern (e.g., butterflies, bats) and implement strategies to avoid impacts to those species.	all species	Impact Mitigation	3	2	CC MSHCP
2	Site landfills away from populations and habitat areas susceptible to the effects of landfills and associated species; implementation of appropriate landfill management (daily cover of working face, appropriate liners, raven monitoring programs, fencing and road access control); control type of refuse accepted for disposal.	all species	Impact Mitigation	3	2	CC MSHCP
2	Conservation easements or agreements will be established to protect habitats threatened by development.	all species	Management Action	2	2	CCMSHCP & EIS APP B

Table 4-9 Conservation Actions Associated with Conservation Objective 6

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
2	Allow surface flows to return to ecosystem use in developed canyons.	all species	Impact Mitigation	2	2	CC MSHCP
2	Incorporate design feature into new towers to inhibit raptor or raven perching and nesting; as appropriate, retrofit existing towers with devices to discourage raptor and raven perching.	all species	Protective Measure	3	2	CC MSHCP
2	Avoid large-scale removal of buffaloberry except on a scheduled rotation designed to maintain stand vigor at a scale that does not impact present habitat suitability.	blue grosbeak, phainopepla, western bluebird, Lucy's warbler	Protective Measure	3	1	Nevada Partners in Flight Bird Conservation Plan
2	Implement desert tortoise conservation measures following development including: 1. Remove all remaining construction waste and materials. Remove and appropriately dispose of contaminated soil. Desert tortoises moved between November 1 and March 15, or those in hibernation regardless of date, must be placed in an adequate burrow (BO specific). If one is not available, one will be constructed. After placement of the tortoise in the burrow, the entrance shall be partially blocked with loose topsoil. 2. The applicant is responsible for removal of any project-related materials such as flagging, markers, etc. within one week of the activity. 3. All construction refuse will be removed from the site and disposed. 4. Dead or injured DT shall be reported to the Service and NDOW immediately. Animals shall be transported to a veterinarian. The Service shall determine final disposition for animals taken to a veterinarian. 5. Operation of the Desert Tortoise Pick-Up Service and holding Facility: This measure will provide a means to collect displaced, wandering or unwanted pet tortoises throughout the county and humane treatment for tortoises held in captivity, thus minimizing effects that would result from unauthorized release of captive tortoises 6. The project proponent will submit a report to the Service detailing all tortoise related monitoring activity, incidental take, and effectiveness of mitigation measures.	desert tortoise	Impact Mitigation	3	1	BO Sempra Energy's Eldorado Valley Ext Project (1) Emergency Biological Opinion for the Virgin Valley Water District Well and Water Main, Bunkerville, Nevada (2) BO for the City of Mesquite Landfill and Access Road Right-of-Way, Clark and Lincoln Counties, NV; File No. 1-5-94-F-265 (3) Red Rock Programmatic BO (4) Biological Opinion and Request for Concurrence with Effect Determination for Listed and Proposed Species Associated with the Kern River Gas Transmission Company Project in California, Nevada, Utah, and Wyoming, Docket No. CP01-422-000 (5) Sec 7 McCullough Substation Maint. Work (6) CC MSHCP BO (7) CC MSHCP (8)

Table 4-9 Conservation Actions Associated with Conservation Objective 6						
Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
	7. If topsoil is removed, stockpiled, and replaced on disturbed areas, effects on the vegetation should be minimized by preserving the native seed bed. 8. Construct desert tortoise barriers along roads and highways. 9. Provide a copy of study results including any management recommendations to the Service and BLM wildlife staff representative upon completion of the project to aid in recovery and future management of the tortoise and its habitat. 10. Routine road surface maintenance activities on existing access and/or patrol roads shall be conducted during the inactive season of tortoise. 11. Reports will be submitted to wildlife staff representative following the end of the permit period or as designated showing the number of desert tortoises injured, killed, collected, encountered or moved; UTM coordinates or GIS coverage of the collection sites; the number and location species of collected associated with permitted activities (BO specific). 12. Tortoise surveys and removals shall be conducted within 72 hours of construction activities in accordance with the Bureau's proposed protocol. The entire project area shall be surveyed using techniques that provide 100-percent coverage a maximum of three times, unless no tortoises are located after two complete searches (BO specific). 13. Restore disturbed areas to pre disturbance conditions. This includes closing access to nondesignated roads and restoring nondesignated roadbeds to their pre disturbance state.					

Table 4-9 Conservation Actions Associated with Conservation Objective 6

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
2	Implement desert tortoise conservation measures before development including: 1. Activities that involve ground disturbance, such as installation of wells, fences, or other infrastructures shall comply with the proposed measures for ground-disturbing actions for any actions within the VRCMA,. 2. A litter-control program will be implemented to reduce the attractiveness of the area to opportunistic predators such as desert kit fox, coyotes and common ravens. Trash and food items will be disposed of properly in predator-proof containers with re-sealing lids. Trash containers will be emptied and removed from the area and disposed of in an approved landfill at the conclusion of the event. 3. All pipeline markers within desert tortoise habitat will be fitted with "bird-be-gone" or similar bird repellent devices to minimize the potential for increased predation from aerial predators during operation of the proposed pipeline. 4. Employees will not bring pets to project site. 5. Herbicide shall not be used on the ROW or access roads unless approved in writing by the Service. 6. Overnight parking and storage of equipment and materials, including stockpiling, shall be within previously disturbed areas or within areas cleared by a tortoise biologist to minimize habitat destruction.	desert tortoise	Impact Mitigation	3	1	Red Rock Programmatic BO (1) Request to Append Red Rock Fire Station Utility Line (2) Biological Opinion and Request for Concurrence with Effect Determination for Listed and Proposed Species Associated with the Kern River Gas Transmission Company Project in California, Nevada, Utah, and Wyoming, Docket No. CP01-422-000 (3) Biological Opinion on a Proposed Amendment to an Existing Right-of-Way Grant for a Substation near Pahrump in Nye County, Nevada (4) BO for Proposed Community Park in Goodsprings, Nevada (5) BO for the City of Mesquite Landfill and Access Road Right-of-Way, Clark and Lincoln Counties, NV (6) BO for the Proposed Water System for the State Prison and Jean, NV (7) Red Rock Programmatic BO (8) BO on Clark County Regional Flood Control District's Master Plan (9) Sec 7 McCullough Substation Maint. Work (10) Biological Opinion on a Proposed Amendment to an Existing Right-of-Way Grant for a Substation near Pahrump in Nye County, Nevada (11) BO Sempra Energy's Eldorado Valley Ext Project (12) Emergency consultation for Nickel Fire, Virgin Mtns, Clark Co., & Mohave Co. (13) File No. 1-5-95-F-119 Formal Section 7 Consultation on the Proposed Sale of Public Lands Northeast of Las Vegas, Nevada (14) Informal and Formal Consultation on Proposed Construction of the Harry Allen to Mead 500kV Transmission Line, Clark County, Nevada (15) 1-5-96-F-023R.3 (16) Informal and Formal Consultation on Proposed Construction of the Harry Allen to Mead 500kV Transmission Line, Clark County, Nevada (17)

Table 4-9	Conservation Actions Associated with Conservation Objective 6					
Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
	7. Briefings will be conducted that include: a. The legal and sensitive status of the tortoise. b. General measures designed to minimize impacts, such as importance of confining disturbance to the project site and prohibition of cross-country travel in adjacent areas. c. Distribution, general behavior, ecology, and the sensitivity of the desert tortoise to human activities. d. Additional measures, such as respecting established speed limits and checking under vehicles for tortoises seeking shade prior to traveling. e. Protocol to follow if a tortoise is encountered, including appropriate contact points, such as construction supervisors, construction inspectors, and environmental monitors. All personnel who will be onsite prior to construction, such as surveyors and construction engineers, shall attend the briefing. An acknowledgement form shall be returned to the Bureau upon complete circulation to all onsite personnel. All personnel shall be informed to check under all vehicles before moving such vehicles. 8. Prior to surface disturbance of the proposed landfill and access road, the site shall be surveyed by a qualified biologist to locate and remove tortoises no more than 24 hours prior to surface-disturbing activities. 9. All burrows found in the construction zone shall be evaluated by a biologist to determine occupancy, then collapsed or blocked to prevent tortoise from re-entry. Tortoises should be relocated 300 to 1,000 feet from the original capture point to undeveloped land. 10. If removed from a burrow, the tortoise shall be placed in an existing similar unoccupied burrow. If a suitable natural burrow is not found, an artificial burrow shall be constructed that is approximately the same size, depth, and orientation as the original burrow. 11. Tortoises shall be handled by approved tortoise handlers in accordance with Service standards under permit only. 12. All appropriate State and Federal permits, including NDOW and Service permits for handling desert tortoises or their parts, must be acquired by the tortoise biologists or other personnel before project initiation and prior to handling any desert tortoise or their parts, or conducting any activity requiring a permit.					

Table 4-9 Conservation Actions Associated with Conservation Objective 6

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
	13. A qualified desert tortoise biologist will be onsite during construction activity. 14. The lands to be developed within the proposed action site will be either patrolled by a full time monitor or fenced with a permanent or temporary tortoise-proof fence prior to construction activity and clearances. This fence will remain in place until the construction activity is complete. Typical fence design will consist of 1-inch mesh, 48-inch wide, plastic fence constructed to maintain zero clearance between the ground and the bottom edge of the fence. Other proposed fence designs must be approved by the Service prior to implementation. The tortoise-proof fence shall be monitored at least monthly, especially following precipitation, and maintained in perpetuity. Monitoring and maintenance shall include regular removal of trash and sediment accumulation and restoration of zero clearance between the ground and bottom of the fence. A tortoise survey of the fenceline will be conducted by a qualified tortoise biologist no more than 24 hours before construction of the fence. After completion of the fence, the area within the fence will be surveyed for desert tortoises. Surveys will include 100-percent coverage of all proposed surface disturbance sites. Transects will be no greater than 10 meters wide. All tortoise burrows, and other species burrows which may be used by tortoises, will be examined, with a fiber-optic scope if necessary, to determine occupancy of each burrow by tortoises. The parcel shall be surveyed three times, unless two complete searches result in no tortoises being found. 15. Vehicle traffic shall be restricted to existing access roads, unless otherwise authorized. All vehicle use in desert tortoise habitat for these actions shall be restricted to existing roads, trails, large sandy washes, and ways. No new access roads shall be created.					

Table 4-9 Conservation Actions Associated with Conservation Objective 6

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
	16. A trash abatement program shall be implemented by the applicant during pre-construction phases and continue through post-construction cleanup activities. The applicant shall use covered, scavenger-proof receptacles. All trash shall be placed in these receptacles, and the receptacles will be emptied into a solid-waste disposal facility. Vehicles hauling trash to the landfill and leaving the landfill must be covered to prevent litter along the access road. It is the responsibility of the City of Mesquite to remove all litter along the access road and any litter that exits the landfill. Cleanup of this litter shall be done weekly. 17. A tortoise education program is presented to all supervisors, workers, permittees, and other employees or participants working in the project area. The program will consist of a fact sheet or a presentation by a tortoise biologist, and will include information on the life history of the DT, legal protection for DTs, penalties for violations of Federal and State laws, general tortoise activity patterns, reporting requirements, measures to protect tortoises, terms and conditions of the appended consultation, and personal measures employees can take to promote conservation of DTs. The definition of "take" will also be explained. Specific and detailed instructions will be provided on the proper techniques to capture and move tortoises which appear onsite in imminent danger, in accordance with Service-approved protocol. Workers and project associates will be encouraged to carpool to and from the project sites. 18. A formal Reclamation Plan will be developed by the project proponent and submitted to the resource agencies at least 90 days prior to construction in tortoise habitat. 19. Tortoise burrows found in the construction zone, whether occupied or vacant, will be excavated by a biologist and collapsed or blocked to prevent tortoise re-entry under permit and authorization of NDOW, the Service and/or BO. Prior to handling any tortoise, state-required permits will be obtained from the Nevada Department of Wildlife. To reduce the handling stress and risk to the animal, tortoises will only be handled by biologists authorized by the agencies.					
2	Implement desert tortoise conservation measures during development including:	desert tortoise	Management Action	3	1	File Nos. 1-5-94-F-334, 1-5-94-F-335, 1-5-94-F-336, 1-5-95-F-035 BO for Issuance of Rights-of-Way to Install Four Proposed Fiber-Optic Lines in Clark and Lincoln Counties, Nevada (1) BO for the

Table 4-9 Conservation Actions Associated with Conservation Objective 6

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
	1. Ensure that a qualified DT biologist is onsite or fencing is installed according to approved protocol (project specific) during construction activities during times when DT activity is greatest (generally March through the end of October), and a biologist on call during periods of lower tortoise activity (generally November through the end of February). 2. A biologist must be present or fencing installed according to protocol (project specific) during those times when the ambient temperature reaches 65°F or greater for three or more consecutive days. 3. Any fuel or hazardous waste leaks or spills will be stopped/ repaired immediately and cleaned up at the time of occurrence. 4. Tortoise burrows are avoided whenever possible and that disturbance is limited to the minimum necessary. If a DT is found onsite during project activities in harm's way, the DT shall be moved by an approved qualified DT biologist under permit or as allowed in BO. If a qualified biologist is not onsite, all activities that could create harm to the tortoise will cease until the tortoise moves out of harm's way of its own volition. Tortoises that are moved offsite and released into undisturbed habitat on public land must be placed in the shade of a shrub, in a natural unoccupied burrow similar to the hibernaculum in which it was found, or in an artificially constructed burrow in accordance with DTC (1994, revised 1996). Any tortoise found within one hour before nightfall will be placed in a separate clean cardboard box and held in a cool, predator-free location. The box will be covered and kept upright at all times to minimize stress to the tortoise. Each box will be used once and then disposed of properly. The tortoise will be released the next day in the same area from which it was collected and using proper procedures. Each tortoise will be handled with new disposable latex gloves. After use, the gloves will be properly discarded and a fresh set used for each subsequent tortoise handling. (Desert tortoises shall be treated in a manner to ensure that they do not overheat, exhibit signs of overheating (e.g., gaping, foaming at the mouth, etc.), or are placed in a situation where they cannot maintain surface and core temperatures necessary to their well-being. Desert tortoises shall be kept shaded at all times until it is safe to release them. No desert tortoise shall be captured,					Proposed Water System for the State Prison and Jean, NV (2) File No. 1-5-94-F-265 (3) Emergency Biological Opinion for the Virgin Valley Water District Well and Water Main, Bunkerville, Nevada (4) Request to Append Red Rock Fire Station Utility Line (5) Request to Append Red Rock Fire Station Utility Line (6) Red Rock Programmatic BO (7) File No. 1-5-95-F-230 BO for the Proposed Issuance of a Right-of-Way Permit to Saguaro Power Company for Construction of a Natural Gas Pipeline (8) BO for the City of Mesquite Landfill and Access Road Right-of-Way, Clark and Lincoln Counties, NV (9) Biological Opinion for the 1996 Community Development Block Grant Project for the Searchlight Water Improvements, Clark County, Nevada (10) Biological Opinion and Request for Concurrence with Effect Determination for Listed and Proposed Species Associated with the Kern River Gas Transmission Company Project in California, Nevada, Utah, and Wyoming, Docket No. CP01-422-000 (11) Biological Opinion for the Proposed Multi-use Recreation Facility in Pahrump, Nevada (12) Biological Opinion on a Proposed Amendment to an Existing Right-of-Way Grant for a Substation near Pahrump in Nye County, Nevada (13) Sec 7 McCullough Substation Maint. Work (14) 1-5-96-F-023R.3 (15) Biological Opinion on the Chemical-Lime Quarry Quality Station, Clark County, Nevada (16) Biological Opinion and Request for Concurrence with Effect Determination for Listed and Proposed Species Associated with the Kern River Gas Transmission Company Project in California, Nevada, Utah, and Wyoming, Docket No. CP01-422-000 (17) CCMSHCP (18) BO on Clark County Regional Flood Control District's Master Plan (19) File No. 1-5-94-F-283 BO on the Sale of Public Lands in Eldorado Valley (PL 85-339, as Amended) (20) Request to Append Red Rock Fire Station Utility Line (21)

Table 4-9 Conservation Actions Associated with Conservation Objective 6

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
	moved, transported, released, or purposefully caused to leave its burrow for whatever reason when the ambient air temperature is above 95°F (35°C). Ambient air temperature shall be measured in the shade, protected from wind, at a height of 2 inches (5 centimeters) above the ground surface. No desert tortoise shall be captured if the ambient air temperature is anticipated to exceed 95°F (35°C) before handling and relocation can be completed. If the ambient air temperature exceeds95°F (35°C) during handling or processing, desert tortoises shall be kept shaded in an environment that does not exceed 95°F (35"C), and the animals shall not be released until ambient air temperature declines to below 95°F (35°C). Desert tortoises encountering heat stress will be placed in a tub with 1/2-inch of water in an environment with a temperature between 76 and 95 degrees for several hours, until heat stress symptoms are no longer evident (Temperature thresholds may be updated as research proceeds). 5. Desert tortoise burrows will be avoided whenever possible; if not, the burrow will be excavated by hand with hand tools to allow removal of tortoises or eggs. 6. Hazardous materials shall not be drained onto the ground or into streams or drainage areas. Totally enclosed containment shall be provided for all trash. All construction waste including trash and litter, garbage, other solid waste, petroleum products, and other potentially hazardous materials shall be removed to a disposal facility authorized to accept such materials. 7. If a tortoise wanders onto the project site during construction, all activity will cease until the tortoise wanders out of harm's way of its own volition. Based on project specifics, if it does not move out of harm's way within 15 minutes, it may be removed by the qualified tortoise biologist and placed in a burrow or under a shrub in the shade, 500 to 1,000 feet from the project. 8. Painting of rocks or establishment of permanent markers or installation of permanent infrastructure is not allowed with these activities. 9. Measures shall be taken to minimize destruction of desert tortoise habitat, such as soil compaction, erosion, or crushed vegetation, due to construction activities					

Table 4-9 Conservation Actions Associated with Conservation Objective 6

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
	10. Measures shall be taken to minimize predation on tortoises by ravens drawn to construction areas. 11. All vehicular travel and construction activities will be confined to within the fenced or flagged areas. 12. The fence shall be monitored on a project specific time schedule, particularly following precipitation, and maintained for the life of the project. Monitoring and maintenance shall include regular removal of trash and sediment accumulation and restoration of zero clearance. 13. A speed limit of 5 to 15 mph will be established on project sites, and 25 mph on paved and unpaved roads to minimize risk of DT/vehicle encounters from March 1 to November 1 every year to minimize risk of tortoise/vehicle encounters. 14. During construction if trenches are to remain open overnight, they shall be checked for DTs at least immediately before work in the morning and at the end of the workday. The trenches will also be checked immediately before back-filling. 15. If a tortoise wanders onto a road during maintenance or into a construction area, all driving activity will cease until the tortoise wanders out of harm's way of its own volition. If it does not move out of harm's way within 15 minutes, it will be removed on a project specific basis per BO. 16. If blasting is required in desert tortoise critical habitat, a biological monitor will be assigned to each blasting crew or area in which blasting would occur. 17. Project activities that may endanger a tortoise will cease if a tortoise is found on a project site. Project activities will resume after an authorized desert tortoise biologist removes the tortoise from danger or after the tortoise has moved to a safe area of its own volition. 18. Other than emergency conditions, vehicles associated with construction, operation, or maintenance shall be restricted to existing graded or paved roads or within the proposed construction zones. On existing graded or paved roads, such vehicles shall not exceed the posted speed limit. 19. All vehicle traffic will be restricted to existing access roads. New access roads will be created only when absolutely necessary.					

Table 4-9 Conservation Actions Associated with Conservation Objective 6

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
	20. Damage to vegetation will be avoided whenever possible. Blading of the area will also be avoided. 21. Firearms and domestic dogs will be prohibited from the project site and site access routes. 22. Servicing of vehicles and equipment will happen in a designated area. 23. Tortoises fatally injured or killed by project activities will be submitted for necropsy, according to Salvage Protocols for Dying and Recently Dead Tortoise (2001). 24. If possible, overnight parking and storage of equipment and materials, including stockpiling, shall be in previously disturbed areas or areas to be disturbed that have been cleared by a tortoise biologist. If not possible, areas for overnight parking and storage of equipment shall be designated by the tortoise biologist, which will minimize habitat disturbance. Workers will be instructed to check underneath all vehicles before moving them. 25. Limit utility corridors to 3,000 feet in width, or less (or as amended).					
2	Actions during development should include: 1) Avoid habitat conversion of any kind inside a 1.6 km radius buffer zone around any documented Ferruginous Hawk nest site occurring on native structures,. 2) Curtail wood-cutting activities in occupied Ferruginous Hawk nest territories during April. 3) Increase periodic patrol of occupied nest territories, particularly during the near-fledging stage. 4) When planning pinyon-juniper removal by chaining or prescribed fire, keep intact the naturally-occurring woodland edge where isolated, mature Utah junipers might provide nest sites.	ferruginous hawk, western bluebird	Protective Measure	3	2	Nevada Partners in Flight Bird Conservation Plan
2	Identify mature pinyon-juniper areas and provide information to land managers regarding the importance of managing for and retaining healthy pinyon-juniper habitats.	gray vireo	Management Action	3	1	Nevada Partners in Flight Bird Conservation Plan
2	Ensure construction of the Mesquite Airport does not significantly impact viability on public lands.	three corner milkvetch and sticky buckwheat	Protective Measure	3	2	A Conservation Management Strategy for Nine Low Elevation Rare Plants in Clark County, Nevada

Table 4-9 Conservation Actions Associated with Conservation Objective 6

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
3	Develop and implement a plan to protect bat roosts in mines and caves. The plan will address the following protective measures: Gating or closing mines and caves to protect bat roost sites, removing important bat roost mines and caves from future additions to maps, avoiding identification of exact locations of maternity roosts, caves, and occupied mines to the general public, determining the need to close roads to mines and caves, and avoiding use of heavy equipment near mine and cave roosts.	all bats	Management Action	3	2	CC MSHCP
3	Protect key nesting areas, migration routes, important prey base areas, and concentration areas for birds of prey within the VRCMA.	all raptors	Protective Measure	3	3	CC MSHCP
3	Enhance cooperation among animal control entities to reduce raven and feral animal populations.	all reptiles	Public Outreach, Partnership, and Education Actions	4	2	CMS - Mormon Mesa DWMA, CMS - Gold Butte DWMA
3	Cooperate with participants in the MSHCP for the administration and management of any areas established for the conservation, protection, restoration, and propagation of species of native flora which are threatened with extinction within the VRCMA.	all species	Management Action	3	2	CC MSHCP
3	In construction areas where re-contouring is not required, vegetation would be left in place wherever possible and original contour would be maintained to avoid excessive root damage and allow for re-sprouting.	all species	Impact Mitigation	3	2	Informal and Formal Consultation on Proposed Construction of the Harry Allen to Mead 500kV Transmission Line, Clark County, Nevada
3	Reclamation of the site will involve recontouring all slopes, grading stockpile areas to blend in with the surrounding terrain, and replacing all available cover soil. If available, native plants will be salvage.	all species	Impact Mitigation	3	2	Biological Opinion for the Expansion of the North Jean Lake Community Gravel Pit, Clark County, Nevada
3	Water will be applied to the construction ROW for dust control and to the topsoil piles as necessary to prevent the loss of topsoil due to wind erosion.	all species	Impact Mitigation	3	2	Biological Opinion and Request for Concurrence with Effect Determination for Listed and Proposed Species Associated with the Kern River Gas Transmission Company Project in California, Nevada, Utah, and Wyoming, Docket No. CP01-422-000
3	Cooperate with local agencies in developing a backyard habitat program.	all species	Public Outreach, Partnership, and Education Actions	3	2	CC MSHCP

Table 4-9 Conservation Actions Associated with Conservation Objective 6

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
3	Inform the public and agency personnel of the potential effects of these activities on plant and wildlife populations and habitat areas; implement integrated pest management programs as warranted; avoid, to the maximum extent practicable, use of pesticides and herbicides in key areas of sensitive species habitat when this will have a significant adverse effect on project species.	all species	Public Outreach, Partnership, and Education Actions	3	2	CC MSHCP
3	Limit impacts of new administrative facilities on natural and heritage resources, and visual quality.	all species	Impact Mitigation	3	2	CC MSHCP
3	All equipment used off pavement and all portable equipment will be cleaned of weed and grass seed stems, stalks, etc. prior to release from an incident. This includes, but is not limited to, tents, tarps, helicopter support equipment, fold-a-tanks and free-standing tanks, mechanic's vehicles, and logistical support vehicles, trailers and equipment. These vehicles will be washed as in above.	all species	Protective Measure	3	2	Las Vegas Fire Management Plan
3	Carry out a public education programs within the VRCMA: VRCMA will provide pamphlets, fact sheets, and other informational materials to inform the public about species and ecosystem conservation needs for habitat and species conservation.	all species	Public Outreach, Partnership, and Education Actions	3	3	CC MSHCP BO
3	Public information and education: through education, increase the public understanding and awareness of the value of the project area's ecosystems.	all species	Public Outreach, Partnership, and Education Actions	3	3	CC MSHCP BO
3	Observations of listed species and their sign during construction activities will be conveyed to the FCR and/or authorized biologist on a project by project basis. Authorized biologists will maintain a record of all sensitive species encountered during project surveys and monitoring.	all species	Inventory and Monitoring Actions	4	2	Biological Opinion and Request for Concurrence with Effect Determination for Listed and Proposed Species Associated with the Kern River Gas Transmission Company Project in California, Nevada, Utah, and Wyoming, Docket No. CP01-422-000
3	Where possible, establish erosion control in areas that present problems.	all species	Management Action	3	3	CC MSHCP
3	Maintain air quality at a level that is adequate for the protection and use of resources (Air Quality Related Values) and that meets or exceeds air quality standards.	all species	Impact Mitigation	3	4	CMS - Mormon Mesa DWMA
3	Increase coordination among all agencies to minimize negative effects to the species and its habitat; Federal, state, and local agencies should address, minimize, or avoid impacts to the species in biological evaluations or environmental reviews for land use planning and action.	banded Gila monster	Public Outreach, Partnership, and Education Actions	3	3	CCMSHCP & EIS APP B

Table 4-9 Conservation Actions Associated with Conservation Objective 6

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
3	Minimize mortality by conducting extensive surveys prior to surface disturbance; capture and relocate individuals in area of impact in accordance with NDOW protocol.	banded Gila monster	Protective Measure	4	2	CCMSHCP & EIS APP B
3	When opportunities exist, acquire breeding habitat from willing sellers via land exchange, purchase, or conservation easement.	blue grosbeak, yellow-breasted chat	Protective Measure	2	3	Nevada Partners in Flight Bird Conservation Plan
3	Work with developers in urban and suburban areas to preserve open space within developments for burrowing owl use.	burrowing owl	Protective Measure	3	2	Nevada Partners in Flight Bird Conservation Plan
3	All tortoise-proof fencing shall be inspected on a quarterly basis. Any repairs shall be completed within 72 hours from March 15 through October 15, and within seven days from October 16 through March 14.	desert tortoise	Impact Mitigation	4	2	BO and request for Concurrence on Effect Determination for Listed Species Associated with the Proposed Toquop Energy Project
3	Control use of landfills and sewage ponds by desert tortoise predators. Identify and clean up unauthorized dumps in DWMAs. Reduce or eliminate use of authorized landfills and sewage ponds in and near DWMAs by predators of desert tortoise (e.g., ravens & coyotes). Allow no new landfills or sewage ponds within DWMAs.	desert tortoise	Management Action	4	2	Desert Tortoise (Mojave Population) Recovery Plan
3	Relocate desert tortoises and chuckwallas within distance designated in project specific permit of encounter on public lands or approved private lands if there is a direct threat to their safety/survival.	desert tortoise and chuckwalla	Protective Measure	4	2	CC MSHCP
3	Incorporate flammulated owl management recommendations into pertinent land management plans.	flammulated owl	Protective Measure	4	2	Nevada Partners in Flight Bird Conservation Plan
3	In concert with county habitat planning efforts, devise a conservation strategy that identifies lands and appropriate methods for protection.	Le Conte's thrasher	Protective Measure	3	2	Nevada Partners in Flight Bird Conservation Plan
3	Protection measures associated with development should include: 1) Ensure that the commercial collection of reptiles occurs within sustainable harvest parameters with no significant effect on the ecosystems in which they occur. 2) maintain sufficient areas of salt desert scrub habitat with large bush diameters, e.g., mature age classes of greasewood, quailbrush, and other large saltbush species, to provide suitable nesting substrate for Loggerhead Shrikes. 3) manage for long-term regeneration and maturation of montane shrub species. 4) review habitat models and management guidelines. Update as necessary, using most recent data and findings.	loggerhead shrike	Protective Measure	4	1	Nevada Partners in Flight Bird Conservation Plan

Table 4-9 Conservation Actions Associated with Conservation Objective 6

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
3	Encourage minimal pad preparation on larger residential lots and native xeric landscaping techniques after building. Encourage the maintenance of naturally vegetated corridors through residential developments.	loggerhead shrike	Impact Mitigation	4	2	Nevada Partners in Flight Bird Conservation Plan
3	In suitable habitats on the urban interface or as a temporary population-saving measure, install nest boxes to increase nesting opportunities for Lucy's Warbler and other cavity-nesting birds using mesquite habitats.	Lucy's warbler	Protective Measure	4	2	Nevada Partners in Flight Bird Conservation Plan
3	Take measures to protect northern goshawk during development including: 1) Manage northern goshawk territories at the landscape level, providing within territories suitable nesting sites as well as replacement stands where aspen regeneration has been initiated through prescribed fire and other methods. 2) Occupancy surveys should be conducted prior to any land use projects designed to significantly alter the habitat or capable of producing significant levels of disturbance to a nesting pair within known or potential territories. 3) Recommend the observance of "no disturbance" buffer zones around and including active nesting territories during the nesting season. 4) Review action plan proposals in coniferous forest habitat and provide recommendations for the avoidance and/or mitigation of impacts to Northern Goshawk nesting and productivity.	northern goshawk	Protective Measure	3	2	Nevada Partners in Flight Bird Conservation Plan
3	Revegetate appropriate sites now for future habitats. Suggest creation of new habitat in mitigation strategies when appropriate.	phainopepla, Lucy's warbler	Restoration Effort	3	2	Nevada Partners in Flight Bird Conservation Plan
3	Protection measures for pinyon jay should include: 1) Chainings and prescribed burns should leave adequate stands of mature, cone-bearing trees adjacent to any treatment area. 2) The cutting of mature live trees should be discouraged in fuel wood harvest activities.	pinyon jay	Protective Measure	4	2	Nevada Partners in Flight Bird Conservation Plan

Table 4-9 Conservation Actions Associated with Conservation Objective 6

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
3	Protective measures for prairie falcon: 1) Highlight the uniqueness of Nevada's Prairie Falcon resource through media profiles, bulletins, etc. Promote the importance of Nevada to the maintenance of the world's Prairie Falcon population, its ecology, habitat needs, and its value as a predator of agricultural pests. 2) Minimize human disturbances around nest sites during the nesting period where impacts on productivity have been identified. 3) pursue special land designation for top priority sites i.e. "Areas of Critical Environmental Concern", "Research Natural Area", etc. 4) Where nest sites are likely to be significantly disturbed by project activities, mitigate for seasonal work restrictions after surveys have determined the site to be active.	prairie falcon	Public Outreach, Partnership, and Education Actions	4	1	Nevada Partners in Flight Bird Conservation Plan
3	Protective measures for Scott's oriole: 1) Develop a public information campaign aimed at highlighting the unique qualities of Joshua tree habitat and the interesting organisms, of which Scott's Oriole is one, that inhabit it. Foster public interest in preserving Joshua tree habitat. 2) Initiate conservation protection on key sites at risk.	Scott's oriole	Public Outreach, Partnership, and Education Actions	4	2	Nevada Partners in Flight Bird Conservation Plan
3	Ensure that long term viability of low elevation rare plants is not significantly impacted by rural development and sprawl.	sticky ringstem	Management Action	4	3	A Conservation Management Strategy for Nine Low Elevation Rare Plants in Clark County, Nevada
3	Management actions for vesper sparrow: 1) Implement management practices designed to achieve and/or maintain at least 20 percent ground cover from grasses and forbs. 2) Incorporate Vesper Sparrow management strategies into public land planning processes in appropriate landscapes. 3) Target a remnant of five percent shrub cover averaged over four hectare blocks for nest locations and singing perches when implementing measures to increase the native grass and forb component (prescribed fire, etc.).	vesper sparrow	Management Action	4	1	Nevada Partners in Flight Bird Conservation Plan
3	Encourage citizen-scientist participation in establishing and maintaining western bluebird nest box routes.	western bluebird	Public Outreach, Partnership, and Education Actions	4	1	Nevada Partners in Flight Bird Conservation Plan
4	Identify key areas (sensitive populations and habitats); manage existing facilities to minimize adverse effects on biological resources; site new facilities away from key populations or habitat areas; provide for adaptive management responses to adverse changes.	all species	Impact Mitigation	3	4	CC MSHCP

Table 4-9 Conservation Actions Associated with Conservation Objective 6

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
4	Use a diverse array of media, (i.e. slide shows, television segments, brochures, magazine articles, bulletin board displays) to raise public awareness of the relationships between mesquite/catclaw habitats and their unique birdlife.	loggerhead shrike, phainopepla, Lucy's warbler	Public Outreach, Partnership, and Education Actions	5	3	Nevada Partners in Flight Bird Conservation Plan

4.3.5 Conservation Objective 7: Offset Potential Effects of Agriculture and Grazing on Special Status Species

Presented below are conservation actions for Conservation Objective 7 (Table 4-10).

Table 4-10 Conservation Actions Associated with Conservation Objective 7

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
2	Remove exotic plants and noxious weeds within the VRCMA.	all plants	Public Outreach, Partnership, and Education Actions	3	2	CC MSHCP
3	Wherever possible, select only locally native species for restoration, and where appropriate, use seed from the plant species of concern and endemic butterfly host plants.	all plants	Restoration Effort	3	2	CC MSHCP
3	Develop and implement Fire Management Plan. Identify key habitat areas potentially susceptible to fire and manage to minimize conversion; remove or manage species from key susceptible habitat areas; and provide for adaptive management responses to adverse changes. As part of the fire management plan, develop and maintain a network of shaded fuelbreaks to interrupt continuous stands of fuel. Return fire, as a historic ecological process, to the VRCMA. Maintain and improve ecosystem function and health through the management of prescribed fire and prescribed natural fire.	all species	Management Action	3	4	CC MSHCP
3	Use U.S. Department of Agriculture (USDA) Nevada Animal Damage Control Program to monitor and aid in control of feral cats and dogs, brown-headed cowbirds, ravens, and other predator species that may affect the special status species.	all species	Management Action	3	4	CC MSHCP BO
3	Cooperate with other agencies to: 1) prevent negative impacts on critical threatened and endangered habitat, 2) increase species of concern populations, and 3) avoid listing additional species by maintaining populations, critical habitats, and ecological processes. Consider additional protective designations when appropriate and enforce implementation of CAs.	all species	Management Action	3	2	CMS - Mormon Mesa DWMA, CMS - Gold Butte DWMA
2	Protect and improve sensitive habitat such as nesting areas and migration routes.	all species	Restoration Effort	1	3	CMS - Mormon Mesa DWMA, CMS - Gold Butte DWMA
2	Do not permit introduction of new non-native species of fish or wildlife.	all species	Management Action	2	2	CC MSHCP
3	Increase populations of threatened, endangered, and sensitive species, and species of concern, and their suitable habitat over the long term.	all species	Protective Measure	2	4	CC MSHCP

Table 4-10 Conservation Actions Associated with Conservation Objective 7

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
3	Protect large tracts of suitable habitat, well dispersed throughout the range.	desert tortoise	Protective Measure	2	4	Nevada Wildlife Action Plan
2	Reduce impacts on species and habitat during incident control (e.g. limit helicopter landings to previously used areas).	all species	Protective Measure	3	2	Las Vegas Fire Management Plan
4	Maintain a healthy mix of coniferous forest/woodland foraging habitats across the VRCMA.	Allen's big-eared bat, silver-haired bat, western red bat, hoary Bat, California myotis, western small-footed Myotis, long-eared myotis, long-legged myotis, fringed myotis, western mastiff bat, little brown bat, big free-tailed bat, Yuma myotis	Protective Measure	3	4	Revised Nevada Bat Conservation Plan
2	Evaluate the need for area closures at the Overton Wildlife Management Area (OWMA) to protect nesting sites of sensitive species.	birds	Management Action	3	1	CC MSHCP
3	For fuelwood management, implement the following actions. 1) Allow collection of snags only between the months of October and the end of February. 2) Prohibit or limit by permit requirements the collection of wood in key habitat areas; provide alternative areas for wood collecting; provide firewood for sale at campgrounds and other appropriate locations; prohibit peeling bark, disturbing or collecting plant litter, or dead or apparently dead plant parts, including yucca and cholla skeletons. 3) Retain a minimum of 5 snags per acre in late seral stages of the Pinyon/juniper, Mixed Conifer, and Bristlecone Pine Land Type Associations in all cases.	cavity nesters and raptors	Management Action	3	2	CC MSHCP
3	Educate all fire/support personnel on tortoises and habitat.	desert tortoise	Management Action	4	2	Las Vegas Fire Management Plan
4	Organize interagency transfer workshops to develop modes of communication and disseminate information among land management agencies.	desert tortoise, banded gecko, banded Gila monster, California kingsnake, desert iguana, desert kangaroo rat, desert night lizard, desert pocket mouse, glossy snake, Great Basin collared lizard, Kit fox, large-spotted leopard lizard, Las Vegas bearpoppy, Mojave green rattlesnake, Pale Townsends big eared bat, sidewinder, Sonoran lyre snake, southern desert horned lizard, speckled rattlesnake, sticky buckwheat, western burrowing owl, western chuckwalla, western leaf-nosed snake, western long-nosed snake, western red-tailed skink, white bearpoppy, yellow twotone beardtongue.	Public Outreach, Partnership, and Education Actions	4	3	CMS - Gold Butte DWMA

Table 4-10 Conservation Actions Associated with Conservation Objective 7

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
3	Use pesticides to treat exotic pests and disease outbreaks as a last resort (when threat to public safety, private property, or in extreme fire danger), or when scientific evaluations indicate a need; and use only EPA registered and approved formulations at their minimum effective rates in the least invasive method, such as single tree treatment. Determine potential impact of pesticides on species of concern and avoid their use in sensitive habitat whenever possible.	desert tortoise, banded gecko, banded Gila monster, California kingsnake, desert iguana, desert kangaroo rat, desert night lizard, desert pocket mouse, glossy snake, Great Basin collared lizard, Kit fox, large-spotted leopard lizard, Las Vegas bearpoppy, Mojave green rattlesnake, Pale Townsends big eared bat, sidewinder, Sonoran lyre snake, southern desert horned lizard, speckled rattlesnake, sticky buckwheat, western burrowing owl, western chuckwalla, western leaf-nosed snake, western long-nosed snake, western red-tailed skink, white bearpoppy, yellow twotone beardtongue.	Protective Measure	3	2	CMS - Mormon Mesa DWMA, CMS - Gold Butte DWMA
3	Prohibit destructive collecting techniques such as breaking off rock flakes and rolling cap rocks to uncover lizards.	lizards	Protective Measure	4	2	CC MSHCP
3	Avoid cutting fuelwood, or cutting trees for salvage or sanitation within 0.5 mile of active or recently active flammulated owl or goshawk nest. Trees hazardous to public safety or extreme fire danger may be removed. Insect and disease treatments may occur within this area to control epidemic outbreaks.	northern goshawk and flammulated owl	Protective Measure	4	2	CC MSHCP
3	Conserve important bat roosting sites in cliffs, crevices, and talus habitat.	pallid bat, western mastiff bat, western pipistrelle, big free-tailed bat, Brazilian free-tailed bat	Protection Measure	3	3	Revised Nevada Bat Conservation Plan
3	Develop and implement a plan to inventory and map problem areas of nonnative plants, and monitor encroachment over time.	plants	Inventory and Monitoring Actions	3	3	CC MSHCP
3	Develop and implement plan to collect seed for endowment and cultivation of sensitive and rare plants.	plants	Protective Measure	3	2	CC MSHCP
3	Proactively protect and manage for long term viability of all populations of rare plants on Federal lands (IMAs, LIMAs, MUMAs, and UMAs as appropriate) in the VRCMA.	sticky ringstem, Las Vegas bearpoppy, white bearpoppy, sticky buckwheat, threecorner milkvetch, forked buckwheat	Management Action	2	3	A Conservation Management Strategy for Nine Low Elevation Rare Plants in Clark County, Nevada
2	Protective measures for western bluebird: 1) Preserve existing old growth forest remnants. Connect existing old-growth tracts by treating second-growth corridors to break self-perpetuating even-aged stand characteristics. 2) Promote timber harvest strategies that leave larger, older trees in an open-canopied array. Leave snags for cavity provision. 3) Thin second-growth stands with high stem densities “from the bottom up” where they occur adjacent to meadows; that is, thin smaller-diameter trees and leave well-spaced, larger-diameter trees, opening up a park-like interface with meadows.	western bluebird	Protective Measure	3	1	Nevada Partners in Flight Bird Conservation Plan

Table 4-10 Conservation Actions Associated with Conservation Objective 7

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
3	If proposed actions will result in surface disturbance near a population of special status plants, remove soil with seed source and relocate to a potential habitat site and monitor over time.	white bearpoppy	Protective Measure	4	1	CC MSHCP

4.3.6 Conservation Objective 8: Offset Potential Effects of Recreation on Special Status Species

Presented below are conservation actions for Conservation Objective 8 (Table 4-11).

Table 4-11 Conservation Actions Associated with Conservation Objective 8

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
2	Develop and distribute information to equestrians on the importance of using pelletized feed and develop and distribute a weed-free feed policy for equestrians on public lands in the VRCMA boundary.	all plants	Public Outreach, Partnership, and Education Actions	3	2	CC MSHCP
2	Restrict mountain bikes and other mechanized non-motorized vehicles to designated trails and only allow new trails consistent with the conservation of special status species.	all plants	Management Action	2	2	CC MSHCP
2	Develop and implement a climbing “self registration” process that encourages development of new routes away from ecologically sensitive areas.	all species	Impact Mitigation	3	2	CC MSHCP
2	Encourage trail use outside of all sensitive biodiversity hotspots to avoid further adverse effects on rare and sensitive species. Focus recreation activities into less sensitive areas.	all species	Impact Mitigation	2	3	CC MSHCP
2	Enhance developed sites where feasible to restore resource or wildlife values where recreation use has adversely affected resources.	all species	Impact Mitigation	2	2	CC MSHCP
2	Consider seasonal restrictions on rock climbing in sensitive areas.	all species	Impact Mitigation	2	2	CC MSHCP
2	Rehabilitate, reclaim or revegetate areas subjected to surface-disturbing activities where feasible. When rehabilitating disturbed areas, first manage for optimum species diversity by seeding native species, except where non-native species are appropriate.	all species	Restoration Effort	2	2	CC MSHCP
2	Develop and implement memoranda of understanding with climbing and caving groups and hold annual meetings emphasizing species conservation, identifying protective measures, and specifying surveys for the species of concern prior to establishment of new climbing or caving opportunities. The information derived from these programs will assist in determining future management actions for species protection. Identify additional special interest groups and develop memoranda of understanding.	all species	Public Outreach, Partnership, and Education Actions	2	2	CC MSHCP
2	Educate the public about the role of bats in the ecosystem and the importance of leaving roost sites undisturbed.	bats	Public Outreach, Partnership, and Education Actions	3	1	CC MSHCP

Table 4-11 Conservation Actions Associated with Conservation Objective 8

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
2	For organized, motorized events on unpaved roads or trails within 0.5 mile of active desert tortoise burrows, require special permit provisions for desert tortoise protection.	Desert tortoise, banded gecko, banded Gila monster, California kingsnake, desert iguana, desert kangaroo rat, desert night lizard, desert pocket mouse, glossy snake, Great Basin collared lizard, Kit fox, large-spotted leopard lizard, Las Vegas bearpoppy,	Management Action	3	2	CC MSHCP
2	When maintaining trail switch-backs, minimize ground disturbance to protect rare plants.	plants	Protective Measure	3	1	CC MSHCP
3	Limit caving and rock climbing to areas away from bat roosts.	all bats	Protective Measure	2	3	CC MSHCP
3	Enhance law enforcement and ranger capabilities on federal lands.	all species	Management Action	2	4	CC MSHCP BO
3	Develop and implement a recreation monitoring. This strategy will include development of methods resulting in collection of data to assess recreation trends and effects on the species of concern and ecological resources.	all species	Inventory and Monitoring Actions	3	3	CC MSHCP
3	Develop new relationships/partnerships and strengthen existing efforts with user groups, including hunters, trappers, rock climbers, cavers, trail users, summer home and special use permittees, and American Indians, to help manage the VRCMA and protect resources.	all species	Public Outreach, Partnership, and Education Actions	3	3	CC MSHCP
3	Inform rock climbers of conservation impacts of rock climbing.	all species	Impact Mitigation	3	2	CC MSHCP
3	Protect habitat of the species of concern from dispersed recreation (e.g., heavy foot traffic, off-road vehicles, mountain bikes), and the adverse effects of wild horses and burros.	all species	Protective Measure	2	4	CC MSHCP
3	Use temporary closures (roads, trails, dispersed areas) to protect important seasonal habitat for species of concern (animals, plants, and insects), in coordination with appropriate state and local agencies.	all species	Impact Mitigation	2	3	CC MSHCP
3	Evaluate effects of rock climbing on biological resources.	all species	Inventory and Monitoring Actions	4	3	CC MSHCP
3	Allow access to all caves only from the beginning of March through the end of May; and from the beginning of September through the end of October. Seasonal restrictions will remain in place until bat roosting/hibernating inventories have been completed. Long-term seasonal restrictions will be determined based on survey results.	bats	Impact Mitigation	3	2	CC MSHCP

Table 4-11 Conservation Actions Associated with Conservation Objective 8

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
3	Monitor and quantify the impacts of off-road vehicle recreation on burrowing owl habitats, particularly centers of breeding concentration. Mitigate impacts by adjustment of sanctioned event routes, closure of casual use in burrowing owl breeding centers, education of off-road vehicle enthusiasts and consensus planning involving off-road vehicle advocacy groups.	burrowing owl	Applied Research Actions	4	2	Nevada Partners in Flight Bird Conservation Plan
3	Mitigate loss of burrowing owl nest sites by constructing artificial burrows in suitable alternative habitat with attendant site protection.	burrowing owl	Impact Mitigation	4	2	Nevada Partners in Flight Bird Conservation Plan
3	Rehabilitate and maintain current and, where practicable, historical desert washes.	California leaf-nosed bat, pallid pat, Allen's big-eared bat, California myotis, fringed myotis, western pipistrelle, Brazilian free-tailed bat	Protective Measure	3	3	Revised Nevada Bat Conservation Plan
3	Study feasibility of Green Sticker licensing for off-road vehicles in the State of Nevada, with funds earmarked to restore areas impacted by OHVs and/or establish alternative recreation sites.	desert tortoise, banded gecko, banded Gila monster, California kingsnake, desert iguana, desert kangaroo rat, desert night lizard, desert pocket mouse, glossy snake, Great Basin collared lizard, Kit fox, large-spotted leopard lizard, Las Vegas bearpoppy, Mojave green rattlesnake, Pale Townsends big eared bat, sidewinder, Sonoran lyre snake, southern desert horned lizard, speckled rattlesnake, sticky buckwheat, western burrowing owl, western chuckwalla, western leaf-nosed snake, western long-nosed snake, western red-tailed skink, white bearpoppy, yellow twotone beardtongue.	Impact Mitigation	3	2	CMS - MMDWMA, CMS - GBDWMA
3	Focus recreation activities (OHV activity, mountain bikes, and heavy foot traffic) into less sensitive areas to protect habitat of the species of concern.	desert tortoise, banded gecko, banded Gila monster, California kingsnake, desert iguana, desert kangaroo rat, desert night lizard, desert pocket mouse, glossy snake, Great Basin collared lizard, Kit fox, large-spotted leopard lizard, Las Vegas bearpoppy, Mojave green rattlesnake, Pale Townsends big eared bat, sidewinder, Sonoran lyre snake, southern desert horned lizard, speckled rattlesnake, sticky buckwheat, western burrowing owl, western chuckwalla, western leaf-nosed snake, western long-nosed snake, western red-tailed skink, white bearpoppy, yellow twotone beardtongue	Management Action	3	2	CMS - GBDWMA
3	Rock climbing within 100 yards of known active or recently active peregrine falcon nests will be allowed on a case by case basis only from the beginning of July through the end of January. Specific routes may be signed as necessary to inform of seasonal closures if nests are identified. Monitor peregrine nesting success to determine if the 100-yard closure is effective.	peregrine falcon	Protective Measure	4	3	CC MSHCP

Table 4-11 Conservation Actions Associated with Conservation Objective 8

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
3	Adopt and implement policies to protect plant species from dispersed or unregulated recreation.	plants	Protective Measure	2	3	CC MSHCP
4	Establish environmental education programs and facilities. Develop a series of environmental education programs (slide presentations, display boards, etc.), for presentation to schools, user groups, town board meetings, and other community events. Individual programs will highlight biodiversity, sensitive ecological resources, endemic butterflies and plants, and sensitive bats. Ensure that materials are available for use by other agencies and teachers.	all species	Public Outreach, Partnership, and Education Actions	3	4	Desert Tortoise (Mojave Population) Recovery Plan

4.3.7 Conservation Objective 9: Offset Potential Effects of Roads on Special Status Species

Presented below are conservation actions for Conservation Objective 9 (Table 4-12).

Table 4-12 Conservation Actions Associated with Conservation Objective 9

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
2	Site new highway construction to avoid key populations and habitat areas; develop appropriate construction and maintenance management programs to avoid, minimize, or mitigate effects to key populations and habitat areas.	all species	Protective Measure	1	2	CC MSHCP
2	Allow motorized vehicle use only on designated roads and trails, except for snowmobile use in approved areas. Close washes to motorized use.	all species	Management Action	2	1	CC MSHCP
2	Driving on designated roads only.	all species	Protective Measure	2	1	CC MSHCP
2	Allow bicycle use only on established and/or designated roads and trails.	all species	Protective Measure	3	1	CC MSHCP
2	Leave natural, large woody debris in place wherever possible, particularly out of sight from roads.	all species	Protective Measure	3	1	CC MSHCP
2	Prohibit woodcutting and shrub clearing and limit other human disturbance off existing roadways.	all species	Management Action	3	1	CC MSHCP
2	Avoid designating roads and trails in washes in sensitive or key areas; prohibit vehicular traffic along wash beds or on wash banks; confine travel in washes to crossing them in the shortest possible distance, if rerouting them is not feasible.	all species	Protective Measure	2	2	CC MSHCP
2	Manage designated and informal use (unnumbered) trails that are causing resource damage to reduce damage and restrict use to a single trail.	all species	Management Action	2	2	CC MSHCP
2	New facilities and roads will be sited so as to avoid vital populations or habitats of species of concern.	all species	Protective Measure	3	1	CC MSHCP
2	Monitor traffic volume on road and trails near sensitive resources as appropriate.	all species	Inventory and Monitoring Actions	3	1	CC MSHCP
2	Minimize new road construction associated with new utility facilities; where possible close and rehabilitate unneeded existing roads or new roads after construction	all species	Impact Mitigation	3	2	CC MSHCP

Table 4-12 Conservation Actions Associated with Conservation Objective 9

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
2	Avoid any Covered Species discovered in disturbed or undisturbed habitat in proposed maintenance or construction areas, if possible. If unable to avoid, best efforts will be made to relocate/salvage species. Relocation/salvage will only be attempted if the species is highly likely to survive the action and it is reasonably cost effective. This will be determined by NDOT's Environmental Services Division.	all species	Management Action	3	1	CC MSHCP
2	Implement a program to rehabilitate surface disturbances including the first hundred feet or so of "closed" roads and trails and other areas important for special status species.	all species	Restoration Effort	2	2	CC MSHCP
2	Restore/rehabilitate all key access points of closed roads and areas.	all species	Restoration Effort	3	2	CC MSHCP
2	Close access roads to bat roosts where this does not inhibit access to other resources.	bats	Protective Measure	4	1	CCMSHCP & EIS APP B
2	Do not allow OHV speed events, mountain bike races, horse endurance rides, four-wheel drive hill climbs, mini events, publicity rides, high speed testing, and other similar speed based events within tortoise habitat where prohibited.	desert tortoise	Protective Measure	3	1	CC MSHCP
2	Avoid further ROWs in all DWMA assessment area when feasible.	Desert tortoise, banded gecko, banded Gila monster, California kingsnake, desert iguana, desert kangaroo rat, desert night lizard, desert pocket mouse, glossy snake, Great Basin collared lizard, Kit fox, large-spotted leopard lizard, Las Vegas bearpoppy, Mojave green rattlesnake, Pale Townsends big eared bat, sidewinder, Sonoran lyre snake, southern desert horned lizard, speckled rattlesnake, sticky buckwheat, western burrowing owl, western chuckwalla, western leaf-nosed snake, western long-nosed snake, western red-tailed skink, white bearpoppy, yellow twotone beardtongue	Management Action	3	2	CMS - Mormon Mesa DWMA, CMS - Gold Butte DWMA
3	Coordinate with Nevada Department of Transportation and USFS road crews to ensure that road maintenance activities (e.g., shoulder work, road salting) do not adversely affect native species.	all plants	Protective Measure	3	3	CC MSHCP
3	Conduct biological surveys prior to road maintenance and retrofit activities.	all plants, all reptiles	Inventory and Monitoring Actions	3	2	CC MSHCP
3	Identify the extent of collecting along roadways, and possible impacts of habitat modification resulting from unethical collecting practices.	chuckwalla	Inventory and Monitoring Actions	4	2	Nevada Wildlife Action Plan

Table 4-12 Conservation Actions Associated with Conservation Objective 9

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
3	Ensure new roadside structures are designed and constructed to prevent animals from becoming trapped. Encourage retrofitting existing structures that pose a trapping problem.	all reptiles, Pacific tree frog, desert pocket mouse	Management Action	4	2	CC MSHCP
3	During emergency situations (e.g., casualties, disasters, flooding, fire, national defense, security), public safety is first priority. Work on roadways in Covered Species habitat will be conducted in an expedited manner and confined to the road shoulder or previously disturbed area.	all species	Impact Mitigation	3	2	CMS - Mormon Mesa DWMA, CMS - Gold Butte DWMA
3	Ensure that roads are engineered to adequately spread runoff to minimize erosion.	all species	Impact Mitigation	3	2	CMS - Mormon Mesa DWMA, CMS - Gold Butte DWMA
3	Close unnecessary roads and trails in key habitat areas through signage and rehabilitation; eliminate proliferation of roads and trails in key habitat areas.	all species	Protective Measure	2	3	CC MSHCP
3	Minimize and avoid impacts to rock outcrops, lava flows, and surrounding areas. If these areas cannot be avoided and must be disturbed, clearance surveys by a qualified biologist must be conducted prior to maintenance or construction activities.	all species	Protective Measure	3	2	CC MSHCP
3	Manage woodcutting, shrub clearing, and limit other human activity disturbance off existing roads.	all species	Protective Measure	3	2	CC MSHCP
3	Maintain roads to a standard necessary for public safety and as needed to respond to resource management objectives, including resource protection and recreation, through maintenance of road surfaces and minimizing erosion.	all species	Management Action	3	3	CC MSHCP
3	Modify highway maintenance practices to minimize damage to wildlife and flora by restricting maintenance activities to NDOT ROWs, conducting pre-activity surveys for biological resources, avoiding or relocating individuals or habitat as necessary, and avoiding maintenance activity during sensitive times.	all species	Protective Measure	3	3	CMS - Mormon Mesa DWMA, CMS - Gold Butte DWMA
3	Provide a biological monitor during material site sampling/exploration.	all species	Protective Measure	3	2	CC MSHCP

Table 4-12 Conservation Actions Associated with Conservation Objective 9

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
3	Implement appropriate methods and designs to minimize erosion during construction of highways and to avoid the creation of erosive flows from highways; encourage construction of pollution control devices, such as oil sand separators, drop inlets, and stormwater treatment systems.	all species	Impact Mitigation	2	4	CC MSHCP
3	The following actions will be implemented to control vehicular access: 1. Restrict or reduce establishment of new roads. 2. Implement closure to vehicular access with the exception of designated routes, including Federal, State, and County maintained vehicle routes. 3. Implement emergency closures of dirt roads and routes as needed to reduce human access and disturbance in areas where human caused mortality of desert tortoises is a problem. 4. Fence or otherwise establish effective barriers to tortoises along heavily-traveled roads; install culverts that allow underpass of tortoises to alleviate habitat fragmentation.	desert tortoise	Management Action	3	2	Desert Tortoise (Mojave Population) Recovery Plan
3	Work to design new roads and motorized trails to maintain a minimum 0.5 mile distance from active or recently active desert tortoise burrows as done by NPS.	desert tortoise	Impact Mitigation	3	2	CC MSHCP
3	Enforce regulations. Several areas have serious problems with vandalism, collecting of desert tortoises, release of captives, and unauthorized vehicle use, all of which contribute to abnormally high desert tortoise mortality rates. Therefore, regular and frequent patrols by law enforcement personnel in areas at risk of these threats should be conducted.	desert tortoise	Management Action	4	2	Desert Tortoise (Mojave Population) Recovery Plan
3	Fence heavily traveled transportation corridors. Monitor and inventory all culvert/bridge crossings and tortoise fencing within assessment area and ameliorate existing or install new culverts/bridges to allow passage of terrestrial species.	Desert tortoise, banded gecko, banded Gila monster, California kingsnake, desert iguana, desert kangaroo rat, desert night lizard, desert pocket mouse, glossy snake, Great Basin collared lizard, Kit fox, large-spotted leopard lizard, Las Vegas bearpoppy, Mojave green rattlesnake, Pale Townsends big eared bat, sidewinder, Sonoran lyre snake, southern desert horned lizard, speckled rattlesnake, sticky buckwheat, western burrowing owl, western chuckwalla, western leaf-nosed snake, western long-nosed snake, western red-tailed skink, white bearpoppy, yellow twotone beardtongue.	Impact Mitigation	3	2	CMS - Mormon Mesa DWMA, CMS - Gold Butte DWMA

Table 4-12 Conservation Actions Associated with Conservation Objective 9

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
3	Ensure adequate law enforcement presence to deter new road incursions and protect the resources.	desert tortoise, banded gecko, banded Gila monster, California kingsnake, desert iguana, desert kangaroo rat, desert night lizard, desert pocket mouse, glossy snake, Great Basin collared lizard, Kit fox, large-spotted leopard lizard, Las Vegas bearpoppy, Mojave green rattlesnake, Pale Townsends big eared bat, sidewinder, Sonoran lyre snake, southern desert horned lizard, speckled rattlesnake, sticky buckwheat, western burrowing owl, western chuckwalla, western leaf-nosed snake, western long-nosed snake, western red-tailed skink, white bearpoppy, yellow twotone beardtongue	Protective Measure	2	3	CMS - Mormon Mesa DWMA, CMS - Gold Butte DWMA
3	Utilize permanent and temporary road closures to manage road use in sensitive habitats. Whenever possible, prohibit new road construction in areas of sensitive habitat and within 0.5 miles of active desert tortoise burrows or 100 yards of water sources.	desert tortoise, banded gecko, banded Gila monster, California kingsnake, desert iguana, desert kangaroo rat, desert night lizard, desert pocket mouse, glossy snake, Great Basin collared lizard, Kit fox, large-spotted leopard lizard, Las Vegas bearpoppy, Mojave green rattlesnake, Pale Townsends big eared bat, sidewinder, Sonoran lyre snake, southern desert horned lizard, speckled rattlesnake, sticky buckwheat, western burrowing owl, western chuckwalla, western leaf-nosed snake, western long-nosed snake, western red-tailed skink, white bearpoppy, yellow twotone beardtongue.	Protective Measure	3	2	CMS - Gold Butte DWMA

4.3.8 Conservation Objective 10: Offset Potential Effects of Mining on Special Status Species

Presented below are conservation actions for Conservation Objective 10 (Table 4-13).

Table 4-13 Conservation Actions Associated with Conservation Objective 10

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
2	Site toxic ponds associated with mining activities away from key populations or habitat areas; provide measures to discourage wildlife from using ponds (fencing, cover) as required by state law.	all birds and all reptiles	Protective Measure	2	2	CC MSHCP
2	The tortoise-proof fence will be removed at completion of the operation. Surfaces will be recontoured to maintain positive drainage, and slopes will not exceed a horizontal/vertical ratio of 2:l. Any remaining stockpiles will be graded, and compacted areas will be ripped. Prior to closure of the pit, a vegetative rehabilitation plan shall be developed by the project proponent. Vegetation rehabilitation actions shall be done during the time of year with the most potential for success, within 1 year of project completion. Recovery includes recontouring to natural contours and reestablishing native plant species within the disturbed sites either through seeding or transplant of seedlings. The rehabilitation plan shall also describe in detail how the evaluation will be made for determining the success of the rehabilitation effort. Mine sites will be reclaimed as required in permit.	all species	Impact Mitigation	2	2	File No. 1-5-95-F-199 BO on the Proposed McVane Mineral Material Sale in Clark County, Nevada
2	Site leasable/saleable mineral development and mining away from key populations or habitat areas to the extent feasible; provide measures to avoid, minimize, or mitigate effects of these activities.	all species	Management Action	3	2	CC MSHCP
2	Only use existing material sites for development within the VRCMA. Prior to sampling/testing or excavating in material sites a biologist will meet on-site with the USFWS to determine avoidance areas (undisturbed habitat) and develop appropriate minimization measures. (Expansion of existing materials sites or acquisition of new material sites which involves Federal lands or another Federal nexus shall be in compliance with Section 7 of the ESA.)	all species	Protective Measure	3	2	CC MSHCP
2	Fence or gate mines susceptible to human disturbance or of public safety concern.	bats	Protective Measure	2	2	CCMSHCP & EIS APP B

Table 4-13 Conservation Actions Associated with Conservation Objective 10

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
2	The following actions should occur after mineral sampling has occurred: 1) After the material is sampled, the test hole will be immediately backfilled and recontoured to the original grade, using either the excavator or small bulldozer. Test holes will never be left open. 2) A report shall be submitted by the applicant to the Bureau on an annual basis detailing the amount of new surface disturbance which has occurred and the mitigation fees paid, all tortoise-related monitoring activity, incidental take, and the effectiveness. 3) Backfilled mineral excavations will be furrowed and seeded with a native seed mix. 4) Mineral excavations will be backfilled immediately after collection of mineral samples, 5) After completion of each sampling phase, the operator will document the number of mineral samples taken, number of acres of desert tortoise habitat disturbed at each sampling site, and number of miles driven off road from a road or wash.	desert tortoise	Impact Mitigation	3	1	BO NDOT Sampling and Testing Material Site CL82-03; Biological Opinion for the Gornowich Sand and Gravel Operation in Eldorado Valley, Clark County, Nevada (NV-053);File No. 1-5-94-F-97 BO For a Mining Plan of Operations in Piute Valley, Nevada;
2	The following actions will occur on a project specific basis before mining activities: 1) A clearance survey of the area will be performed prior to any sampling or testing activity. Any DT found on-site will be closely watched so that they do not interfere with any activities. All burrows will be avoided while moving equipment from test pit to test pit. 2) A tortoise biologist shall survey access roads immediately prior to the use of heavy duty trucks and equipment such as those used to haul water, chemical dust suppressants, and ore during the period of February 15 through October 31. 3) A tortoise survey of the fence line will be conducted by a qualified tortoise biologist no more than 24 hours before construction of the fence. After completion of the fence, the area within the fence will be surveyed for desert tortoise. Surveys will include 100 percent coverage (transects will be no greater than 10 meters wide) of all proposed surface disturbance sites. All tortoise burrows, and other species' burrows which may be utilized by tortoises, will be examined, with a fiberoptic scope if necessary, to determine occupancy of each burrow by tortoises. The parcel will be surveyed three times, unless two complete searches result in no tortoises being found. 4) Any undisturbed areas will be cleared by a tortoise biologist before initial grubbing or grading of the area. The parcel shall be surveyed for desert tortoise using survey techniques which provide 100-percent coverage. 5) Information on desert tortoises will be provided to the operator/claimant and all employees. This will include information on the protected status of the desert tortoise, the definition of take, the penalties for illegal take, and the protocol	desert tortoise	Management Action	3	1	BO NDOT Sampling and Testing Material Site CL82-03; Biological Opinion for the Proposed Cactus Mining Corporation Mining Plan of Operation, Eldorado Valley, Clark County, Nevada; File No. 1-5-95-F-199 BO on the Proposed McVane Mineral Material Sale in Clark County, Nevada; Biological Opinion for the Gornowich Sand and Gravel Operation in Eldorado Valley, Clark County, Nevada (NV-053); File No. 1-5-94-F-97 BO For a Mining Plan of Operations in Piute Valley, Nevada; File No. 1-5-94-F-97 BO For a Mining Plan of Operations in Piute Valley, Nevada; Biological Opinion on the Mineral Material Sale to International Sand and Gravel (Bureau Case No. NV-054-95-045); File No. 1-5-95-F-205 BO on the Proposed Approval of the Black Hawk Mine Plan of Operations

Table 4-13 Conservation Actions Associated with Conservation Objective 10

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
	for dealing with tortoises. 6) Most mineral exploration and testing activities will be conducted in the summer or winter when most desert tortoises are inactive. 7) The fenced area shall be inspected for tortoises by a qualified tortoise biologist following construction of the fence and prior to the onset of mining activities, using techniques providing 100-percent coverage of all areas. All desert tortoise burrows and other species' burrows which may be used by tortoises, shall be examined, with a fiber-optic scope if necessary, to determine occupancy of each burrow by desert tortoises. Any desert tortoises or eggs found within the fence shall be removed by a qualified tortoise biologist in accordance with Service-approved protocol. 8) The material sale area shall be clearly marked or flagged at the outer boundaries before the onset of surface disturbance. All workers shall be instructed that their activities shall be confined to locations within the marked area. 9) Road realignment routes outside the fenced area will be surveyed for the presence of desert tortoise within 48 hours before construction begins. If the road is constructed between November 1 and February 28/29, a biologist need not be on site after initial site grading has been completed. If the road is constructed during the tortoise active season (March 1 through October 31), a biologist shall be onsite during construction. Tortoises found within the road realignment will be relocated. 10) The desert tortoise educational information shall be distributed to the operator/claimant and all employees prior to start of exploration and testing activities. In addition, all such persons shall be provided with the terms and conditions included in this Biological Opinion. All such persons shall sign a statement indicating that they have reviewed the educational information and understand fully the terms and conditions included in this Biological Opinion. 11) The Bureau shall designate a representative responsible for overseeing compliance with the reasonable and prudent measures, terms and conditions, reporting requirements, and reinitiation requirements contained in this Biological Opinion. The designated representative shall coordinate with the Service and Pilot.					
2	The following actions should occur **during** mining operations: 1) A qualified biologist will be on-site to monitor the sampling and testing crews on a project specific basis. 2) A litter-control program will be implemented to reduce possible conflicts with predators and ravens. 3) If fenced, access gates to both sites shall remain closed at all times except to allow traffic to move in and out of the site. 4) All equipment and materials shall be	desert tortoise	Inventory and Monitoring Actions	3	1	BO NDOT Sampling and Testing Material Site CL82-03;File No. 1-5-95-F-205 BO on the Proposed Approval of the Black Hawk Mine Plan of Operations; File No. 1-5-94-F-97 BO For a Mining Plan of Operations in Piute Valley, Nevada; Biological Opinion on the Mineral Material Sale to International Sand and Gravel (Bureau Case No. NV-054-95-045); File Nos. 1-5-94-F-178 and 1-5-94-F-190 BO for the Proposed Sale of Sand and Gravel in the Muddy Mountains and in Meadow Valley Wash;

Table 4-13 Conservation Actions Associated with Conservation Objective 10

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
	stored within the boundaries of the project sites or within previously disturbed areas. Cross-country travel will not be allowed. On existing graded or paved roads such vehicles shall not exceed the posted speed limit. On the project site such vehicles shall not exceed a speed limit of 10 miles per hour or as project requires in desert tortoise habitat to minimize risk of tortoise/vehicle encounters. 5) An individual qualified in identification of desert tortoise sign will be onsite during all mineral exploration and testing activities. This individual will be responsible for selecting vehicular routes in designated washes or off-road that will avoid desert tortoises and tortoise burrows. In addition, this individual will select mineral sample sites that are void of desert tortoises and tortoise burrows. If desert tortoises cannot be avoided, they will be relocated offsite in accordance with approved Service handling protocol. 6) A tortoise biologist will be onsite so during the application of chemical dust suppressants. 7) Contractors shall carpool to and from their mining sites as is feasible and practical to reduce the number of vehicular trips. The objective is to have no more than one round trip to each site for employees per day. 8) Relocation of tortoises or eggs will occur a designate distance by project from the site boundary.9) Measures shall be taken to minimize entrapment of desert tortoises in open mineral excavations. 10) Mineral sample sites will be located at least 50 feet from desert tortoise burrows. 11) Overnight parking and storage of equipment and stock piling of materials shall be limited to the fenced area, 12) Measures shall be taken to minimize mortality or injury of desert tortoises due to mineral exploration and testing activities, 13) The Bureau should closely monitor direct and indirect effects of mining activities in designated desert tortoise critical habitat. Any substantial changes in desert tortoise population numbers or adverse effects on tortoises should be documented and reported to the Service.14) From March 1 through October 31, a maximum of one roundtrip per day will be allowed during daylight hours to transport ore from the mine to the mill site or as allowed by project specifics. The remainder of the 12 trips per week shall be made between sunset and sunrise. 15) If a tortoise appears on the project site, any activities which threaten the tortoise will cease until the tortoise wanders out of harm's way of its own volition. If it does not move out of harm's way within 15 minutes, it may be removed by a qualified tortoise biologist and placed in a burrow or under a shrub in the shade according to project specific directions. 16) Prior to handling any desert tortoise, carcass, or					Biological Opinion for the Proposed Cactus Mining Corporation Mining Plan of Operation, Eldorado Valley, Clark County, Nevada; File No. 1-5-95-F-274R BO on the Expansion of the Pahrump Community Material Pit, Nye County, Nevada

Table 4-13 Conservation Actions Associated with Conservation Objective 10

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
	egg, appropriate State permits will be acquired from the Nevada Department of Wildlife. 17) The material pit expansion area and access road fencing shall be project specific and determined to onset of surface disturbance. A qualified tortoise biologist shall be onsite during construction of the tortoise-proof fence to ensure that no tortoises are harmed. Fencing will consist of 1 inch by 2-inch mesh (USFWS protocol) with zero ground clearance. The fence alignment shall be cleared of tortoises 24 hours prior to of fence construction. The operators shall confine all operations to the fenced area. 18) The material pit expansion area shall be inspected for tortoises by qualified tortoise biologists following construction of the fence and prior to onset of mining activities, using techniques providing 100-percent coverage of all areas. The enclosed area will be searched completely three times. All desert tortoise burrows, and other species' burrows which may be used by tortoises, shall be excavated or examined, with fiber-optic scope if necessary, to determine occupancy of each burrow by desert tortoises. Any desert tortoises or eggs found within the fenced area will be removed by a qualified tortoise biologist in accordance with Service approved protocol. The current Service-approved protocol is Desert Tortoise Council 1994. 19) Desert tortoises removed from the project site shall be released into undisturbed habitat at a project specific distance outside the boundary nearest to the collection site and placed in the shade of a shrub or in a natural unoccupied burrow similar to the hibernaculum in which it was found or in an artificially constructed burrow following Service-approved protocol. [The current Service-approved protocol is Desert Tortoise Council 1994.) Tortoises shall be purposefully moved only by qualified tortoise biologists, solely for the purpose of moving them out of harm's way. If a tortoise is threatened by any construction activity, that activity shall cease until a qualified tortoise biologist moves the tortoise to safety. 20) Tortoises shall not be placed on lands not under the ownership of the Bureau of another federal agency or as stipulated by BO. 21) The tortoise-proof fence shall be monitored at least quarterly, particularly following precipitation, and maintained for the life of the project. 22) Monitoring and maintenance shall include regular removal of trash and sediment accumulation and restoration of zero clearance between the ground and the bottom of the fence.					

Table 4-13 Conservation Actions Associated with Conservation Objective 10

Calculated Ranking	Conservation Action	Affected Species	Type of Conservation Action	Biological Ranking	Feasibility Ranking	Source of Conservation Action
2	The mining operator shall attach a tortoise-proof fence to the existing chain-link fence surrounding the mill-site site and maintain at zero ground clearance on project specific basis.	desert tortoise, desert pocket mouse, all reptiles	Management Action	3	1	File No. 1-5-95-F-257 BO for A&N Mining Plan of Operations, Piute Valley, Nevada
3	Gate cave or mine openings where needed for public safety and resource protection.	all bats	Impact Mitigation	3	2	CC MSHCP
3	Programs will be developed and implemented to successfully revegetate, with native vegetation, disturbed desert areas which were impacted by past surface disturbing activities.	all species	Management Action	2	3	File No. 1-5-95-F-274R BO on the Expansion of the Pahrump Community Material Pit, Nye County, Nevada
3	Design and install bat-friendly gates on mines and caves that prevent access by people, while allowing access by bat species. All gates on caves and mines will be designed to provide for unrestricted access for bats. Temporary (test) gates of PVC or other light, impermanent material will be constructed first to determine bats' reaction to gate design, prior to final design and construction of permanent gates.	bats	Protective Measure	2	3	CC MSHCP BO
3	The tortoise fences around each of the sites shall be inspected weekly and after significant rainstorms to ensure that they have not been breached.	desert tortoise, desert pocket mouse, all reptiles	Protective Measure	3	2	Biological Opinion for the Proposed Cactus Mining Corporation Mining Plan of Operation, Eldorado Valley, Clark County, Nevada
3	The tortoise-proof fence shall be monitored at least quarterly, particularly following precipitation, and maintained for the life of the project. Monitoring and maintenance shall include regular removal of trash and sediment accumulation and restoration of zero clearance between the ground and the bottom of the fence.	desert tortoise, desert pocket mouse, all reptiles	Protective Measure	3	2	File No. 1-5-95-F-205 BO on the Proposed Approval of the Black Hawk Mine Plan of Operations
3	Develop a partnership between conservationists, mining companies, and federal land management agencies to solve the conflicts of alternate nesting habitat creation and establish nest site mitigation as standard operating procedure for mining proposals and activities.	prairie falcon	Impact Mitigation	4	2	Nevada Partners in Flight Bird Conservation Plan (Neel 1999)
3	When constructed high walls are not available or feasible to maintain, identify alternate natural cliffs for pothole construction.	prairie falcon	Impact Mitigation	5	1	Nevada Partners in Flight Bird Conservation Plan (Neel 1999)
3	Ensure gypsum mining will not significantly impact on rare plants.	sticky ringstem	Impact Mitigation	4	2	A Conservation Management Strategy for Nine Low Elevation Rare Plants in Clark County, Nevada

4.3.9 Summary of Conservation Actions

The outcomes of prioritizing the full suite of conservation actions have been included in Table 4-14 below. Table 4-15 compares the types of conservation actions identified for different groups of species.

Overall, the majority of the conservation actions were identified for addressing Conservation Objective 4 (data gaps) and Conservation Objective 6 (offsetting development). Protective Measures, Inventory and Monitoring Actions, Management Actions, and Impact Mitigation were the four types of conservation actions with the most conservation actions identified. Most of the conservation actions applied to all species or to selected birds or selected reptiles. For all species, Protective Measures, Impact Mitigation, and Management Actions were the most common types of conservation actions identified. For selected reptiles, Management Actions, Protective Measures, and Applied Research Actions were the most common types, while Protective Measures and Inventory and Monitoring Actions were the most common for selected bird species.

The majority of conservation actions identified were prioritized as a three, because the biological ranking was often a three and feasibility rankings were often a two. The types of conservation actions with the most highly ranked actions (category = 2) were Protective Measure, Management Action, and Impact Mitigation.

Table 4-14 Summary of VRCMA Conservation Actions with Respect to Their Distribution Based on Conservation Objective, Ranking, Type of Action, and Affected Species

Conservation Objective	1, 2, and 3	4	5	6	7	8	9	10	Total
Total Number of Conservation Actions	24	56	6	78	24	29	36	19	272
Preliminary Ranking (Combination of Biological and Feasibility Rankings)									
1	0	0	0	0	0	0	0	0	0
2	6	5	1	40	6	12	17	10	97
3	16	46	5	36	16	16	19	9	163
4	2	5	0	2	2	1	0	0	12
5	0	0	0	0	0	0	0	0	0
Biological Ranking									
1	1	0	0	0	1	0	1	0	3
2	4	4	2	17	4	12	8	5	56
3	14	15	3	44	14	13	23	11	137
4	5	37	1	16	5	4	4	2	74
5	0	0	0	1	0	0	0	1	2
Feasibility Ranking									
1	3	16	0	18	3	2	10	6	58
2	11	26	4	48	11	14	20	11	145
3	5	10	2	10	5	10	5	2	49
4	5	4	0	2	5	3	1	0	20
5	0	0	0	0	0	0	0	0	0
Type of Conservation Action									
Inventory and Monitoring Action	1	35	0	2	1	2	3	1	45
Management Action	8	2	2	13	8	4	9	4	50
Protective Measure	11	1	2	26	11	7	16	7	81
Public Outreach	2	4	2	11	2	5	0	0	26
Restoration Effort	2	0	0	4	2	1	2	0	11
Applied Research	0	13	0	0	0	1	0	0	14
Impact Mitigation	0	1	0	22	0	9	6	7	45
Affected Species									
All plants	2	1	0	2	4	5	1	0	15
All birds	2	3	0	0	2	3	0	1	11
All mammals	2	0	0	0	0	0	0	0	2
All reptiles	0	2	1	1	0	0	3	4	11

Table 4-14 Summary of VRCMA Conservation Actions with Respect to Their Distribution Based on Conservation Objective, Ranking, Type of Action, and Affected Species

Conservation Objective	1, 2, and 3	4	5	6	7	8	9	10	Total
All bats	0	1	0	4	0	2	1	3	11
All species	8	5	2	41	8	15	23	6	108
All wildlife	0	0	2	1	0	0	0	0	3
Selected plants	2	1	0	2	0	0	0	1	6
Selected birds	3	21	0	20	4	0	0	2	50
Selected mammals	2	7	0	0	2	1	1	3	16
Selected reptiles	4	14	1	9	4	3	8	6	49

Table 4-15 Summary of Types of Conservation Actions with Respect to Their Distribution based on Calculated Ranking and Affected Species

Type of Conservation Action	Calculated Ranking (Rank; N)	All species	All plants	All wildlife	All birds	All mammals	All reptiles	All bats	Selected plants	Selected birds	Selected mammals	Selected reptiles	Selected amphibians
Inventory and Monitoring Action	1; 0 2; 6 3; 37 4; 2 5; 0	9	3	0	2	0	3	1	3	14	7	6	0
Management Action	1; 0, 2; 22 3; 28 4; 0 5; 0	24	1	1	2	0	4	1	6	4	5	11	1
Protective Measure	1; 0 2; 34 3; 45 4; 2 5; 0	30	6	1	1	0	3	5	7	18	11	12	0
Public Outreach	1; 0 2 ; 6 3;16 4; 4 5; 0	10	3	0	1	0	1	1	2	9	3	3	0
Restoration Effort	1; 0 2; 8 3; 3 4; 0 5; 0	7	2	1	0	0	0	1	0	1	0	0	0
Applied Research	1; 0 2; 1 3; 10 4; 3 5; 0	0	1	0	0	0	0	0	0	4	0	9	0
Impact Mitigation	1; 0 2; 22 3; 22 4; 1 5; 0	30	1	0	0	2	0	4	3	5	2	7	0

4.4 ASSESSMENT OF HABITAT DIVERSITY

To better assess *where* the prioritized conservation actions should be focused within the VRCMA Boundary, an assessment was made that incorporated habitat diversity and land protection. Areas that have the highest natural habitat diversity (thereby, not incorporating agriculture and development) would presumably have the highest species diversity. Once indices of diversity were calculated, they were overlaid with the Southwest Regional GAP Project's (SWReGAP) land ownership GIS dataset. The combination of these data allow the means to assess levels of protection with respect to potential diversity, particularly where biologically diverse areas are potentially inadequately protected from threats and human activities.

This assessment was completed for the VRCMA Boundary, and, to put this assessment into a landscape context, the same assessment was made for the greater Lower Virgin River Watershed as a whole.

The steps for this process are detailed below.

- The VRCMA Boundary was divided into grid cells of one kilometer by one kilometer and the Shannon-Weiner index was calculated for each grid cell using the following formula:

  H = -sum(Piln[Pi]) (natural log)

  This diversity measure indicates the number of habitat types observed within the 1 km x 1 km grid square. It has also been called the Shannon index and the Shannon-Weaver index (REWHC 2000).

- The one kilometer by one kilometer grid cells, with their associated Shannon-Weiner index data, were intersected with the SWReGAP land ownership dataset. The SWReGAP land ownership dataset (USGS 2005) identifies the protection status of lands within the VRCMA Boundary and the Lower Virgin River Watershed. The four biodiversity management status categories are generally defined as follows:

  – **Status 1:** An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events (of natural type, frequency, intensity, and legacy) are allowed to proceed without interference or are mimicked through management.

  – **Status 2:** An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but which may receive uses or management practices that degrade the quality of existing natural communities, including suppression of natural disturbance.

  – **Status 3:** An area having permanent protection from conversion of natural land cover for the majority of the area, but subject to extractive uses of either a broad, low-intensity type (e.g., logging) or localized intense type (e.g., mining). It also confers protection to federally listed endangered and threatened species throughout the area.

  – **Status 4:** There are no known public or private institutional mandates or legally recognized easements or deed restrictions held by the managing entity to prevent conversion of natural habitat types to anthropogenic habitat types. The area generally allows conversion to unnatural land cover throughout (USGS 2005).

  Within the VRCMA Boundary and the watershed, only status levels two through four occur. In the dataset created by the SWReGAP, zero is used to describe open water.

- The following matrix was created to assign categories (blue = one, orange = two, yellow = three, and green = four) based upon a combination of habitat diversity and land protection levels (Table 4-16). The goal of this step was to identify highly diverse areas with low land protection statuses (e.g., blue in Table 4-16) and vice-versa.

Table 4-16 Habitat Diversity (Categories 1 through 5) and Land Protection Status Defined for the VRCMA Boundary and the Entire Lower Virgin River Watershed

		Habitat Diversity				
		Category 1 (high)	Category 2 (high)	Category 3 (med)	Category 4 (low)	Category 5 (low)
Land Protection Status (GAP Status)	2 (high)	HH	HH	MH	LH	LH
	3 (med)	HM	HM	MM	LM	LM
	4 (low)	HL	HL	ML	LL	LL

Categories are color-coded by level of relative diversity and relative level of land protection. These same color codes are mapped for the VRCMA Boundary and the entire Lower Virgin River watershed (Figures 4-3a and 4-3b).

4.4.1 Habitat Diversity within the VRCMA Boundary and Lower Virgin River Watershed

These steps were completed for both the VRCMA Boundary and the entire Lower Virgin River Watershed. The Shannon-Weiner indices described were divided into five separate categories based on natural breaks in the data and color coded for a visual representation across the watershed and within the VRCMA Boundary (Figures 4-1a and 4-1b). Land protection status levels for the VRCMA Boundary and the entire watershed were also mapped for the VRCMA Boundary and the entire watershed (Figures 4-2a and 4-2b respectively). These two values (diversity and land protection status) were then mapped together for the VRCMA Boundary and the entire Lower Virgin River Watershed by grouping into categories defined in Table 4-16 (Figures 4-3a and 4-3b).

To better understand the overall value of protecting the area defined in the VRCMA boundary, the amount of individual habitat types within the VRCMA Boundary and Lower Virgin River Watershed was assessed (Tables 4-17 and 4-18). Aside from modified (agriculture, development) and riparian habitats, North American Warm Desert Pavement, North American Warm Desert Badland, and Rocky Mountain Ponderosa Pine Woodland are the three habitat types with the greatest representation proportionally in the entire watershed that occurs within the VRCMA Boundary, at 40, 32, and 17 percent, respectively (highlighted rows in Table 4-17).

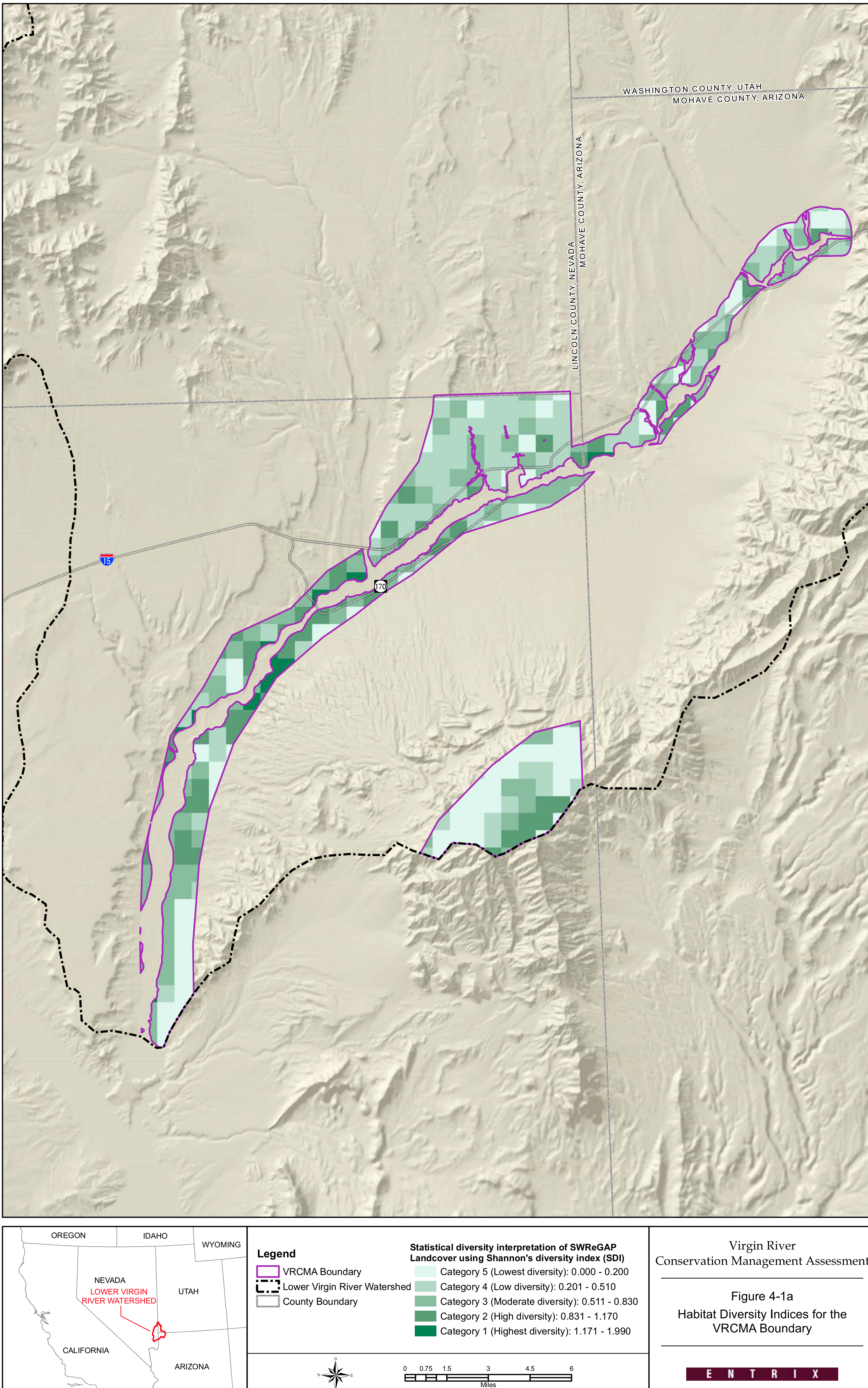
For those habitats which had lands in landownership (GAP) status level 4, which affords no protection from threats or human activities, the following habitat types had a disproportionately large amount of the habitat occurring within the VRCMA Boundary:

- North American Warm Desert Pavement,
- North American Warm Desert Badland,
- North American Warm Desert Wash, and
- Sonora-Mojave Creosotebush-White Bursage Desert Scrub (highlighted rows in Table 4-18).

A description of each of these habitat types (North American Warm Desert Pavement, North American Warm Desert Badland, Rocky Mountain Ponderosa Pine Woodland, North American Warm Desert Wash, and Sonora-Mojave Creosotebush-White Bursage Desert Scrub) and a list of the species associated with each type is provided below.

4.4.1.1 North American Warm Desert Pavement

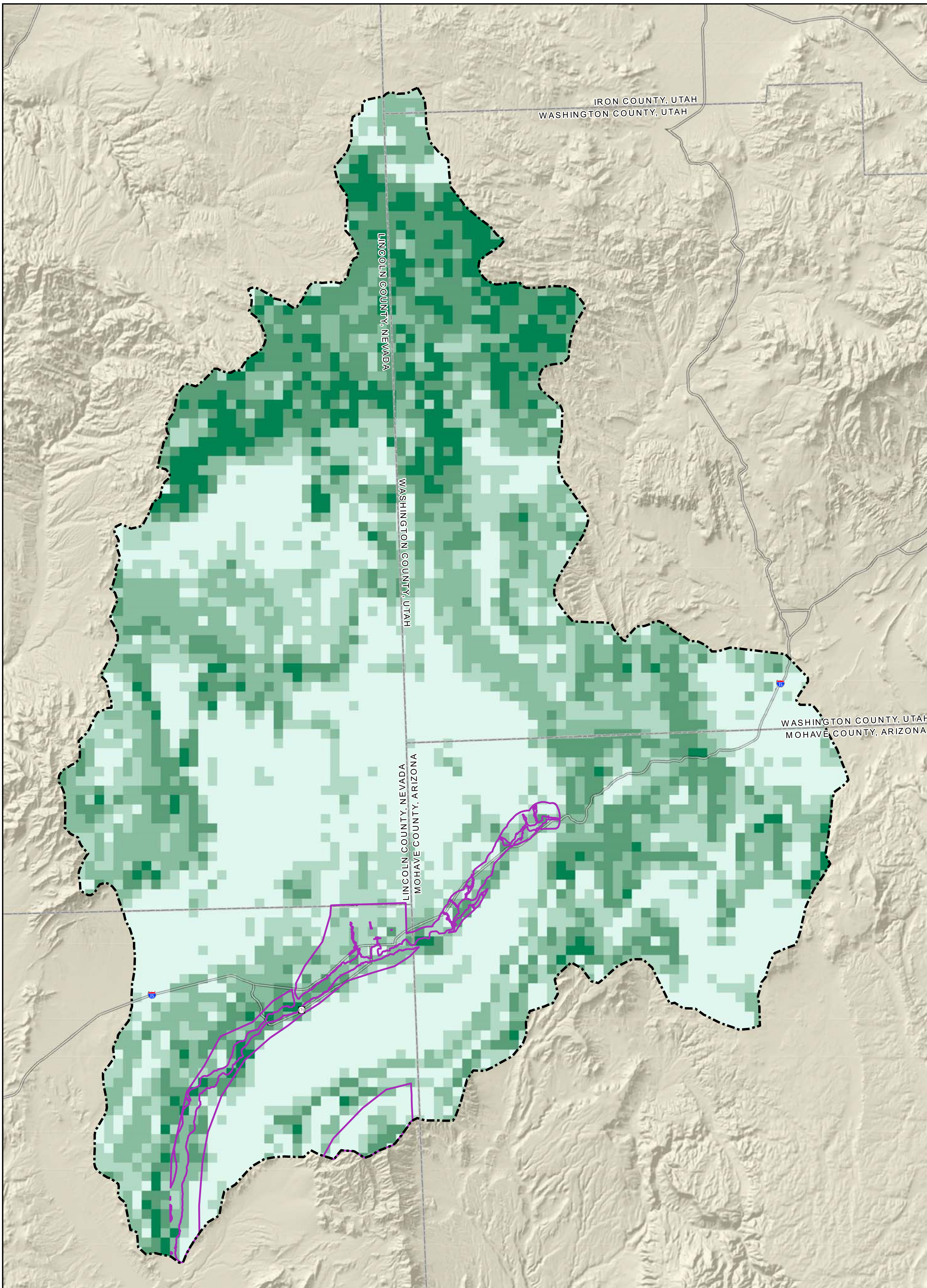
"This ecological system occurs throughout much of the warm deserts of North America and is composed of unvegetated to very sparsely vegetated (<2% plant cover) landscapes, typically flat basins where extreme temperature and wind develop ground surfaces of fine to medium gravel coated with "desert varnish." Very low cover of desert scrub species such as *Larrea tridentata* or *Eriogonum fasciculatum* is usually present. However, ephemeral herbaceous species may have high cover in response to seasonal precipitation, including *Chorizanthe rigida, Eriogonum inflatum*, and *Geraea canescens*" (USGS 2004).

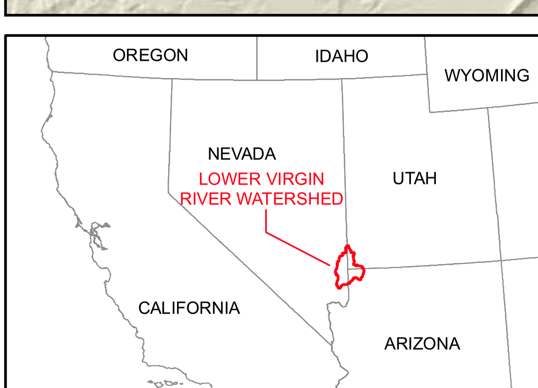


Virgin River
Conservation Management Assessment

Figure 4-1a
Habitat Diversity Indices for the VRCMA Boundary

E N T R I X





Legend

- VRCMA Boundary
- Lower Virgin River Watershed
- County Boundary

Statistical diversity interpretation of SWReGAP Landcover using Shannon's diversity index (SDI)

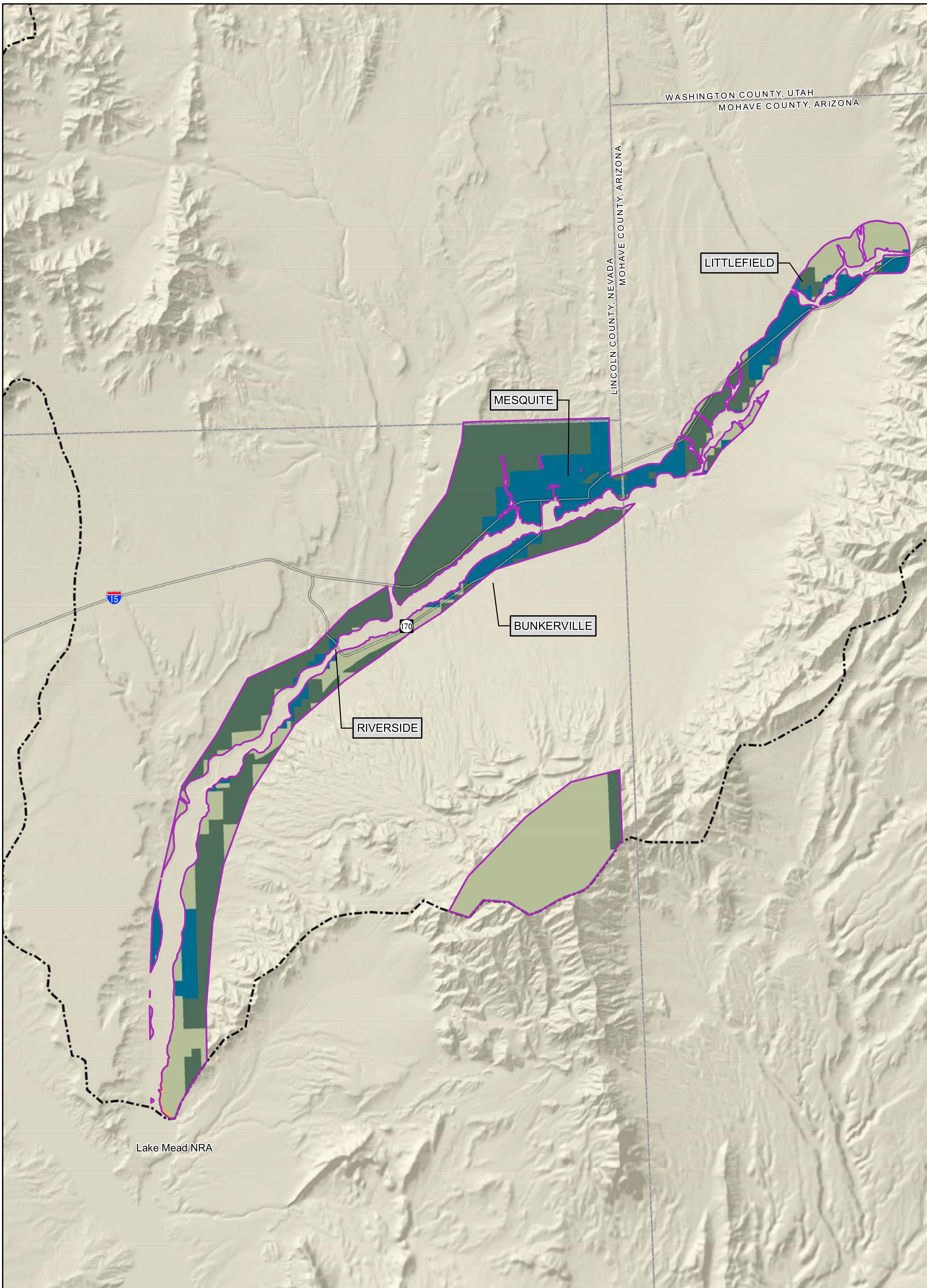
- Category 5 (Lowest diversity): 0.000 - 0.200
- Category 4 (Low diversity): 0.201 - 0.510
- Category 3 (Moderate diversity): 0.511 - 0.830
- Category 2 (High diversity): 0.831 - 1.170
- Category 1 (Highest diversity): 1.171 - 1.990

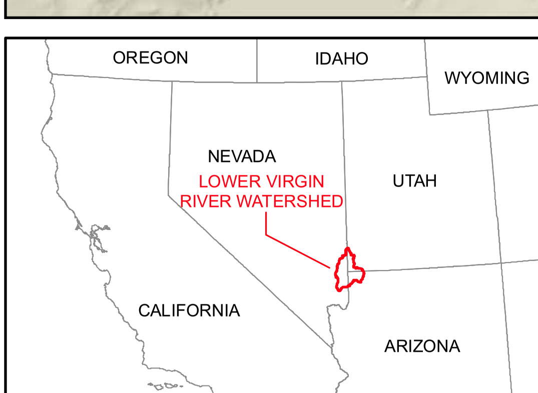
0 1.5 3 6 9 12
Miles

Virgin River
Conservation Management Assessment

Figure 4-1b
Habitat Diversity Indices for the Lower Virgin River Watershed

E N T R I X





Legend

- VRCMA Boundary
- Lower Virgin River Watershed
- County Boundary

USGS National GAP Land Protection Status

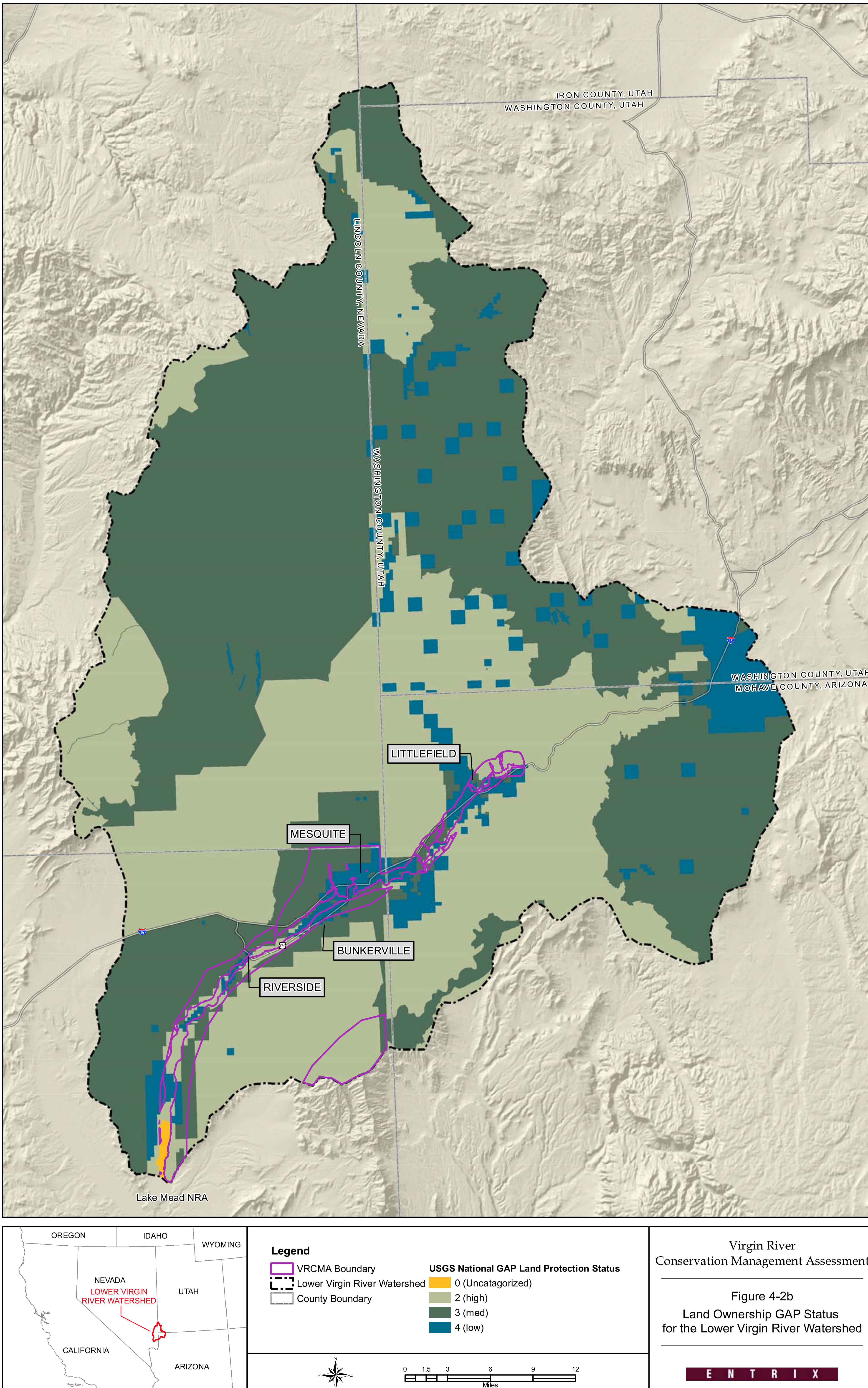
- 0 (Uncatagorized)
- 2 (high)
- 3 (med)
- 4 (low)

0 0.75 1.5 3 4.5 6
Miles

Virgin River
Conservation Management Assessment

Figure 4-2a
Land Ownership GAP Status
for the VRCMA Boundary

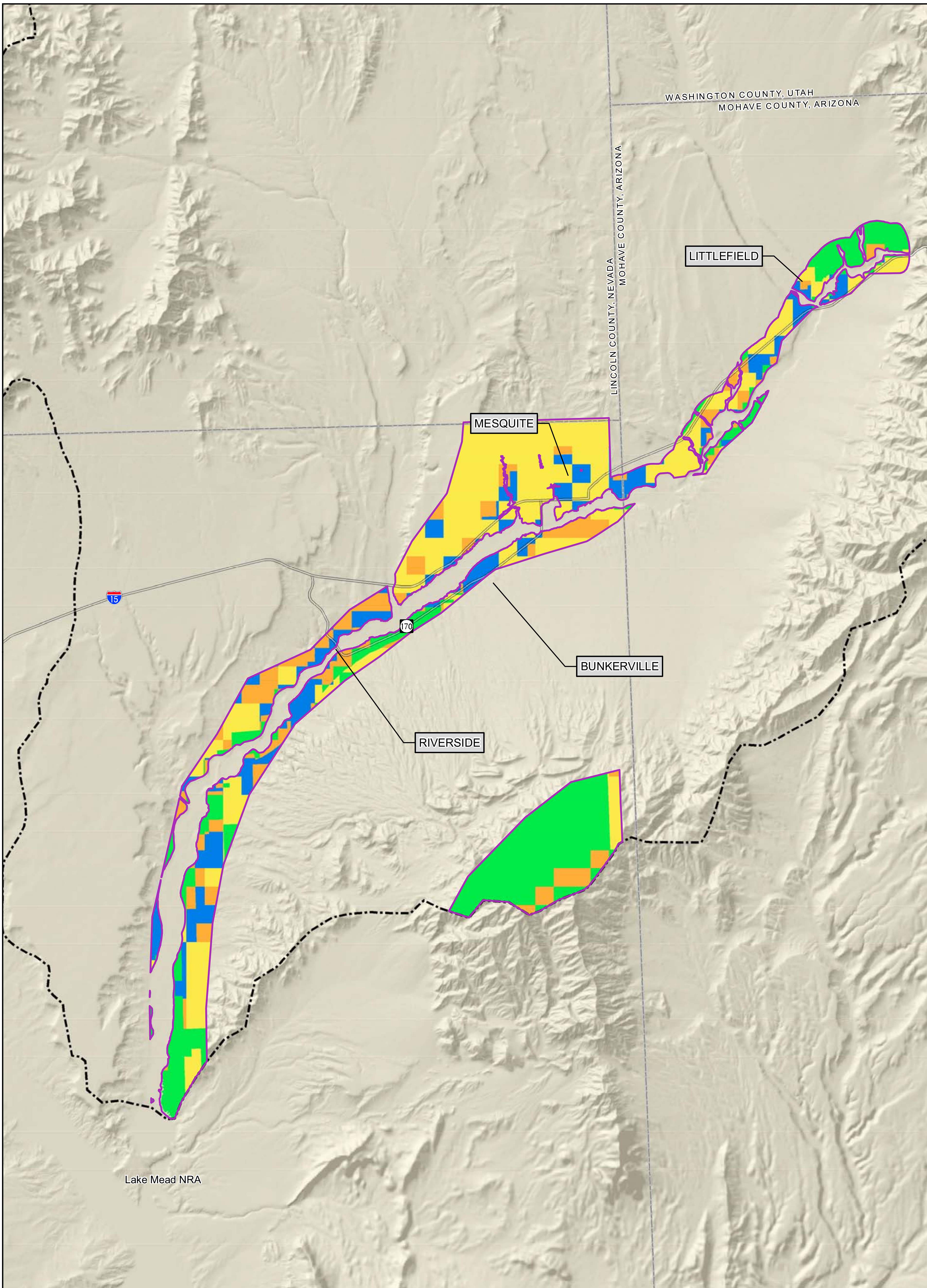
E N T R I X

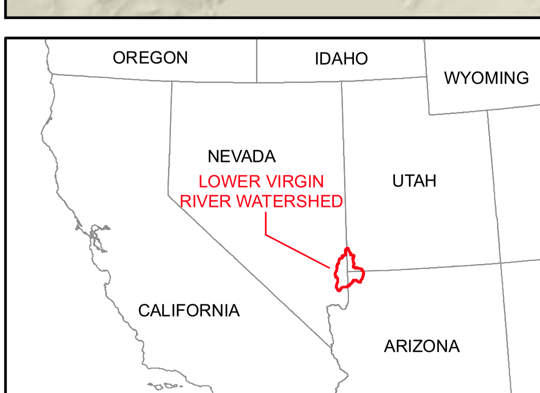


Virgin River
Conservation Management Assessment

Figure 4-2b
Land Ownership GAP Status
for the Lower Virgin River Watershed

ENTRIX





Legend

- VRCMA Boundary
- Lower Virgin River Watershed
- County Boundary

SDI habitat diversity/GAP land protection status

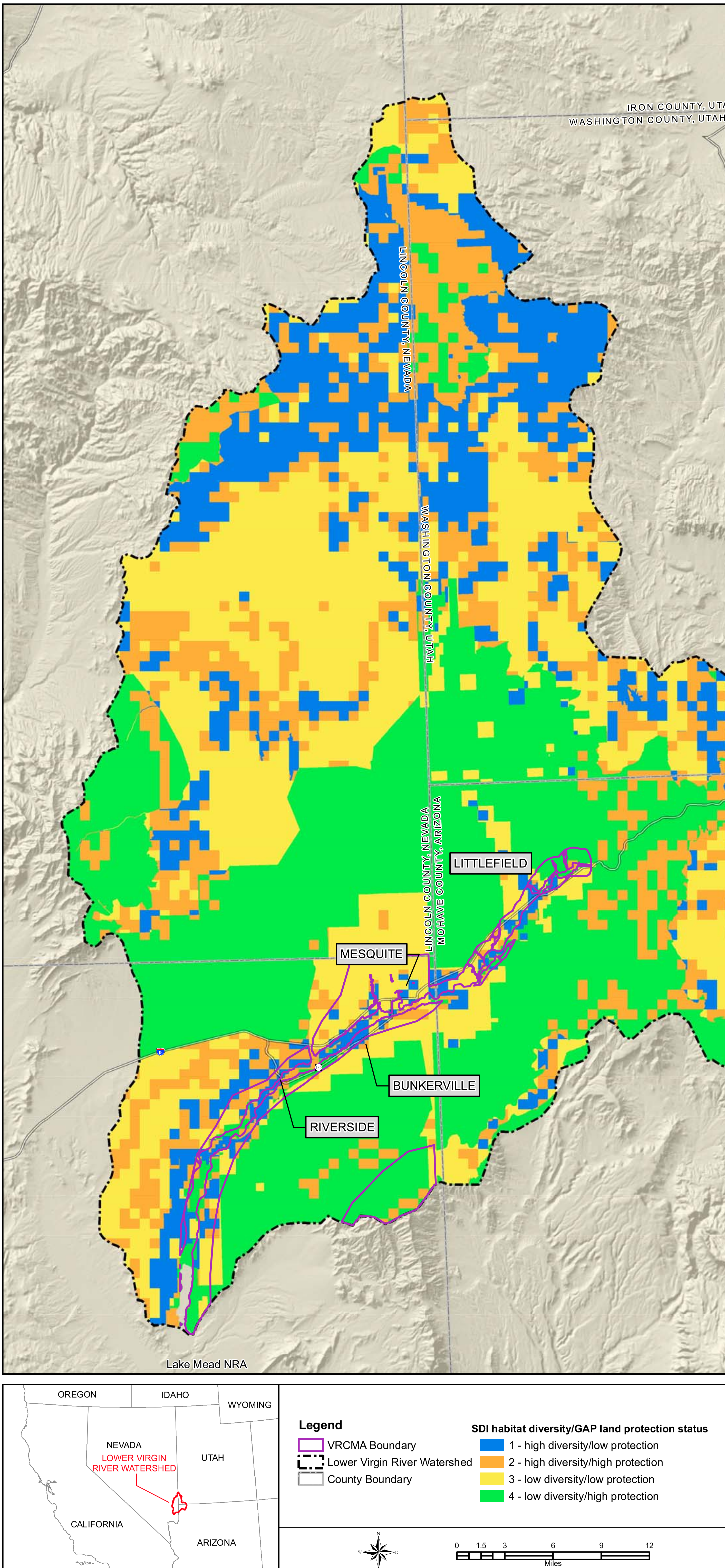
- 1 - high diversity/low protection
- 2 - high diversity/high protection
- 3 - low diversity/low protection
- 4 - low diversity/high protection

0 0.75 1.5 3 4.5 6
Miles

Virgin River
Conservation Management Assessment

Figure 4-3a
Assessment of Protection of
Habitat Diversity for the
VRCMA Boundary

ENTRIX



Virgin River
Conservation Management Assessment

Figure 4-3b
Assessment of Protection of Habitat Diversity for the Lower Virgin River Watershed

ENTRIX

Table 4-17 Amount of Habitat Type (Acres) within the VRCMA Boundary and Lower Virgin River Watershed			
Land Cover (Habitat) Description	Acres of Land Cover (Habitat) Type within the VRCMA Boundary	Acres of Land Cover (Habitat) Type within the Lower Virgin River Watershed	Land Cover (Habitat) Type within the VRCMA Boundary as a Percentage of the Entire Watershed
Mojave Mid-Elevation Mixed Desert Scrub	3.5	344,076.4	0.00%
Inter-Mountain Basins Big Sagebrush Shrubland	7.4	11,307.0	0.1%
North American Warm Desert Playa	4.3	706.8	0.6%
Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	1.5	155.0	1.0%
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	211.0	20,745.4	1.0%
Mogollon Chaparral	577.6	56,678.4	1.0%
Colorado Plateau Blackbrush-Mormon-tea Shrubland	19.5	1,842.3	1.2%
Sonora-Mojave Mixed Salt Desert Scrub	93.9	3,894.3	2.4%
Colorado Plateau Mixed Bedrock Canyon and Tableland	27.4	1,050.3	2.6%
Great Basin Pinyon-Juniper Woodland	8,145.7	186,445.5	4.4%
North American Warm Desert Bedrock Cliff and Outcrop	2,025.1	44,805.5	4.5%
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	31,944.0	568,142.5	5.6%
North American Warm Desert Wash	1901.3	31,704.4	6.0%
Invasive Southwest Riparian Woodland and Shrubland*	579.2	9,335.0	6.2%
North American Arid West Emergent Marsh*	28.8	339.3	8.5%
Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	10.4	103.9	10.0%
Open Water*	107.6	666.2	16.2%
Rocky Mountain Ponderosa Pine Woodland	853.3	4,936.3	17.3%
Developed, Medium - High Intensity	676.8	2,687.0	25.2%
North American Warm Desert Badland	540.9	1,714.2	31.6%
North American Warm Desert Riparian Woodland and Shrubland*	15.7	39.9	39.3%
North American Warm Desert Pavement	662.5	1,677.3	39.5%
Agriculture	1,013.8	2,384.0	42.5%
North American Warm Desert Riparian Mesquite Bosque*	210.7	414.7	50.8%
Developed, Open Space - Low Intensity	2,292.2	4,165.5	55.0%
All Land Cover Types that Occur in the VRCMA Boundary	51,954.2	1,342,512.0	3.9%
* These habitats are riparian and/or aquatic and are not included in this Virgin River Conservation Management Assessment.			

Table 4-18 Habitat Types and Associated Land Ownership Status and Acres within the VRCMA Boundary and Lower Virgin River Watershed

Land Cover (Habitat) Description	Landownership Status (GAP Status)	Acres within the VRCMA	Land Cover/Gap Status Combination as a Percentage of the VRCMA	Acres within the Lower Virgin River Watershed	Land Cover/Gap Status Combination as a Percentage of the Entire Watershed	Acres within the VRCMA as a Percentage of the Watershed
Agriculture	2	12.94	0.02%	68.006	0.01%	19.02%
Agriculture	3	24.97	0.05%	41.752	0.00%	59.80%
Agriculture	4	975.90	1.88%	2274.233	0.23%	42.91%
Colorado Plateau Blackbrush-Mormon-tea Shrubland	2	19.49	0.04%	688.523	0.07%	2.83%
Colorado Plateau Mixed Bedrock Canyon and Tableland	2	27.39	0.05%	878.239	0.09%	3.12%
Developed, Medium - High Intensity	2	13.72	0.03%	1328.252	0.13%	1.03%
Developed, Medium - High Intensity	3	367.07	0.71%	649.560	0.06%	56.51%
Developed, Medium - High Intensity	4	296.03	0.57%	709.211	0.07%	41.74%
Developed, Open Space - Low Intensity	3	21.80	0.04%	26.536	0.00%	82.16%
Developed, Open Space - Low Intensity	4	2,270.42	4.38%	4131.398	0.41%	54.96%
Great Basin Pinyon-Juniper Woodland	2	7,512.54	14.48%	60748.091	6.07%	12.37%
Great Basin Pinyon-Juniper Woodland	3	633.11	1.22%	120310.631	12.02%	0.53%
Inter-Mountain Basins Big Sagebrush Shrubland	2	7.43	0.01%	963.551	0.10%	0.77%
Invasive Southwest Riparian Woodland and Shrubland	2	187.66	0.36%	4283.365	0.43%	4.38%
Invasive Southwest Riparian Woodland and Shrubland	3	99.96	0.19%	1267.439	0.13%	7.89%
Invasive Southwest Riparian Woodland and Shrubland	4	287.65	0.55%	2957.484	0.30%	9.73%
Mogollon Chaparral	2	529.11	1.02%	18642.694	1.86%	2.84%
Mogollon Chaparral	3	48.53	0.09%	37163.117	3.71%	0.13%
Mojave Mid-Elevation Mixed Desert Scrub	2	3.55	0.01%	78269.117	7.82%	0.00%
North American Arid West Emergent Marsh*	2	14.07	0.03%	103.151	0.01%	13.64%
North American Arid West Emergent Marsh*	4	12.11	0.02%	46.610	0.00%	25.99%
North American Warm Desert Badland	2	153.76	0.30%	484.914	0.05%	31.71%
North American Warm Desert Badland	3	307.88	0.59%	667.081	0.07%	46.15%
North American Warm Desert Badland	4	79.31	0.15%	562.200	0.06%	14.11%
North American Warm Desert Bedrock Cliff and Outcrop	2	337.70	0.65%	25824.967	2.58%	1.31%
North American Warm Desert Bedrock Cliff and Outcrop	3	1,596.40	3.08%	16376.588	1.64%	9.75%
North American Warm Desert Bedrock Cliff and Outcrop	4	91.00	0.18%	2602.368	0.26%	3.50%
North American Warm Desert Pavement	2	51.77	0.10%	134.099	0.01%	38.61%
North American Warm Desert Pavement	3	551.76	1.06%	1426.551	0.14%	38.68%
North American Warm Desert Pavement	4	58.92	0.11%	116.687	0.01%	50.49%
North American Warm Desert Playa	3	1.04	0.00%	290.011	0.03%	0.36%
North American Warm Desert Playa	4	3.26	0.01%	113.263	0.01%	2.88%
North American Warm Desert Riparian Mesquite Bosque*	2	4.87	0.01%	32.338	0.00%	15.06%
North American Warm Desert Riparian Mesquite Bosque*	3	200.46	0.39%	321.872	0.03%	62.28%
North American Warm Desert Riparian Mesquite Bosque*	4	5.37	0.01%	60.494	0.01%	8.88%

Table 4-18 Habitat Types and Associated Land Ownership Status and Acres within the VRCMA Boundary and Lower Virgin River Watershed

Land Cover (Habitat) Description	Landownership Status (GAP Status)	Acres within the VRCMA	Land Cover/Gap Status Combination as a Percentage of the VRCMA	Acres within the Lower Virgin River Watershed	Land Cover/Gap Status Combination as a Percentage of the Entire Watershed	Acres within the VRCMA as a Percentage of the Watershed
North American Warm Desert Riparian Woodland and Shrubland*	2	5.93	0.01%	22.049	0.00%	26.91%
North American Warm Desert Riparian Woodland and Shrubland*	4	9.75	0.02%	17.085	0.00%	57.07%
North American Warm Desert Wash	2	452.87	0.87%	6468.446	0.65%	7.00%
North American Warm Desert Wash	3	971.78	1.87%	23307.770	2.33%	4.17%
North American Warm Desert Wash	4	476.62	0.92%	1928.218	0.19%	24.72%
Open Water*	2	19.49	0.04%	31.277	0.00%	62.31%
Open Water*	3	4.09	0.01%	4.089	0.00%	100.00%
Open Water*	4	24.00	0.05%	29.183	0.00%	82.24%
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	2	210.96	0.41%	7165.514	0.72%	2.94%
Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	2	1.53	0.00%	131.984	0.01%	1.16%
Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	2	10.43	0.02%	91.305	0.01%	11.42%
Rocky Mountain Ponderosa Pine Woodland	2	851.50	1.64%	3684.928	0.37%	23.11%
Rocky Mountain Ponderosa Pine Woodland	3	1.80	0.00%	1166.866	0.12%	0.15%
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	2	7,394.75	14.26%	311677.718	31.15%	2.37%
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	3	18,086.53	34.87%	202033.094	20.19%	8.95%
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	4	6,457.49	12.45%	54413.012	5.44%	11.87%
Sonora-Mojave Mixed Salt Desert Scrub	2	5.77	0.01%	1022.017	0.10%	0.56%
Sonora-Mojave Mixed Salt Desert Scrub	3	26.18	0.05%	1361.714	0.14%	1.92%
Sonora-Mojave Mixed Salt Desert Scrub	4	61.96	0.12%	1506.955	0.15%	4.11%
Total of Land Cover/GAP Status		51,870.38		1,000,559.61		5.18%

* These habitats are riparian and/or aquatic and are not included in this Virgin River Conservation Management Assessment.

Table 4-19 Special Status Species that Potentially Occur in the Most Represented Habitat Types within the VRCMA

Taxon	Common Name	Scientific Name	Rocky Mountain Ponderosa Pine Woodland	North American Warm Desert Badland	North American Warm Desert Pavement	North American Warm Desert Wash	Sonora-Mojave Creosotebush-White Bursage Desert Scrub
bird	American peregrine falcon	*Falco peregrinus*	x				
bird	bald eagle	*Haliaeetus leucocephalus*					x
bird	Bendire's thrasher	*Toxostoma bendirei*			x	x	x
bird	blue grosbeak	*Guiraca caerulea*					x
bird	cactus wren	*Campylorhynchus brunneicapillus*				x	
bird	crissal thrasher	*Toxostoma crissale*				x	
bird	ferruginous hawk	*Buteo regalis*				x	
bird	flammulated owl	*Otus flammeolus*	x				
bird	golden eagle	*Aquila chrysaetos*	x			x	x
bird	gray vireo	*Vireo vicinior*				x	
bird	Le Conte's thrasher	*Toxostoma lecontei*				x	x
bird	loggerhead shrike	*Lanius ludovicianus*				x	x
bird	long-eared owl	*Asio otus*	x				x
bird	Lucy's warbler	*Vermivora luciae*	x			x	
bird	northern goshawk	*Accipiter gentilis*	x				
bird	phainopepla	*Phainopepla nitens*				x	
bird	pinyon jay	*Gymnorhinus cyanocephalus*	x				
bird	prairie falcon	*Falco mexicanus*	x				x
bird	Scott's oriole	*Icterus parisorum*					
bird	summer tanager	*Piranga rubra*				x	
bird	western bluebird	*Sialia mexicana*	x				
bird	western burrowing owl	*Speotyto cunicularia hypugea*					
bird	western screech owl	*Otus kennicotti*	x			x	
bird	yellow-breasted chat	*Icteria virens*					
mammal	Allen's big-eared bat	*Idionycteris phyllotis*	x			x	x
mammal	big free-tailed bat	*Nyctinomops macrotis*	x		x	x	x
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	x				x
mammal	California leaf-nosed bat	*Macrotus californicus*			x	x	
mammal	California myotis	*Myotis californicus*	x				
mammal	desert pocket mouse	*Chaetodipus penicillatus*				x	x
mammal	fringed myotis	*Myotis thysanodes*	x				x
mammal	hoary bat	*Lasiurus cinereus*				x	
mammal	long-eared myotis	*Myotis evotis*	x				
mammal	long-legged myotis	*Myotis volans*	x				x
mammal	pallid bat	*Antrozous pallidus*					x
mammal	silver-haired bat	*Lasionycteris noctivagans*	x				x

Table 4-19 Special Status Species that Potentially Occur in the Most Represented Habitat Types within the VRCMA

Taxon	Common Name	Scientific Name	Rocky Mountain Ponderosa Pine Woodland	North American Warm Desert Badland	North American Warm Desert Pavement	North American Warm Desert Wash	Sonora-Mojave Creosotebush-White Bursage Desert Scrub
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	x				x
mammal	western pipistrelle	*Pipistrellus hesperus*		x	x	x	x
mammal	western red bat	*Lasiurus blossevillii*				x	
mammal	western small-footed myotis	*Myotis ciliolabrum*					x
plant	alpine stinking lomatium	*Lomatium graveolens* var. *alpinum*	x				
plant	barrel cactus	*Ferocactus acanthoides* var. *lecontei*					x
plant	Beaver Dam scurfpea	*Pediomelum castoreum*		x	x	x	x
plant	catchfly gentian	*Eustoma exaltatum*				x	
plant	Clark Mountain agave	*Agave utahensis* var. *nevadensis*					x
plant	Clarke phacelia	*Phacelia filiae*					x
plant	Clokey fleabane	*Erigeron clokeyi*	x				
plant	Clokey pincushion	*Coryphantha vivipara* ssp. *rosea*					x
plant	crossidium moss	*Crossidium seriatum*		x	x	x	x
plant	dune linanthus	*Linanthus arenicola*		x	x	x	x
plant	dune sunflower	*Helianthus deserticola*		x	x		x
plant	fissidens sublimbatus	*Fissidens sublimbatus*	x				
plant	forked (Pahrump Valley) buckwheat	*Eriogonum bifurcatum*					x
plant	Las Vegas bearpoppy	*Arctomecon californica*		x	x		x
plant	Las Vegas Valley buckwheat	*Eriogonum corymbosum* var. *aureum*		x	x	x	x
plant	Littlefield milkvetch	*Astragalus preussii* var. *laxiflorus*		x	x	x	
bird	Mokiak milkvetch	*Astragalus mokiacensis*		x		x	
plant	Nevada didymodon	*Didymodon nevadensis*		x	x	x	x
plant	Nevada willowherb	*Epilobium nevadense*	x				
plant	Nye milkvetch	*Astragalus nyensis*		x	x	x	x
plant	rosy twotone beardtongue	*Penstemon bicolor* ssp. *roseus*		x	x	x	x
plant	silverleaf sunray	*Enceliopsis argophylla*		x	x	x	x
plant	splachnobryum obtusum	*Splachnobryum obtusum*			x	x	
plant	sticky buckwheat	*Eriogonum viscidulum*				x	x
plant	sticky ringstem	*Anulocaulis leisolenus*					x

Table 4-19 Special Status Species that Potentially Occur in the Most Represented Habitat Types within the VRCMA

Taxon	Common Name	Scientific Name	Rocky Mountain Ponderosa Pine Woodland	North American Warm Desert Badland	North American Warm Desert Pavement	North American Warm Desert Wash	Sonora-Mojave Creosotebush-White Bursage Desert Scrub
plant	straw milkvetch	*Astragalus lentiginosus* var. *stramineus*				x	x
plant	threecorner milkvetch	*Astragalus geyeri* var. *triquetrus*				x	x
plant	trichostomum moss	*Trichostomum sweetii*		x	x	x	x
plant	white bearpoppy	*Arctomecon merriamii*					x
reptile	banded gecko	*Coleonyx variegatus*				x	x
reptile	banded Gila monster	*Heloderma suspectum cinctum*					x
reptile	California (common) king snake	*Lampropeltis getulus californiae*	x	x	x	x	x
reptile	common zebra-tailed lizard	*Callisaurus draconoides draconoides*		x	x	x	x
reptile	desert iguana	*Dipsosaurus dorsalis*					x
reptile	desert night lizard	*Xantusia vigilis*	x				
reptile	desert tortoise	*Gopherus agassizii*				x	x
reptile	glossy snake	*Arizona elegans*				x	x
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*				x	
reptile	large-spotted leopard lizard	*Gambelia wislizenii wislizenii*					x
reptile	Mojave green rattlesnake	*Crotalus scutulatus scutulatus*					x
reptile	sidewinder	*Crotalus cerastes*					x
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*	x				
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*		x	x	x	x
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*	x		x		x
reptile	speckled rattlesnake	*Crotalus mitchelli*					x
reptile	western leaf-nosed snake	*Phyllorhynchus decurtatus*					x
reptile	western red-tailed skink	*Eumeces gilberti rubricaudatus*	x				

4.4.1.2 North American Warm Desert Badland

"This ecological system is restricted to barren and sparsely vegetated (generally <10% plant cover) substrates typically derived from marine shale or mudstone (badlands and mudhills). The harsh soil properties and high rate of erosion and deposition are driving environmental variables supporting sparse shrubs and dwarf-shrubs e.g., *Atriplex hymenelytra*, and herbaceous vegetation" (USGS 2004).

4.4.1.3 Rocky Mountain Ponderosa Pine Woodland

"This very widespread ecological system is most common throughout the cordillera of the Rocky Mountains. It is also found in the Colorado Plateau region, west into scattered locations in the Great Basin, and north into southern British Columbia. These woodlands occur at the lower treeline/ecotone between grassland or shrubland and more mesic coniferous forests typically in warm, dry, exposed sites. Elevations range from less than 500 meters in British Columbia to 2800 meters in the New Mexico mountains. Occurrences are found on all slopes and aspects, however, moderately steep to very steep slopes or ridgetops are most common. This ecological system generally occurs on igneous, metamorphic, and sedimentary material derived soils, with characteristic features of good aeration and drainage, coarse textures, circumneutral to slightly acid pH, an abundance of mineral material, rockiness, and periods of drought during the growing season. These woodlands in the eastern Cascades, Okanagan and northern Rockies regions receive winter and spring rains, and thus have a greater spring "green-up" than the drier woodlands in the central Rockies. *Pinus ponderosa* is the predominant conifer; *Pseudotsuga menziesii*, *Pinus edulis*, and *Juniperus* spp. may be present in the tree canopy. The understory is usually shrubby. Mixed fire regimes and ground fires of variable return interval maintain these woodlands, depending on climate, degree of soil development, and understory density" (USGS 2004).

4.4.1.4 North American Warm Desert Wash

"This ecological system is restricted to intermittently flooded washes or arroyos that dissect bajadas, mesas, plains and basin floors throughout the warm deserts of North America. Although often dry, the intermittent fluvial processes define this system, which are often associated with rapid sheet and gully flow. This system occurs as linear or braided strips within desert scrub- or desert grassland-dominated landscapes. The vegetation of desert washes is quite variable ranging from sparse and patchy to moderately dense and typically occurs along the banks, but may occur within the channel. The woody layer is typically intermittent to open and may be dominated by shrubs and small trees such as *Acacia greggii, Brickellia laciniata, Baccharis sarothroides, Chilopsis linearis, Fallugia paradoxa, Hymenoclea salsola, Hymenoclea monogyra, Juglans microcarpa, Prosopis* spp., *Psorothamnus spinosus, Prunus fasciculata, Rhus microphylla, Salazaria mexicana*, or *Sarcobatus vermiculatus*" (USGS 2004).

4.4.1.5 Sonora-Mojave Creosotebush-White Bursage Desert Scrub

"This ecological system forms the vegetation matrix in broad valleys, lower bajadas, plains and low hills in the Mojave and lower Sonoran deserts. This desert scrub is characterized by a sparse to moderately dense layer (2 to 50 percent cover) of xeromorphic microphyllous and broad-leaved shrubs. *Larrea tridentata* and *Ambrosia dumosa* are typically dominants, but many different shrubs, dwarf-shrubs, and cacti may codominate or form typically sparse understories. Associated species may include *Atriplex canescens*, *Atriplex hymenelytra*, *Encelia farinosa*, *Ephedra nevadensis*, *Fouquieria splendens*, *Lycium andersonii*, and *Opuntia basilaris*. The herbaceous layer is typically sparse, but may be seasonally abundant with ephemerals. Herbaceous species such as *Chamaesyce* spp., *Eriogonum inflatum*, *Dasyochloa pulchella*, *Aristida* spp., *Cryptantha* spp., *Nama* spp., and *Phacelia* spp. are common" (USGS 2004).

Special status species with the potential to occur in these habitat types are presented in Table 4-17.

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Chapter 5: Conservation Management Assessment

5.1 INTRODUCTION

The overarching objectives of this conservation management assessment, according to the Elements of a Conservation Management Strategy are to "ensure the conservation of species and habitats to prevent future species listing" and to implement conservation actions in an "orderly organized and public fashion, complying with permit conditions and goals of the Clark County MSHCP." A conservation management strategy is a series of guidelines for decision-makers to try to ensure that biodiversity considerations are fully integrated into the resource management planning and development process.

A clear understanding of the conservation actions available, and the implementation process, is an important component of developing a successful conservation strategy.

The purpose of this chapter is to integrate the information about existing conditions (Chapter 1), information deficiencies (Chapter 2), conservation objectives (Chapter 3), and existing conservation actions (Chapter 4) into a conservation management assessment that identifies and incorporates:

- Stakeholder priorities,
- Implementation coordination and process,
- Cost and funding considerations, and
- Elements for Monitoring Performance

These elements are described in detail below. Tables 5-1, 5-2, and 5-3 summarize this information. The conservation actions were re-sorted according to their conservation objective within general stakeholder priority categories. Information to aid in implementation of these actions is also identified: responsible parties, estimated costs, and monitoring and adaptive management elements.

5.1.1 Guiding Principles of Implementation

To best achieve successful implementation of the VRCMA, societal obstacles such as cost constraints and deficient time and labor must be overcome. As such, a guiding principle of the VRCMA is to involve diverse scientific and social interests.

Conservation actions implemented as a part of the VRCMA will address these potential conflicts at the initial stages of the planning process. This is particularly of value here where land-ownership and public interests vary across the landscape. The ecological needs of a conservation management area have the greatest potential to be met when the local community investments are greatest. Implementation of these actions can be increased by developing beneficial relationships between local communities and the natural environment. The interaction between needs and investments provides a basis for conservation action implementation, which potentially reduces both ecological and resource roadblocks to success.

Existing relationships between landowners and stakeholders will be used to encourage participation of private landowners in conservation actions where appropriate. Through the VRHCRP process, additional relationships will be developed that also may allow for increased participation of landowners in conservation activities.

5.2 STAKEHOLDER RANKING

The final ranking of conservation actions for the VRCMA was determined by the stakeholders Clark County, USFWS, BLM, NPS, NDF, and NDOW for the project. By using expert opinion and accounting for whether actions are already ongoing or planned, the participating stakeholders ranked actions as "high," "medium," or "low." Presented below are the final rankings of the conservation actions (Tables 5-1, 5-2 and 5-3). Additional information to aid in implementation of these actions identifies the responsible parties, estimated cost, and a unique identification number for tracking. Many of the actions developed in Chapter 4, Conservation Actions, have been combined or modified to create this final list. Additionally, agency representatives recommended conservation actions not previously identified in Chapter 4. Actions are organized by conservation objective within each table (Table 5-1 [high], Table 5-2 [medium], Table 5-3 [low]).

5.3 IMPLEMENTATION OF CONSERVATION ACTIONS

For each conservation action, a general timeframe for implementation has also been identified (Tables 5-1, 5-2, and 5-3). These timeframe assessments were based upon input from the stakeholders. Decisions were based upon a consensus. For those actions identified by stakeholders as currently being implemented, "ongoing" has been identified in the table. For other actions, a timeframe of less than one year, 1 to 3 years, 3 to 5 years, 5 to 10 years, or 10 to 15 years is identified. Duration of each conservation action is also identified.

The schedule and conservation actions are subject to change based on agency priorities, resources and funding capacities, best available information, and adaptive management. As additional information is gained and/or changes in funding or agency capacity occur, priorities of the conservation actions may be adjusted and new conservation actions may be added.

5.3.1 Status of Conservation Actions

A conservation actions database has been developed as a tool for the stakeholders to more effectively manage conservation goals for the area. The database has been developed and populated with the conservation actions identified in this document. This database can be updated by each VRCMA participant as necessary, as implementation occurs or as warranted. Updates do not require alterations to the VRCMA document. Additional conservation actions can be added, ranking of conservation actions can be adjusted, and searches can be conducted on keywords.

The database contains the following fields:

- Conservation action
- Associated conservation objective
- Affected habitat type(s)
- Type of conservation action
- Calculated ranking
- Final ranking
- Biological ranking
- Feasibility ranking
- Beginning year
- Ending year
- Duration of project (months or years)
- Cost
- Notes on cost
- Implementation status
- Resulting reports/publications
- Lead agency(ies)
- Funding source
- Contact person
- Affected species
- General notes

These fields will allow the users of the database to track which conservation actions have been implemented and which are yet to be implemented. The lead agency for a particular conservation action and other variables can also be tracked through this database. The database will also be available on a VRCMA webpage.

Table 5-1 High priority actions from the stakeholders

Conservation Objective	Conservation Action	Conservation Action ID	Taxa	Lead Agency	Cost	Implementation Status	Time until Implemented	Duration
Conservation Objective 1: Promoting efforts in the VRCMA Boundary that will lead to the recovery and delisting of federally threatened and endangered species that occur or have the potential to occur in the VRCMA Boundary. Conservation Objective 2: Promoting efforts in the VRCMA Boundary that will lead to the conservation of species protected under Nevada Revised Statutes that occur or have the potential to occur in the VRCMA Boundary. Conservation Objective 3: Promoting efforts in the VRCMA Boundary that will lead to the conservation of other species not mentioned above included on the NNHP at risk and watch list species list and/or included as Covered, Evaluation, or Watch List species in the Clark County MSHCP that occur or have the potential to occur in the VRCMA Boundary.								
1, 2, and 3	Do not permit introduction of new non-native invasive species of fish or wildlife.	71	all special status species	NDOW	Under 10,000 dollars	ongoing	ongoing	multiple years
1, 2, and 3	Develop and implement Fire Management Plan, including prescribed natural fires where appropriate on undeveloped portions of the VRCMA. Identify key habitat areas potentially susceptible to fire and manage to minimize conversion; remove or manage species from key susceptible habitat areas; and provide for adaptive management responses to adverse changes. As part of the fire management plan, develop and maintain a network of shaded fuelbreaks to interrupt continuous stands of fuel. Return fire, as a historic ecological process, to the VRCMA. Maintain and improve ecosystem function and health through the management of prescribed fire and prescribed natural fire.	72	all special status species	FWS, BLM, NPS	100,000 to 500,000	ongoing	ongoing	multiple reoccurring
1, 2, and 3	Increase populations where appropriate by supplementation of individuals of threatened, endangered, and sensitive species, and species of concern, and their suitable habitat over the long term.	73	all special status species	USFWS, BLM, NPS, Clark County, NDOW, NDF	500,000 to 1 million dollars	future action	3 to 5 years - decisions whether to implement	reoccurring
1, 2, and 3	Reduce impacts on species and habitat during incident control (e.g., limit helicopter landings to previously used areas)	76	all special status species	BLM, NPS, Clark County	Under 10,000 dollars	ongoing	ongoing	reoccurring
1, 2, and 3	Develop better response time dialogue and guidelines for wildland fires with federal partners to prevent habitat loss.	77	all special status species	BLM, NPS, NDOW	Under 10,000 dollars	future action	1 to 3 years	up to a year to complete
1, 2, and 3	Identify key areas and breeding habitats where private land acquisitions and/or conservation easements shall provide benefits to special status species in the VRCMA and adjacent areas.	79	all special status species	BLM, NDOW, NPS, Clark County, USFWS, VRHCRP	Under 10,000 dollars	future action	1 to 3 years	up to a year to complete
1, 2, and 3	Use pesticides to treat exotic pests and disease outbreaks, including West Nile virus from mosquitoes, as a last resort (when threat to public safety, private property, or in extreme fire danger), or when scientific evaluations indicate a need; and use only EPA registered and approved formulations at their minimum effective rates in the least invasive method, such as single tree treatment. Inform the public and agency personnel of the potential effects of these activities on plant and wildlife populations and habitat areas; implement integrated pest management programs as warranted. Prior to use of pesticides and other chemicals, determine potential impacts to special status species and implement strategies to avoid impacts. Avoid, to the maximum extent practicable, use of pesticides and herbicides in key areas of special status species habitat when this shall have a significant adverse effect on special status species.	81	all special status species	BLM, Clark County, NPS, NDOW	500,000 to 1 million dollars	ongoing	ongoing	reoccurring
1, 2, and 3	Evaluate inventory needs regularly and coordinate on maintaining a digital inventory database. This database shall need to be created and implemented. Maintain survey data in a central database accessible to local biologists.	83	all special status species	Clark County, BLM, NDOW, NPS, USFWS, NDF, VRHCRP		future action	1 to 3 years	reoccurring
1, 2, and 3	Evaluate the need for area closures at the Overton Wildlife Management Area (OWMA) to protect nesting sites of special status bird species.	96	birds	NDOW	Under 10,000 dollars	ongoing	ongoing	less than one month
1, 2, and 3	Maintain and improve ecosystem function and health through the management of prescribed and natural fires.	98	birds	BLM, NPS, Clark County, NDOW	100,000 to 500,000	ongoing	ongoing	reoccurring
1, 2, and 3	For fuelwood management, implement the following actions. 1) Maintain woodland and conifer forest where possible for all age stands with an understory forage value at moderate or better. 2) Firewood cutting and gathering is limited to approved areas subject to restrictions developed for protection of sensitive species. 3) Allow harvest of dead and/or downed wood for BLM marked green mesquite trees for dwarf mistletoe control only in approved areas.	104	cavity nesters and raptors	BLM	Under 10,000 dollars	ongoing	ongoing	multiple years
1, 2, and 3	Avoid cutting fuelwood, or cutting trees for salvage or sanitation within 0.5 mile of active or recently active flammulated owl or goshawk nest. Trees hazardous to public safety or extreme fire danger may be removed. Insect and disease treatments may occur within this area to control epidemic outbreaks.	140	northern goshawk and flammulated owl	BLM, Clark County, NPS, NDOW	Under 10,000 dollars	future action	within 1 year	multiple years
1, 2, and 3	Maintain a healthy mix of foraging habitats for special status bat species across the VRCMA.	93	bats	BLM, NPS, NDOW	500,000 to 1 million dollars	ongoing through avoidance	ongoing	reoccurring
1, 2, and 3	Conserve important bat roosting sites in cliffs, crevices, and talus habitat.	141	pallid bat, western mastiff bat, western pipistrelle, big free-tailed bat, Brazilian free-tailed bat	BLM, NPS	100,000 to 500,000	ongoing	ongoing	up to a year to complete, reoccurring
1, 2, and 3	Prohibit destructive collecting techniques such as breaking off rock flakes and rolling cap rocks to uncover lizards.	136	lizards	NDOW	Under 10,000 dollars	future action		reoccurring
1, 2, and 3	Protect large tracts of suitable desert tortoise habitat, well dispersed throughout the range.	126	desert tortoise	BLM, NPS, USFWS, Clark County	500,000 to 1 million dollars	ongoing	ongoing	reoccurring
1, 2, and 3	Develop and implement plan to collect seed for endowment and cultivation of sensitive and rare plants	153	plants	BLM, NPS, NDF,NRCS	10,000 to 100,000 dollars	ongoing	ongoing	up to a year to complete, reoccurring
1, 2, and 3	Develop and implement a plan to inventory and map problem areas of nonnative plants, and monitor encroachment over time.	154	plants	BLM, NPS, NDF, NDOW, Clark County (MSHCP Weed Sentry, NPS Inventory, BLM Weed coordinator, 4 Rivers Cooperative Weed Management Area)	100,000 to 500,000	ongoing	ongoing	up to a year to complete, reoccurring
1, 2, and 3	Proactively protect and manage for long-term viability of all populations of rare plants on Federal lands (IMAs, LIMAs, MUMAs, and UMAs as appropriate) in the VRCMA.	163	sticky ringstem, Las Vegas bearpoppy, white bearpoppy, sticky buckwheat, threecorner milkvetch, forked buckwheat	BLM, NPS, FWS, NDF	100,000 to 500,000	ongoing	ongoing	reoccurring
1, 2, and 3	If proposed actions shall result in surface disturbance near a population of white bearpoppy, remove soil with seed source and relocate to a potential habitat site and monitor over time.	167	white bearpoppy	NDF, BLM, FWS	Under 10,000 dollars	ongoing	ongoing	less than one month, reoccurring
Conservation Objective 4: Eliminating gaps in knowledge related to life history, habitat needs, and threats for special status species that occur or have the potential to occur in the VRCMA Boundary.								

Table 5-1 High priority actions from the stakeholders

Conservation Objective	Conservation Action	Conservation Action ID	Taxa	Lead Agency	Cost	Implementation Status	Time until Implemented	Duration
4	Use remote sensing and satellite imagery to track land use and establish a baseline for non-disturbed habitat within the VRCMA.	9	all special status species		10,000 to 100,000 dollars			less than one month
4	Inventory and monitor mines and other natural and artificial habitats within the VRCMA that support, or once supported, important bat colonies and populations. Work cooperatively with interested groups to evaluate caves. The inventory process shall document all unique biological, hydrological, geological, mineralogical, paleontological, educational, scientific, cultural, and/or recreational values.	88	bats	BLM, NPS, NDOW, FWS	100,000 to 500,000 dollars	ongoing	ongoing	up to a year to complete, reoccurring
4	Monitor the effects of land management practices, human disturbances, and artificial assistance on bats within the VRCMA.	89	bats	BLM, NPS, Clark County, NDOW, FWS	10,000 to 100,000 dollars	ongoing	ongoing	up to a year to complete, reoccurring
4	Undertake genetic studies to bats related to management and conservation.	90	bats	BLM, NPS, NDOW, FWS	10,000 to 100,000 dollars	ongoing	ongoing	up to a year to complete
4	Initiate research and monitoring activities to provide information on life history population status and trend, location of key concentrations, and conservation needs of cave and mine, cliff, crevice and talus, and structure roosting bats.	91	bats	BLM, NPS, Clark County, NDOW, FWS	500,000 to 1 million dollars			up to a year to complete, reoccurring
4	Develop detailed predictive models of species distribution within the VRCMA.	134	Great Basin collared lizard, desert night lizard	NDOW, BLM, NPS	10,000 to 100,000 dollars	ongoing	ongoing	up to a year to complete, reoccurring
4	Investigate the basic ecology of obligate pollinators of target plant species to ensure complementarity of conservation recommendations and the location of protected areas, insuring the inclusion of the pollinator's full habitat and food source requirements.	146	plants	BLM, NPS, NDF, NDOW	10,000 to 100,000 dollars	partially implement due to funding limitations		less than one month, reoccurring
4	Develop a relative abundance index, a measurement of chuckwalla population repatriation, a regional chuckwalla genetic history, and its relevance to viability of local populations.	166	western chuckwalla	NDOW	10,000 to 100,000 dollars	ongoing	ongoing	multiple years
Conservation Objective 5: Offset potential effects of hunting on special status species.								
5	Develop and maintain cooperative partnerships with hunters and trappers to benefit ecosystem health.	10	all special status species	NDOW	10,000 to 100,000 dollars	ongoing	ongoing	ongoing
5	Increase awareness of law enforcement and land management staff on the potential collection of banded Gila monster, particularly in areas most accessible by collectors and suitable for the banded Gila monster	85	banded Gila monster	BLM, NPS, NDOW, FWS	Under 10,000 dollars	ongoing		up to a year to complete
5	Use population demographic data to adjust collection limits for Great Basin collared lizard, desert iguana, long-nosed leopard lizard, and desert horned lizard.	133	Great Basin collared lizard, desert iguana, long-nosed leopard lizard, desert horned lizard	NDOW, BLM	Under 10,000 dollars	ongoing	ongoing	up to a year to complete, reoccurring
Conservation Objective 6: Offset potential effects of development on special status species.								
6	Work with the utility companies to ensure that support towers and poles within the VRCMA are "raptor-safe" and have perch deterrents.	4	all raptors	BLM, NPS, NDOW	Under 10,000 dollars	ongoing for new lines and amendments to old lines	ongoing	up to a year to complete
6	Protect key nesting areas, migration routes, important prey base areas, and concentration areas for birds of prey within the VRCMA.	5	all raptors	BLM, NPS, NDOW	10,000 to 100,000 dollars	partially implemented due to funding limitations		multiple years
6	Clean all road grading equipment that is used off pavement and all portable equipment of weed and grass seed stems, stalks, etc. prior to leaving the site where the equipment is being used.	12	all special status species	BLM, NPS, NDF, NDOW, Clark County	Under 10,000 dollars	ongoing	ongoing	ongoing
6	Provide site-specific fencing and signage; retrofit existing roads and highways and design new roads and highways for safe passage of wildlife.	13	all special status species	BLM, NPS, Clark County, NDOT	100,000 to 1 million dollars	ongoing	ongoing	ongoing
6	Use weed-free, native seed mix if re-vegetation is required. No species on the state and adjacent states' noxious weed list (NV, AZ, UT, CA) shall be included in the revegetation seed mixes.	14	all special status species	BLM, NPS, Clark County, NDOT	Under 10,000 dollars	ongoing	ongoing	reoccurring
6	Use existing material sites for development within the VRCMA to the greatest extent possible. Prior to sampling/testing or excavating in material sites, a biologist shall meet on-site with the USFWS to determine avoidance areas (undisturbed habitat) and develop appropriate minimization measures.	15	all special status species	BLM, NDOT, Clark County	Under 10,000 dollars	ongoing	ongoing	ongoing
6	All surface-disturbing activities within the range of any special status species shall be conducted in a manner that reduces, as much as possible, the potential for take of individuals of a special status species on the VRCMA.	17	all special status species	BLM, NPS	10,000 to 100,000 dollars	ongoing	ongoing	ongoing
6	If lands shall be temporarily disturbed within the VRCMA, a reclamation plan shall be developed.	18	all special status species	BLM	10,000 to 100,000 dollars	ongoing	ongoing	reoccurring
6	Prior to the disposal of identified public lands, an analysis shall be conducted to determine their resource values, including the occurrence of special status species and sensitive habitats such as riparian and aquatic habitats. Land disposal shall be consistent with conservation of special status species unless there is an overriding public benefit.	19	all special status species	BLM	10,000 to 100,000 dollars	ongoing	ongoing	reoccurring
6	To the maximum extent practicable, avoid construction and maintenance projects in habitats during sensitive times, such as breeding or nesting or overwintering (e.g., near bat hibernacula, mowing of potential butterfly habitat, or in rare plant habitat).	20	all special status species	BLM	10,000 to 100,000 dollars	ongoing	ongoing	reoccurring
6	Minimize grading, blading, clearing or cutting of trees or other vegetation to accommodate vehicle access.	23	all special status species	BLM	Under 10,000 dollars	ongoing	ongoing	reoccurring
6	In construction areas where re-contouring is not required, vegetation shall be left in place wherever possible and original contour shall be maintained to avoid excessive root damage and allow for re-sprouting.	24	all special status species	BLM	Under 10,000 dollars	ongoing	ongoing	reoccurring
6	Incidences of observations of special status species and their sign during construction activities shall be conveyed to the FCR (field contract representative) and/or authorized biologist. Authorized biologists shall maintain a record of all sensitive species encountered during project surveys and monitoring.	25	all special status species	BLM, NPS	Under 10,000 dollars	ongoing	ongoing	reoccurring
6	No debris shall be left on right-of-ways (ROWs).	27	all special status species	BLM, NPS	Under 10,000 dollars	ongoing	ongoing	reoccurring
6	To the extent feasible, ensure that minimal impacts occur to resources during the planning stages for projects.	29	all special status species	BLM, NPS	Under 10,000 dollars	ongoing	ongoing	reoccurring
6	Where possible, establish erosion control in areas that present problems.	30	all special status species	BLM, NPS, NDOW, NDF, Clark County, USFWS	100,000 to 1,000,000 dollars	ongoing	ongoing	reoccurring

Table 5-1 High priority actions from the stakeholders

Conservation Objective	Conservation Action	Conservation Action ID	Taxa	Lead Agency	Cost	Implementation Status	Time until Implemented	Duration
6	Conduct pre-activity surveys for the species of concern prior to any actions that may affect them, and design projects to minimize or avoid adverse effects. Ensure that surveys are designed to take unique habitat components of the species of concern into consideration. Encourage private landowners to identify loss of habitat for species of concern and minimize impacts.	32	all special status species	BLM, NPS, Clark County	10,000 to 100,000 dollars	ongoing (BLM, NPS), future action (Clark County)	ongoing	reoccurring
6	Prohibit dumping, refuse disposal, and littering.	33	all special status species	BLM, NPS, NDOW, Clark County	10,000 to 100,000 dollars	ongoing	ongoing	reoccurring
6	Using "best management practices" as identified by the State of Nevada, minimize contributions from both point and non-point sources of pollution (including salts) resulting from public land management actions. Where applicable, proposed management actions shall comply with local, state, tribal and Federal air quality laws, regulations, and standards (Conformity; per 40 CFR 93.100 et seq.).	38	all special status species	BLM, NPS	Under 10,000 dollars	ongoing	ongoing	a one time effort, reoccurring
6	Workers shall be instructed not to drive or park vehicles where catalytic converters can ignite dry vegetation and to exhibit care when smoking in natural areas. Fire protective mats or shields shall be used during grinding or welding. Vehicles shall carry water and shovels or fire extinguishers during times of high fire hazards.	39	all special status species	BLM, NPS, NDOW, Clark County	Under 10,000 dollars	ongoing on projects on public lands, future action on private land	ongoing	a one time effort, reoccurring
6	Avoid any special status species discovered in disturbed or undisturbed habitat in proposed maintenance or construction areas, if possible. If disturbance is unavoidable, best efforts shall be made to relocate/salvage species. Relocation/salvage shall only be attempted if the species is highly likely to survive the action and it is reasonably cost effective. This shall be determined by NDOT's Environmental Services Division. Perform plant salvages and/or seed collection prior to work in undisturbed habitat and/or when special status plant species cannot be avoided, especially cactus and yucca species within the VRCMA.	40	all special status species	BLM, NPS, NDF, NDOW, Clark County	Under 10,000 dollars	ongoing	ongoing	reoccurring
6	Enhance law enforcement and ranger capabilities on federal lands.	168	all special status species	BLM, NPS, NDOW, Clark County	over 1 million dollars	future action	3 to 10 years	reoccurring
6	Increase coordination among all agencies to minimize negative effects to the species and its habitat; Federal, state, and local agencies shall address, minimize, or avoid impacts to the species in biological evaluations or environmental reviews for land use planning and action.	86	banded Gila monster	BLM, NPS, NDOW, FWS	10,000 to 100,000 dollars	ongoing	ongoing	reoccurring
6	Minimize mortality by conducting extensive surveys prior to surface disturbance; capture and relocate individuals in area of impact in accordance with NDOW protocol.	87	banded Gila monster	BLM, NPS, NDOW, FWS	10,000 to 100,000 dollars	ongoing	ongoing	less than one month, reoccurring
6	Develop and implement a bat conservation plan to protect bat roosts in mines and caves, including abandoned and orphaned mines and to monitor bats, emphasizing roost site and water source monitoring for known occurrences of bats. Multiple chapters will be created for the plan to address the following issues. Frequency and intensity of monitoring identified in the plan shall be based on species occurrence, habitat suitability, and threats. Conduct periodic monitoring for bats. The plan shall address the following protective measures: Gating or closing mines and caves to protect bat roost sites, removing important bat roost mines and caves from future additions to maps, avoiding identification of exact locations of maternity roosts, caves, and occupied mines to the general public, determining the need to close roads to mines and caves, and avoiding use of heavy equipment near mine and cave roosts. Design and install bat-friendly gates on mines and caves that prevent access by people, while allowing access by bat species. All gates on caves and mines shall be designed to provide for unrestricted access for bats. Temporary (test) gates of PVC or other light, impermanent material shall be constructed first to determine bats' reaction to gate design, prior to final design and construction of permanent gates. Fence or gate mines susceptible to human disturbance or of public safety concern. Where possible, maintain native vegetation around cave openings for a minimum distance of 100 yards within the VRCMA. Educate the public about the role of bats in the ecosystem and the importance of leaving roost sites undisturbed. Construction above or near a cave, within the VRCMA, shall be designed in a way to insure protection of the cave resources. Diversion of surface drainage into caves is prohibited. Limit caving and rock climbing to areas away from bat roosts. Protect springs and man-made water development sites, create new open water resources. Allow access to all caves only from the beginning of March through the end of May; and from the beginning of September through the end of October.	92	bats	NDOW, Nevada Department of Minerals, USFS, NPS, BLM	10,000 to 100,000 dollars	ongoing		multiple years
6	Create new open water resources for bats and other wildlife within the VRCMA.	95	bats and wildlife	NDOW	500,000 to 1 million dollars	future action		multiple years
6	Measures shall be taken to minimize take of desert tortoises due to project related activities	115	desert tortoise	FWS, BLM, NPS, Clark County	10,000 to 100,000 dollars	ongoing		reoccurring
6	Measures shall be taken to minimize take of desert tortoises from potential tortoise predators attracted to project areas.	116	desert tortoise	FWS, BLM, NPS, Clark County	10,000 to 100,000 dollars	ongoing		a one time effort, reoccurring
6	Control use of landfills and sewage ponds by desert tortoise predators. Identify and clean up unauthorized dumps. Reduce or eliminate use of authorized landfills and sewage ponds in and near the VRCMA Boundary by predators of desert tortoise (e.g., ravens & coyotes). Allow no new landfills or sewage ponds within the VRCMA Boundary.	117	desert tortoise	FWS, BLM, NPS, Clark County	10,000 to 100,000 dollars			reoccurring
6	Measures shall be taken to minimize destruction of desert tortoise habitat, such as soil compaction, erosion, or crushing of vegetation, due to project related activities.	118	desert tortoise	FWS, BLM, NPS, Clark County	10,000 to 100,000 dollars	ongoing		a one time effort, reoccurring
6	Relocate desert tortoises and chuckwallas within 1,000 feet of encounter on public lands or approved private lands if there is a direct threat to their safety/survival.	128	desert tortoise and chuckwalla - remove	BLM. FWS, NPS, NDOW	10,000 to 100,000 dollars	ongoing	ongoing	a one time effort, reoccurring
6	Identify mature pinyon-juniper areas and provide information to land managers regarding the importance of managing for and retaining mature pinyon-juniper habitats.	132	gray vireo	BLM	10,000 to 100,000 dollars			up to a year to complete, reoccurring
6	In concert with county habitat planning efforts, devise a conservation plan for the Le Conte's thrasher strategy that identifies lands and appropriate methods for protection.	135	Le Conte's thrasher	NDOW, BLM, NPS, FWS, Clark County	10,000 to 100,000 dollars	planning stages		up to a year to complete, reoccurring

Table 5-1 High priority actions from the stakeholders

Conservation Objective	Conservation Action	Conservation Action ID	Taxa	Lead Agency	Cost	Implementation Status	Time until Implemented	Duration
6	Protection measures associated with development shall include: 1) Ensure that the commercial collection of reptiles occurs within sustainable harvest parameters with no significant effect on the ecosystems in which they occur, 2) maintain sufficient areas of salt desert scrub habitat with large bush diameters, e.g., mature age classes of greasewood, quailbrush, and other large saltbush species, to provide suitable nesting substrate for Loggerhead Shrikes, 3) manage for long-term regeneration and maturation of montane shrub species 4) review habitat models and management guidelines. Update as necessary, using most recent data and findings. Conserve identified population centers where populations are productive and contributing individuals to surrounding populations. Encourage minimal pad preparation on larger residential lots and native xeric landscaping techniques after building. Encourage the maintenance of naturally vegetated corridors through residential developments.	137	loggerhead shrike	NDOW, FWS, NPS, Clark County	10,000 to 100,000 dollars	ongoing	ongoing	a one time effort, reoccurring
6	Suggest creation of new habitat in mitigation strategies when appropriate.	143	phainopepla, Lucy's warbler	Clark County, BLM, NPS	100,000 to 500,000			reoccurring
6	Ensure construction of the Mesquite Airport does not significantly impact viability on public lands.	164	three corner milkvetch and sticky buckwheat	BLM, FWS, NDF	10,000 to 100,000 dollars	ongoing	ongoing	multiple years
Conservation Objective 7: Offset potential effects of agriculture and grazing on special status species.								
7	Encourage trail use outside of biodiversity hotspots to avoid further adverse effects on rare and sensitive species. Focus recreation activities into less sensitive areas.	41	all species	BLM, NPS	Under 10,000 dollars	ongoing, with greater efforts in future	ongoing	reoccurring
7	Continue to remove exotic plants and noxious weeds within the VRCMA.	148	plants	BLM, NPS, NDF, NDOW, Clark County	500,000 to 1 million dollars	ongoing	ongoing	reoccurring
Conservation Objective 8: Offset potential effects of recreation on special status species.								
8	Use temporary closures (roads, trails, dispersed areas) to protect important seasonal habitat for species of concern (animals, plants, and insects), in coordination with appropriate state and local agencies. Consider seasonal restrictions on rock climbing in sensitive areas. Evaluate effects of rock climbing on biological resources.	44	all special status species	BLM, NPS, NDOW	100,000 to 500,000	future action, needs resources (incl. law enforcement)	when resources are available	reoccurring
8	Develop an OHV plan for the VRCMA. Coordinate with VRHCRP partners.	49	all special status species	BLM, NDOW, NPS, Clark County, USFWS, VRHCRP, NDF	10,000 to 100,000 dollars	future action	1 to 3 years	multiple years
8	Study feasibility of Green Sticker licensing for off-road vehicles in the State of Nevada, with funds earmarked to restore areas affected by OHVs and/or establish alternative recreation sites.	50	all special status species		10,000 to 100,000 dollars			multiple years
8	Adopt and implement policies to protect plant species from dispersed recreation. Protect habitat of the species of concern from dispersed recreation (e.g., heavy foot traffic, off-road vehicles, mountain bikes).	51	all special status species	BLM, NPS	10,000 to 100,000 dollars	ongoing for OHV activities	ongoing	reoccurring
8	Rehabilitate and maintain habitat quality in current wash systems.	103	California leaf-nosed bat, pallid pat, Allen's big-eared bat, California myotis, fringed myotis, western pipistrelle, Brazilian free-tailed bat	BLM, NPS	10,000 to 100,000 dollars	ongoing	ongoing	reoccurring
8	For organized, motorized events on unpaved roads or trails near active desert tortoise burrows, require special permit provisions for desert tortoise protection.	119	desert tortoise	BLM, NPS	10,000 to 100,000 dollars	ongoing	ongoing	reoccurring
8	Rock climbing within 100 yards of known active or recently active peregrine falcon nests shall be allowed only from the beginning of July through the end of January. Specific routes may be signed as necessary to inform of seasonal closures if nests are identified. Monitor peregrine nesting success to determine if the 100-yard closure is effective.	142	peregrine falcon	FWS, Clark County, NPS	10,000 to 100,000 dollars	ongoing	ongoing	reoccurring
8	Restrict mountain bikes and other mechanized non-motorized vehicles to designated trails and only allow new trails consistent with the conservation of special status species	149	plants	BLM, NPS	Under 10,000 dollars	BLM RMP and NPS GMP	ongoing	reoccurring
Conservation Objective 9: Offset potential effects of roads on special status species.								
9	Monitor and inventory all culvert/bridge crossings and tortoise fencing within assessment area and ameliorate existing or install new culverts/bridges to allow passage of terrestrial species.	1	all ground-dwelling mammals and reptiles		100,000 to 1,000,000 dollars			multiple years
9	Allow bicycle use only on established and/or designated roads and trails.	52	all special status species	BLM, NPS	Under 10,000 dollars	ongoing	ongoing	reoccurring
9	Allow motorized vehicle use only on designated roads and trails.	53	all special status species	BLM, NPS	Under 10,000 dollars	in progress/planning stages	within 1 year	reoccurring
9	Avoid designating roads and trails in washes in sensitive or key areas where an alternative exists or could be created.	54	all special status species	BLM, NPS	Under 10,000 dollars	ongoing	ongoing	reoccurring
9	Minimize new road construction associated with new utility facilities and close/rehabilitate unneeded roads after construction	55	all special status species	BLM	100,000 to 1,000,000 dollars	ongoing	ongoing	reoccurring
9	Site new highway construction to avoid key populations and habitat areas; develop appropriate construction and maintenance management programs to avoid, minimize, or mitigate effects to key populations and habitat areas.	56	all special status species	NDOT/FHWA	Under 10,000 dollars	ongoing	ongoing	ongoing
9	Implement a program to restore/rehabilitate surface disturbances for roads, trails, and other important areas for special status species focusing on the first 100 feet (or as appropriate) of 'closed' roads and trails, unnecessary roads and trails in sensitive areas, and the elimination of road and trail proliferation. Signage should be used as appropriate to facilitate road and trail closures.	57	all special status species	BLM, NPS	100,000 to 1,000,000 dollars	ongoing	ongoing	multiple years
9	Provide a biological monitor during material site sampling/exploration outside fenced areas.	60	all special status species	BLM	10,000 to 100,000 dollars	ongoing	ongoing	a one time effort, reoccurring

Table 5-1 High priority actions from the stakeholders

Conservation Objective	Conservation Action	Conservation Action ID	Taxa	Lead Agency	Cost	Implementation Status	Time until Implemented	Duration
9	Implement appropriate methods and designs to minimize erosion during construction of highways and to avoid the creation of erosive flows from highways; encourage construction of pollution control devices, such as oil sand separators, drop inlets, and stormwater treatment systems. Modify highway maintenance practices to minimize damage to wildlife and flora by restricting maintenance activities to NDOT right-of-ways (ROWs), conducting pre-activity surveys for biological resources, avoiding or relocating individuals or habitat as necessary, and avoiding maintenance activity during sensitive times.	61	all special status species	NDOT	100,000 to 500,000	ongoing	ongoing	a one time effort, reoccurring
9	GPS all roads according to the 1998 BLM Resource Management Plan. Roads created after the inventory is complete should be closed and rehabilitated as well as all redundant roads.	63	all special status species	BLM	10,000 to 100,000 dollars	completed		completed
9	Avoid further right-of-ways (ROWs) within the VRCMA when feasible.	64	all special status species		10,000 to 100,000 dollars			reoccurring
9	Identify the extent of collecting along roadways, and possible impacts of habitat modification resulting from unethical collecting practices.	105	chuckwalla	NPS, FWS, NDOW	10,000 to 100,000 dollars	ongoing	ongoing	multiple years
9	Do not allow OHV speed events, mountain bike races, horse endurance rides, four-wheel drive hill climbs, mini events, publicity rides, high speed testing, and other similar speed based events within tortoise habitat.	120	desert tortoise	BLM, NPS	Under 10,000 dollars	ongoing	ongoing	reoccurring
9	The following actions shall be implemented to control vehicular access: Fence or otherwise establish effective barriers to tortoises along heavily-traveled roads; install culverts that allow underpass of tortoises to alleviate habitat fragmentation.	121	desert tortoise	BLM, NPS	500,000 to 1 million dollars	ongoing	ongoing	multiple years
9	Conduct biological surveys prior to road maintenance and retrofit activities.	156	plants, reptiles	BLM, NPS, NDF, NDOW, Clark County, NDOT	10,000 to 100,000 dollars	ongoing	ongoing	one time event, reoccurring
Conservation Objective 10: Offset potential effects of mining on special status species.								
10	Where feasible, proposals for saleable materials in essential habitats for special status species shall be avoided.	65	all special status species	BLM	Under 10,000 dollars	ongoing	ongoing	a one time effort, reoccurring
10	Site leasable/saleable mineral development and mining away from key populations or habitat areas to the extent feasible; provide measures to avoid, minimize, or mitigate effects of these activities.	66	all special status species	BLM	Under 10,000 dollars			reoccurring
10	Develop and implement programs to successfully revegetate, with native vegetation, disturbed areas impacted by past surface disturbing activities.	67	all special status species	BLM	100,000 to 500,000	ongoing	ongoing	reoccurring
10	The tortoise-proof fence shall be removed at completion of the operation. Surfaces shall be recontoured to maintain positive drainage, and slopes shall not exceed a horizontal/vertical ratio of 2:1 unless natural slope exceeded that ratio. Any remaining stockpiles shall be graded, and compacted areas shall be ripped. Prior to closure of the pit, a vegetative rehabilitation plan shall be developed by the project proponent. Vegetation rehabilitation actions shall be done during the time of year with the most potential for success, within 1 year of project completion. Recovery includes recontouring to natural contours and reestablishing native plant species within the disturbed sites either through seeding or transplant of seedlings. The rehabilitation plan shall also describe in detail how the evaluation shall be made for determining the success of the rehabilitation effort.	68	all special status species	BLM	Under 10,000 dollars	future action	10 to 15 years when the pits have been fully mined	reoccurring
10	Site toxic ponds associated with mining activities away from key populations or habitat areas; provide measures to discourage wildlife from using ponds (fencing, cover) as required by state law.	99	birds and reptiles	BLM	Under 10,000 dollars	ongoing	ongoing	reoccurring
10	Measures shall be implemented to educate project personnel on the desert tortoise to eliminate or minimize potential impacts to desert tortoise and its habitat.	124	desert tortoise	BLM	10,000 to 100,000 dollars	ongoing where appropriate per the mining plan of operation or lease	ongoing	reoccurring
10	The mining operator shall attach a tortoise-proof fence to the existing chain-link fence surrounding the mill-site site and maintain at zero ground clearance.	129	desert tortoise, desert pocket mouse, all reptiles	BLM	Under 10,000 dollars	ongoing where appropriate	ongoing	reoccurring
10	The tortoise-proof fence shall be monitored at least quarterly, particularly following precipitation, and maintained for the life of the project. Monitoring and maintenance shall include regular removal of trash and sediment accumulation and restoration of zero clearance between the ground and the bottom of the fence.	185	desert tortoise, desert pocket mouse, all reptiles	BLM	Under 10,000 dollars	ongoing	ongoing	reoccurring
10	Ensure gypsum mining shall not significantly impact rare plants	162	sticky ringstem	BLM	10,000 to 100,000 dollars	ongoing	ongoing	reoccurring

Table 5-2 Medium priority actions from the stakeholders

Conservation Objective	Conservation Action	Conservation Action ID	Taxa	Lead Agency	Cost	Implementation Status	Time until Implemented	Duration
Conservation Objective 1: Promoting efforts in the VRCMA Boundary that will lead to the recovery and delisting of federally threatened and endangered species that occur or have the potential to occur in the VRCMA Boundary. Conservation Objective 2: Promoting efforts in the VRCMA Boundary that will lead to the conservation of species protected under Nevada Revised Statutes that occur or have the potential to occur in the VRCMA Boundary. Conservation Objective 3: Promoting efforts in the VRCMA Boundary that will lead to the conservation of other species not mentioned above included on the NNHP at risk and watch list species list and/or included as Covered, Evaluation, or Watch List species in the Clark County MSHCP that occur or have the potential to occur in the VRCMA Boundary.								
1, 2, and 3	Protect and improve sensitive habitat such as nesting areas and migration routes.	74	all special status species	BLM, NPS, Clark County, NDOW	100,000 to 500,000	ongoing	ongoing	reoccurring
1, 2, and 3	Use U.S. Department of Agriculture (USDA) Nevada Animal Damage Control Program and/or Clark County Animal Control Program to monitor and aid in control of feral cats and dogs, brown-headed cowbirds, ravens, and other predator species that may affect the special status species.	75	all special status species	BLM, NDOW, NPS, Clark County, USFWS	100,000 to 500,000	future action	5 to 10 years	reoccurring
1, 2, and 3	Utilize and refine current wildlife predictive habitat methodologies (i.e., SWREGAP) to identify important overlaps or 'biodiversity hotspots' of wildlife species assemblages.	80	all special status species	Clark County, BLM, NDOW, NPS, USFWS	100,000 to 500,000	ongoing	ongoing	up to a year to complete
1, 2, and 3	Develop a consolidated database of all water sources.	94	bats and all special status species	VRHCRP	Under 10,000 dollars	ongoing	ongoing	up to a year to complete
1, 2, and 3	Model habitat use and habitat quality indicators for selected species. Evaluate Breeding Bird Atlas data for distribution and occurrence.	97	birds		10,000 to 100,000 dollars			up to a year to complete
1, 2, and 3	Conduct landscape analysis that delineates and classifies key foraging areas associated with the top priority sites. Promote the maintenance of Prairie Falcon habitat at a landscape scale.	157	prairie falcon	NDOW, BLM	100,000 to 500,000	ongoing	ongoing	less than one month, reoccurring
1, 2, and 3	Implement the following protective measures for the western bluebird: 1) Preserve existing old growth forest remnants. 2) Connect existing old-growth tracts by treating second-growth corridors to break self-perpetuating even-aged stand characteristics. 3) Promote timber harvest strategies that leave larger, older trees in an open-canopied array. 4) Leave snags for cavity provision. 5) Thin second-growth stands with high stem densities "from the bottom up" where they occur adjacent to meadows; that is, thin smaller-diameter trees and leave well-spaced, larger-diameter trees, opening up a park-like interface with meadows.	165	western bluebird	NDOW, BLM	10,000 to 100,000 dollars	ongoing	ongoing	multiple years
Conservation Objective 4: Eliminating gaps in knowledge related to life history, habitat needs, and threats for special status species that occur or have the potential to occur in the VRCMA Boundary.								
4	Incorporate winter raptor surveys into Audubon Society winter field trips. Recruit volunteers to conduct periodic winter raptor surveys, both on established and new routes wherever needed.	2	all raptors	BLM, NPS, NDOW	No cost handled internal agency budgets	ongoing	ongoing	a one time effort, reoccurring
4	Implement comprehensive monitoring program for all special status species in the VRCMA. An inventory of rare flora and fauna shall be completed regularly within the VRCMA, with occurrence records submitted to the NNHP and the VRCMA database. Coordinate survey efforts between agencies. Provide protocols, training, and survey tapes to all affected agency biologists and interested biological consultants.	7	all special status species	Clark County, BLM, NDOW, NPS, USFWS, NDF, VRHCRP	100,000 to 500,000	future action	3 to 5 years	reoccurring
4	Inventory desert pocket mouse and complete genetic studies.	107	desert pocket mouse	NPS, FWS, NDOW, Clark County	10,000 to 100,000 dollars	ongoing	ongoing	multiple years
4	Research sources of mortality and their representation of the total mortality, including human, natural predation, diminishment of required resources, etc. within the VRCMA to better mitigate against tortoise deaths.	108	desert tortoise	BLM, NPS, Clark County, NDOW, FWS	10,000 to 100,000 dollars	ongoing	ongoing	up to a year to complete
4	Conduct long-term research on the nutritional and physiological ecology of various age-size classes of desert tortoises throughout the VRCMA.	109	desert tortoise	BLM, NPS, Clark County, NDOW, FWS	100,000 to 500,000	ongoing	ongoing	multiple years
4	Develop long-term hypothesis-based studies targeting management issues for recovery of desert tortoise populations.	110	desert tortoise	BLM, NPS, Clark County, NDOW, FWS	100,000 to 500,000	ongoing	ongoing	multiple years
4	Conduct appropriately designed, long-term research on the impacts of grazing, road density, barriers, human-use levels, restoration, augmentation, and translocation on desert tortoise population dynamics within the VRCMA.	111	desert tortoise	BLM, NPS, Clark County, NDOW, FWS	500,000 to 1 million dollars	ongoing	ongoing	multiple years
4	Develop a comprehensive model of desert tortoise demography within the VRCMA. Such a model shall be based on at least 25 years of data. This time span represents one desert tortoise generation and is necessary to capture the effects of normal environmental variability on desert tortoise survival and reproduction. Research shall be done in both high- and low-density areas.	112	desert tortoise	BLM, NPS, Clark County, NDOW, FWS	500,000 to 1 million dollars	ongoing	ongoing	multiple years
4	Fund research to determine minimum viable population sizes in various habitat types, nutritional forage quantity and quality needs, the juvenile niche, nest microhabitat requirements, temperature-dependent sex determination as determined by field nest temperature cycles, mating systems in nature, and genetics.	113	desert tortoise	BLM, NPS, Clark County, NDOW, FWS	500,000 to 1 million dollars	ongoing	ongoing	multiple years
4	Coordinate with the DRTO on research necessary to monitor and guide recovery efforts.	114	desert tortoise	BLM, NPS, Clark County, NDOW, FWS	100,000 to 500,000	ongoing	ongoing	multiple years
Conservation Objective 5: Offset potential effects of hunting on special status species.								
5	Analyze the impact on falconry collection on populations.	3	all raptors	NDOW, FWS	10,000 to 100,000 dollars	new, not active		up to a year to complete
5	Inform recreational shooters of conservation impacts of indiscriminate shooting.	11	all special status species	BLM	10,000 to 100,000 dollars	future action	3 to 5 years	reoccurring
5	Regulate illegal trapping, collection (other than for scientific research), or harassment of any wildlife.	84	all wildlife	NDOW	10,000 to 100,000 dollars			reoccurring
Conservation Objective 6: Offset potential effects of development on special status species.								
6	Site new power lines in consolidated utility corridors adjacent to existing facilities; retrofit existing lines where appropriate.	16	all special status species	Clark County, BLM (if sited on public land)	Under 10,000 dollars	ongoing	ongoing	up to a year to complete, reoccurring
6	Limit impacts of new administrative facilities on natural and heritage resources, and visual quality.	26	all special status species	Clark County, BLM, NPS	Under 10,000 dollars	ongoing (BLM, NPS), unknown implementation (Clark County)	ongoing	reoccurring
6	Site new facilities away from key populations and habitat areas; provide measures to avoid, minimize, or mitigate effects of these activities; provide protection for populations and habitat areas not affected by existing facilities.	28	all special status species	BLM	Under 10,000 dollars	ongoing	ongoing	reoccurring

Table 5-2 Medium priority actions from the stakeholders

Conservation Objective	Conservation Action	Conservation Action ID	Taxa	Lead Agency	Cost	Implementation Status	Time until Implemented	Duration
6	Implement a public outreach program to inform the public about species, habitat and ecosystem conservation needs and values for the Virgin River CMA area. Clark County MSHCP and participating agencies shall provide informational materials to inform the public about species and ecosystem conservation needs for habitat and species conservation, as well as the value of these ecosystems. Establish environmental education programs and facilities. Develop a series of environmental education programs (slide presentations, display boards, etc.), for presentation to schools, user groups, town board meetings, and other community events. Individual programs shall highlight biodiversity, sensitive ecological resources, endemic plants, and sensitive bats. Ensure that materials are available for use by other agencies and teachers. Develop a public information campaign aimed at highlighting the unique qualities of Joshua tree habitat and the interesting organisms, of which Scott's Oriole is one, that inhabit it. Foster public interest in preserving Joshua tree habitat.	31	all special status species	BLM, NPS, NDOW, NDF, Clark County, USFWS	10,000 to 100,000 dollars	future action	3 to 10 years/5 to 10 years	multiple years
6	Resource management agencies shall ensure that restoration activities shall occur based on prior agreements.	34	all special status species	BLM, NPS, NDOW, Clark County, USFWS, NDF	10,000 to 100,000 dollars	ongoing	ongoing	reoccurring
6	Maintain air quality at a level that is adequate for the protection and use of resources (Air Quality Related Values) and that meets or exceeds air quality standards.	36	all special status species	Clark County, EPA and NDEP (non partners)	100,000 to 500,000	ongoing	ongoing	reoccurring
6	Inform the public of potential impacts of domestic animals on native species	37	all special status species	Clark County	10,000 to 100,000 dollars	future action	3 to 10 years	up to a year to complete, reoccurring
6	Work with developers in urban and suburban areas to preserve open space within developments for burrowing owl use.	100	burrowing owl	BLM, NPS, Clark County, NDOW, FWS	100,000 to 500,000	ongoing	ongoing	multiple years
6	In suitable habitats on the urban interface or as a temporary population-saving measure, increase nesting opportunities for Lucy's Warbler and other cavity-nesting birds using mesquite habitats.	138	Lucy's warbler	NDOW	10,000 to 100,000 dollars	ongoing	ongoing	multiple years
6	Protective measures for prairie falcon are: 1) Highlight the uniqueness of Nevada's Prairie Falcon resource through media profiles, bulletins, etc. 2) Promote the importance of Nevada to the maintenance of the world's Prairie Falcon population, its ecology, habitat needs, and its value as a predator of agricultural pests. 3) Minimize human disturbances around nest sites during the nesting period where impacts on productivity have been identified. 4) Pursue special land designation for top priority sites i.e. "Areas of Critical Environmental Concern," "Research Natural Area," etc. 5) Where nest sites are likely to be significantly disturbed by project activities, mitigate for seasonal work restrictions after surveys have determined the site to be active.	158	prairie falcon	NDOW, BLM	10,000 to 100,000 dollars	ongoing	ongoing	multiple years
6	All new administrative facilities shall use drought tolerant landscaping with an emphasis on native species.	147	plants	BLM, NPS, NDF, NDOW, Clark County	100,000 to 500,000	ongoing	ongoing	reoccurring
6	Wherever possible, select only locally native species for restoration, and where appropriate, use seed from the plant species of concern and endemic butterfly host plants.	155	plants	BLM, NPS, NDF, NDOW	10,000 to 100,000 dollars	ongoing	ongoing	up to a year to complete, reoccurring
Conservation Objective 8: Offset potential effects of recreation on special status species.								
8	Work with climbing and caving groups and hold outreach meetings emphasizing species conservation, identifying protective measures, and specifying surveys for the species of concern prior to establishment of new climbing or caving opportunities. The information derived from these programs shall assist in determining future management actions for species protection. Identify additional special interest groups and develop memoranda of understanding.	42	all special status species	NDOW	10,000 to 100,000 dollars	future action		reoccurring
8	Develop new relationships/partnerships and strengthen existing efforts with user groups, including hunters, trappers, rock climbers, cavers, trail users, summer home and special use permittees, and American Indians, to help manage the VRCMA and protect resources.	43	all special status species	BLM, NPS, NDOW, USFWS, NDF, Clark County	10,000 to 100,000 dollars	future action	5 to 10 years	reoccurring
8	Develop and implement a recreation monitoring strategy involving trail counters. This strategy shall include development of methods resulting in collection of data to assess recreation trends and effects on the species of concern and ecological resources. Monitor traffic volume on road and trails near sensitive resources as appropriate.	46	all special status species	BLM, NDOW, NPS, Clark County	10,000 to 100,000 dollars	future action	5 to 10 years	up to a year to complete, reoccurring
8	Focus new recreation development (campgrounds, picnic areas, and other facilities), in the least sensitive areas at lower elevations, to lessen visitor impacts on the species of concern and other sensitive ecological resources. Focus recreation activities (OHV activity, mountain bikes, and heavy foot traffic) into less sensitive areas to protect habitat of the species of concern.	47	all special status species	BLM	10,000 to 100,000 dollars	future action	5 to 10 years	reoccurring
8	Enhance developed sites where feasible to restore resource or wildlife values where recreation use has adversely affected resources.	48	all special status species	Clark County, NPS	100,000 to 500,000	future action	5 to 10 years - with R&PP leases	reoccurring
8	Mitigate loss of burrowing owl nest sites by constructing artificial burrows in suitable alternative habitat with attendant site protection.	101	burrowing owl	BLM, NPS, Clark County, NDOW. FWS	10,000 to 100,000 dollars	ongoing	ongoing	a one time effort, reoccurring
8	Monitor and quantify the impacts of off-road vehicle recreation on burrowing owl habitats, particularly centers of breeding concentration. Mitigate impacts by adjustment of sanctioned event routes, closure of casual use in burrowing owl breeding centers, education of off-road vehicle enthusiasts and consensus planning involving off-road vehicle advocacy groups.	102	burrowing owl	BLM, NPS, Clark County, NDOW, FWS	10,000 to 100,000 dollars	ongoing	ongoing	multiple years
Conservation Objective 9: Offset potential effects of roads on special status species.								
9	Ensure new roadside structures are designed and constructed to prevent animals from becoming trapped. Encourage retrofitting existing structures that pose a trapping problem.	6	all reptiles, Pacific tree frog, desert pocket mouse	NDOW, USFWS, BLM, NDOT, Clark County	10,000 to 100,000 dollars	ongoing	ongoing	reoccurring
9	Manage designated and informal use (unnumbered) trails that are causing resource damage to reduce damage and restrict use to a single trail.	58	all special status species	BLM, NPS	Under 10,000 dollars	ongoing	ongoing	reoccurring
9	Ensure that roads are engineered to adequately spread runoff to minimize erosion from an ecosystem perspective.	59	all special status species	NDOT/FHWA, BLM, NPS, Clark County (Public Works)	10,000 to 100,000 dollars	future action	3 to 5 years	reoccurring
9	Maintain roads to a standard necessary for public safety and as needed to respond to resource management objectives, including resource protection and recreation, through maintenance of road surfaces and minimizing erosion.	62	all special status species	BLM	100,000 to 500,000	ongoing (75 miles per year for BLM)	ongoing	reoccurring

Table 5-2 Medium priority actions from the stakeholders

Conservation Objective	Conservation Action	Conservation Action ID	Taxa	Lead Agency	Cost	Implementation Status	Time until Implemented	Duration
9	Minimize and avoid impacts to rock outcrops, lava flows, and surrounding areas. If these areas cannot be avoided and must be disturbed, clearance surveys by NDOT biologists or NDOT approved biological consultants for chuckwalla and banded Gila monster must be conducted prior to maintenance or construction activities.	106	chuckwalla, banded Gila monster	NDOT, NDOW	10,000 to 100,000 dollars	ongoing	ongoing	reoccurring
9	Ensure that road maintenance activities (e.g., shoulder work, road salting) do not adversely affect native species.	152	plants	BLM, NPS, NDF, NDOW, Clark County, NDOT	10,000 to 100,000 dollars	ongoing	ongoing	reoccurring
Conservation Objective 10: Offset potential effects of mining on special status species.								
10	When constructed high walls are not available or feasible to maintain, identify alternate natural cliffs for pothole construction.	159	prairie falcon	BLM, NDOW	10,000 to 100,000 dollars	future action		reoccurring on a periodic basis
10	Develop a partnership between conservationists, mining companies, and federal land management agencies to solve the conflicts of alternate nesting habitat creation and establish nest site mitigation as standard operating procedure for mining proposals and activities.	160	prairie falcon	BLM	100,000 to 500,000	future action	5 to 10 years	multiple years

Table 5-3 Low priority actions from the stakeholders

Conservation Objective	Conservation Action	Conservation Action ID	Taxa	Lead Agency	Cost	Implementation Status	Time until Implemented	Duration
Conservation Objective 1: Promoting efforts in the VRCMA Boundary that will lead to the recovery and delisting of federally threatened and endangered species that occur or have the potential to occur in the VRCMA Boundary. Conservation Objective 2: Promoting efforts in the VRCMA Boundary that will lead to the conservation of species protected under Nevada Revised Statutes that occur or have the potential to occur in the VRCMA Boundary. Conservation Objective 3: Promoting efforts in the VRCMA Boundary that will lead to the conservation of other species not mentioned above included on the NNHP at risk and watch list species list and/or included as Covered, Evaluation, or Watch List species in the Clark County MSHCP that occur or have the potential to occur in the VRCMA Boundary.								
1, 2, and 3	Conduct a general wildlife inventory of mammals, reptiles, and birds in the Virgin Mountains.	78	all special status species	NDOW	100,000 to 500,000	future action		multiple years
1, 2, and 3	Organize interagency transfer workshops to develop modes of communication and disseminate information among land management agencies.	82	all special status species	BLM, Clark County, NPS, NDOW, VRHCRP	10,000 to 100,000 dollars	future action	3 to 5 years	multiple years
1, 2, and 3	Protection measures for pinyon jay shall include: 1) Chainings and prescribed burns shall leave adequate stands of mature, cone-bearing trees adjacent to any treatment area and 2) The cutting of mature live trees shall be discouraged in fuel wood harvest activities.	145	pinyon jay		500,000 to 1 million dollars			multiple years
1, 2, and 3	Maintain native sagebrush habitats with high shrub vigor, horizontal shrub patchiness, and an open understory of native bunchgrasses and forbs.	170	Brewer's sparrow					reoccurring
1, 2, and 3	Design Brewer's sparrow population objectives into sagebrush restoration projects.	171	Brewer's sparrow					one time event, reoccurring
1, 2, and 3	Research needs for Brewer's sparrow include: 1) extent of breeding in the Mojave habitat type, as well as the salt desert scrub type in the Great Basin, 2) determine the possibility of multiple breeding seasons (one of each major habitat type), 3) effects of grazing regimes greatly needed given the complex interactions of resulting changes to plan composition and densities and changes in fire cycles, 4) response to prescribed burn patterns, 5) understanding of minimum patch sizes, fragmentation effects, spatial juxtaposition of habitat patches and other aspects of landscape ecology needed, 6) studies of extent, brood parasitism, and indirect impacts of herbicides and pesticides typically used in sagebrush steppe ranges, and 7) research life history and ecology during migration and wintering .	173	Brewer's sparrow					multiple years
1, 2, and 3	Develop conservation and restoration strategies for montane shrub communities.	175	black-chinned sparrow					reoccurring
1, 2, and 3	Conserve isolated populations based upon soils analysis and genetic analysis.	179	desert kangaroo rat					
Conservation Objective 4: Eliminating gaps in knowledge related to life history, habitat needs, and threats for special status species that occur or have the potential to occur in the VRCMA Boundary.								
4	Continue NDOW annual aerial surveys.	169	bighorn sheep	NDOW		ongoing	ongoing	reoccurring
4	Inventory pinyon stands by age class in the five priority areas.	144	pinyon jay		10,000 to 100,000 dollars			less than one month
4	Monitor results of other conservation actions and track population changes.	172	Brewer's sparrow					reoccurring
4	Monitor the black-chinned sparrow via the Nevada bird count.	174	black-chinned sparrow			ongoing	ongoing	reoccurring
4	Research needs include: 1) habitat ecology at local and landscape scales, including successional and fire regime relations, and area requirements; 2) causes of mortality; 3) responses to grazing; 4) impacts of OHV use on habitats; 5) habitat mitigation strategies; 6) causes of population declines; 7) factors affecting food availability, nest success, and survivorship unknown; 8) brood parasitism (three records known; Tenney 1997); 9) predators; and virtually all aspects of its biology and ecology need further study, including details of habitat associations and habitat ecology, nest site selection, site fidelity, territory, juvenile dispersal, migration routes and winter distribution, quantitative study of diet and metabolism, social behavior, predation, susceptibility to brood parasitism, life span and survivorship, causes of mortality, response to climatic changes.	176	black-chinned sparrow					
4	Research needs for the desert kangaroo rat include: 1) a better understanding of population connectivity and potential effects of fragmentation and 2) as a component of this effort, genetic analysis of known populations to determine degree of population isolation.	177	desert kangaroo rat					
4	Conduct a landscape-scale soils analysis that shall indicate degree or potential for inter-population connectivity.	178	desert kangaroo rat					
4	Research needs for Merriam's shrew include the impacts of cattle grazing on its distribution and abundance.	180	Merriam's shrew					
4	Implement Merriam's shrew inventory.	181	Merriam's shrew					
4	Develop a trend monitoring framework to track population status.	182	kit fox					
4	Research needs include: landscape analysis of potential habitat using soil maps	183	kit fox					
4	Based on expert consensus, project the number of potential habitats. Inventory identified sites and develop map of occupied habitats.	184	kit fox					
Conservation Objective 6: Offset potential effects of development on special status species.								
6	Cooperate with local agencies in developing a backyard habitat program.	21	all special status species	Clark County, NDOW, USFWS	Under 10,000 dollars	future action - already established	5 to 10 years	multiple years
6	Actions during development shall include 1) Avoid habitat conversion of any kind inside a 1.6 km radius buffer zone around any documented Ferruginous Hawk nest site, 2)Curtail wood-cutting activities in occupied Ferruginous Hawk nest territories during April, 3) Increase periodic patrol of occupied nest territories, particularly during the near-fledging stage, 4) When planning pinyon-juniper removal by chaining or prescribed fire, keep intact the naturally-occurring woodland edge where isolated, mature Utah junipers might provide nest sites.	130	ferruginous hawk, western bluebird	BLM	500,000 to 1 million dollars			a one time effort, reoccurring
6	Incorporate flammulated owl management recommendations into pertinent land management plans.	131	flammulated owl	BLM	500,000 to 1 million dollars			a one time effort, reoccurring
6	Take measures to protect northern goshawk during development including: 1) Manage northern goshawk territories at the landscape level, providing within territories suitable nesting sites as well as replacement stands where aspen regeneration has been initiated through prescribed fire and other methods, 2) Occupancy surveys shall be conducted prior to any land use projects designed to significantly alter the habitat or capable of producing significant levels of disturbance to a nesting pair within known or potential territories, 3) Recommend the observance of "no disturbance" buffer zones around and including active nesting territories during the nesting season, 4) Review action plan proposals in coniferous forest habitat and provide recommendations for the avoidance and/or mitigation of impacts to Northern Goshawk nesting and productivity, 5)	139	northern goshawk		100,000 to 500,000			multiple years

Table 5-3 Low priority actions from the stakeholders

Conservation Objective	Conservation Action	Conservation Action ID	Taxa	Lead Agency	Cost	Implementation Status	Time until Implemented	Duration
6	Ensure that long term viability of low elevation rare plants is not significantly impacted by rural development and sprawl.	161	sticky ringstem		100,000 to 500,000			ongoing
Conservation Objective 8: Offset potential effects of recreation on special status species.								
8	Develop and implement a climbing "self registration" process that encourages development of new routes away from ecologically sensitive areas.	45	all special status species	BLM, NPS, NDOW	10,000 to 100,000 dollars	future action	10 to 15 years	less than one month, reoccurring
8	When maintaining trail switch-backs, minimize ground disturbance to protect rare plants.	150	plants	BLM, NPS	Under 10,000 dollars	not active		a one time effort, reoccurring
8	Develop and distribute information to equestrians on the importance of using pelletized feed and develop and distribute a weed-free feed policy for equestrians on public lands in the VRCMA boundary.	151	plants	BLM, NPS	10,000 to 100,000 dollars	permit based equestrian events only		reoccurring

This ACCESS-based database allows the user to sort through conservation actions according to affected species or groups of species, land management activity, conservation objectives, or other fields identified above. Thus, this database will be dynamic and can serve as a mechanism for the sharing of information within an individual organization and among the stakeholders. Report templates have been established that allow for generation of an updated, printable report of all conservation actions, as needed.

5.4 IMPLEMENTATION COORDINATION AND PROCESS

The successful coordination and implementation of priority conservation measures for the VRCMA will be guided by two important elements: 1) existing resource management coordination efforts within the Lower Virgin River Watershed, and 2) the adaptive management concept.

5.4.1 Virgin River Basin Resource Management Coordination Context

For decades efforts have been underway along the Virgin River to address species conservation and protection concerns for the endangered fish (woundfin and Virgin River chub) and riparian bird (southwestern willow flycatcher, Yuma clapper rail) species utilizing the Lower Virgin River and its floodplain. The Lower Virgin River Recovery Implementation Team and other agencies and organizations have been at work to implement conservation and restoration activities along the Lower Virgin River. In the Upper Virgin River in Utah, the Virgin River Resource Management and Recovery Program, a recovery action program, was established in 1999.

In 2001, the USFWS approved the Clark County MSHCP (CCMSHCP) and associated Section 10 Incidental Take Permit for 78 covered species. The CCMSHCP is a comprehensive, long-term habitat conservation plan for the covered species listed in the Section 10 permit. Many of the 78 species addressed by the CCMSHCP occur within the Virgin River area. As such, permit condition J(2)(b) for the take permit requires the permittees to participate in development of a conservation management plan for the Virgin River riparian habitat. The CCMSHCP currently covers the City of Mesquite for take of species covered by the CCMSHCP, however, there are species that occur along the Virgin River that require incidental take and are not covered by the CCMSHCP. This prompted the City of Mesquite to move forward with the development of an HCP to cover those species, (Virgin River chub, woundfin, Yuma clapper rail, southwestern willow flycatcher and yellow-billed cuckoo).

Furthermore, in 2004, the Virgin River Habitat Conservation and Recovery Program (VRHCRP) was formed as a combination of the Virgin River Resource Management and Recovery Program and the Virgin River HCP being prepared by the City of Mesquite to implement conservation measures and recovery actions within the 100-year floodplain of the Lower Virgin River.

Additionally, on May 15, 2007, Clark County signed a MOA by and between the USFWS, BLM, NPS, NDOW, the City of Mesquite, VVWD, and SNWA that refined the framework for the development, determination of roles and responsibilities, participation in and implementation of the multi-party VRHCRP. The VRHCRP is being designed to merge the multiple efforts to protect listed species and their habitat, as well as conservation and management efforts for non-listed species and their respective habitat, in and along the Virgin River, into a single collaborative process to maximize the protections afforded the species and habitat by making the most efficient use of the time and resources of the signatories to the MOA.

The MOA also modified the boundary for consideration in the conservation management plan provision J(2)(b) of the Clark County MSHCP take permit which was under contract at the time of the signing of the MOA. The boundary for inclusion in the CMP was changed from the Virgin River riparian habitat to the adjacent or associated upland areas of the Virgin River watershed beyond the 100-year floodplain or riparian area and named the document a VRCMA. Although the VRCMA does not include the potential imperiled aquatic and riparian Virgin River species, species description were prepared for them are are located in Appendix E.

The signatories agreed to cooperate in coordinating the VRCMA with the VRHCRP. The VRCMA has since been designed to provide information to the VRHCRP. The goals of the VRHCRP are to identify, plan, coordinate and/or assist in implementing avoidance, minimization, mitigation or conservation activities to contribute to the long-term recovery and conservation of listed and non-listed species and their habitats in the Virgin River watershed. This will be accomplished for each species or group of species in the order of priority outlined below.

i. Virgin River listed species, including the woundfin, Virgin River chub, southwestern willow flycatcher, yellow-billed cuckoo, and Yuma clapper rail.

ii. Virgin River riparian-dependent species proposed for coverage under the CCMSHCP.

iii. Other species and resources in the Virgin River watershed identified as appropriate for inclusion in the VRHCRP by the Executive Committee, including Species of Conservation Priority identified by the State of Nevada.

In contrast, the VRCMA is a non-regulatory conservation management plan that provides assessment information useful for the VRHCRP and other management actions for the surrounding upland areas.

5.4.2 Adaptive Management Context

The primary reason for using an adaptive management approach is to allow for changes in the conservation strategies that may be necessary to reach long-term goals of the conservation management assessment and to ensure the likelihood of survival and recovery of the species in the wild (USFWS and NMFS 1996). Often, gaps in the scientific literature exist with respect to biological requirements of imperiled species, which can result in a level of uncertainty in the effectiveness of proposed conservation measures. Monitoring conservation measures can confirm whether they are effective in protecting species. If monitoring indicates that conservation measures are inadequate for protecting species, conservation measures can be tailored to provide more effective protection and/or new conservation measures can be implemented. Therefore, incorporating adaptive management concepts into this VRCMA can assist in minimizing the level of uncertainty associated with effectiveness of conservation measures. For this reason, an Adaptive Management Program has been developed and is described in Section 5.7.

5.5 ROLES AND RESPONSIBILITIES FOR VRCMA PARTICIPANTS

5.5.1 Stakeholders

The stakeholders participating in the VRCMA (Clark County, USFWS, BLM, NPS, NDF, and NDOW) will have the following roles and responsibilities in the VRCMA:

- Update the VRCMA Conservation Actions Database as appropriate over the 20-year anticipated life of the assessment,
- Where possible, incorporate identified conservation actions into the agency planning processes as appropriate,
- Attend future meetings regarding the VRCMA and implementation of associated conservation actions, and
- Fund and implement conservation actions as appropriate.

5.6 MONITORING

Monitoring tracks compliance with species conservation commitments and provides information for making adaptive management decisions. Three general categories of monitoring have been identified for the VRCMA: 1) compliance monitoring which tracks compliance with the species conservation commitments of the VRCMA; 2) conservation measures (action) effectiveness monitoring which tracks the progress of the conservation actions in meeting the VRCMA species goals and objectives; and 3) species surveys and biological trend monitoring within the Virgin River Basin.

Monitoring is the most important tool when using an adaptive management approach and should be designed such that data are properly collected, analyzed, and used to adjust conservation strategies, as appropriate. Monitoring programs for the VRCMA should provide the information necessary to assess compliance and project impacts, and verify progress toward the biological goals and objectives in the VRCMA. Monitoring also provides the scientific data necessary to evaluate the success of the conservation actions.

For each conservation action, the implementing stakeholder(s) would establish one or more units of measurement to evaluate success of the action, termed “performance metrics.” Some of these metrics are derived from compliance monitoring, while others are derived from effectiveness and trend monitoring.

- **Compliance Monitoring.** Asks the question, are the avoidance and/or minimization measures being implemented properly? For these, the performance metric will be a numeric tally or straightforward “yes” or “no” observations; i.e., “yes” it is being implemented properly, or “no” it is not.
- **Effectiveness Monitoring.** Questions whether the mitigation action is effective at achieving the overall objective of the VRCMA.
- **Long-Term Trend Monitoring.** Monitors species population trends within the VRCMA.

5.6.1 Compliance Monitoring

Compliance Monitoring addresses simple performance of actions. Such monitoring will ensure that conservation measures identified for implementation are, in fact, implemented. Additionally, it ensures that the conservation actions are completed in a timely manner.

5.6.2 Effectiveness Monitoring

Effectiveness Monitoring maximizes the likelihood that overall long-term goals and objectives of the VRCMA will be met. Effectiveness Monitoring can contribute both to Compliance Monitoring and a long-term assessment of conditions within the VRCMA Boundary. It includes monitoring of conservation actions that have direct and indirect outcomes that meet specific management goals, may be accompanied by response lags in targeted species or resources, and may be measured using surrogate response variables.

Biological resources will be monitored through Effectiveness Monitoring as appropriate. The purpose of this monitoring is: 1) to measure the success of conservation actions in avoiding and minimizing adverse effects of various actions and 2) to measure the level of success of conservation actions in contributing to the increased benefit to species of concern.

Effectiveness Monitoring will include monitoring populations of various species, based upon the conservation actions within the geographic scope of the VRCMA Boundary. Depending upon the species, data collected may vary (e.g., presence/absence, abundance, demographics). As monitoring occurs, a standardized approach will be developed and implemented for each species, to ensure data will be comparable across years and with other monitoring programs in nearby areas.

Habitat conditions will also be measured depending on the goal of particular conservation actions. Function, health, and extent of habitats will be documented. A standardized approach will be developed and implemented, to ensure data will be comparable across years.

It is reasonable to expect that monitoring techniques and related technology could change substantially through the life of the VRCMA. Therefore, it is essential to build flexibility into the monitoring efforts to respond to such changes. Some monitoring protocols may be replaced, by more efficient, and/or accurate techniques, to address the same issues, and entirely new monitoring approaches may be implemented to address unforeseen issues. Proposed changes to the monitoring efforts will be evaluated by the VRCMA Participants to ensure that they do not reduce the ability of the program to achieve its goals and objectives and to provide feedback for adaptive management. Periodic reviews of the monitoring efforts, every 5 years or upon substantially changed circumstance(s), should justify any changes.

Results of Effectiveness Monitoring and trends in monitoring data will be included in each report.

5.6.3 Long-Term Trend Monitoring

Long-term monitoring efforts are anticipated to occur over the life of the VRCMA. Much of this effort will be associated with the ongoing efforts within the basin. However, additional species-specific efforts are likely needed. Specific protocols will be developed and approved during the first year following implementation. The information acquired from these efforts will be incorporated into an annual report. Survey design will be developed to be compatible with existing species protocols by NDOW and other researchers, to allow for the exchange and use of data. Presence/absence and abundance data would be collected.

Baseline conditions for particular species and habitat will be measured to aid in the elimination of data gaps. These baseline conditions will be established throughout the VRCMA Boundary as funding is available. Long-term monitoring will be implemented by various entities associated with a particular project (i.e., implemented conservation action).

5.6.4 Measures of Success

To determine whether a conservation action has been implemented successfully, a measure of success must be defined for each type of conservation action. This section provides general targets for conservation actions described. These measures of success provide a general foundation for focusing efforts required to achieve the goals of the VRCMA and to sustain potential benefits to important and valuable resources covered. These measures of success are a component of the adaptive management aspect of the VRCMA, described in Chapter 6: Implementation Schedule. Table 5-4 presents the stakeholder prioritized conservation actions and identifies which types of measures of success apply for each action.

To determine whether or not conservation actions are successful, the following measures are recommended for each type.

5.6.4.1 Management Action (MA)

Based on the definition proposed in Section 4.1.1, Types of Conservation Actions in Chapter 4: Conservation Actions, a management action regulates activities over which a land management or regulatory agency has control. Once specific necessary management actions have been identified, measures of success may include: implementation (e.g., through change in legislation, development of management plans, etc.), enforcement, compliance, and ultimately the effectiveness of the action to protect status of species and habitat associated with management action.

5.6.4.2 Protective Measure (PM)

A protective measure is designed to protect specific species and/or habitat. Measures of success include protection of defined habitat area (e.g., percentage of habitat type, total hectares, etc.), and status of protected species based on defined goals.

5.6.4.3 Restoration Effort (RE)

Success of restoration efforts can be measured by implementation of defined restoration actions and by effect of restoration action on targeted species and habitat. Metrics specifically identified to measure success of a particular restoration project must be identified based upon restoration goals and the temporal and spatial scale at which the goals will be measured.

5.6.4.4 Public Outreach, Partnership, and Education Actions (POE)

Public outreach, partnership, and education actions are designed to educate about specific issues and solicit behavioral change in the targeted audience followed by stabilization and/or improvement of the species or habitat of concern. Measures of success include implementation of these actions, assessment of behavioral change, and status of species and habitat with respect to POE implementation.

5.6.4.5 Inventory and Monitoring Actions (IMA)

Inventory and monitoring actions are designed to obtain information about species and their habitats. Measures of success include acquisition of data sufficient to fill data gaps.

5.6.4.6 Applied Research Actions (ARA)

Applied research should address specific research questions related to one or more special status species and/or associated habitats considered in this VRCMA. Measures of success should include outlining specific research programs, acquisition of funds for research projects, data acquisition, incorporation of the results of this work into natural resource management, and ultimately associated conservation of species and habitats of concern. .

5.6.4.7 Impact Mitigation (IM)

Impact mitigation actions should be designed to offset activities that may degrade or otherwise adversely affect special status species and/or their habitat within the VRCMA Boundary. Measures of successful implementation of impact mitigation should include the reduction in number and impact of actions that adversely effect species and habitat and subsequently their conservation.

Table 5-4 Measures of success for each stakeholder prioritized conservation action

				Measures of Success									
Conservation Objective	Taxa	Conservation Action ID	Conservation Action	Number or proportion of species/ populations protected	Unit area protected/ enhanced	Population status (increasing, stable, decreasing)	Habitat status (increase, stable, decreased) quality or quantity	Change in ecosystem function (e.g. pollination occurring)	Human behavioral change	Legislation change	Production of materials (e.g. management plans, public outreach materials, etc)	Increase in knowledge base (reduction of data gaps)	Reduction of threats
1, 2, and 3	all special status species	71	Do not permit introduction of new non-native invasive species of fish or wildlife.						●				●
1, 2, and 3	all special status species	72	Develop and implement Fire Management Plan, including prescribed natural fires where appropriate on undeveloped portions of the VRCMA. Identify key habitat areas potentially susceptible to fire and manage to minimize conversion; remove or manage species from key susceptible habitat areas; and provide for adaptive management responses to adverse changes. As part of the fire management plan, develop and maintain a network of shaded fuelbreaks to interrupt continuous stands of fuel. Return fire, as a historic ecological process, to the VRCMA. Maintain and improve ecosystem function and health through the management of prescribed fire and prescribed natural fire.				●	●	●		●		●
1, 2, and 3	all special status species	73	Increase populations where appropriate by supplementation of individuals of threatened, endangered, and sensitive species, and species of concern, and their suitable habitat over the long term.	●	●	●	●						●
1, 2, and 3	all special status species	74	Protect and improve sensitive habitat such as nesting areas and migration routes.		●		●						●
1, 2, and 3	all special status species	75	Use U.S. Department of Agriculture (USDA) Nevada Animal Damage Control Program and/or Clark County Animal Control Program to monitor and aid in control of feral cats and dogs, brown-headed cowbirds, ravens, and other predator species that may affect the special status species.										●
1, 2, and 3	all special status species	76	Reduce impacts on species and habitat during incident control (e.g. limit helicopter landings to previously used areas)	●	●	●	●						●
1, 2, and 3	all special status species	77	Develop better response time dialogue and guidelines for wildland fires with federal partners to prevent habitat loss.		●		●	●	●				●
1, 2, and 3	all special status species	78	General wildlife inventory of mammals, reptiles, and birds in the Virgin Mountains.	●		●						●	

Table 5-4 Measures of success for each stakeholder prioritized conservation action

Conservation Objective	Taxa	Conservation Action ID	Conservation Action	Measures of Success: Number or proportion of species/ populations protected	Unit area protected/ enhanced	Population status (increasing, stable, decreasing)	Habitat status (increase, stable, decreased) quality or quantity	Change in ecosystem function (e.g. pollination occurring)	Human behavioral change	Legislation change	Production of materials (e.g. management plans, public outreach materials, etc)	Increase in knowledge base (reduction of data gaps)	Reduction of threats
1, 2, and 3	all special status species	79	Identify key areas and breeding habitats where private land acquisitions and/or conservation easements shall provide benefits to special status species in the VRCMA and adjacent areas.	●		●						●	
1, 2, and 3	all special status species	80	Utilize and refine current wildlife predictive habitat methodologies (I.e. SWREGAP) to identify important overlaps or 'biodiversity hotspots' of wildlife species assemblages.									●	
1, 2, and 3	all special status species	81	Use pesticides to treat exotic pests and disease outbreaks, including West Nile virus from mosquitoes, as a last resort (when threat to public safety, private property, or in extreme fire danger), or when scientific evaluations indicate a need; and use only EPA registered and approved formulations at their minimum effective rates in the least invasive method, such as single tree treatment. Inform the public and agency personnel of the potential effects of these activities on plant and wildlife populations and habitat areas; implement integrated pest management programs as warranted. Prior to use of pesticides and other chemicals, determine potential impacts to special status species and implement strategies to avoid impacts. Avoid, to the maximum extent practicable, use of pesticides and herbicides in key areas of sensitive species habitat when this shall have a significant adverse effect on project species.										●
1, 2, and 3	all special status species	82	Organize interagency transfer workshops to develop modes of communication and disseminate information among land management agencies.						●		●	●	
1, 2, and 3	all special status species	168	Enhanced law enforcement and ranger capabilities on Federal Lands.	●	●	●	●						●
1, 2, and 3	bats	93	Maintain a healthy mix of foraging habitats for special status bat species across the VRCMA.	●	●	●	●						
1, 2, and 3	bats and all special status species	94	Develop a consolidated database of all water sources.								●	●	

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1, 2, and 3	birds	96	Evaluate the need for area closures at the Overton Wildlife Management Area (OWMA) to protect nesting sites of sensitive species.	●	●	●	●						●
1, 2, and 3	birds	97	Model habitat use and habitat quality indicators for selected species. Evaluate Breeding Bird Atlas data for distribution and occurrence.	●	●	●	●						
1, 2, and 3	birds	98	Maintain and improve ecosystem function and health through the management of prescribed and natural fires.					●					
1, 2, and 3	black-chinned sparrow	175	Develop conservation and restoration strategies for montane shrub communities.		●		●	●					●
1, 2, and 3	Brewer's sparrow	170	Maintain native sagebrush habitats with high shrub vigor, horizontal shrub patchiness, and an open understory of native bunchgrasses and forbs.		●				●				
1, 2, and 3	cavity nesters and raptors	104	For fuelwood management, implement the following actions. 1) Maintain woodland and conifer forest where possible for all age stands with an understory forage value at moderate or better. 2) Firewood cutting and gathering is limited to approved areas subject to restrictions developed for protection of sensitive species. 3) Allow harvest of dead and/or downed wood for BLM marked green mesquite trees for dwarf mistletoe control only in approved areas.		●		●						●
1, 2, and 3	desert tortoise	126	Protect large tracts of suitable habitat, well dispersed throughout the range.		●		●						
1, 2, and 3	lizards	136	Prohibit destructive collecting techniques such as breaking off rock flakes and rolling cap rocks to uncover lizards.				●						●
1, 2, and 3	northern goshawk and flammulated owl	140	Avoid cutting fuelwood, or cutting trees for salvage or sanitation within 0.5 mile of active or recently active flammulated owl or goshawk nest. Trees hazardous to public safety or extreme fire danger may be removed. Insect and disease treatments may occur within this area to control epidemic outbreaks.										●

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1, 2, and 3	pallid bat, western mastiff bat, western pipistrelle, big free-tailed bat, Brazilian free-tailed bat	141	Conserve important bat roosting sites in cliffs, crevices, and talus habitat.		●								●
1, 2, and 3	plants	153	Develop and implement plan to collect seed for endowment and cultivation of sensitive and rare plants		●		●						
1, 2, and 3	plants	154	Develop and implement a plan to inventory and map problem areas of nonnative plants, and monitor encroachment over time.		●		●						
1, 2, and 3	plants	155	Wherever possible, select only locally native species for restoration, and where appropriate, use seed from the plant species of concern and endemic butterfly host plants.		●		●						
1, 2, and 3	sticky ringstem, Las Vegas bearpoppy, white bearpoppy, sticky buckwheat, threecorner milkvetch, forked buckwheat	163	Proactively protect and manage for long-term viability of all populations of rare plants on Federal lands (IMAs, LIMAs, MUMAs, and UMAs as appropriate) in the VRCMA.	●	●	●	●					●	●

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1, 2, and 3	western bluebird	165	Protective measures for western bluebird include: 1) Preserve existing old growth forest remnants. 2) Connect existing old-growth tracts by treating second-growth corridors to break self-perpetuating even-aged stand characteristics. 3) Promote timber harvest strategies that leave larger, older trees in an open-canopied array. Leave snags for cavity provision. 4) Thin second-growth stands with high stem densities “from the bottom up” where they occur adjacent to meadows; that is, thin smaller-diameter trees and leave well-spaced, larger-diameter trees, opening up a park-like interface with meadows.	●	●	●	●						●
1, 2, and 3	white bearpoppy	167	If proposed actions shall result in surface disturbance near a population of special status plants, remove soil with seed source and relocate to a potential habitat site and monitor over time.		●		●						●
4	all raptors	2	Incorporate winter raptor surveys into Audubon Society winter field trips. Recruit volunteers to conduct periodic winter raptor surveys, both on established and new routes wherever needed.									●	
4	all special status species	7	Implement comprehensive monitoring program for all special status species in the VRCMA. An inventory of rare flora and fauna should be completed regularly within the VRCMA, with occurrence records submitted to the NNHP and the VRCMA database. Coordinate survey efforts between agencies. Provide protocols, training, and survey tapes to all affected agency biologists and interested biological consultants.									●	
4	all special status species	8	Use the results of monitoring activities within the VRCMA to help refine management strategies for the protection of species of concern. If monitoring indicates a decline in status or habitat degradation, an assessment should be made on how to reduce the effects and improve the species status and habitat quality.									●	
4	all special status species	9	Use remote sensing and satellite imagery to track land use and establish a baseline for non-disturbed habitat within the VRCMA.									●	

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4	all special status species	83	Evaluate inventory needs regularly and coordinate on maintaining a digital inventory database. This database shall need to be created and implemented. Maintain survey data in a central database accessible to local biologists.									●	
4	bats	88	Inventory and monitor mines, and other natural and artificial s and habitats within the VRCMA that support, or once supported, important bat colonies and populations. Work cooperatively with interested groups to evaluate caves. The inventory process should document all unique biological, hydrological, geological, mineralogical, paleontological, educational, scientific, cultural, and/or recreational values.									●	●
4	bats	89	Monitor the effects of land management practices, human disturbances, and artificial assistance on bats within the VRCMA.	●	●	●	●	●				●	●
4	bats	90	Undertake genetic studies related to management and conservation.									●	
4	bats	91	Initiate research and monitoring activities to provide information on life history population status and trend, location of key concentrations, and conservation needs of cave and mine, cliff, crevice and talus, and structure roosting bats.									●	
4	bighorn sheep	169	Continue NDOW annual aerial surveys.	●		●							
4	black-chinned sparrow	174	Monitor the black-chinned sparrow via the Nevada bird count.	●		●						●	

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4	black-chinned sparrow	176	Research needs include: 1) habitat ecology at local and landscape scales, including successional and fire regime relations, and area requirements; 2) causes of mortality; 3) responses to grazing; 4) impacts of OHV use on habitats; 5) habitat mitigation strategies; 6) causes of population declines; 7) factors affecting food availability, nest success, and survivorship unknown; 8) brood parasitism (three records known; Tenney 1997); 9) predators; and virtually all aspects of its biology and ecology need further study, including details of habitat associations and habitat ecology, nest site selection, site fidelity, territory, juvenile dispersal, migration routes and winter distribution, quantitative study of diet and metabolism, social behavior, predation, susceptibility to brood parasitism, life span and survivorship, causes of mortality, response to climatic changes.	●	●	●	●					●	
4	Brewer's sparrow	171	Design Brewer's sparrow population objectives into sagebrush restoration projects.	●	●	●	●						●
4	Brewer's sparrow	172	Monitor results of other conservation actions and track population changes.	●	●	●	●						
4	Brewer's sparrow	173	Research needs for Brewer's sparrow include: 1) extent of breeding in the Mojave habitat type, as well as the salt desert scrub type in the Great Basin, 2) determine the possibility of multiple breeding seasons (one of each major habitat type), 3) effects of grazing regimes greatly needed given the complex interactions of resulting changes to plan composition and densities and changes in fire cycles, 4) response to prescribed burn patterns, 5) understanding of minimum patch sizes, fragmentation effects, spatial juxtaposition of habitat patches and other aspects of landscape ecology needed, 6) studies of extent, brood parasitism, and indirect impacts of herbicides and pesticides typically used in sagebrush steppe ranges, and 7) research life history and ecology during migration and wintering .	●	●	●	●					●	

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4	desert kangaroo rat	177	Research needs for the desert kangaroo rat include: 1) a better understanding of population connectivity and potential effects of fragmentation and 2) as a component of this effort, genetic analysis of known populations to determine degree of population isolation.									●	
4	desert kangaroo rat	178	Conduct a landscape-scale soils analysis that shall indicate degree or potential for inter-population connectivity.									●	
4	desert kangaroo rat	179	Conserve isolated populations based upon soils analysis and genetic analysis.		●							●	
4	desert pocket mouse	107	Inventory desert pocket mouse and complete genetic studies.	●		●						●	
4	desert tortoise	108	Research sources of mortality and their representation of the total mortality, including human, natural predation, diminishment of required resources, etc. within the VRCMA to better mitigate against tortoise deaths.	●	●	●	●					●	
4	desert tortoise	109	Conduct long-term research on the nutritional and physiological ecology of various age-size classes of desert tortoises throughout the VRCMA.	●	●	●	●					●	
4	desert tortoise	110	Develop long-term hypothesis-based studies targeting management issues for recovery of desert tortoise populations.	●	●	●	●					●	
4	desert tortoise	111	Conduct appropriately designed, long-term research on the impacts of grazing, road density, barriers, human-use levels, restoration, augmentation, and translocation on desert tortoise population dynamics within the VRCMA.	●	●	●	●					●	
4	desert tortoise	112	Develop a comprehensive model of desert tortoise demography within the VRCMA. Such a model should be based on at least 25 years of data. This time span represents one desert tortoise generation and is necessary to capture the effects of normal environmental variability on desert tortoise survival and reproduction. Research should be done in both high- and low-density areas.	●		●						●	

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4	desert tortoise	113	Fund research to determine minimum viable population sizes in various habitat types, nutritional forage quantity and quality needs, the juvenile niche, nest microhabitat requirements, temperature-dependent sex determination as determined by field nest temperature cycles, mating systems in nature, and genetics.	●		●						●	
4	desert tortoise	114	Initiate research necessary to monitor and guide recovery efforts.									●	
4	Great Basin collared lizard, desert night lizard	134	Develop detailed predictive models of species distribution within the VRCMA.	●								●	
4	kit fox	182	Develop a trend monitoring framework to track population status.	●								●	
4	kit fox	183	Research needs include: landscape analysis of potential habitat using soil maps		●		●					●	
4	kit fox	184	Based on expert consensus, project the number of potential habitats. Inventory identified sites and develop map of occupied habitats.		●		●					●	
4	Merriam's shrew	180	Research needs for Merriam's shrew include the impacts of cattle grazing on its distribution and abundance.										●
4	Merriam's shrew	181	Implement Merriam's shrew inventory.	●		●						●	
4	pinyon jay	144	Inventory pinyon stands by age class in the five priority areas.				●					●	●
4	plants	146	Investigate the basic ecology of obligate pollinators of target plant species to ensure complementarity of conservation recommendations and the location of protected areas, insuring the inclusion of the pollinator's full habitat and food source requirements.	●	●	●	●	●				●	
4	prairie falcon	157	Conduct landscape analysis that delineates and classifies key foraging areas associated with the top priority sites. Promote the maintenance of Prairie Falcon habitat at a landscape scale.	●	●	●	●					●	
4	western chuckwalla	166	Chuckwalla ecology and genetics: develop a relative abundance index, and a measurement of chuckwalla population repatriation, and a regional chuckwalla genetic history, and its relevance to viability of local populations shall be developed.	●		●						●	

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5	all raptors	3	Analyze the impact on falconry collection on populations.									●	
5	all special status species	10	Develop and maintain cooperative partnerships with hunters and trappers to benefit ecosystem health.					●					
5	all special status species	11	Inform recreational shooters of conservation impacts of indiscriminate shooting.			●							
5	all wildlife	84	Regulate illegal trapping, collection (other than for scientific research), or harassment of any wildlife.						●				●
5	banded Gila monster	85	Increase awareness of law enforcement and land management staff on the potential collection of banded Gila monsters, particularly in areas most accessible by collectors and suitable for the species						●		●		●
5	Great Basin collared lizard, desert iguana, long-nosed leopard lizard, desert horned lizard	133	Use population demographic data to adjust collection limits.	●								●	
6	all raptors	4	Work with the utility companies to ensure that support towers and poles within the VRCMA are "raptor-safe" and have perch deterrents	●	●	●	●						
6	all raptors	5	Protect key nesting areas, migration routes, important prey base areas, and concentration areas for birds of prey within the VRCMA.	●	●	●	●						
6	all special status species	12	All road grading equipment that used off pavement and all portable equipment shall be cleaned of weed and grass seed stems, stalks, etc. prior to leaving the site.				●						
6	all special status species	13	Provide site-specific fencing and signage; retrofit existing roads and highways and design new roads and highways for safe passage of wildlife.						●				●
6	all special status species	14	Use weed-free, native seed mixed if re-vegetation were required. No species on the state and adjacent states' noxious weed list (NV, AZ, UT, CA) shall be included in the revegetation seed mixes.										●

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6	all special status species	15	Use existing material sites for development within the VRCMA to the greatest extent possible. Prior to sampling/testing or excavating in material sites a biologist shall meet on-site with the USFWS to determine avoidance areas (undisturbed habitat) and develop appropriate minimization measures.						●				●
6	all special status species	16	Site new power lines in consolidated utility corridors adjacent to existing facilities; retrofit existing lines where appropriate.				●		●				●
6	all special status species	17	All surface-disturbing activities within the range of any special status species shall be conducted in a manner that reduces, as much as possible, the potential for take of individuals of a listed species on the VRCMA.		●		●						●
6	all special status species	18	If lands shall be temporarily disturbed within the VRCMA a reclamation plan shall be developed.				●						●
6	all special status species	19	Prior to the disposal of identified public lands, an analysis shall be conducted to determine their resource values, including the occurrence of special status species and sensitive habitats such as riparian and aquatic habitats. Land disposal shall be consistent with conservation of special status species unless there is an overriding public benefit.			●							●
6	all special status species	20	To the maximum extent practicable, avoid construction and maintenance projects in habitats during sensitive times, such as breeding or nesting or overwintering times (e.g., near bat hibernacula, mowing of potential butterfly habitat, or in rare plant habitat).				●						●
6	all special status species	21	Cooperate with local agencies in developing a backyard habitat program.				●		●		●		
6	all special status species	22	Conservation easements or agreements shall be established to protect habitats threatened by development.				●						●
6	all special status species	23	Minimize grading, blading, clearing or cutting of trees or other vegetation to accommodate vehicle access.				●		●				●

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6	all special status species	24	In construction areas where re-contouring is not required, vegetation shall be left in place wherever possible and original contour shall be maintained to avoid excessive root damage and allow for re-sprouting.				●						●
6	all special status species	25	Incidences of observations of special status species and their sign during construction activities shall be conveyed to the FCR (field contract representative) and/or authorized biologist. Authorized biologists shall maintain a record of all sensitive species encountered during project surveys and monitoring.	●									
6	all special status species	26	Limit impacts of new administrative facilities on natural and heritage resources, and visual quality.										●
6	all special status species	27	No debris should be left on the right-of-way (ROW).				●						●
6	all special status species	28	Site new facilities away from key populations and habitat areas; provide measures to avoid, minimize, or mitigate effects of these activities; provide protection for populations and habitat areas not affected by existing facilities.				●						●
6	all special status species	29	To the extent feasible, ensure that minimal impacts occur to resources during the planning stages for projects.				●						●
6	all special status species	30	Where possible, establish erosion control in areas that present problems.				●						●

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6	all special status species	31	Carry out a public education programs within the VRCMA: Clark County MSHCP and participating agencies shall provide informational materials to inform the public about species and ecosystem conservation needs for habitat and species conservation, as well as the value of these ecosystems. Establish environmental education programs and facilities. Develop a series of environmental education programs (slide presentations, display boards, etc.), for presentation to schools, user groups, town board meetings, and other community events. Individual programs shall highlight biodiversity, sensitive ecological resources, endemic plants, and sensitive bats. Ensure that materials are available for use by other agencies and teachers. Develop a public information campaign aimed at highlighting the unique qualities of Joshua tree habitat and the interesting organisms, of which Scott's Oriole is one, that inhabit it. Foster public interest in preserving Joshua tree habitat.						•		•		
6	all special status species	32	Conduct pre-activity surveys for the species of concern prior to any actions that may affect them, and design projects to minimize or avoid adverse effects. Ensure that surveys consider unique habitat components of the species of concern. Encourage private land owners to identify loss of habitat for species of concern and minimize impacts.	•			•						•
6	all special status species	33	Prohibit dumping, refuse disposal, and littering.										•
6	all special status species	34	Resource management agencies shall ensure that restoration activities shall occur based on prior agreements.		•		•						•
6	all special status species	35	Water shall be applied to the construction right-of-way (ROW) for dust control and to the topsoil piles as necessary to prevent the loss of topsoil due to wind erosion. A watering plan shall be developed to ensure water conservation.				•						•
6	all special status species	36	Maintain air quality at a level that is adequate for the protection and use of resources (Air Quality Related Values) and that meets or exceeds air quality standards.				•						•

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6	all special status species	37	Inform the public of potential impacts of domestic animals on native species								●		●
6	all special status species	38	Using “best management practices” as identified by the State of Nevada, minimize contributions from both point and non-point sources of pollution (including salts) resulting from public land management actions. Where applicable, proposed management actions shall comply with local, state, tribal and Federal air quality laws, regulations, and standards (Conformity; per 40 CFR 93.100 et seq.).				●				●		●
6	all special status species	39	Workers shall be instructed not to drive or park vehicles where catalytic converters can ignite dry vegetation and to exhibit care when smoking in natural areas. Fire protective mats or shields shall be used during grinding or welding. Vehicles shall carry water and shovels or fire extinguishers during times of high fire hazards.										●
6	all special status species	40	Avoid any special status species discovered in disturbed or undisturbed habitat in proposed maintenance or construction areas, if possible. If unable to avoid, best efforts shall be made to relocate/salvage species. Relocation/salvage shall only be attempted if the species is highly likely to survive the action and it is reasonably cost effective. This shall be determined by NDOT’s Environmental Services Division. Perform plant salvages and/or seed collection prior to work in undisturbed habitat and/or when special status plant species cannot be avoided, especially cactus and yucca species within the VRCMA.	●	●	●	●						
6	banded Gila monster	86	Increase coordination among all agencies to minimize negative effects to the species and its habitat; Federal, state, and local agencies should address, minimize, or avoid impacts to the species in biological evaluations or environmental reviews for land use planning and action.	●		●			●				●
6	banded Gila monster	87	Minimize mortality by conducting extensive surveys prior to surface disturbance; capture and relocate individuals in area of impact in accordance with NDOW protocol	●		●						●	●

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6	bats	92	Develop and implement a bat conservation plan to protect bat roosts in mines and caves, including abandoned and orphaned mines and to monitor bats, emphasizing roost site and water source monitoring for known occurrences of bats. Multiple chapters will be created for the plan to address the following issues. Frequency and intensity of monitoring identified in the plan shall be based on species occurrence, habitat suitability, and threats. Conduct periodic monitoring for bats. The plan shall address the following protective measures: Gating or closing mines and caves to protect bat roost sites, removing important bat roost mines and caves from future additions to maps, avoiding identification of exact locations of maternity roosts, caves, and occupied mines to the general public, determining the need to close roads to mines and caves, and avoiding use of heavy equipment near mine and cave roosts. Design and install bat-friendly gates on mines and caves that prevent access by people, while allowing access by bat species. All gates on caves and mines shall be designed to provide for unrestricted access for bats. Temporary (test) gates of PVC or other light, impermanent material shall be constructed first to determine bats' reaction to gate design, prior to final design and construction of permanent gates. Fence or gate mines susceptible to human disturbance or of public safety concern. Where possible, maintain native vegetation around cave openings for a minimum distance of 100 yards within the VRCMA. Educate the public about the role of bats in the ecosystem and the importance of leaving roost sites undisturbed. Construction above or near a cave, within the VRCMA, shall be designed in a way to insure protection of the cave resources. Diversion of surface drainage into caves is prohibited. Limit caving and rock climbing to areas away from bat roosts. Protect springs and man-made water development sites, create new open water resources. Allow access to all caves only from the beginning of March through the end of May; and from the beginning of September through the end of October.	●	●	●	●		●				●

Table 5-4 Measures of success for each stakeholder prioritized conservation action

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				Number or proportion of species/ populations protected	Unit area protected/ enhanced	Population status (increasing, stable, decreasing)	Habitat status (increase, stable, decreased) quality or quantity	Change in ecosystem function (e.g. pollination occurring)	Human behavioral change	Legislation change	Production of materials (e.g. management plans, public outreach materials, etc)	Increase in knowledge base (reduction of data gaps)	Reduction of threats
6	bats and wildlife	95	Create new open water resources for bats and other wildlife within the VRCMA.		●			●					
6	burrowing owl	100	Work with developers in urban and suburban areas to preserve open space within developments for burrowing owl use.		●		●						
6	desert tortoise	115	Measures shall be taken to minimize take of desert tortoises due to project related activities.	●	●	●	●						●
6	desert tortoise	116	Measures shall be taken to minimize take of desert tortoises from potential tortoise predators attracted to project areas.		●								●
6	desert tortoise	117	Control use of landfills and sewage ponds by desert tortoise predators. Identify and clean up unauthorized dumps in DWMAs. Reduce or eliminate use of authorized landfills and sewage ponds in and near the VRCMA Boundary by predators of desert tortoise (e.g., ravens & coyotes). Allow no new landfills or sewage ponds within the VRCMA Boundary.		●								●
6	desert tortoise	118	Measures shall be taken to minimize destruction of desert tortoise habitat, such as soil compaction, erosion, or crushing of vegetation, due to project related activities.	●	●								●
6	desert tortoise and chuckwalla - remove	128	Relocate desert tortoises and chuckwallas within 1,000 feet of encounter on public lands or approved private lands if there is a direct threat to their safety/survival.	●									●
6	ferruginous hawk, western bluebird	130	Actions during development should include 1) Avoid habitat conversion of any kind inside a 1.6 km radius buffer zone around any documented Ferruginous Hawk nest site, 2)Curtail wood-cutting activities in occupied Ferruginous Hawk nest territories during April, 3) Increase periodic patrol of occupied nest territories, particularly during the near-fledging stage, 4) When planning pinyon-juniper removal by chaining or prescribed fire, keep intact the naturally-occurring woodland edge where isolated, mature Utah junipers might provide nest sites.	●	●								●
6	flammulated owl	131	Incorporate flammulated owl management recommendations into pertinent land management plans.	●	●				●		●		●

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6	gray vireo	132	Identify mature pinyon-juniper areas and provide information to land managers regarding the importance of managing for and retaining mature pinyon-juniper habitats.								●		●
6	Le Conte's thrasher	135	In concert with county habitat planning efforts, devise a conservation plan for the Le Conte's thrasher strategy that identifies lands and appropriate methods for protection.		●		●						
6	loggerhead shrike	137	Protection measures associated with development should include: 1) Ensure that the commercial collection of reptiles occurs within sustainable harvest parameters with no significant effect on the ecosystems in which they occur, 2) maintain sufficient areas of salt desert scrub habitat with large bush diameters, e.g., mature age classes of greasewood, quailbrush, and other large saltbush species, to provide suitable nesting substrate for Loggerhead Shrikes, 3) manage for long-term regeneration and maturation of montane shrub species 4) review habitat models and management guidelines. Update as necessary, using most recent data and findings. Conserve identified population centers where populations are productive and contributing individuals to surrounding populations. Encourage minimal pad preparation on larger residential lots and native xeric landscaping techniques after building. Encourage the maintenance of naturally vegetated corridors through residential developments.	●	●	●	●						●
6	Lucy's warbler	138	In suitable habitats on the urban interface or as a temporary population-saving measure, increase nesting opportunities for Lucy's Warbler and other cavity-nesting birds using mesquite habitats.	●	●								●

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6	northern goshawk	139	Take measures to protect northern goshawk during development including: 1) Manage northern goshawk territories at the landscape level, providing within territories suitable nesting sites as well as replacement stands where aspen regeneration has been initiated through prescribed fire and other methods, 2) Occupancy surveys should be conducted prior to any land use projects designed to significantly alter the habitat or capable of producing significant levels of disturbance to a nesting pair within known or potential territories, 3) Recommend the observance of “no disturbance” buffer zones around and including active nesting territories during the nesting season, 4) Review action plan proposals in coniferous forest habitat and provide recommendations for the avoidance and/or mitigation of impacts to Northern Goshawk nesting and productivity, 5)	●	●	●	●					●	●
6	phainopepla, Lucy's warbler	143	Suggest creation of new habitat in mitigation strategies when appropriate.		●		●						●
6	pinyon jay	145	Protection measures for pinyon jay should include: 1) Chainings and prescribed burns should leave adequate stands of mature, cone-bearing trees adjacent to any treatment area and 2) The cutting of mature live trees should be discouraged in fuel wood harvest activities.	●	●	●	●					●	●
6	plants	147	All new administrative facilities shall use drought tolerant landscaping with an emphasis on native species.		●		●		●				●

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6	prairie falcon	158	Protective measures for prairie falcon are: 1) Highlight the uniqueness of Nevada's Prairie Falcon resource through media profiles, bulletins, etc. 2) Promote the importance of Nevada to the maintenance of the world's Prairie Falcon population, its ecology, habitat needs, and its value as a predator of agricultural pests. 3) Minimize human disturbances around nest sites during the nesting period where impacts on productivity have been identified. 4) Pursue special land designation for top priority sites i.e. "Areas of Critical Environmental Concern," "Research Natural Area," etc. 5) Where nest sites are likely to be significantly disturbed by project activities, mitigate for seasonal work restrictions after surveys have determined the site to be active.	●	●	●	●					●	●
6	sticky ringstem	161	Ensure that long term viability of low elevation rare plants is not significantly impacted by rural development and sprawl.	●	●	●	●					●	●
6	three corner milkvetch and sticky buckwheat	164	Ensure construction of the Mesquite Airport does not significantly impact viability on public lands.	●	●	●	●						●
7	plants	148	Continue to remove exotic plants and noxious weeds within the VRCMA.		●		●						●
8	all special status species	41	Encourage trail use outside of biodiversity hotspots to avoid further adverse effects on rare and sensitive species. Focus recreation activities into less sensitive areas.		●		●						●
8	all special status species	42	Work with climbing and caving groups and hold outreach meetings emphasizing species conservation, identifying protective measures, and specifying surveys for the species of concern prior to establishment of new climbing or caving opportunities. The information derived from these programs shall assist in determining future management actions for species protection. Identify additional special interest groups and develop memoranda of understanding.		●		●						●

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8	all special status species	43	Develop new relationships/partnerships and strengthen existing efforts with user groups, including hunters, trappers, rock climbers, cavers, trail users, summer home and special use permittees, and American Indians, to help manage the VRCMA and protect resources.				●				●		●
8	all special status species	44	Use temporary closures (roads, trails, dispersed areas) to protect important seasonal habitat for species of concern (animals, plants, and insects), in coordination with appropriate state and local agencies. Consider seasonal restrictions on rock climbing in sensitive areas. Evaluate effects of rock climbing on biological resources.		●								●
8	all special status species	45	Develop and implement a climbing “self registration” process that encourages development of new routes away from ecologically sensitive areas.		●		●				●		●
8	all special status species	46	Develop and implement a recreation monitoring strategy involving trail counters. This strategy shall include development of methods resulting in collection of data to assess recreation trends and effects on the species of concern and ecological resources. Monitor traffic volume on road and trails near sensitive resources as appropriate.		●		●				●		●
8	all special status species	47	Focus new recreation development (campgrounds, picnic areas, and other facilities), in the least sensitive areas at lower elevations, to lessen visitor impacts on the species of concern and other sensitive ecological resources. Focus recreation activities (OHV activity, mountain bikes, and heavy foot traffic) into less sensitive areas to protect habitat of the species of concern.		●		●						●
8	all special status species	48	Enhance developed sites where feasible to restore resource or wildlife values where recreation use has adversely affected resources.		●		●						
8	all special status species	49	Develop an OHV plan for the VRCMA. Coordinate with VRHCRP partners.		●		●				●		●

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8	all special status species	50	Study feasibility of Green Sticker licensing for off-road vehicles in the State of Nevada, with funds earmarked to restore areas impacted by OHVs and/or establish alternative recreation sites.		●		●				●		●
8	all special status species	51	Adopt and implement policies to protect plant species from dispersed recreation. Protect habitat of the species of concern from dispersed recreation (e.g., heavy foot traffic, off-road vehicles, mountain bikes).	●	●	●	●						●
8	burrowing owl	101	Mitigate loss of burrowing owl nest sites by constructing artificial burrows in suitable alternative habitat with attendant site protection.	●		●							
8	burrowing owl	102	Monitor and quantify the impacts of off-road vehicle recreation on burrowing owl habitats, particularly centers of breeding concentration. Mitigate impacts by adjustment of sanctioned event routes, closure of casual use in burrowing owl breeding centers, education of off-road vehicle enthusiasts and consensus planning involving off-road vehicle advocacy groups.	●	●	●	●					●	●
8	California leaf-nosed bat, pallid pat, Allen's big-eared bat, California myotis, fringed myotis, western pipistrelle, Brazilian free-tailed bat	103	Rehabilitate and maintain habitat quality in current washes systems.		●		●						●
8	desert tortoise	119	For organized, motorized events on unpaved roads or trails near active desert tortoise burrows, require special permit provisions for desert tortoise protection.										●

Table 5-4 Measures of success for each stakeholder prioritized conservation action

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8	peregrine falcon	142	Rock climbing within 100 yards of known active or recently active peregrine falcon nests shall be allowed only from the beginning of July through the end of January. Specific routes may be signed as necessary to inform of seasonal closures if nests are identified. Monitor peregrine nesting success to determine if the 100-yard closure is effective.	●	●	●	●						●
8	plants	149	Restrict mountain bikes and other mechanized non-motorized vehicles to designated trails and only allow new trails consistent with the conservation of special status species		●		●						●
8	plants	150	When maintaining trail switch-backs, minimize ground disturbance to protect rare plants.		●		●						●
8	plants	151	Develop and distribute information to equestrians on the importance of using pelletized feed and develop and distribute a weed-free feed policy for equestrians on public lands in the VRCMA boundary.		●		●						●
9	all ground-dwelling mammals and reptiles	1	Monitor and inventory all culvert/bridge crossings and tortoise fencing within assessment area and ameliorate existing or install new culverts/bridges to allow passage of terrestrial species.		●		●					●	●
9	all reptiles, Pacific tree frog, desert pocket mouse	6	Ensure new roadside structures are designed and constructed to prevent animals from becoming trapped. Encourage retrofitting existing structures that pose a trapping problem.										●
9	all special status species	52	Allow bicycle use only on established and/or designated roads and trails.		●		●						●
9	all special status species	53	Allow motorized vehicle use only on designated roads and trails.		●		●						●
9	all special status species	54	Avoid designating roads and trails in washes in sensitive or key areas where an alternative exists or could be created.		●		●						●
9	all special status species	55	Minimize new road construction associated with new utility facilities; where possible close and rehabilitate unneeded existing roads or new roads after construction		●		●						●

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9	all special status species	56	Site new highway construction to avoid key populations and habitat areas; develop appropriate construction and maintenance management programs to avoid, minimize, or mitigate effects to key populations and habitat areas.		●		●						●
9	all special status species	57	Implement a program to rehabilitate surface disturbances including the first hundred feet or so of "closed" roads and trails and other areas important for special status species. Close unnecessary roads and trails in key habitat areas through signage and rehabilitation; eliminate proliferation of roads and trails in key habitat areas. Restore/rehabilitate all key access points of closed roads and areas.				●						●
9	all special status species	58	Manage designated and informal use (unnumbered) trails that are causing resource damage to reduce damage and restrict use to a single trail.				●						●
9	all special status species	59	Ensure that roads are engineered to adequately spread runoff to minimize erosion from an ecosystem perspective.				●						●
9	all special status species	60	Provide a biological monitor during material site sampling/exploration outside fenced areas.				●						●
9	all special status species	61	Implement appropriate methods and designs to minimize erosion during construction of highways and to avoid the creation of erosive flows from highways; encourage construction of pollution control devices, such as oil sand separators, drop inlets, and stormwater treatment systems. Modify highway maintenance practices to minimize damage to wildlife and flora by restricting maintenance activities to NDOT right-of-ways (ROWs), conducting pre-activity surveys for biological resources, avoiding or relocating individuals or habitat as necessary, and avoiding maintenance activity during sensitive times.				●						●
9	all special status species	62	Maintain roads to a standard necessary for public safety and as needed to respond to resource management objectives, including resource protection and recreation, through maintenance of road surfaces and minimizing erosion.				●						●

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9	all special status species	63	GPS all roads as per establishment of current BLM Resource Management Plan (RMP) circa 1998. Any new proliferation of roads after that point to be closed and rehabilitated. Close redundant roads (roads that go to same place).		●		●						●
9	all special status species	64	Avoid further right-of-ways (ROWs) within the VRCMA when feasible.		●								●
9	chuckwalla	105	Identify the extent of collecting along roadways, and possible impacts of habitat modification resulting from unethical collecting practices.		●		●						
9	chuckwalla, banded Gila monster	106	Minimize and avoid impacts to rock outcrops, lava flows, and surrounding areas. If these areas cannot be avoided and must be disturbed, clearance surveys by NDOT biologists or NDOT approved biological consultants for chuckwalla and banded Gila monster must be conducted prior to maintenance or construction activities.										●
9	desert tortoise	120	Do not allow OHV speed events, mountain bike races, horse endurance rides, four-wheel drive hill climbs, mini events, publicity rides, high speed testing, and other similar speed based events within tortoise habitat.										●
9	desert tortoise	121	The following actions should be implemented to control vehicular access: Fence or otherwise establish effective barriers to tortoises along heavily-traveled roads; install culverts that allow underpass of tortoises to alleviate habitat fragmentation.										●
9	plants	152	Ensure that road maintenance activities (e.g., shoulder work, road salting) do not adversely affect native species.	●	●	●	●						●
9	plants, reptiles	156	Conduct biological surveys prior to road maintenance and retrofit activities.	●	●	●	●					●	
10	all special status species	65	Where feasible, proposals for saleable materials in essential habitats for special status species shall be avoided.		●		●						●
10	all special status species	66	Site leasable/saleable mineral development and mining away from key populations or habitat areas to the extent feasible; provide measures to avoid, minimize, or mitigate effects of these activities.	●	●		●						●

Table 5-4 Measures of success for each stakeholder prioritized conservation action

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10	all special status species	67	Programs shall be developed and implemented to successfully revegetate, with native vegetation, disturbed desert areas which were impacted by past surface disturbing activities.		●		●						●
10	birds and reptiles	99	Site toxic ponds associated with mining activities away from key populations or habitat areas; provide measures to discourage wildlife from using ponds (fencing, cover) as required by state law.		●		●						●
10	desert tortoise	124	Measures shall be implemented to educate project personnel on the desert tortoise to eliminate or minimize potential impacts to desert tortoise and its habitat.	●	●								●
10	desert tortoise, desert pocket mouse, all reptiles	129	The mining operator shall attach a tortoise-proof fence to the existing chain-link fence surrounding the mill-site site and maintain at zero ground clearance.										●
10	prairie falcon	159	When constructed high walls are not available or feasible to maintain, identify alternate natural cliffs for pothole construction.		●		●						●
10	prairie falcon	160	Develop a partnership between conservationists, mining companies, and federal land management agencies to solve the conflicts of alternate nesting habitat creation and establish nest site mitigation as standard operating procedure for mining proposals and activities.		●		●		●				●
10	sticky ringstem	162	Ensure that gypsum mining shall not significantly impact rare plants.	●	●	●	●					●	●

Chapter 6: Implementation Schedule

The purpose of Chapter 6, Implementation Schedule, is to identify the process for implementing the VRCMA. Funding and Adaptive Management are also discussed in this Chapter. An overview of the general framework of ranking for priority conservation actions is also identified.

6.1 OVERVIEW OF CONSERVATION ACTIONS

As previously stated in Chapter 5, species' conservation efforts have been underway along the Virgin River to address species conservation and protection concerns for endangered fish (woundfin and Virgin River chub) and riparian bird (southwestern willow flycatcher, Yuma clapper rail) species utilizing the Lower Virgin River and its floodplain. The Lower Virgin River Recovery Implementation Team and other agencies and organizations have been at work to implement conservation and restoration activities along the Lower Virgin River. In the Upper Virgin River in Utah, the Virgin River Resource Management and Recovery Program, a recovery action program, was established in 1999.

The Virgin River Habitat Conservation and Recovery Program (VRHCRP) was formed in 2004 as a combination of the Virgin River Resource Management and Recovery Program and the Virgin River HCP to implement conservation measures and recovery actions within the 100-year floodplain of the Lower Virgin River. The VRCMA has since been designed to provide information to the VRHCRP. The goals of the VRHCRP are to identify, plan, coordinate and/or assist in implementing avoidance, minimization, mitigation or conservation activities to contribute to the long-term recovery and conservation of listed and non-listed species and their habitats throughout the Virgin River watershed.

6.2 GENERAL FRAMEWORK OF RANKING FOR CONSERVATION ACTIONS

Conservation action rankings were finalized in Chapter 5, Conservation Management Assessment. Actions were identified as high, medium, or low.

- **High.** Actions identified as *ongoing or vital to protecting species populations and habitats or removing threats within the VRCMA Boundary* were ranked as high. Examples include avoidance and minimization measures for development and mining activities that adversely affect desert tortoise and its habitat, population monitoring, and purchasing conservation easements.
- **Medium.** Actions identified as *beneficial to protecting species populations and habitats or removing threats* were identified as medium. Examples include use of native species for restoration activities and design of recreation activities and roads.
- **Low.** Actions identified as *indirectly beneficial to special status species or of limited benefit* were identified as low. Examples include surveys of general wildlife species in the VRCMA Boundary and education opportunities.

6.3 IMPLEMENTATION OF THE VRCMA PROGRAM

Clark County and the resource management agencies (USFWS, NDOW, NPS, BLM, and NDF) will update the conservation actions database associated with the VRCMA. Each agency will update the database annually, or as needed. The database will also be available for the VRHCRP's use. The VRHCRP can also update the database as appropriate.

The VRCMA document will be reviewed every five years (with a two year window) to determine whether the document needs to be updated. Clark County and the resource management agencies participating in the VRCMA will hold a meeting to update the document as needed.

To effectively implement the VRCMA, additional review and identification of specific conservation actions, use of monitoring and trend data to fine tune existing conservation actions, and tracking of conservation action implementation and results in a conservation actions database will be necessary.

Initial information collected for the VRCMA process will be provided to the VRHCRP for use in their planning process. As updates to the VRCMA occur, they will be provided to the VRHCRP. This includes access to the conservation action database through the VRHCRP web-based database and website.

6.4 ADAPTIVE MANAGEMENT

Adaptive management is a relatively recent method of resource management. Where applicable, an adaptive management approach will be used for implementation of conservation actions for the VRCMA. Instead of the traditional approach of developing a plan and implementing it in the same manner until the plan is out-of-date, adaptive management includes a feedback loop in the resource management process. An overall management strategy is developed. Explicit goals are set, and information is collected to evaluate whether defined goals are being met. Based upon this new information, management actions are adjusted as necessary to ensure that goals of the management strategy are being met. The process of adaptive management improves the effectiveness of managing systems for which there is limited information available, as is the case for the Lower Virgin River Watershed. Because ecological systems often have limited available data and not all mechanisms of these systems are understood, adaptive management is well suited for managing natural resources.

An adaptive management approach allows for up-front necessary changes in a management plan upon which all participating parties can agree. This is particularly important when information about a species is incomplete or management methods are not well tested. Monitoring and research activities funnel information into the adaptive management approach, which results in management decisions tailored to what is best to achieve the goals for the species being considered.

An adaptive management approach is critical for the ecosystem-based conservation goals of the VRCMA. Implementation of conservation actions defined in the VRCMA will be considered in the broadest context possible. Actions will be directed by the desired ecosystem function characteristics associated with future conditions, rather than a characterization of the attributes from the past.

The over-arching goal of a conservation management assessment is protection of existing resources and, where necessary, improved function to facilitate natural recovery, improve productivity, stabilize site ecosystems, and reduce risks (Ehrenfeld and Toth 1997; Falk et al. 2006). It is anticipated additionally that improved ecosystem function may also increase economic return from recreation or agricultural activities, as well as restore high-value ecosystem services (Daily 1997).

Steps used in the adaptive management process for this VRCMA are as follows:

- **Step 1.** Identify conservation objective and associated measure of success.
- **Step 2.** Identify and implement conservation action to meet objective.
- **Step 3.** Identify and track measure(s) of success for conservation action.
- **Step 4.** As needed, adjust conservation action to meet conservation objective, based upon the outcome of its measure(s) of success.

The measures of success identified in Chapter 5: Conservation Management Assessment for each conservation action will be evaluated and summarized in the annual report described in Chapter 5. Where measures of success are not being met, individual resource management agencies would alter their implementation of conservation actions accordingly.

6.4.1 Adjustment of Management

Based upon monitoring results, Clark County and the resource management agencies will identify how to incorporate these results into their respective management planning processes and on-the-ground activities. Depending upon status measured through monitoring, these recommendations may include some or all of the following adjustments that relate to the VRCMA:

- Changes to the extent, timing, or types of monitoring activities carried out for biological monitoring, status for species, or outcomes of actions and
- Changes to the extent, timing method, or types of conservation actions implemented under the VRCMA.

These recommendations will be based upon setting goals (including objectives and measures of success), defining monitoring, reviewing monitoring results, as well as resulting committee discussions.

Clark County and each resource management agency associated with the VRCMA will develop their own adaptive management goals for conservation actions where they are the lead agency(ies) and develop their own decisions for achieving them.

As an example, the adaptive management process is explained here for one of the proposed conservation actions. The conservation action is “Work with the utility companies to ensure that support towers and poles within the VRCMA are “raptor-safe" and have perch deterrents.” Using adaptive management, how the conservation action would be implemented could be adjusted as a result of 1) evaluating how many support towers and poles have perch deterrents (compliance monitoring), 2) monitoring the number of dead raptors near artificial porch sites (effectiveness and/or long-term monitoring), or 3) some other factor. Adjustments to the conservation action’s implementation could be made if the compliance, effectiveness, and/or long-term monitoring determined it necessary in order to improve the expected outcome.

6.5 FUNDING

Successful implementation of conservation actions depends highly upon the availability of adequate funding. Criteria are presented here to be used as guidelines in the development of choosing whether to fund an action, or when, and what approach or resource might be the most beneficial.

6.5.1 Guidelines

When considering whether to fund a particular conservation action, in addition to the ranking provided by the participating resource management agencies, the following guidelines should be considered (TNC 2007):

- **Urgency.** Is implementing the conservation action going to prevent or remove an immediate risk to a species?
- **Availability of Funding.** Is funding available for that particular conservation action from potential sources? Can funding be sought?
- **Socioeconomic Factors.** Is the socioeconomic climate appropriate for implementation of the conservation action? Is there opposition to the action? Would negotiations be required that would slow down or prevent the implementation process?
- **Biophysical Factors.** Are there biophysical factors such as fire risk that would prevent implementation of the conservation action at a given point in time?
- **Available Expertise.** Do the participating organizations have the appropriate expertise for implementing the conservation action? Is there another organization that could serve as a partner that has available expertise?
- **Agency Capacity.** Do the participating organizations have the current capacity to effectively implement the conservation action?
- **Window of Opportunity.** Are there particular circumstances where low cost and ease of implementation would exist?
- **Coordinating and Facilitating Efforts of Others.** Are there programs or projects with which the VRCMA participants could coordinate to reduce the cost of implementing the conservation action for Clark County and the participating resource management agencies? For example, using the VRHCRP process and funds to implement a conservation action would be appropriate.

6.5.2 Approach for Estimating Costs

Detailed costs for each conservation action need to be estimated prior to implementation. This involves estimating both labor and materials. For many actions, additional labor may not be necessary, as participating agencies can provide the labor.

Materials will need to be identified for each conservation action and their quantity determined. A per unit cost estimate can be developed and then multiplied by the number of units. Examples of a unit include the amount of fencing per foot or the cost of an individual mist net for bird demographics surveys.

The cost estimate will need to address whether the project is a one-time cost or whether it involves ongoing, recurring costs. For monitoring activities, labor and materials may be required to be budgeted annually.

General cost estimates provided in the final ranking tables in Chapter 5: Conservation Management Assessment (Tables 5-1 to 5-3) are those used to assess feasibility of conservation actions identified in Chapter 4: Conservation Actions. These estimates are general. Detailed cost estimates should be developed prior to the implementation of any conservation action.

6.5.3 Potential Sources

Funding sources are often specific to particular types of projects. Successful funding depends upon matching the appropriate source to each project, and being prepared to take advantage of unexpected funding opportunities should they become available.

There are a number of potential sources for funding VRCMA conservation actions. Examples include monies from the Clark County MSHCP, as well as Conservation Initiatives, Capital Improvement and Sensitive Land Acquisition funds made available through the Southern Nevada Public Land Management Act (SNPLMA), which became law in October 1998. SNPLMA allows the BLM to sell public land within a specific boundary around Las Vegas, Nevada. The revenue derived from land sales is split between the State of Nevada General Education Fund (five percent), the Southern Nevada Water Authority (ten percent), and a special account available to the Secretary of the Interior. The Secretary's special account funds are made available for certain types of projects.

Section 6 funds received from USFWS can provide resources to NDOW and end of year funds are often available for state-directed projects for all species. Federal grants could be applied for, particularly for research and monitoring. These are best developed in partnership with academic institutions that can receive federal funds directly.

State of Nevada funding sources include state bonds that target restoration of wildlife and habitats and grants and programs focusing on restoration of wildlife habitats on private lands, including the Landowner Incentive Program (LIP). Partners for Fish and Wildlife is a USFWS-based program that also focusing on restoration of wildlife habitats on private lands.

Partnerships can be used to match funds and/or labor, and generally increases likelihood of funding opportunities.

Chapter 7: References

Alcorn, J.R. 1988. The Birds of Nevada. Fairview West Publishing. Fallon, Nevada.

Allen, M.F. 1996. The of restoration ecology in ecosystem management: opportunities and responsibilities. In The Role of Restoration in Ecosystems Management.

American Bird Conservancy (ABC). 2007. Domestic cat predation on birds and other wildlife. Available online at http://www.abcbirds.org/abcprograms/policy/cats/materials/predation.pdf.

American Ornithologists' Union (AOU). 1998. Check-list of North American birds. 7th ed. Am. Ornithol. Union, Washington, D.C.

Ammon, E. 2003. Coordinated Bird Monitoring in Nevada. Draft. GBBO. Reno, Nevada. http://www.gbbo.org/pdf/NV_Plan_12_noAppC_textonly.pdf.

Anderson, A.H., and Anne Anderson. 1963. Life history of the cactus wren. Part VI: Competition and survival. The Condor: Vol. 65, No. 1, January-February, 1963.

Arizona Department of Mines and Mineral Resources (ADMMR). 2002. Map of Arizona Mineral Producers. 2002. Available on the Internet at: http://www.admmr.state.az.us/Info/producers_map2002.pdf.

Arizona Department of Mines and Mineral Resources (ADMMR). 2007. State of Arizona Department of Mines and Mineral Resources. Mining on State Trust Land. Exploration Permits – Mineral Leases – Oil and Gas Leases – Common Variety Mineral Leases. Available on the Internet at: http://www.admmr.state.az.us/Info/aztrustlands.html.

Arizona Department of Transportation (ADOT). 2007. Available on the Internet at http://www.dot.state.az.us/.

Arizona Game and Fish Department (AGFD). 2001a. *Idionycteris phyllotis*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 4 pp.

Arizona Game and Fish Department (AGFD). 2001b. *Nyctinomops macrotis*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 6 pp.

Arizona Game and Fish Department (AGFD). 2001c. *Macrotus californicus*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 6 pp.

Arizona Game and Fish Department (AGFD). 2002a. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 4 pp.

Arizona Game and Fish Department (AGFD). 2002b. *Aquila chrysaetos*.Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona.

Arizona Game and Fish Department (AGFD). 2002c. *Eumops perotis californicus*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 6 pp.

Arizona Game and Fish Department (AGFD). 2002d. *Falco peregrinus anatum*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 6 pp.

Arizona Game and Fish Department (AGFD). 2002e. *Heloderma suspectum cinctum*. Unpublished Abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 5 pp.

Arizona Game and Fish Department (AGFD). 2003a. Arizona Bat Conservation Strategic Plan. Hinman, K.E., and T.K. Snow, eds. 182 pp. Available on the Internet at http://www.azgfd.gov/w_c/bat_conservation.shtml.

Arizona Game and Fish Department (AGFD). 2003b. *Accipiter gentilis, Corynorhinus townsendii*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 6 pp. 9 pp.

Arizona Game and Fish Department (AGFD). 2003c. Fringed myotis. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 6 pp.

Arizona Game and Fish Department (AGFD). 2003d. Western small-footed myotis. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 5 pp.

Arizona Game and Fish Department (AGFD). 2003e. *Macrotus californicus*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 5 pp.

Arizona Game and Fish Department (AGFD). 2003f. *Myotis ciliolabrum*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 4 pp.

Arizona Game and Fish Department (AGFD). 2003g. *Myotis evotis*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 5 pp.

Arizona Game and Fish Department (AGFD). 2003h. *Myotis thysanodes*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 4 pp.

Arizona Game and Fish Department (AGFD). 2003i. *Myotis yumanensis*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 5 pp.

Arizona Game and Fish Department (AGFD). 2003j. *Nyctinomops macrotis*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 5 pp.

Arizona Game and Fish Department (AGFD). 2003k. *Penstemon bicolor* ssp. *roseus*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 5 pp.

Arizona Game and Fish Department (AGFD). 2003l. *Xantusia vigilis*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 6 pp.

Arizona Game and Fish Department (AGFD). 2003m. *Myotis volans*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 5 pp.

Arizona Game and Fish Department (AGFD). 2003n. *Euderma maculatum*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 9 pp.

Arizona Game and Fish Department (AGFD). 2004a. *Astragalus geyeri* var. *triquetrus*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 5 pp.

Arizona Game and Fish Department (AGFD). 2004b. *Astragalus preussi* var. *laxiflorus*. Unpublished abstract complied and edited by the Heritage Data Management System. Arizona Game and Fish Department. Phoenix, Arizona. http://www.azgfd.gov/w_c/edits/documents/Astrprcu.d_000.pdf.

Arizona Game and Fish Department (AGFD). 2004c. *Lanius ludovicianus*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 5 pp. Available online at http://www.azgfd.gov/w_c/edits/documents/Laniludo.d_001.pdf.

Arizona Game and Fish Department (AGFD). 2004d. *Lasionycteris noctivagans*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 4 pp.

Arizona Game and Fish Department (AGFD). 2004e. *Lasiurus cinereus*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 5 pp.

Arizona Game and Fish Department (AGFD). 2004f. *Myotis californicus*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 5 pp.AGFD. 2005a. Cirsium virginense. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 5 pp.

Arizona Game and Fish Department (AGFD). 2004g. *Pipistrellus hesperus*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 5 pp.

Arizona Game and Fish Department (AGFD). 2004h. *Tadarida brasiliensis*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 5 pp.

Arizona Game and Fish Department (AGFD). 2005a. *Agave utahensis* var. *kaibabensis*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 5 pp. Available online at: http://www.azgfd.gov/w_c/edits/documents/Agavutka.d.pdf.

Arizona Game and Fish Department (AGFD). 2005b. *Eriogonium phoeniceum*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 5 p.

Arizona Game and Fish Department (AGFD). 2005c. *Escobaria vivipara* var. *rosea*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 6 pp.

Arizona Game and Fish Department (AGFD). 2005d. *Ferocactus cylindraceus* var. *cylindraceus*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 5 pp. Available online at: http://www.azgfd.gov/w_c/edits/documents/Ferocycy.d.pdf.

Arizona Game and Fish Department (AGFD). 2005e. *Hyla regilla*. Unpublished abstract compiled and edited by Heritage Data Management System. Arizona Game and Fish Department. December 20, 2007. http://www.azgfd.gov/w_c/edits/documents/Pseuregi.d.pdf.

Arizona Game and Fish Department (AGFD). 2005f. *Lupinus latifolius* ssp. Leucanthus. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 5 pp.

Arizona Game and Fish Department (AGFD). 2005g. *Otus flammeolus*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 5 pp.

Arizona Game and Fish Department (AGFD). 2005h. *Pediomelum castoreum*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 4 pp.

Arizona Game and Fish Department (AGFD). 2005i. *Penstemon petiolatus*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 4 pp. Unpublished abstract compiled and edited by the Heritage Data Management.

Arizona Game and Fish Department (AGFD). 2005j. *Townsendia smithii*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 5 pp.

Arizona Game and Fish Department (AGFD). 2005k. *Tricardia watsonii*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 4 pp.

Arizona Game and Fish Department (AGFD). 2005l. *Sauromalus obesus obesus*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 4 pp.

Arizona Game and Fish Department (AGFD). 2005m. *Enceliopsis argophylla*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 4 pp.

Arizona Game and Fish Department (AGFD). 2006a. Arizona’s Comprehensive Wildlife Conservation Strategy: 2005-2015. Available on the Internet at: http://www.azgfd.gov/w_c/cwcs.shtml.

Arizona Game and Fish Department (AGFD). 2006b. *Echinocactus polycephalus* var. *xeranthemoides*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona. 6 pp.

Arizona Game and Fish Department (AGFD). 2006c. *Lasiurus blossevillii*. Nongame Species. Available on the Internet at http://www.azgfd.gov/w_c/nongame_western_red_bat.shtml.

Arizona Game and Fish Department (AGFD). 2007a. Hunting. Available on the Internet at http://www.AGFDd.gov/h_f/hunting.shtml.

Arizona Game and Fish Department (AGFD). 2007b. *Callisaurus draconoides*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona.

Arizona Game and Fish Department (AGFD). 2007c. *Crotaphytus bicinctores*. Arizona Game and Fish Department Heritage Data Management System. Available online at http://www.azgfd.gov/w_c/edits/documents/Crotbici.d.pdf.

Arizona Game and Fish Department (AGFD). 2007d. Natural heritage program element occurrence GIS dataset for Arizona portion of Lower Virgin River Watershed. Current as of June 2007.

Arizona Game and Fish Department (AGFD). 2007e. Minutes of the Arizona Fish and Game Commission. Available on the Internet at http://www.azgfd.gov/pdfs/inside_azgfd/minutes/2007/011907CommMtgMinutes.pdf.

Arizona Game and Fish Department (AGFD). 2008. Natural Heritage Program. Available on the Internet at http://www.azgfd.gov/w_c/edits/species_concern.shtmlam.

Arizona Partners in Amphibians and Reptile Conservation (AZPARC). 2006. Reptiles and Amphibians of Arizona. Available on the Internet at Reptiles of Arizona.

Arizona State Land Department (ASLD). 2007. Arizona State Land Parcel Viewer. Available on the Internet at http://sco.az.gov/website/parcels/viewer.htm.

Armstrong, D.M., and J.K. Jones, Jr. 1971. *Sorex merriami*. Mammalian Species 2:1-2.

Arrowood, P.C., C.A. Finley, and B.C. Thompson. 2001. Analysis of Burrowing Owl populations in New Mexico. Journal of Raptor Research 35:362-370.

Arsenault, D.P. 2002. Flammulated owl surveys in the Spring Mountains, Clark County, Nevada. Prepared for U.S. Forest Service, Spring Mountains National Recreation Area, Humboldt-Toiyabe National Forest.

Ashley, P., and S. Stival. 2004. Southeast Washington Ecoregional Assessment- Flammulated Owl (*Otus flammeolus*). January 2004.

Atwood, N.D., F.J. Smith, and T.A. Knight. 2002. Two New Species of Phacelia (*Hydrophyllaceae*) from the Southwestern United States. Novon 12(1):18-26.

Audubon Watch List. 2007. National Audubon Society, Inc. Available on the Internet at http://www.audubon2.org/watchlist/viewSpecies.jsp?id=128.

Azerrad, J.M. 2004. Management Recommendations for Washington's Priority Species – Volume V: Mammals, July 2004. Washington Department of Fish and Wildlife. Available on the Internet at http://www.wdfw.wa.gov/hab/phs/vol5/some.pdf.

Baicich, P.J., and C.J. Harrison. 1997. A Guide to the Nests, Eggs, and Nestlings of North American Birds. Second Edition. Academic Press, San Diego, California. p. 104.

Bangle, D. 2006. Assessment and distribution of *Astragalus mokiacensis*. Unpublished report. Prepared for the Lake Mead National Recreation Area, National Park Service, Boulder City, Nevada.

Baril, A. 1993. Pesticides and wildlife in the prairies: current regulatory issues. In G.L. Holroyd, H.L. Dickson, M. Regnier, and H.C. Smith, editors. Proceedings of the third endangered species and prairie conservation workshop. Natural History Occasional Paper 19. Provincial Museum of Alberta, Edmonton. Alberta, Canada.

Barneby, R.C. 1964. Atlas of North American Astragalus, parts I and II (separately bound). Memoirs of the New York Botanical Garden 13: 1-1188.

Bechard, M. J., and J. K. Schmutz. 1995. Ferruginous Hawk (*Buteo regalis*). In The Birds of North America, No. 172 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.

Beck, D.D. 1985. The natural history, distribution, and present status of the Gila monster in Utah. Department of Biology and Ecology Center, Utah State University, Logan, Utah. Report submitted to Utah Division of Wildlife Resources.

Behle, W.H., E.D. Sorensen, and C.M. White. 1985. Utah birds: a revised checklist. Occas. Publ. No. 4. Utah Museum of Natural History, University of Utah, Salt Lake City, Utah.

Behler, J. L., and F. W. King. 1979. The Audubon Society field guide to North American reptiles and amphibians. Alfred A. Knopf, New York. 719 pp.

Belsky, A.J., A. Matzke, and S. Uselman. 1999. Survey of livestock influences on stream and riparian ecosystems in the United States. Journal of Soil and Water Conservation. 54: 419-431. Available on the Internet at http://www.onda.org/library/papers/BelskyGrazing.pdf. Accessed July 31, 2006.

Benedict, R.A., J.D. Druecker, and H.H. Genoways. 1999. New records and habitat information for *Sorex merriami* in Nebraska. Great Basin Naturalist 59:285-287.

Bent, A. C. 1958. Life histories of North American blackbirds, orioles, tanagers, and allies. U.S. Natl. Mus. Bull. 211.

Bent, A.C. 1953. Life histories of North American wood warblers, part 1. U.S. Natural History Museum Bulletin 203. (Reprinted 1965 by Dover Publishers, New York.).

Bent, A.C. 1960. Life Histories of North American Birds. Volume II, Land Birds. Harper and Brothers, New York. 555 pp.

Berger, A.J. 1968. Vesper Sparrow. Pp. 868–886 In Life Histories of North American Cardinals, Grosbeaks, Buntings, Towhees, Finches, Sparrows, and their Allies. Pt. 2 (O. L. Austin, ed.). U.S. Natl. Mus. Bull. 237.

Berry, K.H. 1974. Desert tortoise relocation project: Status report for 1972. Div. of Highways, State of California, Desert tortoise relocation project. Contract No. F-9353.

Berry, K.H. 1984. Human activities in desert tortoise crucial habitats in California. In K.H. Berry, (ed.) The status of the desert tortoise (*Gopherus agassizii*) in the United States, Chapter 6. Desert Tortoise Council Report to Fish and Wildlife Service, Sacramento, California. Order No. 11310-0083-81.

Berry, K.H. 1986. Desert tortoise (*Gopherus agassizii*) relocation: Implications of social behavior and movements. Herpetologica 42:113-125.

Berry, K.H. 2003. Declining trends in desert tortoise populations at long-term study plots in California between 1979 and 2002: Multiple Issues. Abstract of paper presented at the Twenty-eighth Annual Meeting of the Desert Tortoise Council.

Berry, K.H. and B.L. Burge. 1984. The desert tortoise in Nevada. Chapter 8 In K.H. Berry. (ed.) 1984. The Status of the Desert Tortoise (*Gopherus agassizii*) in the United States. Report to U.S. Fish and Wildlife Service from the Desert Tortoise Council. Order No. 11210-0083-81.

Berry, K.H. and L.L. Nicholson. 1984. A summary of human activities and their impacts on desert tortoise populations and habitat in California. Chapter 3. In K. H. Berry (ed.), The Status of the Desert Tortoise (*Gopherus agassizii*) in the United States. Desert Tortoise Council report to U.S. Fish and Wildlife Service, Order No. 11310-0083-81, Sacramento, California.

Berry, K.H., and B.L. Burge. 1984. The desert tortoise in Nevada. Chapter 8 in K.H. Berry. (ed.) 1984. The Status of the Desert Tortoise (*Gopherus agassizii*) in the United States. Report to U.S. Fish and Wildlife Service from the Desert Tortoise Council. Order No. 11210-0083-81.

Berry, K.H., E.K. Spangenberg, B.L. Homer, and E.R. Jacobson. 2002. Deaths of desert tortoises following periods of drought and research manipulation. Chelonian Conservation and Biology 4(2):436-448.

Best, L.B. and N. L. Rodenhouse. 1984. Territory preference of vesper sparrows in cropland. Wilson Bull. 96: 72–82.

Best, T.L., N.J. Hildreth, and C. Jones. 1989. Dipodomys Deserti. Am. Soc. Mamm., Mammalian Species No. 339:1-8.

Biota Information System of New Mexico. 2000. Burrowing Owl (*Athene cunicularia hypugaea*). BISON Species Account 041320. New Mexico Department of Game & Fish. http://www.fw.vt.edu/fishex/nmex_main/species/041320.htm. Pp. 1-30.

BIO-WEST, Inc. 2001. An Ecological Evaluation of the Lower Virgin River Riparian Corridor. Southern Nevada Water Authority, Las Vegas, Nevada. BIO-WEST, Inc. Logan, Utah.

BIO-WEST, Inc. 2005. Colorado River Backwaters Evaluation Species Profiles Report. Submitted to: U.S. Bureau of Reclamation Lower Colorado Region Boulder City, Nevada. BIO-WEST, Inc. Logan, Utah.

BirdLife International. 2006. Species factsheet: *Gymnorhinus cyanocephalus*, Pinyon Jay Available on the Internet at http://www.birdlife.org/datazone/species/index.html?action=SpcHTMDetails.asp&sid=5685&m=0.

BLM and AGFD. 1983. The Virgin River-Pakoon Basin Habitat Management Plan. Bureau of Land Management. St. George, Utah. 240 pp.

BLM, USFWS, and California Department of Fish and Game (CDFG). 1989. Environmental Assessment for Selected Control of the Common Raven to Reduce Desert Tortoise Predation in the Mojave Desert, California. BLM, Riverside, California.

Blue Planet Biomes. 2008. Available on the Internet at http://www.blueplanetbiomes.org/kangaroo_rat.htm

Boarman, W.I. 2002. Threats to Desert Tortoise Populations: A Critical Review of the Literature. Prepared for West Mojave Planning Team, Bureau of Land Management by USGS. Available on the Internet at http://www.werc.usgs.gov/sandiego/pdfs/tortoisethreats.pdf.

Bock, C.E., and J. H. Bock. 1999. Response of winter birds to drought and short-duration grazing in southeastern Arizona. Conserv. Biol. 15: 1117–1123.

Bock, C.E., V.A. Saab, T.D. Rich, and D.S. Dobkin. 1993. Effects of livestock grazing on Neotropical migratory landbirds in western North America. In D.M. Finch and P.W. Stangel, editors. Status and Management of Neotropical Migratory Birds. Pages 296-309. U.S.D.A. Forest Service, General Technical Report RM-229.

Borysenko, M. and S. Lewis. 1979. The effect of malnutrition on immunocompetence and whole body resistance to infection in *Chelydra serpentina*. Developmental and Comparative Immunology 3:89-100.

Bradford, D.F., J.R. Jaeger, and R.D. Jennings. 2001. Unpublished report from Arizona division of United States Fish and Wildlife Service, received pursuant to FOIA request.

Bradley, P.V., M.J. O'Farrell, J.A. Williams, and J.E. Newmark. (Eds.). 2006. The revised Nevada bat conservation plan. Nevada Bat Working Group. Reno, Nevada. Brady, N.C. and R.R. Weil. 2002. Elements of the Nature and Properties of Soils, Second Edition. Pearson Prentice Hall. Upper Saddle River, New Jersey.

Braun, CE., M.F. Baker, R.L. Eng, J.S. Gashwiler and M.H. Schroeder. 1976. Conservation committee report on effects of alteration of sagebrush communities on the associated avifauna. Wilson Bull. 88: 165–171.

Breeding Bird Survey (BBS). 1999. The North American Breeding Bird Survey, Results and Analysis 1966-1999. Draft as of 8-4-00. USGS Patuxent Wildlife Research Center, Laurel, Maryland.

Brennan, T.C. 2006. Lizards of Arizona. Available on the Internet at http://www.reptilesofaz.com/Lizards-Subpages/h-x-vigilis.html.

Breshears, D.D., N. Cobb, P. Rich. 2006. Regional vegetation die-off in response to global change type drought. Proceedings of the National Academy of Sciences. In press.

Brian, N.J. 2000. A Field Guide to the Special Status Plants of Grand Canyon National Park. Science Center, Grand Canyon National Park. Grand Canyon, Arizona.

Britten, H.B., Riddle, B.R., Brussard, P.F., Marlow, R., and Lee, T.E., Jr. 1997. Genetic delineation of Management Units for the desert tortoise, *Gopherus agassizii*, in the northeastern Mojave Desert. Copeia 1997(3):523-530.

Brock, R.E., and D.A. Kelt. 2004. Influence of roads on the endangered Stephens' kangaroo rat (*Dipodomys stephensi*): are dirt and gravel roads different? Biological Conservation 118: 633-640.

Brooks, M.L. 1998. Alien Annual Grass Distribution, Abundance, and Impact on Desert Tortoise Habitat in the Western Mojave Desert. Ph.D. Dissertation. University of California at Riverside.

Brooks, M.L., and T.C. Esque. 2002. Alien plants and fire in desert tortoise (*Gopherus agassizii*) habitat of the Mojave and Colorado deserts. Chelonian Conservation and Biology 4:330-340.

Brown, D.E., and R.A. Minnich. 1986. Fire and changes in creosote bush scrub in the western Sonoran Desert, California. American Midlands Naturalist 1 16(2):41 1-422.

Brown, D.R., I.M. Schumacher, G.S. McLaughlin, L.D. Wendland, M.B. Brown, P.A. Klein, and E.R. Jacobson. 2002. Application of diagnostic tests for mycoplasmal infections of desert and gopher tortoises, with management recommendations. Chelonian Conservation and Biology 4: 497–507. Available on the Internet at http://www.jwildlifedis.org/cgi/content/full/41/4/839.

Brown, J.H., and G.A. Lieberman. 1973. Resources utilization and coexistence of seed eating desert rodents in sand dune habitats. Ecology 54:788-797.

Brown, M.B., I.M. Schumacher, P.A. Klein, K. Harris, T. Correll, and E.R. Jacobson. 1994. *Mycoplasma agassizii* causes upper respiratory tract disease in the desert tortoises. Infection and Immunity. 62(10):4580-4586.

Brown, M.B., K.H. Berry, I.M. Schumacher, K.A. Nagy, M.M. Christopher, and P.A. Kleinches. 1999. Seroepidemiology of upper respiratory tract disease in the desert tortoise of California. J. Wildlife Diseases. 35(4):716–727.

Brown, N.L. 1998. The Howdy Owls of Arizona. Abstract and notes. Second International Burrowing Owl Symposium, September 29-30, 1998, Ogden, Utah. Canadian Wildlife Service, Environment Canada.

Buechner, H.K. 1960. The bighorn sheep in the United States: its past, present, and future. Wildlife Monograph Number 4.

Bureau of Land Management (BLM). 1990. Final Wilderness Management Plan. Paiute and Beaver Dam Wilderness. Arizona Strip District and Cedar City District, Mohave County, Arizona, and Washington County, Utah. June 1990.

Bureau of Land Management (BLM). 1998. Proposed Las Vegas Resource Management Plan and Final Environmental Impact Statement Volume I: Summary, Purposed and Need, Alternatives, Affected Environment, Impacts, Consultation and Coordination, and Plan Implementation, Maintenance, and Amendment. May 1998. Las Vegas Field Office.

Bureau of Land Management (BLM). 2003a. Nevada BLM Sensitive Species. Available at http://www.nv.blm.gov/wildlife/documents/sensitivespecies.pdf. Access July 12, 2006.

Bureau of Land Management (BLM). 2003b. Instruction Memorandum No. UT 2003-027

Bureau of Land Management (BLM). 2005. Arizona BLM Sensitive Species List. Available on the Internet at http://www.blm.gov/nhp/efoia/az/2000IMs/AZIM2000-18.htm.

Bureau of Land Management (BLM). 2006. Conservation Management Strategy for Mesquite and Acacia Woodlands in Clark County, Nevada. Portion of document available at http://www.co.clark.nv.us/air_quality/Environmental/ShortTermPages/CMS%20for%20mesquite%20and%20acacia%20woodlands%20March%202006.pdf. Accessed July 12, 2006.

Bureau of Land Management (BLM). 2007. Draft Las Vegas Field Office Biological Assessment.

Bureau of Land Management (BLM). 2007a. Arizona Strip Proposed Plan/Final Environmental Impact Statement. Arizona Strip Field Office. Available on the Internet at http://www.blm.gov/az/LUP/strip/FEIS.htm.

Bureau of Land Management (BLM). 2007a. Proposed Resource Management Plan and Environmental Impact Statement for the Arizona Strip Field Office, Vermilion Cliffs Field Office, and Bureau of Land Management portion of the Grand Canyon-Parashant National Monument, and a Proposed General Management Plan for the National Park Service Portion and Final Environmental Impact Statement for the National Park Service Portion of Grand Canyon-Parashant National Monument. Prepared by Arizona Strip Bureau of Land Management and National Park Service. Available on the Internet at http://www.blm.gov/az/LUP/strip/FEIS.htm.

Bureau of Land Management (BLM). 2007b. Land and Mineral Use Records Viewer. Available on the Internet at http://www.geocommunicator.gov/NILS-PARCEL2/map.jsp?MAP=MC.

Bureau of Land Management (BLM). 2007b. Nevada State Office website. Available on the Internet at http://www.blm.gov/nv/st/en.html.

Bureau of Land Management (BLM). 2007c. Prairie Falcon (*Falco mexicanus*). Available on the Internet at http://www.birdsofprey.blm.gov/nat-res/prfa.htm.

Bureau of Land Management (BLM). 2007c. U.S. Department of the Interior Bureau of Land Management Arizona Minerals and Mining Programs. Available on the Internet at: http://www.blm.gov/az/st/en/prog/mining.html

Bureau of Land Management (BLM). 2007d. U.S. Department of the Interior Bureau of Land Management. Minerals and Mining – Mineral Materials. Available on the Internet at http://www.blm.gov/wo/st/en/prog/more/non-energy_minerals.html.

Bureau of Land Management (BLM). 2008. Draft Vernal Resource Management Plan Synopsis. Available on the Internet at http://www.ut.blm.gov/vernalrmpguide/recreation.htm.

Burge, B.L. 1978. Physical characteristics and patterns of utilization of cover sites used by *Gopherus agassizii* in southern Nevada. Desert Tortoise Council Symp. 1978:132–140.

Burge, B.L. 1989. What goes up must come down. Massive balloon releases are a potential threat to tortoises and other wildlife. Tortoise Tracks l0 (3):4.

Burge, B.L. and Bradley, W.G. 1976. Population density, structure and feeding habits of the desert tortoise, *Gopherus agassizii*, in a low desert study area in southern Nevada. Desert Tortoise Council Symposium 1976:51-74.

Burridge, B. 1995. Sonoma County breeding bird atlas: detailed maps and accounts for our nesting birds. Madrone Audubon Society, Santa Rosa, California.

Bury, R.B. 1987. Desert tortoise research – U.S. Fish and Wildlife Service. Proceedings of the 1987–1991 Desert Tortoise Council Symposia. pp. 4–7.

Butterworth, B.B. 1961. The breeding of Dipodomys deserti in the laboratory. J. Mammal. 42:413-414.

Butts, K.O. 1973. Life history and habitat requirements of Burrowing Owls in western Oklahoma. M.S. Thesis. Oklahoma State University, Stillwater, Oklahoma.

Butts, K.O. and J.C. Lewis. 1982. The importance of prairie dog towns to Burrowing Owls in Oklahoma. Proceedings of the Oklahoma Academy of Science 62:46-5.

CalFlora: Information on California plants for education, research, and conservation. [web application]. 2002. Berkeley, California: The CalFlora database [a non-profit organization]. Available on the Internet at www.calflora.org.

California Department of Fish and Game (CDFG). 2005. State of California Resources Agency, Department of Fish and Game, Habitat Conservation Division, Wildlife and Habitat Data Analysis Branch, California Natural Diversity Database. Special Animals. July 2005. Available at: http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.asp.

California Native Plant Society (CNPS). 2004. California Native Plant Link Exchange. Available on the Internet at http://www.cnplx.info/index.html. Accessed on February 2, 2007.

Californiaherps. 2007. California Reptiles and Amphibians. Available http://www.californiaherps.com/index.html (Accessed: December 10, 2007)

Campbell, J.A., and W.W. Lamar. 2004. The Venomous Reptiles of the Western Hemisphere. 2 volumes. Cornell University Press.

Cannings, R.J. 1993. Northern Saw-whet Owl (*Aegolius acadicus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/042doi:bna.42.

Cannings, R.J., and Tony Angell. 2001. Western Screech-Owl (*Megascops kennicottii*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/597doi:bna.597.

Carraway, L.N. 1995. A key to recent Soricidae of the western United States and Canada based primarily on dentaries. Occasional Papers of the Natural History Museum, University of Kansas (175):1-49.

Carter, M.F., and K. Barker. 1993. An interactive database for setting conservation priorities for western Neotropical migrants. Pp. 120–144 inStatus and management of Neotropical migratory birds (D. M. Finch and P. W. Stangel, eds.). Gen. Tech. Rep. RM-229, U.S. Dep Agric., Forest Service, Fort Collins, Colorado.

Chamberland, M. 1997. Systematics of the *Echinocactus polycephalus complex* (Cactaceae). Syst. Bot. 22: 303-313.

Christopher, M.M., K.H. Berry, B.T. Henen, and K.A. Nagy. 2003. Clinical disease and laboratory abnormalities in free-ranging desert tortoises in California (1990-1995). J. Wildl. Dis. 39(1):35-56.

Chu, M.C., and G. Walsberg. 1999. Phainopepla (*Phainopepla nitens*). The Birds of North America 415.

Churchfield, S. 1990. The Natural History of Shrews. Ithaca, NT. U.S.A: Cornell University Press.

City of Mesquite, Nevada. 2006. Final Land Use Element. City of Mesquite Master Plan. Finalized May 2006. Available on the Internet at http://www.mesquitenv.com/emplibrary/Final_LandUse_052306.pdf.

City of Mesquite. 1994. Recreational Plan Element. Mesquite Master Plan. Available on the Internet at http://www.mesquitenv.com/file/MP1994Chapter13RecreationPlanElement.

City of Mesquite. 2003. Official site of the City of Mesquite, Nevada. Available on the Internet at http://www.mesquitenv.com/.

City of Mesquite. 2007. Land use element for the City of Mesquite, Nevada. Available on the Internet at http://www.mesquitenv.gov/SiteObjects/published/3E5E0C29ED1D8A9691E63E547AB9637E/6DE2C78D7151872EC2B9749A473D8DD8/file/LandUseElement.pdf.

City of Mesquite. 2008. Parks and Trails System Map. Prepared January 4, 2008. Available on the Internet at http://www.mesquitenv.gov/SiteObjects/published/3E5E0C29ED1D8A9691E63E547AB9637E/8CD102144D82D06B63DE4CEA24425506/file/Park&TrailsMap11x17.pdf.

Clark County Department of Comprehensive Planning (CCCP). 1994. Northeast County Land Use Plan, Clark County. Available on the Internet at http://www.co.clark.nv.us/comprehensive_planning/LUP/NortheastCounty.htm#History.

Clark County Department of Comprehensive Planning (CCCP). 2006a. Clark County, Nevada 2006 Population Estimates, by Place. Available on the Internet at http://www.co.clark.nv.us/comprehensive_planning/Advanced/Demographics/2006PopulationEstimate/2006PlacePopulation.pdf.

Clark County Department of Comprehensive Planning (CCCP). 2006b. Land Use Map for Northeast Clark County. Adopted September 6, 2006. Available on the Internet at http://gisgate.co.clark.nv.us/gisplot_pdfs/cp/neplu.pdf.

Clark County Department of Comprehensive Planning (CCCP). 2007. Clark County Demographics. Brochure. March 2007. Available on the Internet at http://www.co.clark.nv.us/Comprehensive_planning/Advanced/Demographics/popbroch2007color.pdf.

Clark County Department of Comprehensive Planning (CCCP). 2008. Northeast County [Bunkerville] Individual Rural Planning Area Map. Available on the Internet at http://gisgate.co.clark.nv.us/gismo/cpmapprod.htm.

Clark County Desert Conservation Program (Clark County DCP). 2007a. Conservation Management Strategy – Gold Butte Desert Wildlife Management Strategy. February 2007. Available on the Internet at http://accessclarkcounty.com/daqem/epd/desert/pdf/GoldButteDWMA.pdf.

Clark County Desert Conservation Program (Clark County DCP). 2007a. Conservation Management Strategy – Mormon Mesa Desert Wildlife Management Strategy. February 2007. Available on the Internet at http://accessclarkcounty.com/daqem/epd/desert/pdf/MormonMesaDWMA.pdf.

Clark County Environmental Planning Division (Clark County EPD). 2008. Clark County Trail Development Program. Available on the Internet at http://www.co.clark.nv.us/Air_Quality/oldweb/Environmental/TrailsPlanning.htm.

Clark County Regional Flood Control District (CCRFCD). 2001. City of Mesquite Flood Control Master Plan.

Clark County. 2002. Bunkerville Secondary Trails Plan. An Addendum to the Parks and Recreation Master Plan. 2000-2020. May 7, 2002.

Clark County. 2006a. Adaptive Management Report for the Clark County, Nevada Multiple Species Habitat Conservation Plan. Unpublished report from Clark County, Nevada as Plan Administrator to U.S. Fish and Wildlife Service.

Clark County. 2006b. Land Use Plans – Northeast County. Department of Comprehensive Planning, Las Vegas, Nevada. Available at: http://www.co.clark.nv.us/comprehensive_planning/LUP/NortheastCounty.htm. Accessed April 2007.

Clark County. 2007. Conservation Management Strategy for Mormon Mesa Desert Wildlife Management Area. Available on the Internet at http://accessclarkcounty.com/daqem/epd/desert/pdf/MormonMesaDWMA.pdf.

Clark, T.W., and M.R. Stromberg. 1987. Mammals in Wyoming. Univ. Kansas Mus. Nat. Hist. Publ. Education Series No. 10. xii + 314 pp.

CNPS. 2007. Inventory of Rare and Endangered Plants (online edition, v7-07d). California Native Plant Society. Sacramento, CA. Dec. 20, 2007. http://www.cnps.org/inventory.

Cole, K.L. and S. T. Arundel. In Press. Modeling the Climatic Requirements for Southwestern Plant Species, In, Proceedings of the Twenty first Annual Pacific Climate Workshop, S. Starratt and N. Bloomquist (eds), State of California Department of Water Resources.

Collins, E.P. 2003. Long-nosed Leopard Lizard. Available on the Internet at http://www.azgfd.gov/w_c/nongame_longnosed_leopard_lizard.shtml

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, S. Pyne, M. Reid, K. Schulz, K. Snow and, J. Teague, 2003. Ecological systems of the United States: A working classification of U.S. terrestrial systems. NatureServe, Arlington, Virginia. Available on the Internet at http://www.natureserve.org/library/usEcologicalsystems.pdf

Commission for Environmental Cooperation (CEC). 2005. North American Conservation Action Plan. Western Burrowing Owl, 55 pp.

Corn, P.S. 1994. What we know and don't know about amphibian declines in the west. In: Sustainable Ecological Systems: Implementing an Ecological Approach to Land Management. Covington and DeBano, editors. USFS, Rocky Mt. Forest and Range Exp. Sta., Ft. Collins, CO. General Technical Report RM 247. May, 1994. pp. 59-67.

Cornell Lab of Ornithology. 2003a. All about birds: Bendire's Thrasher. Available online at: http://www.birds.cornell.edu/AllAboutBirds/BirdGuide/Bendires_Thrasher_dtl.html.

Cornell Lab of Ornithology. 2003b. All about birds: Blue Grosbeak. Available online at: http://www.birds.cornell.edu/AllAboutBirds/BirdGuide/Blue_Grosbeak.html.

Cornell Lab of Ornithology. 2003c. All about birds: Crissal Thrasher. Available online at: http://www.birds.cornell.edu/AllAboutBirds/BirdGuide/Crissal_Thrasher_dtl.html.

Cornell Lab of Ornithology. 2003d. All about birds: Gray Vireo. Available online at: http://www.birds.cornell.edu/AllAboutBirds/BirdGuide/Gray_Vireo.html.

Cornell Lab of Ornithology. 2003e. All about birds: Le Conte's Thrasher. Available online at: http://www.birds.cornell.edu/AllAboutBirds/BirdGuide/Le_Contes_Thrasher_dtl.html.

Cornell Lab of Ornithology. 2003f. All about birds: Pinyon Jay. Available on the Internet at http://www.birds.cornell.edu/AllAboutBirds/BirdGuide/Pinyon_Jay_dtl.html.

Cornell Lab of Ornithology. 2006. *Phainopepla nitens* species account. Available at http://www.birds.cornell.edu/AllAboutBirds/BirdGuide/Phainopepla_dtl.html. Accessed July 11, 2006. Source for species account is Chu, M., and G. Walsberg. 1999. Phainopepla (Phainopepla nitens). In The Birds of North America, No. 415 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, Pennsylvania.

Coues, E. 1878. Birds of the Colorado Valley. U.S. Geological Service of Territory. Miscellaneous Publication 11.

Crampton, L., J. Krueger, and D. Murphy. 2006. Conservation Management Strategy for Mesquite and Acacia Woodlands in Clark County, Nevada. BLM Las Vegas Field Office.

Crampton, L.H. 2004. Ecological determinants of phainopepla (*Phainopepla nitens*) abundance and breeding success in the northeastern Mojave Desert. Dissertation. University of Nevada Reno, Reno.

Cronquist, A., A.H. Holmgren, N.H. Holmgren, J. L. Reveal, and P. K. Holmgren. 1984. Intermountain flora vol. 4. Subclass Asteridae (except Asteraceae). Bronx: The New York Botanical Garden. 573 pages.

Crooks, K.R., A.V. Suarez, and D.T. Bolger. 2004. Avian assemblages along a gradient of urbanization in a highly fragmented landscape. Biological Conservation. 11: 451-462.

Csuti, B. and Crist, P. 1998. Methods for assessing accuracy of animal distribution maps. Available on the Internet at http://www.gap.uidaho.edu/VertebrateDistributionAssessment/default.htm.

Czaplewski, N.J. 1983. *Idionycteris phyllotis*. Mammalian Species. 208:1-4.

Daily, G. C., ed. 1997. Nature's Services. Island Press: Washington, DC.

Davis, William B. and David J. Schmidly. 1994. Desert Pocket Mouse. The Mammals of Texas: Online Edition. Texas Parks and Wildlife Department. Available on the Internet at http://www.nsrl.ttu.edu/tmot1/chaepeni.htm.

Dawson, W.L. 1923. The birds of California. Volume 1. South Moulton Co., San Diego, California.

Dawson, W.R. and F. C. Evans. 1960. Relation of growth and development to temperature regulation in nestling Vesper Sparrows. Condor 62: 329–340.

Dechant, J.A., M.L. Sondreal, D.H. Johnson, L.D. Igl, Goldade, A.L. Zimmerman, B.R. Euliss; revisions by J.D. Reichel, E.C. Atkinson, G. Hammerson, M. Koenen, and D.W. Mehlman. 2001. The Nature Conservancy Species Management Abstract for Ferruginous Hawk (*Buteo regalis*). Available on the Internet at http://conserveonline.org/docs/2001/03/feha.doc.

DeForge, J.R. 1980. Population biology of desert bighorn sheep in the San Gabriel Mountains of California. Desert Bighorn Council Transactions 24:29-32.

DeForge, J.R., and J.E. Scott. 1982. Ecological investigations into high lamb mortality. Desert Bighorn Council Transactions 26:65-76.

DeForge, J.R., J.E. Scott, G.W. Sudmeier, R.L. Graham and S.V. Segreto. 1982. The loss of two populations of desert bighorn sheep in California. Desert Bighorn Council Transactions 26:36-38.

Degenhardt, W.G., C.W. Painter, and A.H. Price. 1996. Amphibians and Reptiles of New Mexico. University of New Mexico Press, Albuquerque. xix + 431 pp.

Delgadillo, M.C. 2006. Crossidium, Bryophyte Flora of North America, Provisional Publication, Buffalo Museum of Science, Date of publication, http://www.mobot.org/plantscience/BFNA/v1/PottCrossidium.htmL. Downloaded July 24, 2007.

Dennis, J.V. 1958. Some aspects of the breeding ecology of the yellow-breasted chat (*Icteria virens*). Bird-Banding 29:169-83.

DeSante, D.F. and T.L. George. 1994. Population trends in the landbirds of western North America. Stud. Avian Biol. 15: 173–189.

DeSante, D.F., E.D. Ruhlen, S.L. Adamany, K.M. Butron, and S. Amin. 1997. A census of Burrowing Owls in central California in 1991. In J. Lincer and K. Steenhoff, editors. The Burrowing Owl, its biology and Management including the proceedings of the First International Burrowing Owl Symposium. Raptor Research Report Number 9. Pages 38-48.

Desert USA. 2005. Kangaroo Rats. Available on the Internet at http://www.desertusa.com/aug96/du_krat.html.

Desert USA. 2008. Bighorn Sheep. Available on the Internet at http://www.desertusa.com/big.html.

Desmond, M.J., and J.A. Savidge. 1996. Factors influencing Burrowing Owl (*Speotyto cunicularia*) nest densities and numbers in western Nebraska. American Midland Naturalist 136:143-148.

Desmond, M.J., and J.A. Savidge. 1998. Burrowing Owl conservation in the Great Plains. Page 9 in Abstracts of the Second International Burrowing Owl Symposium, Ogden, Utah.

Desmond, M.J., and J.A. Savidge. 1999. Satellite burrow use by Burrowing Owl chicks and its influence on nest fate. In P.D. Vickery and J.R. Herkert, editors. Ecology and conservation of grassland birds in the western hemisphere. Studies in Aviation Biology 19.

Desmond, M.J., J.A. Savidge, and K.M. Eskridge. 2000. Correlations between Burrowing Owl and black-tailed prairie dog declines: a 7-year analysis. Journal of Wildlife Management 64:1

Dickinson, J.L., W. D. Koenig and F. A. Pitelka. 1996. Fitness consequences of helping behavior in the Western Bluebird. Behav. Ecol. 7: 168–177.

Discover Life. 2007. *Sceloporus tristichus*. Available on the Internet at http://pick4.pick.uga.edu/mp/20q?search=Sceloporus+tristichus&guide=Lizards.

Dixon, G.L. and Terry Katzer, 2002. Geology and hydrology of the Lower Virgin River Valley in Nevada, Arizona, and Utah. Prepared for the Virgin Valley Water District, VVWD-01.

Donohue, D.L. 1999. The Western Range Revisited: Removing Livestock from Public Lands to Conserve Native Biodiversity. University of Oklahoma Press, Norman.

Driesner, D. and A. Coyner. 2007. The Nevada Department of Minerals. Nevada Bureau of Mines and Geology. Major Mines of Nevada 2006 – Mineral Industries in Nevada's Economy. College of Science University of Nevada, Reno. Special Publication P-18. 2007.

Dundas, H. and J. Jensen. 1995. Burrowing Owl status and conservation. Bird Trends 4:21-22.

Dunn, J.L. and K.L. Garrett. 1997. A field guide to warblers of North America. Houghton Mifflin Co., Boston, Massachusetts.

Dunn, W.C., and C.L. Douglas. 1982. Interactions between desert bighorn sheep and feral burros at spring areas in Death Valley. Desert Bighorn Council Transactions 26:87-96.

Eckerle, K.P., and C.F. Thompson. 2001. Yellow-breasted Chat (*Icteria virens*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/575doi:bna.575

Ehrenfeld, J.G., and L.A. Toth. 1997. Restoration ecology and the ecosystem perspective. Restoration Ecology. 5(4):307-317.

Ehrlich, P., D.S. Dobkin, and D. Wheye. 1988. The Birder's Handbook: A Field Guide to the Natural History of North American Birds Including All Species That Regularly Breed North of Mexico.

Eltzroth, E.K. 1983. Breeding biology and mortality of Western Bluebirds near Corvallis, Oregon. Sialia 5: 83–87.

Emerson, K.C. 1972. Checklist of the Mallophaga of North America (north of Mexico), Part IV. Bird host list. Desert Test Center. Dugway Proving Grounds, Dugway, Utah.

Enature. 2005. Desert Iguana. Available online at: http://www.enature.com/fieldguides/detail.asp?recnum=AR0066.

ENTRIX. 2008. Draft Virgin River Habitat Conservation and Recovery Program document. February 2008. Preliminary Draft.

Environmental Protection Agency (EPA). 2007. Level III Ecoregions of the Conterminous United States map. Available on the Internet at http://www.epa.gov/wed/pages/ecoregions/level_iii.htm.Falk, M. and P. Jenkins., 2001. Arizona Rare Plant Field Guide. Published by a collaboration of agencies and organizations. Pages unnumbered.

EnviroPlus Consulting. 1995. Methods of reducing desert tortoise mortality along roadways. Draft report submitted to Clark County Manager's Office, 500 South Grand Central Pkwy, Las Vegas, Nevada, 89155. 78 pages.

Evans, D.R., and J.E. Gates. 1997. Cowbird selection of breeding areas: The role of habitat and bird species abundance. Wilson Bulletin 109(3): 470-480. Available online at: http://elibrary.unm.edu/sora/Wilson/v109n03/p0470-p0480.pdf.

Falk, D.A., M.A. Palmer, and J.B. Zedler. 2006. Foundations of Restoration Ecology. Island Press: Washington, DC.

Federal Register. 1999. Endangered and Threatened Wildlife and Plants; final rule to remove the American peregrine falcon from the Federal List of Endangered and Threatened Wildlife, and to remove the Similarity of Appearance Provision for free-flying peregrines in the conterminous United States. Final rule. U.S. Fish and Wildlife Service. Vol. 64, No. 164.

Fenton, M. B., D. C. Tennant, and J. Wyszeck. 1987. Using echolocation calls to measure distribution of bats: the case of *Euderma maculatum*. J. Mamm. 68:142-144.

Fenton, M.G., and R.M.R. Barclay. 1980. *Myotis lucifugus*. Mammalian Species 142:1-8.

Finley, W.L. 1907. Two studies in blue. Condor 9: 121–127.

Fleischner, T.L. 1994. Ecological costs of livestock grazing in western North America. Conservation Biology 8: 629-644.

Flood, Nancy J. 2002. Scott's Oriole (*Icterus parisorum*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/608doi:bna.608

Flora of North America (FNA), Editorial Committee, eds. 1993. Flora of North America North of Mexico. 12+ vols. New York and Oxford. Available at: http://www.efloras.org/flora_page.aspx?flora_id=1.

Floyd, T., C.S. Elphick, G. Chisholm, K. Mack, R.G. Elston, E.M. Ammon, and J.D. Boone. 2007. The Atlas of Breeding Birds of Nevada. Univ. of Nevada Press. 150 pp.

Franklin, M.A. 1995. Field Survey of *Epilobium nevadense* Munz in the Dixie Resource Area, Washington County, Utah. Final Report for 1994 Challenge Cost Share Report. Utah Natural Heritage Program. Unpublished survey report on file.

Franklin, M.A. 2005. Plant Information Compiled by the Utah Natural Heritage Program: A Progress Report. Utah Division of Wildlife Resources. Publication No. 05-40. AGFD 2005 4 pages.

Fraternity of Desert Bighorn. 2008. Available on the Internet at http://www.desertbighorn.com.

Frid, A. and L.M. Dill. 2002. Human-caused disturbance stimuli as a form of predation risk. Conservation Ecology 6(1): 11. Available on the Internet at http://www.consecol.org/vol6/iss1/art11/.

Frischknecht, N.C. 1975. Native faunal relationships within the pinyon-juniper ecosystem. Pages 55-65 In G. F. Gifford and F. E. Busby, eds. The pinyon-juniper ecosystem: a symposium. Utah State Univ., Col. Natur. Res. and Utah Agric. Exp. Sta. Publ., Logan, Utah.

Garland, T., Jr. and W.G. Bradley. 1984. Effects of a highway on Mojave Desert rodent populations. American Midland Naturalist 111:47-56.

Garside, L.J., R.H. Hess, K.L. Fleming, and B.S. Weimer. 1988. Nevada Bureau of Mines and Geology. Bulletin 104 Oil and Gas Developments in Nevada. Available on the Internet at http://www.nbmg.unr.edu/dox/b104/b104.htm

Geist, V. 1971. Mountain sheep: a study in behavior and evolution. University of Chicago Press, Chicago, IL. 383 pp.

George, S.B. 1990. Unusual records of shrews in New Mexico. Southwest. Nat. 35:464-465.

Germano, D.J., R.B. Bury, T.C. Esque, T.H. Fritts, and P.A. Medica. 1994. Range and habitats of the desert tortoise. pp. 73-84 In Bury, R.B., and D.J. Germano (eds.), Biology of North American Tortoises. U.S. Department of the Interior National Biological Survey, Fish and Wildlife Research 13, Washington, D.C.

Ginnett, T.F., and C.L. Douglas. 1982. Food habits of feral burros and desert bighorn sheep in Death Valley National Monument. Desert Bighorn Council Transactions 26:81-87.

Gleason, R.S. 1978. Aspects of the Breeding Biology of Burrowing Owls in Southeastern Idaho. M.S. Thesis. University of Idaho, Moscow, Idaho.

Glinski, R.L. Ed. 1998. The Raptors of Arizona. The University of Arizona Press, Tucson. p. 128-132.

Godfrey, W. E. 1986. The Birds of Canada. Natl. Mus. of Nat. Sci., Ottawa, Canada.

Goodlett, G., and A.P. Woodman. 2003. Desert tortoise population survey at Virgin Slope desert tortoise study plot, spring 2003. Report prepared for Arizona Game and Fish Dept, Nongame, Contract G90040-K, Phoenix, Arizona.

Goodsell, J.A., and L. B. Kats. 1999. Effect of introduced mosquitofish on Pacific treefrogs and the role of alternative prey. Conservation Biology 13:921-924.

Gorrell, J.V., M.E. Andersen, K.D. Bunell, M.F. Canning, A.G. Clark, D.E. Dolsen, and FP Howe. 2005. Utah Comprehensive Wildlife Conservation Strategy. Utah Division of Wildlife Reources. Salt Lake City, Utah. Publication Number 05-19.

Gough, G.A., Sauer, J.R., Iliff, M. Patuxent Bird Identification Infocenter. 1998. Version 97.1. Patuxent Wildlife Research Center, Laurel, MD. http://www.mbrpwrc.usgs.gov/Infocenter/i6430id.html.

Grant, R.A. 1965. The burrowing owl in Minnesota. Loon 37:2-17.

Great Basin Bird Observatory (GBBO). 2005. Landbirds of Nevada and the habitats they need: a resource manager's guide to conservation priority species. Great Basin Bird Observatory Technical Report No. 05-01. Great Basin Bird Observatory, Reno, Nevada.

Green, T.W., and G.E. Bohart. 1975. The Pollination Ecology of *Astragalus cibarius* and *Astragalus utahensis* (Leguminosae). American Journal of Botany, 62: 379-386.

Greiner, E.C., G.F. Bennett, E.M. White and R.F. Coombs. 1975. Distribution of the avian hematozoa of North America. Can. J. Zool. 53: 1762–1787.

Grinnell, J. and A.H. Miller. 1944. Distribution of the birds of California. Pacific Coast Avifauna 27.

Grinnell, J. and H.S. Swarth. 1913. An account of the birds and mammals of the San Jacinto area of southern California. Univ. Calif. Publ. Zool. 10: 197–406.

Grinnell, J., H.C. Bryant, and T.I. Storer. 1918. The Game Birds of California. Univ. California Press, Berkeley, California.

Guinan, Judith A., Patricia A. Gowaty, and Elsie K. Eltzroth. 2000. Western Bluebird (*Sialia mexicana*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/510doi:bna.510.

Hafner, J. C., and M. S. Hafner. 1983. Evolutionary relationships of heteromyid rodents. Great Basin Naturalist Memoirs 7: 3-29.

Hall, E. Raymond. 1981. The Mammals of North America, Vols. I & II. John Wiley & Sons, New York, New York. 1181 pp.

Hallock, L.A. and McAllister, K.R. 2005. Pacific Treefrog. Washington Herp Atlas. Available on the Internet at http://www.dnr.wa.gov/nhp/refdesk/herp/

Hanski, I. 1999. Metapopulation Ecology. Oxford University Press, New York.

Harraka, J. 2002. The Biogeography of Bighorn Sheep (Ovis Canadensis), SFS University. Available on the Internet at http://bss.sfsu.edu/geog/bholzman/courses/Fall02%20projects/bighorn.html.

Harris, M. 2002. *Haliaeetus leucocephalus*. Animal Diversity Web. Accessed September 11, 2007 at http://animaldiversity.ummz.umich.edu/site/accounts/information/Haliaeetus_leucocephalus.html

Harrison, H.H. 1979. A field guide to western birds' nests. Houghton Mifflin, Boston, Massachusetts.

Harvey et al. 1999. Bats of the United States. Published by the Arkansas Game and Fish Commission. 64 pp.

Haug, E.A., B.A. Millsap, and M.S. Martell. 1993. Burrowing Owl (*Speotyto cunicularia*). In A. Poole and F. Gill, editors. The Birds of North America, No. 61. The Academy of Natural Sciences, Philadelphia, Pennsylvania; The American Ornithologists' Union, Washington, DC.

Hawes, M.L. 1977. Home range, territoriality and ecological separation in sympatric shrews, *Sorex vagrans* and *Sorex obscurus*. Journal of Mammalogy. 58:354-367.

Hawk Mountain. 2007. Northern goshawk. Species account. Available on the Internet at http://hawkmountain.org/media/goshawk.pdf.

Henen, B.T. 1997. Seasonal and annual energy budgets of female desert tortoises (*Gopherus agassizii*). Ecology 78(1):283–296.

Herlugson, C. J. 1975. Status and distribution of the Western Bluebird and the Mountain Bluebird in the state of Washington. Master's thesis, Washington State Univ., Pullman.

Herron, G.B., C.A. Mortimore, and M.S. Rawlings. 1985. Nevada Raptors: Their biology and management. Nevada Department of Wildlife.

Hiatt, H. and J. Boone, ed. 2004. Clark County, Nevada Species Account Manual. Dept. Comprehensive Planning, Clark County, Nevada.

Hickman, J. 1993. Web treatment of The Jepson Manual, UC/JEPS. The Regents of the University of California. Accessed 24 July 2007 at http://ucjeps.berkeley.edu/cgi-bin/get_JM_treatment.pl?4518,4720,4721.

Hiks, L.L., and J.M. Elder. 1979. Human disturbances of Sierra Nevada bighorn sheep. Journal of Wildlife Management 43:909-915.

Hjertaas, D.G. 1997. Recovery plan for the Burrowing Owl in Canada. In J. Lincer and K. Steenhof, editors. The Burrowing Owl, its biology and management including the Proceedings of the First International Burrowing Owl Symnposium. Raptor Research Report Number 9.

Hodge, R.P. 2004. Geographic distribution. *Rana aurora*. Herpetological Review 35:79.

Hoffmeister, D.F. 1986. Mammals of Arizona. Univ. Arizona Press and Arizona Game and Fish Dept. 602 pp.

Hollingsworth, Bradford and Kathy Roberts. 2007. *Pseudacris regilla*. San Diego Natural History Museum. 2007. California Department of Fish and Game. December 19, 2007. http://www.sdnhm.org/fieldguide/herps/hyla-reg.html.

Holt, R.L. 1994. Paiute Indians of Utah in Utah History Encyclopedia. Ed. A.K. Powell. University of Utah, Salt Lake City.

Hooper, E.T. 1944. Additional records of the Merriam Shrew in Montana. Journal of Mammalogy 25:92.

Howe, F.P. 1991. Two new host species for the parasitic blowfly *Protocalliphora braueri* . Wilson Bull. 103: 520–521.

Howe, F.P., R.L. Knight, L.C. McEwen, and T.L. George. 1996. Direct and indirect effects of insecticide applications on growth and survival of nestling passerines. Ecological Applications 6:1314-1324.

Hubbard, J.P. 1987. The status of the willow flycatcher in New Mexico. Endangered Species Program, New Mexico Department of Game and Fish, Santa Fe, New Mexico. 29 pp.

Isely, D. 1998. Native and naturalized Leguminosae (Fabaceae) of the United States (exclusive of Alaska and Hawaii). Monte L. Bean Life Science Museum, Brigham Young University; MLBM Press, Provo, Utah. 1007 pp.

IUCN Red List of Threatened Species. 2004. A Global Species Assessment. Available on the Internet at http://www.iucnredlist.org/info/publications_links.

IUCN, Conservation International, and NatureServe. 2006. Global Amphibian Assessment. 04 May 2006. Available on the Internet at http://www.globalamphibians.org/servlet/GAA?searchName=Pseudacris+regilla.

Jacobson, E.R, J.M. Gaskin, M.B. Brown, R.K. Harris, C.H. Gardiner, J.L. LaPointe, H.P. Adams, and C. Reggiardo. 1991. Chronic upper respiratory tract disease of free-ranging desert tortoises (*Xerobates agassizii*). Journal of Wildlife Diseases 27(2):296-316.

Jacobson, J.E., and M.C. Snyder. 2000. Shrub-steppe mapping of eastern Washington using Landsat Satellite Thematic Mapper data. Washington Department of Fish and Wildlife, Olympia, Washington, USA. State GAP Analysis, Volume 3. Washington Cooperative Fish and Wildlife Research Unit, Seattle, Washington, USA.

James, W.B. 1953. The Merriam shrew in Washington State. Journal of Mammalogy 34:121.

Jameson, Jr., E.W. and H.J. Peeters. 2004. Mammals of California. University of California Press.

Jarman, W.M., S.A. Burns, C.E. Bacon, J. Rechtin, S. DeBenedetti, J. L. Linthicum and B. J. Walton. 1996. High levels of HCB and DDE associated with reproductive failure in Prairie Falcons (*Falcon mexicanus*) from California. Bull. Env. Contam. Tox. 57:8-15.

Jennings, M.R. and M.P. Hayes. 1994. Amphibian and reptile species of special concern in California. Final Report prepared for California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California. iii + 255 p. Available online at: http://www.dfg.ca.gov/hcpb/info/herp_ssc.pdf.

Jennings, W.B. 1993. Foraging ecology and habitat utilization of the desert tortoise (*Gopherus agassizii*) in the western Mojave Desert. M.S. Thesis. University of Texas at Arlington.

Jepson Herbarium. 1993a. *Agave utahensis*. Treatment from the Jepson manual. Available online at: http://ucjeps.berkeley.edu/cgi-bin/get_JM_treatment.pl?Agave+utahensis.

Jepson Herbarium. 1993b. *Camissonia brevipes*. Jepson Manual, online version. Available on the Internet at http://ucjeps.berkeley.edu/cgi-bin/get_JM_treatment.pl?5263,5264,5276.

Jepson Herbarium. 1993c. *Dudleya pulverulenta*. Treatment from the Jepson manual. Available online at: http://ucjeps.berkeley.edu/cgi-bin/get_JM_treatment.pl?Dudleya+pulverulenta.

Jepson Herbarium. 1993d. *Erigeron clokeyi*. Treatment from the Jepson manual. Available online at: http://ucjeps.berkeley.edu/cgi-bin/get_JM_treatment.pl?Erigeron+clokeyi.

Jepson Herbarium. 1993e. *Escobaria vivipara* var. *rosea*. Jepson Manual, online version. Downloaded 25 July 2007.

Jepson Herbarium. 1993f. *Linanthus arenicola*. Treatment from the Jepson manual. Available online at: http://ucjeps.berkeley.edu/cgi-bin/get_JM_treatment.pl?Linanthus+arenicola.

Jepson Herbarium. 1993g. *Phacelia anelsonii*. Jepson Manual, online version. Available on the Internet at http://ucjeps.berkeley.edu/cgi-bin/get_JM_treatment.pl?4518,4587,4591.

Jepson Herbarium. 1993h. *P. parviflora* Juss. Jepson Interchange for California floristics. Jepson Flora Project. Jepson Herbarium. University of California, Berkeley. Available on the Internet at http://www.ucjeps.berkeley.edu. Accessed on February 2, 2007.

Jepson Herbarium. 1993i. *P perityloides* var. *laxiflora*. Jepson Interchange for California floristics. Jepson Flora Project. Jepson Herbarium. University of California, Berkeley. Available on the Internet at http://www.ucjeps.berkeley.edu. Accessed on February 2, 2007.

Jessup, D.A. 1981. Pneumonia in bighorn sheep: effects on populations. California-Nevada Wildlife 1981:72-78.

Johnson, M.L., and C.W. Clanton. 1954. Natural history of *Sorex merriami* in Washington State. The Murrelet 35:1-4.

Johnson, N.K. and C. Cicero. 1985. The breeding avifauna of San Benito Mountain, California: evidence for change over a half-century. Western Birds 16: 1–23.

Johnson, R. R., H. K. Yard, and B. T. Brown. 1997. Lucy's Warbler (*Vermivora luciae*) in The Birds of North America, No. 318 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, Pennsylvania, and the American Ornithologists' Union, Washington, D.C.

Jones & Stokes. 2004a. Lower Colorado River Multi-species Conservation Program. Volume II Habitat Conservation Plan. Final. December 17. (J&S 00450.00) Sacramento, California. Available online at http://www.lcrmscp.gov/documents.html

Jones & Stokes. 2004b. Lower Colorado River Multi-species Conservation Program. Volume IV: Appendices to Volumes I-III and V. Final. December 17. (J&S 00450.00) Sacramento, California.

Jones, A. 2001. Review and analysis of cattle grazing effects in the arid west, with implications for BLM grazing management in southern Utah. The Wild Utah Project. Available on the Internet at http://www.rangenet.org/directory/jonesa/litrev.html.

Jones, J.K., Jr., D.M. Armstrong, R.S. Hoffmann, and C. Jones. 1983. Mammals of the Northern Great Plains. University of Nebraska Press, Lincoln, Nebraska.

Jones, J.K., Jr., R.S. Hoffman, D.W. Rice, C. Jones, R.J. Baker, and M.D. Engstrom. 1992. Revised checklist of North American mammals north of Mexico, 1991. Occasional Papers, The Museum, Texas Tech University, 146:1-23.

Jones, S.L., and J.E. Cornely. 2002. Vesper sparrow (*Pooecetes gramineus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: Http://bna.birds.cornell.edu/bna/species/624doi:bna.624

Joslin, G., and H. Youmans, coordinators. 1999. Effects of recreation on Rocky Mountain wildlife: a review for Montana. Committee on Effects of Recreation on Wildlife, Montana Chapter of The Wildlife Society. 307pp.

Kantrud, H.A., and R. L. Kologiski. 1982. Effects of soils and grazing on breeding birds of uncultivated upland grasslands of the northern Great Plains. U.S. Dep. Int., Fish Wildl. Serv. Wildl. Res. Rep. 15, Washington, D.C.

Karl, A. 1981. Distribution and Relative Densities of the Desert Tortoise, Gopherus agassizii, in Lincoln and Nye Counties, Nevada. Proceedings of the Sixth Annual Symposium of the Desert Tortoise Council, 28-30 March 1981, Riverside, California. Pages 76-92. [Riverside, California]: Desert Tortoise Council. TIC: 243166.

Karl, A.E. 1983a. The distribution and relative densities of the desert tortoise (*Gopherus agassizii*) in Clark County, Nevada. Unpublished Report to Bureau of Land Management, Denver, Colorado. Contract No. YA-512-CT9-90. 46 pages.

Karl, A.E. 1983b. The distribution, relative densities, and habitat associations of the desert tortoise (*Gopherus agassizii*) in Nevada. M.S. Thesis, California State University, Northridge. 111 pages.

Kartesz, J.T. 1987. A flora of Nevada. Unpublished PhD dissertation. University of Nevada, Reno. 1729 pp.

Kaufman, K. 1990. A field guide to advanced birding. Houghton Mifflin, Boston, MA.

Kay, F.R., and W.G. Bradley. 1968. The occurrence and distribution of the eastern fence lizard (*Sceloporus undulates*) in southern Nevada. Herpetologica. 24:72-76.

Kearney, T.H. and R.H. Peebles. 1960. Arizona flora. University of California Press, Berkeley, CA. 1085 pp.

Keeley, J.E., and S.C. Keeley. 1988. Chaparral. Pages 165-207, *In* M.G. Barbour and W.D.Billings, editors. North American Terrestrial Vegetation. Cambridge University Press, Cambridge.

Kilburn, D.F. and K. S. Kilburn. 1992. The conservation and status of the endemic mammals of the San Joaquin faunal region, California. Pp. 329-345, in Endangered and sensitive species of the San Joaquin Valley, California: their biology, management, and conservation (D. F. Williams, S. Byrne, and T.A. Rado, eds.).

Kirk, D.A., and U. Banasch. 1995. Updated status report on the Prairie Falcon, *Falco mexicanus*, in Canada. Unpubl. rep. submitted to the Comm. on the Status of Endangered Wildl. in Can., Ottawa. 7pp.

Kirkland, G.L., Jr., R.R. Parmenter, and R.E. Skoog. 1997. A five-species assemblage of shrews from the sagebrush-steppe of Wyoming. Journal of Mammalogy 78:83-89.

Klute, D.S., W.H. Howe, S.R. Sheffield, L.W. Ayers, S.L. Jones, T.S. Zimmerman, M.T. Green, and J.A. Shaffer. 2003. Status Assessment and Conservation Plan for the Western Burrowing Owl in the United States. Biological Technical Publication. BTP-R6001-2003. Accessed on the Internet at http://www.r6.fws.gov/birds/WBO/Western percent20Burrowing percent20Owlrev73003a.pdf#search= percent22burrowing percent20owl percent20urban percent20klute percent22 on September 18, 2006.

Knick, S.T. and J.T. Rotenberry. 1995. Landscape characteristics of shrubsteppe habitats and breeding passerine birds. Conserv. Biol. 9: 1059–1071.

Knight, R. L. Gutzwiller, and J. Kevin, eds. 1995. Wildlife and Recreationists: Coexistence through Management and Research. Island Press: Washington, DC.

Knight, R.L., and J. Kawashima. 1993. Responses of raven and red-tailed hawk populations to linear right-of-ways. Journal of Wildlife Management. 57: 266-271.

Knopf, F.L., and F. B. Samson. 1994. Biological diversity--A time for action. Conservation Biology 8:909-911.

Knowles, C., C. Guntow, P. Knowles, P. Houghton.1989. Relative abundance and distribution of the common raven in the desert of southern California. Boulder, MT, FaunaWest Wildlife Consultants.

Kochert, M.N., K. Steenhof, C. L. Mcintyre, and E. H. Craig. 2002. Golden Eagle (*Aquila chrysaetos*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/684 doi:bna.684

Konrad, P.M. and D.S. Gilmer. 1984. Observations on the nesting ecology of Burrowing Owls in central North Dakota. Prairie Naturalist 16:129-130.

Korfanta, N.M., L.W. Ayers, S.H. Anderson, and D.B. McDonald. 2001. A preliminary assessment of burrowing owl status in Wyoming. Journal of Raptor Research 35:337-343.

Kunz, T.H., and R.A. Martin. 1982. I. Mammalian Species 175: 1-6.

Kwiatkowski, M.A., and B.K. Sullivan. 2002. Mating system structure and population density in a polygynous lizard, *Sauromalus obesus* (= ater). Behavioral Ecology Vol. 13 No. 2: 201-208.

Lady Bird Johnson Wildlife Center. (LBJWC). 2007. Native Plant Database. Available on the Internet at http://www.wildflower.org/plants/result.php?id_plant=CYWH.

Lake Mead National Recreation Area (LMNRA). 2007. No Hunt Zones. Available on the Internet at http://www.nps.gov/lame/planyourvisit/huntingmaps.htm.

Lamb, T., and C. Lydehard. 1994. A molecular phylogeny of the gopher tortoises, with comments on familiar relationships within the Testudinoidea. Molecular Phylogenetics and Evolution 3: 283-91.

Lamb, T., J.C. Avise, and J.W. Gibbons. 1989. Phylogeographic patterns in Mitochondrial DNA of the desert tortoise (*Xerobates agassizi*), and evolutionary relationships among the North American gopher tortoise. Evolution 43: 76-87.

Langenheim, V.E., J.M. Glen, R.C. Jachens, G.L. Dixon, T.C. Katzer, and R.L. Morin. 2000. Open-File Report 00-407. Geophysical Constraints on the Virgin River Depression, Nevada, Utah, and Arizona.Las Vegas Valley Water District (LVVWD). 1992. Hydrology and Interactive Computer Modeling of Ground and Surface-Water in the Lower Virgin River Valley, Primarily in Clark County, Nevada.

Larrison, E.J. 1976. Mammals of the Northwest. Seattle Audubon Society, Seattle, Washington, USA.

Las Vegas Convention and Visitors Authority (LVCVA). 2007. Mesquite, Nevada web site. Available on the Internet at http://www.visitmesquite.com/mtourism/index.jsp.

Latta, M.J., C.J. Beardmore, T.F. Corman. 1999. Arizona Partners in Flight Bird Conservation Plan, Version 1.0. AGFA Nongame and Endangered Wildlife Program Technical Report 142.

Laudenslayer, Jr., W.F., and J.R. Boggs. 1988. Pinyon-Juniper. California Wildlife Habitat Relationships System, California Department of Fish and Game, California Interagency Wildlife Task Group. Available on the Internet at http://www.dfg.ca.gov/bdb/html/wildlife_habitats.html#Tree

Leache, A.D. and T.W. Reeder. 2002. Molecular systematics of the eastern fence lizard (*Sceloporus undulates*): a comparison of parsimony, likelihood, and Bayesian approaches. Systematics Biology. 51:44-68.

Leslie, D.M., Jr., and C.L. Douglas. 1979. Desert bighorn sheep of the River Mountains, Nevada. Wildlife Monographs No. 66. 56pp.

Levins, R., and D. Culver. 1971. Regional coexistence of species and competition between rare species. Proc. Natl Acad. Sci. USA 68, 1246–1248.

Lokemoen, J.T., and H.F. Duebbert. 1976. Ferruginous hawk nesting ecology and raptor populations in northern South Dakota. Condor 78: 464-470.

Lowe, W.P. 1894. A list of the birds of the Wet Mountains, Huerfano County, Colorado. Auk 11: 266–270.

Lowry, J.H., Jr., R. D. Ramsey, K. Boykin, D. Bradford, P. Comer, S. Falzarano, W. Kepner, J. Kirby, L. Langs, J. Prior-Magee, G. Manis, L. O'Brien, T. Sajwaj, K. A. Thomas, W. Rieth, S. Schrader, D. Schrupp, K. Schulz, B. Thompson, C. Velasquez, C. Wallace, E. Waller and B. Wolk. 2005. Southwest Regional Gap Analysis Project: Final Report on Land Cover Mapping Methods, RS/GIS Laboratory, Utah State University, Logan, Utah.

Luckenbach, R.A. 1982. Ecology and management of the desert tortoise (*Gopherus agassizii*) in California. In: R.B. Bury, ed. North American Tortoise: Conservation and Ecology. U.S. Fish and Wildlife Service, Wildlife Research Report 12, Washington, D.C.

MacCracken, J.G., D.W. Uresk, and R.M. Hansen. 1985. Vegetation and soils of Burrowing Owl nest sites in Conata Basin, South Dakota. Condor 89:152-154.

Marantz, C. 1986. The birds of San Luis Obispo County: their status and distribution. Senior Project, Biological Sciences, California Polytechnic University, San Luis Obispo.

Marcus, W. A., G. Milner and B. Maxwell. 1998. Spotted knapweed distribution in stock camps and trails of the Selway-Bitterroot Wilderness. Great Basin Naturalist 58: 156-166.

Marks, J.S., D.L. Evans, and D. W. Holt. 1994. Long-eared Owl (*Asio otus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/133doi:bna.133

Marsh, D.M. and P.C. Trenham. 2001. Metapopulation dynamics and amphibian conservation. Conservation Biology. 15:40-49.

Martell, M.S., J. Schladweiler, and F. Cuthbert. 2001. Status and attempted reintroduction of Burrowing Owls in Minnesota, USA. Journal of Raptor Research 35:331-336.

Matchett, J.R. 2006. Summary of the Summer 2005 Mojave Desert Fire Season: When, Where, and Why Fires Occurred. Desert Tortoise Council. The Hotel Arizona, Tucson, Arizona. February 17-20, 2006

Matthews, K.R., K.L. Pope, H.K. Preisler, and R. A. Knapp. 2001. Effects of nonnative trout on Pacific treefrogs (*Hyla regilla*) in the Sierra Nevada. Copeia 2001:1130-1137.

McCutchen, H.E. 1995. Desert Bighorn Sheep, *In* Stohlgren, T.J.: The Interior West. In: Our Living Resources: A report to the nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems. Washington, D.C.: U.S. Geological Survey.

McLaurin, B.T., Steve Ludington, Stephen B. Castor, and Kathryn S. Flynn. 2006. Chapter 6: Mineral Resource Potential of the Virgin River Area of Environmental Concern, Clark County, Nevada. Mineral Resource Assessment of Selected Areas in Clark and Nye Counties, Nevada. Steve Ludington, ed. USGS Scientific Investigation Report 2006-5197.

McLuckie, A.M. and R.A. Fridell. 2002. Reproduction in a desert tortoise population on the Beaver Dam Slope, Washington County, Utah. Chelonian Conservation and Biology 2002, 4(2):288-294.

McNab, W. H. and M. Meeker. 1987. Oriental bittersweet: a growing threat to hardwood silviculture in the Appalachians. Northern Journal of Applied Forestry 4: 174-177.

Merriam, C.H., 1889. Preliminary revision of the North American pocket mice (genera *Perognathus* et Cricetodipus auct.) with descriptions of new species and subspecies and a key to the known forms, p. 21. North American Fauna, 1:1-36.

Miller, A.H. and R.C. Stebbins. 1964. The lives of desert animals in Joshua Tree National Monument. Univ. of California Press, Berkeley.

Mohave County Board of Supervisors. 1998. The Virgin River Communities Area Plan. Adopted May 8, 1998.

Mohave County. 2007. Mohave County, Arizona website. Available on the Internet at http://www.co.mohave.az.us/.

Mohave Desert Wildlife. 2008. Available on the Internet at http://digital-desert.com/wildlife/bighorn/bighorn-sheep-1.html.

Monsen, S. B. 1994. The competitive influences of cheatgrass (*Bromus tectorum*) on site restoration. pp. 43-50 in Proceedings (Ecology and Management of Annual Rangelands. S. B. Monsen and S. G. Kitchen, eds. INT-GTR-313. USDA Forest Service. Intermountain Research Station.

Monson, G., and L. Sumner, *eds.* 1980. The desert bighorn: its life history, ecology, and management. Univ. Arizona Press, Tucson. 370 pp.

Montana Fish, Wildlife, and Parks. No Date. Townsend's Big-Eared Bat. Animal Field Guide. Available on the Internet at http://fwp.mt.gov/fieldguide/detail_AMACC08010.aspx.

Morefield, J.D., ed. 2001. Nevada Rare Plant Atlas Maps and Fact Sheets. Nevada Natural Heritage Program Department of Conservation and Natural Resources. Carson City: Nevada Natural Heritage Program, compiled for the U.S. Department of the Interior, Fish and Wildlife Service, Portland, Oregon and Reno, Nevada. Available on the internet at: http://heritage.nv.gov/atlas/atlas.html. (Accessed: July 2006).

Morrison, M. 2005. Survey and status of the northern goshawk in the Spring Mountains, 2005. Prepared for U.S. Forest Service, Spring Mountains National Recreation Area, Humboldt-Toiyabe National Forest.

Morse, D.H. 1989. American warblers: an ecological and behavioral perspective. Harvard University Press. 384 pp.

Morse, M., K. Murphy, and J. Jamrog. 2003. Status of the Bureau of Land Management's Desert Tortoise Recovery Program in Nevada. Abstract from 28th Annual Meeting and Symposium of the Desert Tortoise Council, February 21-23, 2003. Available on the Internet at http://www.deserttortoise.org/abstract/abstracts2003/2003abs44.html. Accessed on July 3, 2007.

Mozingo, H.N., and M. Williams. 1980. Threatened and Endangered Plants of Nevada - An illustrated manual.

Mueller, J.M, K.R. Sharp, K.K. Zander, D.L. Rakestraw, K.R. Rautenstrauch, and P.E. Lederle. 1998. Size-specific fecundity of the desert tortoise (*Gopherus agassizii*). Journal of Herpetology 32:313-319.

Murphy, R.K., D.W. Hasselblad, C.D. Grondahl, J.G. Sidle, R.E. Martin and D.W. Freed. 2001. Status of the burrowing owl in North Dakota. Journal of Raptor Research 35:322-330.

Nagorsen, D.W., G.G. E Scudder, D.J. Huggard, H. Stewart, and N. Panter. 2001. Merriam's shrew, *Sorex merriami*, and Preble's shrew, *Sorex preblei*: two new mammals for Canada. The Canadian Field Naturalist 115:1-8.

Nagy, K.A., and P.A. Medica. 1986. Physiological ecology of desert tortoises in southern Nevada. Herpetologica. 42(1):73-92.

National Cooperative Highway Research Program (NCHRP). 2002. Interaction between roadways and wildlife ecology. Available on the Internet at http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_305.pdf.

National Geographic Society (NGS). 1983. Field guide to the birds of North America. National Geographic Society, Washington, DC.

National Marine Fisheries Service (NMFS). 2007. ESA Critical Habitat. Available on the Internet at http://www.nwr.noaa.gov/Salmon-Habitat/Critical-Habitat/

National Park Service (NPS). 1999a. Report on 1997 surveys for sticky buckwheat, Eriogonum viscidulum, in Lake Mead National Recreation Area. Prepared by Elizabeth Powell.

National Park Service (NPS). 1999b. Report on 1997 and 1998 surveys for *Astragalus geyeri* var. *triquetrus* in Lake Mead National Recreation Area. Prepared by Elizabeth Powell.

National Park Service (NPS). 2002. Final Environmental Impact Statement for the Lake Mead National Recreation Area Lake Management Plan. Prepared by the National Park Service, Pacific West Region, Clark County, Nevada and Mohave County, Nevada.

National Park Service (NPS). 2003. Lake Mead National Recreational Area Final Environmental Impact Statement/Lake Management Plan. Available on the Internet at http://www.nps.gov/lame/parkmgmt/planning.htm.

Natural Resources Conservation Service (NRCS). 2004. Soil Survey Geographic (SSURGO) database for Virgin River Area Nevada and Arizona, Parts of Clark and Lincoln Counties, Nevada, and Mohave County, Arizona.

Natural Resources Conservation Service (NRCS). 2006. U.S. General Soils Map (STATSGO). Digital dataset. Available on the Internet at http://www.ncgc.nrcs.usda.gov/products/datasets/statsgo/description.html.

NatureServe. 2008. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.0. NatureServe, Arlington, Virginia. Available on the Internet at http://www.natureserve.org/explorer.

Neel, L.A., ed. 1999. Nevada Partners in Flight Bird Conservation Plan. 260 pp. Available on the Internet at http://www.blm.gov/wildlife/plan/pl-nv-10.pdf.

Nevada Audubon. No Date. Virgin River IBA. Available on the Internet at http://www.nevadaaudubon.org/Iba/Virgin%20River%20IBA.htm. January 17, 2007.

Nevada Bat Working Group 2006. Revised Nevada Bat Conservation Plan. 254 pp. Available on the Internet at http://www.ndow.org/about/pubs/plans/batplan2006-06.pdf.

Nevada Department of Conservation and Natural Resources (NDCNR). 2007. Nevada Natural Resources Status Report. Available online at: http://dcnr.nv.gov/nrp01/bio06.htm.

Nevada Department of Transportation (NDOT). 2006. Nevada's Scenic Byways Website: http://www.nevadadot.com/pub_involvement/scenicbyways/the-byways.asp, May 30, 2006.

Nevada Department of Transportation (NDOT). 2007. Available on the Internet at http://www.nevadadot.com/.

Nevada Department of Wildlife (NDOW). 2005. Gila monster protocol for minimizing impacts in the construction site. NDOW Southern Regional. Las Vegas, Nevada.

Nevada Department of Wildlife (NDOW). 2006. Nevada Action Wildlife Plan. Developed by the Wildlife Action Plan Team. June 23, 2006. Available on the Internet at: http://www.ndow.org/wild/conservation/cwcs/index.shtm.

Nevada Department of Wildlife (NDOW). 2007. Hunt Nevada. Available on the Internet at http://ndow.org/hunt/index.shtm.

Nevada Department of Wildlife (NDOW). 2008. Overton Wildlife Management Area brochure. Available on the Internet at http://www.ndow.org/about/pubs/wma/wma_overton.pdf.

Nevada Department of Wildlife (NDOW). No Date. Phainopepla fact sheet. Available at http://www.ndow.org/wild/animals/facts/birds_phainopepla.shtm. Accessed July 12, 2006.

Nevada Heritage Foundation. 2007. Nevada hay production. Available on the Internet at http://www.nvaitc.org/hay.pdf.

Nevada Natural Heritage Program (NNHP). 2001. Nevada Rare Plant Atlas. Available on the Internet at http://heritage.nv.gov/atlas/atlas.html.

Nevada Natural Heritage Program (NNHP). 2004. NNHP Rare Animal List. March 18, 2004. Available online at http://heritage.nv.gov/animldet.htm.

Nevada Natural Heritage Program (NNHP). 2005. Rare Plant and Lichen List. April 1, 2005.

Nevada Natural Heritage Program (NNHP). 2006. Element Occurrence data for recorded endangered, threatened, candidate, and At Risk plant and animal elements (taxa) within Nevada. Obtained from NNHP by ENTRIX, Inc. in May 2006.

Nevada Natural Heritage Program (NNHP). 2008. Nevada Department of Conservation and Natural Resources. Available on the Internet at http://heritage.nv.gov/images.htm

Nevada State Clearinghouse (NSC). 2008. Available on the Internet at http://budget.state.nv.us/clearinghouse/08_notice_list.htm.

New Mexico Partners in Flight (NMPIF). 2007. Golden Eagle species account. Available on the Internet at http://www.nmpartnersinflight.org/goldeneagle.html.

NGS. 1987. Field guide to the birds of North America (Second addition). National Geographic Society, Washington, D.C.

Nicholls, G. 2002. Alpine Plants of North America: An Encyclopedia of Mountain Flowers from the Rockies to Alaska.

Niles, W. E., P. J. Leary, J. S. Holland, and F. H. Landau. 1999. Survey of special status plants in the Eastern Mojave Desert. Prepared by the Department of Biological Sciences, University of Nevada, Las Vegas and the Bureau of Land Management, Las Vegas, Nevada.

Niles, W.E., J.S. Holland, P.J. Leary, and F.H. Landau. 1997. Survey of Special Status Plants in the Eastern Mojave Desert. Las Vegas, Nevada: University of Nevada, Department of Biological Sciences.

Niles, W.E., P.J. Leary, J.S. Holland, and F.H. Landau. 1995. Occurrence and distribution of *Astragalus geyeri* var. *triquetrus* (threecorner milkvetch) and *Eriogonum viscidulum* (sticky buckwheat) in Lake Mead National Recreation Area and adjacent regions of Nevada and Arizona. University of Nevada, Las Vegas. Unpublished report prepared for the Lake Mead National Recreation Area.

Noble, D. G. and J. E. Elliott. 1990. Levels of contaminants in Canadian raptors, 1966 to 1988; Effects and temporal trends. Can. Field-Nat. 104:222-243.

Northern Nevada Native Plant Society (NNNPS). 1999. Rare Plant Committee Meeting, Nevada Rare Plant Workshop. Available on the Internet at http://heritage.nv.gov/nrpw/commnt99.htm.

Northern Nevada Native Plant Society (NNNPS). 2001. Rare Plant Committee Meeting, Nevada Rare Plant Workshop. Available on the Internet at http://heritage.nv.gov/nrpw/commnt01.htm.

Northern Nevada Native Plant Society (NNNPS). 2004. April 1, 2004. Rare Plant Committee Meeting, Nevada Rare Plant Workshop. December 20, 2007. http://heritage.nv.gov/nrpw/commnt04.htm.

Northern States Bald Eagle Recovery Team (NSBERP). 1983. Northern States Bald Eagle Recovery Team. 131 pp.

Noss, R.F., III, E. T. L., and Scott, J. M. 1995. Endangered ecosystems of the United States: a preliminary assessment of loss and degradation. Biological Report 28, U.S. Department of the Interior National Biological Service, Washington, D.C.

Noss, R.F., Cooperrider, A.Y., 1994. Saving Nature's Legacy. Island Press, Washington, D.C.

O'Farrell, M.J. 2002a. Bat survey at selected water sources and abandoned mines within the Humboldt-Toiyabe National Forest in the Spring Mountains, Clark County, Nevada. Prepared for the USDA Forest Service, Spring Mountains National Recreation Area.

O'Farrell, M.J. 2002b. Bat survey at selected water sources within the Humboldt-Toiyabe National Forest in the Spring Mountains, Clark County, Nevada. Prepared for the USDA Forest Service, Spring Mountains National Recreation Area.

O'Farrell, M.J. 2006. Bat survey at selected water sources and three stationary monitoring sites within the Humboldt-Toiyabe National Forest in the Spring Mountains, Clark County, Nevada. Prepared for the USDA Forest Service, Spring Mountains National Recreation Area.

O'Farrell, M.J. and E.H. Studier. 1973. Reproduction, growth and development in *Myotis thysanodes* and *M. lucifugus* (Chiroptera: Vespertilionidae). Ecology, 54:18-30.

O'Farrell, M.J. and E.H. Studier. 1980. Mammalian species. The American Society of Mammalogists. 137:1-5.

O'Neill, D.M., and E.A. Pilotte. 1997. 1997 Southern Region peregrine falcon monitoring summary. Utah Divison of Wildlife Resources, Cedar City, Utah. 8 pp.

Oberholser, H.C. 1974. The birdlife of Texas. Vol. 2. Univ. of Texas Press, Austin.

Ohmart, R.D. 1994. The effects of human-induced changes on the avifauna of western riparian habitats. Studies in Avian Biology 15:273-285. Notes from B. Lund. Unknown year. Pages taken from an unknown source.

Ohmart, R.D. and B.W. Anderson. 1982. North American desert riparian ecosystems. Pp. 433-479 in Reference Handbook on the Deserts of North America (G. L. Bender, ed.). Greenwood Press, Westport, Connecticut.

Olendorff, R.R. 1993. Status, biology and management of Ferruginous Hawks: a review. Raptor Research and Tech. Assist. Center, Special Report of the Bureau of Land Manag., Boise, Idaho.

Oliver, G.V. 2000. The Bats of Utah: A Literature Review. Utah Division of Wildlife Resources - Utah Natural Heritage Program, Salt Lake City. Publication No. 00-14. Available online at: http://dwrcdc.nr.utah.gov/ucdc/ViewReports/bats.pdf.

Otahal, C.D. 2006. Lucy's Warbler (*Vermivora luciae*). In The Draft Desert Bird Conservation Plan: a strategy for reversing the decline of desert-associated birds in California. California Partners in Flight. December 19, 2007. http://www.prbo.org/calpif/htmldocs/desert.html.

Oxley, D.J., M.B. Fenton and G.R. Carmody. 1974. The effects of roads on populations of small mammals. Journal of Applied Ecology 11: 51-59.

Paige, C. and S.A. Ritter. 1999. Birds in a sagebrush sea: managing sagebrush habitats for bird communities. Idaho Partners in Flight, Idaho Dept. Fish and Game, Boise.

Patten, M.A. 2001. An overview of birds and their habitats at the Salton Sea. Report prepared for the Salton Sea Database Program Atlas Project.

Peck, G. and R. James. 1987. Breeding birds of Ontario: nidiology and distribution. Vol. 2: passerines. R. Ontario Mus. Life Sci. Misc. Publ., Toronto.

Pemberton, J.R. and H.W. Carriger. 1916. From field and study: snakes as nest robbers. Condor 18: 233.

Perry, E.M., and W. A. Perry. 1918. Home life of the Vesper Sparrow and the Hermit Thrush. Auk 35: 310–321.

Petersen, K.L. and L.B. Best. 1986. Diets of nestling Sage Sparrows and Brewer’s Sparrows in an Idaho sagebrush community. J. Field Ornithol. 57: 283–294.

Peterson, R.T. 1990. Western birds. Houghton Mifflin Company, Boston.

Pezzolesi, L.S.W. 1994. The Western Burrowing Owl: Increasing Prairie Dog Abundance, Foraging Theory, and Nest Site Fidelity. M.S. Thesis. Texas Tech University, Lubbock, Texas.

Phillips, A. R., J. Marshall, and G. Monson. 1964. The Birds of Arizona. University of Arizona Press, Tucson, Arizona. 212 pp.

Pierson, E. D., M. C. Wackenhut, J. S. Altenbach, P. Bradley, P. Call, D. L. Genter, C. E. Harris, B. L. Keller, B. Lengus, L. Lewis, B. Luce, K. W. Navo, J. M. Perkins, S. Smith, and L. Welch. 1999. Species conservation assessment and strategy for Townsend’s big-eared bat (*Corynorhinus townsendii townsendii* and *Corynorhinus townsendii pallescens*). Idaho Conservation Effort, Idaho Department of Fish and Game, Boise, Idaho.

Pima County, Arizona (Pima County). 2002. Priority Vulnerable Species Fact Sheets: Sonoran Desert Conservation Plan, 2002. Pima County, Arizona. 30 pp.

Pohlmann, K.F., D.J. Campagna, J.B. Chapman, and S. Earman. 1998. Investigation of the Origin of Springs in the Lake Mead National Recreation Area. Publication Number 41161, Water Resources Center, Desert Research Institute, University and Community College System of Nevada.Rainboth, W.J., D.C. Buth, and F.B. Turner. 1989. Allozyme variation in Mojave populations of the desert tortoise, Gopherus agassizi. Copeia 1989, 115-123.

Ports, M.A., and J.K. McAdoo. 1986. Sorex merriami (Insectivora: Soricidae) in eastern Nevada. Southwestern Naturalist 31:415-416.

Porzer, L.M. 1982. Movements, behavior, and body temperatures of the Gila monster (*Heloderma suspectum* Cope) in the vicinity of Queen Creek, Arizona. MS Thesis, Arizona State University, Tempe, Arizona.

Powers, L.R. 1981. Nesting behavior of the Ferruginous hawk (*Buteo regalis*). Ph.D. dissertation, Idaho State Univ., Pocatello.

Price, M.V., Goldingay, R.L., Szychowski, L.S., and Waser, N.M. 1994. Managing Habitat for the Endangered Stephens' Kangaroo Rat (*Dipodomys stephensi*): Effects of Shrub Removal. American Midland Naturalist 131: 9-16.

Prior-Magee, J.S., K.G. Boykin, D.F. Bradford, W.G. Kepner, J.H. Lowry, D.L. Schrupp, K.A. Thomas, and B.C. Thompson, Editors. 2007. Southwest Regional Gap Analysis Project Final Report. U.S. Geological Survey, Gap Analysis Program, Moscow, Idaho.

PRISM Group (PRISM). 2006. Annual Average Precipitation, 1961-1990 vector digital dataset. Available on the Internet at http://datagateway.nrcs.usda.gov/statusmaps.aspx.

Provencher, L., Nachlinger, J., Forbis, T., Morrill, W. 2003. Antelope & North Spring Valleys, Steptoe Valley & Uplands, Newark Valley Extended Watershed, and Meadow Valley Wash & Uplands Conservation Area Assessment Executive Summary. Available on the Internet at ftp://ftp.fc.sc.egov.usda.gov/NV/web/partnerships/meadowValleyReviewTeam/ElyExecutiveSummary.pdf on July 31, 2007.

Pursell, R.A. 2005. Bryophyte Flora of North America. Fissidentaceae. Available online at: http://www.mobot.org/plantscience/bfna/V1/FissFissidentaceae.htm.

Pyle, P. 1997. Identification guide to North American birds. Part 1: Columbidae to Ploceidae. Slate Creek Press, Bolinas, California.

Quincy Professorship for Wildlife Conflict Management (QPWCM). 1998. Endangered and threatened mammals of Utah. Available on the Internet at http://extension.usu.edu/files/natrpubs/endgspec.pdf.

Racey, K. 1945. Nesting of Western Bluebird. Can. Field-Nat. 59: 43.

Rains, C. 1998. Niche overlap and nearest-neighbor distances of Northern Saw-whet Owls (*Aegolius acadicus*) and Western Screech-Owls (*Otus kennicottii*) in southwestern Idaho. M.S. thesis, Boise State Univ., Boise, ID.

Ramsey, M.A. 1997. Final report on the maternity roost study and status of bat species of concern of the Spring Mountains, Nevada. Prepared for U.S. Fish and Wildlife Service, Nevada State Office, Reno.

Randall, J. M. and M. Rejmanek. 1993. Interference of bull thistle (*Cirsium vulgare*) with growth of ponderosa pine (*Pinus ponderosa*) seedlings in a forest plantation. Canadian Journal of Forest Research 23: 1507-1513.

Rappole, J.H., E.S. Morton, T.E. Lovejoy, III and J.L. Ruos. 1993. Aves migratorias Nearcticas en los Neotropicos. Smithsonian Inst., Washington, D.C.

Ratcliff, B.D. 1986. The Manitoba burrowing owl survey, 1982-1984. Blue Jay 44:31-37.

Raytheon Employees Wildlife Habitat Committee. (REWHC). 2000. Biodiversity Measures. Available on the Internet at http://www.rewhc.org/biomeasures.shtml.

RECON. 2000. Final Clark County Multiple Species Habitat Conservation Plan and Environmental Impact Statement for Issuance of a Permit to Allow Incidental Take of 79 Species in Clark County, Nevada. Prepared for Clark County Department of Comprehensive Planning, Las Vegas, Nevada and U.S. Fish and Wildlife Service, Reno, Nevada. Available online at: http://www.accessclarkcounty.com/daqem/epd/desert/dcp_mshcp.html.

Reimchen, T. E. 1990. Introduction and dispersal of the Pacific treefrog, HYLA REGILLA, on the Queen Charlotte Islands, British Columbia. Canadian Field Naturalist 105:288-290.

Reveal, J.L. 2002. A review of *Eriogonum corymbosum* Benth with emphasis on the species in southern Nevada. Montrose, Colorado: Spring Canyon Enterprises, prepared for the U.S. Fish and Wildlife Service, Las Vegas, Nevada. 39 pages.

Reveal, J.L. 2003. Eriogonoideae (Polygonaceae) of North America, north of Mexico. Tentative treatment of the eriogonoid genera primarily for the Flora of North America project. Downloaded April 25, 2005. Available at http://www.life.umd.edu/emeritus/reveal/pbio/eriog/key.html.

Reynolds, T. 1981. Nesting of the Sage Thrasher, Sage Sparrow, and Brewer's Sparrow in southeastern Idaho. Condor 83: 61–64.

Rich, T.D., C.J. Beardmore, H.Berlanga, P.J. Blancher, M.S.W. Bradstreet, G.S. Butcher, D.W. Demarest, E.H. Dunn, W.C. Hunter, E.E. Iñigo-Elias, J.A. Kennedy, A.M. Martell, A.O. Panjabi, D.N. Pashley, K.V. Rosenberg, C.M. Rustay, J.S. Wendt, T.C. Will. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology. Ithaca, NY. Partners in Flight website. Available on the Internet at http://www.partnersinflight.org/cont_plan/ (VERSION: March 2005).

Ridgely, R.S., and G. Tudor. 1994. The Birds of South America; Suboscine Passerines. University of Texas Press, Austin, Texas. 814 pp.

Rieseberg, L.H., Schwarzbach, A.E., and L.A. Donovan. 2000. Ecological divergence of hybrid lineages. International Association for Ecology newsletter. August, p. 8.

Rising, J.D. 1996. A guide to the identification and natural history of the sparrows of the United States and Canada. Academic Press, San Diego.

Rodriguez-Estrella, R., F. Chavez Ramirez, and G.L. Holroyd. 1998. Current knowledge of the Burrowing Owl in Mexico: what is needed for a conservation plan? Abstract and notes. Second International Burrowing Owl Symposium, Ogden, Utah.

Root, T. 1988. Atlas of Wintering North American Birds: An Analysis of Christmas Bird Count Data. The Univ. of Chicago Press, Chicago, IL. 312 pp.

Rorabaugh, J. C., J. M. Howland, and R. D. Babb. 2004. Distribution and habitat use of the Pacific treefrog (*Pseudacris regilla*) on the lower Colorado River and in Arizona. Southwestern Naturalist 49:94-99.

Rosenberg, K.V., B. Kott, R. S. Hames, R.W. Rohrbaugh, Jr., S.B. Swarthout, J.D. Lowe. 2004. Effects of recreational development on forest-breeding birds in U.S. National Forests. Cornell Lab of Ornithology, Ithaca, NY.

Rosenberg, K.V., R.D. Ohmart, W.C. Hunter, and B.W. Anderson. 1991. Birds of the Lower Colorado River Valley. University of Arizona Press, Tucson, Arizona. 416 pp.

Rostal, D.C., V.A. Lance, J.S. Grumbles, A.C. Alberts. 1994. Seasonal reproductive cycle of the desert tortoise (*Gopherus agassizii*) in the Eastern Mojave Desert. Herpetological Monographs. 8: 72-82.

Rotenberry, J.T. 1998. Avian conservation research needs in western shrublands: exotic invaders and the alteration of ecosystem processes. Pp. 261–272 in Avian conservation: research and management (J. M. Marzluff and R. Sallabanks, eds.). Island Press, Covelo, California.

Rotenberry, J.T. and S.T. Knick. 1999. From the individual to the landscape: multiscale habitat associations of a shrubsteppe passerine and their implications for conservation biology. In Ecology and conservation of grassland birds of the Western Hemisphere (P. Vickery and J. Herkert, eds.). Stud. Avian Biol.

Rotenberry, J. T., M. A. Patten and K. L. Preston. 1999. Brewer's Sparrow (*Spizella breweri*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/review/species/390doi:10.2173/bna.390

Rotenberry, J.T. and J.A. Wiens. 1991. Weather and reproductive variation in shrubsteppe sparrows: a hierarchical analysis. Ecology 72: 1325–1335.

Russell, S. and G. Monson. 1998. The Birds of Sonora. Univ. of Arizona Press, Tucson, Arizona.

Rutman, S. 1991. Letter from Sue Rutman, investigation into candidate status for *Pediomelum castoreum*. Unpublished.

Saab, V.A., and T.D. Rich. 1997. Large-scale conservation assessment for neotropical migratory landbirds in the Interior Columbia River Basin. USDA Forest Service, Pacific Research Station. General Technical Report PNW-GTR-399. Portland, Oregon.

Saint Louis Zoo. No Date. Banded Gila Monster. Available on the Internet at http://www.stlzoo.org/animals/abouttheanimals/reptiles/lizards/bandedgilamonster.htm.

San Diego Natural History Museum (SDNHM). 2007a. *Dipsosaurus doralis*. Available online at: http://www.sdnhm.org/fieldguide/herps/dips-dor.html.

San Diego Natural History Museum (SDNHM). 2007b. *Crotalus mitchelli*. Available on the Internet at http://www.sdnhm.org/fieldguide/herps/crot-mit.html.

San Diego Natural History Museum (SDNHM). 2007c. *Coleonyx variegatus*. Available on the Internet at http://www.sdnhm.org/fieldguide/herps/cole-var.html

Sauer, J.R., J.E. Hines, and J. Fallon. 2002. The North American Breeding Bird Survey, Results and Analysis 1966-2001. Version 2002.1, U.S. Geological Survey, Patuxent Wildlife Research Center, Laurel, Maryland. http://www.mbr-pwrc.usgs.gov/bbs/bbs2001.html.

Sauer, J.R., S. Schwartz, and B. Hoover. 1996. The Christmas Bird Count Home Page. Version 95.1 U.S.G.S. Biological Resource Division, Patuxent Wildlife Research Center, Laurel, MD. Online. Available: http://www.mbr.nbs.gov/bbs/cbc.html.

Schultz, L.M. 1998. A new species of *Eriogonum* (Polygonaceae: Eriogonoideae) from Utah and Nevada. Harvard Papers in Botany 3: 49-52.

Scott, V.E. and D. R. Patton. 1975. Cavity-nesting birds of Arizona and New Mexico forests. U.S. Dep. of Agric., For. Serv. Gen. Tech. Rep. RM-10.

Seegmiller, R.F., and R.D. Ohmart. 1981. Ecological relationships of feral burros and desert bighorn sheep. Wildlife Monographs No. 78. 58pp.

Seiler, G.J. 2005. Wild *Helianthus anomalus* and *Helianthus deserticola* from the Desert Southwest, USA: A potential soruce of stress genes for the cultivated sunflower. USDA, Agricultural Research Service.

Seiler, G.J. 2007. Wild annual Helianthus anomalus and Helianthus deserticola as potential sources of improved oil concentration and quality in sunflower. Industrial Crops and Products. 25:95-100. Available on the Internet at http://dx.doi.org/10.1016/j.indcrop.2006.07.007.

Shackleton, D.M. 1985. *Ovis canadensis*. Mammalian Species No. 230. 9pp.

Sheffield, S.R. 1997a. Current status, distribution, and conservation of the Burrowing Owl (Speotyto cunicularia) in Midwestern North America. In J.R. Duncan, D.H. Johnson, and T.H. Nicholls, editors. Biology and conservation of owls of the Northern Hemisphere. Pages 399-407. U.S.D.A. Forest Service, General Technical Report NC-190. North Central Forest Experiment Station, St. Paul, Minnesota.

Sheffield, S.R. 1997b. Owls as biomonitors of environmental health hazards. In Biology and Conservation of Owls of the North Hemisphere. Pages 383-398. USDA Forest Service, General Technical Report NC-190.

Sheffield, S.R. and M. Howery. 2001. Current status, distribution, and conservation of the Burrowing Owl in Oklahoma. Journal of Raptor Research 35:351-35.

Sherwin, R. E. 2005. Biological Investigations of Caves in the Spring Mountains Natural Resource Area.

Shuford, W.D. 1993. The Marin County breeding bird atlas: a distributional and natural history of coastal California. California Avifauna Series no. 1. Bushtit Books, Bolinas, California.

Sibley, D.A. 2000. The Sibley Guide to Birds. Chanticleer Press, Inc., New York.

Siders, M.S. 2005. Bat Inventory of Grand Staircase-Escalante National Monument Using Mist Nets and Acoustic Monitoring. 17pp + Apendices A-D.

Sillero-Zubiri, C., Hoffman, M. & Macdonald, D.W. 2004. Canids: Foxes, Wolves, Jackals and Dog: Status Survey and Conservation Action Plan. IUCN Publications Services Unit, Cambridge.

Simon, D. 1977. Identification of Clay-colored, Brewer's, and Chipping sparrows in fall plumage. Birding 9: 189–191.

Singer, F.J., L.C. Zeigenfuss, and L. Spicer. 2001 Role of Patch Size, Disease, and Movement in Rapid Extinction of Bighorn Sheep. Conservation Biology 15(5): 1347-1354.

Skelly, D.K., E.E. Werner, and S.A. Cortwright. 1999. Long-term distributional dynamics of a Michigan amphibian assemblage. Ecology 80(7):2326-2337.

Smith, D.G., and J.R. Murphy. 1973. Breeding ecology of raptors in the eastern Great Basin of Utah. Brigham University Science Bulletin. Biol. Service 13: 1-76.

Smith, D.G., and J.R. Murphy. 1978. Biology of the Ferruginous Hawk in Central Utah. Sociobiology 3: 79-95.

Snow, C. 1974. Habitat management series for endangered species. Report 4. Spotted bat Euderma maculatum. Bureau of Land Management.

Snyder, N. F. R., H. A. Snyder. 1991. Birds of Prey. Voyageur Press, Inc. Stillwater, Minnesota.

Southwest Partners in Amphibian and Reptile Conservation (SWPARC. 2007). Southwest Partners in Amphibian and Reptile Conservation website. Available on the Internet at http://chelydra.unm.edu/swparc/index.html.

Southwest Regional Gap Analysis Project (SWReGAP). 2005. Southwest Regional Gap Analysis Wildlife Habitat Relationship. Available on the Internet at http://fws-nmcfwru.nmsu.edu/swregap/.

Stapanian, M. A., S. D. Sundberg, G. A. Baumgardner and A. Liston. 1998. Alien plant species composition and associations with anthropogenic disturbance in North American forests. Plant Ecology 139: 49-62.

Stark, L.R. 1996. The status of *Weissia sweetii*, a species endemic to the Southwestern United States. The Bryologist. 99(3): 345-348.

Stark, L.R. 2001. Rare Bryophytes of Conservation Concern in southern Nevada. Mosses of Nevada On-line. http://heritage.nv.gov/mosses/raremoss.htm. (Accessed: August 1, 2007).

Stark, L.R., and A.T. Whittemore. 2000. Bryophytes from the Northern Mojave Desert. The Southwestern Naturalist. 45(2):226-232.

Stebbins, R.C. 2003. A Field Guide to Western Reptiles and Amphibians. Third edition. Houghton Mifflin Company, Boston.

Stebbins, R.C. and R.T. Peterson. 1985. Western Reptiles and Amphibians. 1985. Houghton Mifflin Company.

Steenhof, K. 1998. Prairie falcon (*Falco mexicanus*). Birds of North America 346: 28 pp.

Stiles, F.G. and A. F. Skutch. 1989. A guide to the birds of Costa Rica. Cornell University Press, Ithaca, New York, USA. 511 pp.SWCA. 2005a. Biological Information Assessment for 52 Species of Concern within the Spring Mountains National Recreation Area. Prepared for Spring Mountains National Recreation Area, Humboldt-Toiyabe National Forest, Las Vegas, Nevada.

Stock, A.D. 1965. Systematics and distribution of mammals of Washington County, Utah. Univ. Utah, unpublished M.S. thesis, 267 pp.

Sublette, J.E., M.D. Hatch, and M.S. Sublette. 1990. The fishes of New Mexico. University of New Mexico Press, Albuquerque, New Mexico.

Sumner, E. L., Jr. 1928. Notes on the development of young screech owls. Condor 30: 333–338.

SWCA. 2005. The Spring Mountains National Recreation Area Physical Environment. Prepared for Spring Mountains National Recreation Area, Humboldt-Toiyabe National Forest, Las Vegas, Nevada.

Tenney, C.R. 1997. Black-chinned Sparrow (*Spizella atrogularis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online

Terres, J.K. 1980. The Audubon Society encyclopedia of North American birds. Alfred A. Knopf, New York.

Texas Parks and Wildlife (TPWD). 2007a. *Eumops perotis californicus*. Species information website. Available on the Internet at http://www.tpwd.state.tx.us/huntwild/wild/species/westmastiff (Accessed July 26, 2007).

Texas Parks and Wildlife (TPWD). 2007b. *Numenius americanus*. Species information website. Available on the Internet at http://www.tpwd.state.tx.us/huntwild/wild/species/curlew/.

Texas Parks and Wildlife (TPWD). 2007c. Brazilian free-tailed bat (*Tadarida brasiliensis*). Available on the Internet at http://www.tpwd.state.tx.us/huntwild/wild/species/brazilfreetailbat/.

Texas Parks and Wildlife (TPWD). 2007d. Long-legged myotis (*Myotis volans*). Available on the Internet at http://www.tpwd.state.tx.us/huntwild/wild/species/longlegmyotis/.

The Conservation Association and Jones & Stokes. 2000. Draft Environmental Assessment for Federal Agency Participation in the Virgin River Resource Management and Recovery Program. Prepared for USFWS, BLM, and NPS. Available on the Internet at http://www.fws.gov/mountain-prairie/NEPA/VirginRiver/pdf_files/chapter_1.pdf.

The Nature Conservancy (TNC). 2001. Prairie Falcon (*Falco mexicanus*). Species Management Abstract. Available on the Internet at http://www.conserveonline.org/docs/2001/10/prfa.doc

The Nature Conservancy. (TNC). 2005. Conservation Action Planning: Developing Strategies, Taking Action, and Measuring Success at Any Scale--Overview of Basic Practices. The Nature Conservancy.

The Nature Conservancy (TNC). 2007. A Conservation Management Strategy for Nine Rare Low Elevation Plants in Clark County Nevada. Available on the Internet at http://www.accessclarkcounty.com/daqem/epd/desert/pdf/LERPCMS_Final_32007 updated1.pdf.

Thompson, C.F., and V. Nolan, Jr. 1973. Population biology of the yellow-breasted chat (*Icteria virens*) in southern Indiana. Ecolog. Monogr. 43:145-171.

Tibbitts, T. 1989. State-wide survey of Peregrine Falcon occurrence on U.S. Forest Service and BLM land. Research Information Sheet - Peregrine Falcon Survey, Arizona Game and Fish Department. Phoenix, Arizona. 2 pp.

Tingley, J.V. 1998. Nevada Bureau of Mines and Geology Report 47, Second Edition. Mining Districts of Nevada. Mackay School of Mines University of Nevada Reno.

Todd, R.L. 1971. Nongame wildlife investigations. Arizona Game and Fish Dept., Proj. W-53-21, Rpt. Work Plan 5, Job I. 11 pp.

Toombs, T.P. 1997. Burrowing Owl nest-site selection in relation to soil texture and prairie dog colony attributes. M.S. Thesis. Colorado State University, Fort Collins, Colorado.

TopoZone. 2007. Online data for Clark County Nevada and Mohave County Arizona. Available on the Internet at http://www.topozone.com/.

Tracy, C. R. 1996. Nutritional ecology of the desert tortoises: preliminary assessment of some impacts due to sheep grazing in the California Desert District. Report to National Biological Service. Univ. Nevada, Reno.

Tracy, C.R., R. Averill-Murray, W.I. Boarman, D. Delehanty, J. Heaton, E. McCoy, D. Morafka, K. Nussear, B. Hagerty, and P. Medica. 2004. Desert tortoise recovery plan assessment. Report to the U.S. Fish and Wildlife Service.

Trudeau, D.A., 1979. Hydrologic Investigation of the Littlefield Springs (near Littlefield, Arizona). Unpublished Thesis for Master of Science in Hydrology, University of Nevada, Reno, Nevada, 136 p.

Trust Lands Administration (TLA). 2006. State of Utah School and Institutional Trust Lands Administration. Material permit sites – Sand and Gravel. July 28, 2006. Available on the Internet at ftp://lands-ftp.state.ut.us/pub/download/maps/Sand percent20and percent20Gravel.pdf

Turner, R.M, and D.E. Brown. 1982. Sonoran desertscrub. In Biotic communities of the American southwest-United States and Mexico. D.E. Brown, ed. Special issue of desert plants, volume 4. pp 181–221

Turner, R.M, P.A. Medica, and C.L. Lyons. 1984. Reproduction and survival of the desert tortoise (*Scaptochelys agassizii*) in Ivanpah Valley, California. Copeia 1984(4):811–820.

U.S. Census Bureau. 2006. American FactFinder website. Available on the Internet at http://factfinder.census.gov/home/saff/main.html?_lang=en.

U.S. Department of Agriculture (USDA). 1999. Forest Service Region 3. Regional Forester's Sensitive Species List. USDI, Bureau of Land Management. 2000. Arizona BLM Sensitive Species List. Instruction Memorandum No. AZ-2000-018.

U.S. Department of Agriculture (USDA). 2007. Quick Stats – Agricultural statistics data base. Available on the Internet at: http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp.

U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). 1996. Endangered Species Habitat Conservation Planning Handbook. November 1996.

U.S. Fish and Wildlife Service (USFWS). 1967. Endangered Species List – 1967. Federal Register. Vol. 32, pp. 4001. March 11, 1967.

U.S. Fish and Wildlife Service (USFWS). 1994a. Desert Tortoise (Mojave Population) Recovery Plan. Available on the Internet at http://ecos.fws.gov/docs/recovery_plans/1994/940628.pdf.

U.S. Fish and Wildlife Service (USFWS). 1994b. Endangered and threatened wildlife and plants; Determination of critical habitat for the Mojave population of the desert tortoise. Final rule. Federal Register Vol. 59 No. 26, page 5,820-5,866. February 8, 1994.

U.S. Fish and Wildlife Service (USFWS). 1998. Recovery plan for upland species of the San Joaquin Valley, California, Region 1, Portland Oregon. 295 pp. Available on the internet at http://www.co.contra-costa.ca.us/depart/cd/water/HCP/archive/final-hcp-rev/pdfs/apps/AppD/02a_kitfox_9-28-06_profile.pdf

U.S. Fish and Wildlife Service (USFWS). 1999a. Endangered and Threatened Wildlife and Plants: Final Rule to Remove the Peregrine Falcon in North America from the List of Endangered and Threatened Wildlife. Federal Register 64(164):46542-46558.

U.S. Fish and Wildlife Service (USFWS). 1999b. Proposed Rule to Remove the Bald Eagle in the Lower 48 States From the List of Endangered and Threatened Wildlife. Federal Register 64(164): 36454-36464.

U.S. Fish and Wildlife Service (USFWS). 2000a. Desert Tortoise (Mojave Population), General Species Information. Arizona Ecological Services Field Office.

U.S. Fish and Wildlife Service (USFWS). 2000b. Draft Environmental Assessment for Federal Agency Participation in the Virgin River Resource and Recovery Management Program. September 2000. Prepared by The Conservation Association, Auburn, California, and Jones & Stokes, Sacramento, California.

U.S. Fish and Wildlife Service (USFWS). 2000c. Recovery plan for bighorn sheep in the Peninsular Ranges, California. U.S. Fish and Wildlife Service, Portland, OR. xv+251 pp.

U.S. Fish and Wildlife Service (USFWS). 2004a. Bald eagle species description. Accessed April 11, 2006 at http://ecos.fws.gov/docs/life_histories/B008.html.

U.S. Fish and Wildlife Service (USFWS). 2005a. Biological and conference opinion on the Lower Colorado River Multi-Species Conservation Program, Arizona, California, and Nevada. AESO/SE 02-21-04-F-0161. Phoenix, Arizona. 214 pp. USFWS. 2005b. Draft Biological Opinion for the proposed Coyote Springs Investment Development in Las Vegas, Clark County, Nevada (Corps of Engineers Permit Application No. 200125042). File No. 1-5-05-FW-536-Tier 02. Reno, Nevada.

U.S. Fish and Wildlife Service (USFWS). 2005b. Threatened and Endangered Species System (TESS). Available on the Internet at http://ecos.fws.gov/tess_public/servlet/gov.doi.tess_public.servlets.VipListed?code=V&listings=0#A.

U.S. Fish and Wildlife Service (USFWS). 2007a. Endangered and Threatened Wildlife and Plants; Removing the Bald Eagle in the Lower 48 States from the List of Endangered and Threatened Wildlife; Final Rule; Endangered and Threatened Wildlife and Plants; Draft Post-Delisting and Monitoring Plan for the Bald Eagle (*Haliaeetus leucocephalus*) and Proposed Information Collection; Notice.

U.S. Fish and Wildlife Service (USFWS). 2007b. Recovery Plan for the Sierra Nevada Bighorn Sheep. Sacramento, California. xiv + 199 pages.

U.S. Fish and Wildlife Service (USFWS). 2007c. Desert Bighorn Sheep of Cabeza Prieta NWR. Cabeza Prieta National Wildlife Refuge. U.S. Fish and Wildlife Service. Retrieved on 2007-08-14. Available on the Internet at http://www.fws.gov/southwest/REFUGES/arizona/cabighrn.html.

U.S. Fish and Wildlife Service (USFWS). 2007d. Migratory Bird Strategic Plan - Birds of Management Concern. Available on the Internet at http://www.fws.gov/migratorybirds/mbstratplan/GPRAMBSpecies.pdf

U.S. Fish and Wildlife Service (USFWS). 2008a. Federal Register. 50 CFR Part 17 RIN ID: RIN 1018-AV09mNOTICE: Part III Document Action: Proposed rule: Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Peninsular Bighorn Sheep (Ovis canadensis nelsoni) and Proposed Taxonomic Revision. http://www.thefederalregister.com/d.p/2007-10-10-07-4959.

U.S. Fish and Wildlife Service (USFWS). 2008b. Species profiles. Available on the internet at http://ecos.fws.gov/speciesProfile/SpeciesReport.do?spcode=A006

U.S. Geological Survey (USGS). 1995. Northern Prairie Wildlife Research Center. Pale Townsend’s big-eared bat. North Dakota’s Federally Listed Endangered, Translated, and Candidate Species – 1995. Available on the Internet at http://www.npwrc.usgs.gov/resource/wildlife/nddanger/species/plectown.htm.

U.S. Geological Survey (USGS). 2003. *Gambelia wislizenii*. Available on the Internet at http://www.werc.usgs.gov/fieldguide/gawi.htm. Western Ecological Research Center, San Diego Field Station.

U.S. Geological Survey (USGS). 2004. Provisional Digital Land Cover Map for the Southwestern United States. Version 1.0. RS/GIS Laboratory, College of Natural Resources, Utah State University.

U.S. Geological Survey (USGS). 2005. Stewardship Data: Objectives and Status Categories webpage. New Mexico Cooperative Fish and Wildlife Research Unit, New Mexico State University. Available on the Internet at http://fws-nmcfwru.nmsu.edu/swregap/Stewardship/Objectives.htmUtah Division of Natural Resources (UDNR). 2007. Desert Night Lizard. Available online at: http://dwrcdc.nr.utah.gov/rsgis2/Search/Display.asp?FlNm=xantvigi.

U.S. Geological Survey National Gap Analysis Program (USGS GAP). 2004. Provisional digital land cover map for the southwestern United States. Version 1.0. RS/GIS Laboratory, College of Natural Resources, Utah State University.

U.S. Bureau of Reclamation (USBR). 2004. Lower Colorado River Multi-species Conservation Plan. Available on the Internet at http://www.lcrmscp.gov/publications/VolumeII.pdf.

U.S. Forest Service (USFS). 2003. Revised Forest Plan. Wasatch-Cache National Forest. Forest Service, Intermountain Region, Salt Lake City, Utah.

Unitt, P. 2004. San Diego County Bird Atlas. San Diego Natural History Museum, San Diego, California.

University of Kansas. No Date. Big free-tailed bat. Mammals of Kansas. University of Kansas Field Station and Ecological Reservers. Available on the Internet at http://www.ksr.ku.edu/libres/Mammals_of_Kansas/nyctic-macr.html.

University of Texas (UT). 1998. *Crotalus scutulatus*. Available online at: http://www.zo.utexas.edu/research/txherps/snakes/crotalus.scutulatus.html

Utah Division of Wildlife Resources (UDWR). 1998. Inventory of Sensitive Species and Ecosystems in Utah, Endemic and Rare Plants of Utah: an Overview of their Distribution and Status. Prepared for the Utah Reclamation Mitigation and Conservation Commission and the U.S. Department of the Interior. June 1998. Available on the Internet at http://dwrcdc.nr.utah.gov/ucdc/ViewReports/plantrpt.pdf.

Utah Division of Wildlife Resources (UDWR). 2005. Utah Comprehensive Wildlife Strategy. Available online at: http://wildlife.utah.gov/cwcs/.

Utah Division of Wildlife Resources (UDWR). 2006a. Utah Sensitive Species List. October, 2006. Available at: http://dwrcdc.nr.utah.gov/ucdc/ViewReports/SSL101706.pdf. Site accessed July 25, 2007.

Utah Division of Wildlife Resources (UDWR). 2006b. Utah Division of Wildlife Resources. Utah Conservation Data Center. Available online at: http://dwrcdc.nr.utah.gov/ucdc/

Utah Division of Wildlife Resources (UDWR). 2007a. *Chaetodipus penicillatus*. Utah Data Conservation Center. Available on the Internet at http://wildlife.utah.gov/habitat/pdf/endgspec.pdf

Utah Division of Wildlife Resources (UDWR). 2007b. *Gambelia wislizenii*. Utah Data Conservation Center. Available on the Internet at http://dwrcdc.nr.utah.gov/rsgis2/search/Display.asp?FlNm=gambwisl

Utah Native Plant Society (UNPS). 2003-2007. Utah Rare Plant Guide. Salt Lake City, UT: Utah Rare Plant Guide Home Page. Http://www.utahrareplants.org. Downloaded July 25, 2007.

Valone, T.J., Brown, J.H., and Jacobi, C.L. 1995. Catastrophic Decline of a Desert Rodent, Dipodomys Spectabilis: Insight from a Long-Term Study. Journal of Mammology 76: 428-436.

Van der Haegen, W.M., F.C. Dobler, and D.J. Pierce. 2000. Shrubsteppe bird response to habitat and landscape variables in eastern Washington, USA. Conservation Biology 14:1145-1160.

Van Tighem, K. 1967. Destruction of the Prairie Falcon at Calgary, Alberta. Blue Jay 25:108.

Vander Haegen, W.M., F.C. Dobler, and D.J. Pierce. 2000. Shrubsteppe bird response to habitat and landscape variables in eastern Washington, USA. Conservation Biology 14:1145-1160.

Verts, B.J., and L.N. Carraway. 1998. Land mammals of Oregon. University of California Press, Berkeley. xvi + 668 pp.

Walker, B. 2004. Effects of management practices on grassland birds: Brewer's Sparrow. Northern Prairie Wildlife Research Center, Jamestown, North Dakota. Northern Prairie Wildlife Research Center Online. Available on the Internet at http://www.npwrc.usgs.gov/resource/literatr/grasbird/brsp/brsp.htm.

Walker, M. and P. Woodman. 2002. Desert tortoise population survey at Beaver Dam Slope exclosure desert tortoise study plot; spring, 2001. Report to Arizona Game and Fish Department, Phoenix, Arizona.

Wallis, I.R., K.A. Nagy, B.S. Wilson, B.R. Henen, C. Peterson, C. Meienberger, and I.A. Girard. 1992. Mortality and upper respiratory tract disease (URTD) in wild desert tortoises: Hematological, biochemical and physiological correlates during two drought years in the Mojave Desert of California. Preliminary–not for distribution.

Walsberg, G.E. 1975. Digestive Adaptations of *Phainopepla nitens* associated with eating of mistletoe berries. Condor 77:169-174.

Walsberg, G.E. 1977. Ecology and Energetics of Contrasting Social Systems in Phainopepla nitens (Aves, Ptilogonatidae). Univ. California Publ. Zool. 108.

Walsberg, G.E. 1978. Brood size and the use of time and energy by the Phainopepla. Ecology 59:147-153.

Warner, R.M., and N. J. Czaplewski. 1984. *Myotis volans*. Mammalian Species. 224:1-4.

Warnock, R.G. and P.C. James. 1997. Habitat fragmentation and Burrowing Owls (*Speotyto cunicularia*) in Saskatchewan. In J.R. Duncan, D.H. Johnson and T.H. Nicholls, editors. Biology and conservation of owls of the Northern Hemisphere: Second International Symposium. U.S.D.A. Forest Service General Technical Report NC-190, North Central Forest Experiment Station, St. Paul, Minnesota.

Waser, P.M., and Ayers, J.M. 2003. Microhabitat use and population decline in banner-tailed kangaroo rats. Journal of Mammology 84: 1031-1043.

Waters, D.L. 1992. Geographic distribution: *Pseudacris regilla*. Herpetol. Review 23:24-25.

Wauer, R.H. 1969. Recent Bird Records from the Virgin River Valley of Utah, Arizona, and Nevada. The Condor, Vol. 71, No. 3 (July 1969), pp. 331-335.

Wauer, R.H. 1974. Changes in the breeding avifauna within the Chisos Mountains system. Transactions of the symposium on the biological resources of the Chiricahua desert region, U.S. and Mexico: Sul Ross State Univ., Nat. Park Service 1977: 597–608.

Weathers, W. 1983. Birds of southern California's deep canyon. Univ. of California Press, Berkeley and Los Angeles.

Webb, R.H., J.W. Steiger, and R.M Turner. 1987. Dynamics of Mojave Desert shrub vegetation in the Panamint Mountains. Ecology. 50:478-490.

Wedgwood, J.A. 1976. Burrowing Owl in south-central Saskatchewan. Blue Jay 34:26-44.

Wehausen, J.D. 1980. Sierra Nevada bighorn sheep: history and population ecology. Ph.D. Dissertation, University of Michigan, Ann Arbor. 240 pp.

Wehausen, J.D. 1983. White Mountain bighorn sheep: an analysis of current knowledge and management alternatives. USDA, Forest Service, Inyo National Forest, Bishop, CA. Adm. Rep., Contract No. 53-9JC9-0-32. 93pp.

Wehausen, J.D. 1996. Effects of mountain lion predation on bighorn sheep in the Sierra Nevada and Granite Mountains of California. Wildlife Society Bulletin 24:471-479.

Wehausen, J.D. and R.R. Ramey II. 2000. Cranial morphometric and evolutionary relationships in the northern range of Ovis canadensis. Journal of Mammology 81: 145-161.

Wehausen, J.D., R.R. Ramey II, and C.W. Epps. 2004. Experiments in DNA extraction and PCR amplification from bighorn sheep feces: the importance of DNA extraction method. Journal of Heredity 95:503-509.

Weinstein, M.N. and K.H. Berry. 1987. Morphometric analysis of desert tortoise populations. Report Prepared for Bureau of Land Management.

Welsh, S.L., N.D. Atwood, S. Goodrich, and L.C. Higgin, editors. 1993. A Utah flora (2nd ed., revised). Provo, UT: Brigham Young University. 986 pp.

Western Bat Working Group. 2005. Species Accounts. Prepared for the Portland Biennial Meeting. Available online at: http://wbwg.org/species_accounts/vespertilonidae/idph.pdf.

Wheelock, I.G. 1910. Birds of California. A. C. McClurg and Co., Chicago.

Whisenant, S.G. 1990. Changing fire frequencies on Idaho's Snake River plains: ecological and management implications. Pp. 4–10 in Proceedings: Symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management (E. D. McArthur, E. M. Romney, S. D. Smith, and P. T. Tueller, eds). USDA Forest Serv. Gen. Tech. Rep. INT-GTR-276.

White, C. M., N. J. Clum, T. J. Cade, and W. G. Hunt. (2002). Peregrine Falcon (*Falco peregrinus*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Laboratory of Ornithology; Retrieved from The Birds of North American Online database.

Wiens, J.A. and J.T. Rotenberry. 1980. Patterns of morphology and ecology in grassland and shrubsteppe bird populations. Ecol. Monogr. 50: 287–308.

Wildlife Action Plan Team (WAPT). 2006. Nevada Wildlife Action Plan. Nevada Department of Wildlife, Reno.

Wilkins, K.T. 1982. Highways as barriers to rodent dispersal. Southwestern Naturalist 27: 459-460.

Williams, D.F. et. al. 1998. Recovery Plan for the Upland Species of the San Joaquin Valley, California. U.S. Fish and Wildlife Service. Available on the Internet at http://ecos.fws.gov/docs/recovery_plans/1998/980930a.pdf.

Williams, J. and Nowak, R. 1993. pp.107 – 139, In The Last Extinction. QH75.L36.

Willoughby, E.J. 1991. Molt of the genus *Spizella* (Passeriformes, Emberizidae) in relation to ecological factors affecting plumage wear. Proc. West. Found. Vertebrate Zool. 4: 247–286.

Wilson, D.E., and S. Ruff. 1999. The Smithsonian book of North American mammals. Smithsonian Institution Press, Washington, D.C. 750 pp.

World Conservation Union (IUCN), Conservation International, and NatureServe. 2006. Global Amphibian Assessment. Available on the Internet at http://www.globalamphibians.org. Accessed on June 20, 2007.

Wright, A.H. and A.A. Wright. 1949. Handbook of Frogs and Toads of the United States and Canada. Third edition. Comstock Publishing Company, Ithaca, New York.

Wunder, L., and A.B. Carey. 1994. Merriam's shrew and small mammal communities on the Yakima Training Center, Washington. Northwest Science 68:1

Zander, R.H. 2004. *Trichostomum planifolium*. Bryophyte Flora of North America. Vol. 1. Available on the Internet at: http://www.eFloras.org. Accessed on July 24, 2007.

Zander, R.H., L.R. Stark, G Marrs-Smith. 1995. *Didymodon nevadensis*, a New Species. The Bryologist 98: 590-595.

Zeiner, D.C. 1990. California's wildlife. Volume II; birds. California statewide wildlife habitat relationships system. Department of Fish and Game. Sacramento, California.

Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, and M. White, eds. 1988. California's Wildlife Volume I: amphibians and reptiles and Volume III: mammals. Sacramento, California: California Department of Fish and Game.

Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, M. White. 1990. California's wildlife. Volume III: Mammals. California Statewide Wildlife Habitat Relationships System. Sacramento, California: California Department of Fish and Game.Ziswiler, V. 1967. Extinct and Vanishing Animals. QL88.Z513. p.114

Zink, T.A., M.F. Allen, B. Heindl-Tenhunen and E. B. Allen. 1995. The effect of a disturbance corridor on an ecological reserve. Restoration Ecology 3: 304-310.

Zugmeyer, C.A and J.L. Koprowski. 2007. Avian nestling predation by endangered Mt. Graham red squirrel. The Southwestern Naturalist, 52:155-157. Available online at http://www.ag.arizona.edu/research/redsquirrel/res_pdf/MGRS%20Publications/Zugmeyer_Koprowski07_RS_nestlingpredation.pdf.

APPENDIX A

SWReGAP Land Cover Type Descriptions

Below are SWReGAP land cover designations within the VRCMA Boundary, compiled from USGS National Gap Analysis Program. 2005. Southwest Regional GAP Analysis Project—Land Cover Descriptions. RS/GIS Laboratory, College of Natural Resources, Utah State University. The full land cover descriptions document is available on the Internet at http://earth.gis.usu.edu/swgap/legend_desc.html.

■ ■ ■

S009 INTER-MOUNTAIN BASINS CLIFF AND CANYON
Division 304, Barren, CES304.779
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Non-vegetated (<10% vasc.), Upland
Diagnostic Classifiers: Cliff (Landform), Rock Outcrops/Barrens/Glades

Non-Diagnostic Classifiers: Montane [Upper Montane], Montane [Montane], Montane [Lower Montane], Lowland [Foothill], Lowland [Lowland], Canyon, Rockfall avalanche, Ridge/Summit/Upper Slope, Sideslope, Toeslope/Valley Bottom, Sedimentary Rock, Metamorphic Rock, Igneous Rock, Temperate [Temperate Continental], Very Shallow Soil

Concept Summary: This ecological system is found from foothill to subalpine elevations and includes barren and sparsely vegetated landscapes (generally <10% plant cover) of steep cliff faces, narrow canyons, and smaller rock outcrops of various igneous, sedimentary, and metamorphic bedrock types. Also included are unstable scree and talus slopes that typically occur below cliff faces. Widely scattered trees and shrubs may include *Abies concolor, Pinus edulis, Pinus flexilis, Pinus monophylla, Juniperus* spp., *Artemisia tridentata, Purshia tridentata, Cercocarpus ledifolius, Ephedra* spp., *Holodiscus discolor*, and other species often common in adjacent plant communities.

DISTRIBUTION

Ecological Divisions: 304
TNC Ecoregions: 11:C, 18:C, 4:?, 6:C
Subnations/Nations: CA:c, ID:c, NV:c, OR:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:

- CERCOCARPUS INTRICATUS SPARSELY VEGETATED ALLIANCE (A.2543) Cercocarpus intricatus Slickrock Sparse Vegetation (CEGL002977)
- CERCOCARPUS MONTANUS SPARSELY VEGETATED ALLIANCE (A.2544) Cercocarpus montanus Rock Pavement Sparse Vegetation (CEGL002978)
- CRATAEGUS RIVULARIS TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.2597) Crataegus rivularis Shrubland (CEGL002889)
- GLOSSOPETALON SPINESCENS SHRUBLAND ALLIANCE (A.1032) Glossopetalon spinescens var. aridum / Pseudoroegneria spicata Shrubland (CEGL001100)
- JUNIPERUS OSTEOSPERMA WOODLAND ALLIANCE (A.536) Juniperus osteosperma / Cercocarpus intricatus Woodland (CEGL000733)
- LEYMUS SALINUS SSP. SALMONIS SPARSELY VEGETATED ALLIANCE (A.1258) Leymus salinus Shale Sparse Vegetation (CEGL002745)
- PINUS MONOPHYLLA - (JUNIPERUS OSTEOSPERMA) WOODLAND ALLIANCE (A.543) Pinus monophylla - Juniperus osteosperma / Sparse Understory Woodland (CEGL000829)
- WOODED BEDROCK SPARSELY VEGETATED ALLIANCE (A.2546) Pinus ponderosa Slickrock Sparse Vegetation (CEGL002972)

SOURCES

References: Knight 1994
Last updated: 20 Feb 2003 **Stakeholders:** WCS, MCS

S010 COLORADO PLATEAU MIXED BEDROCK CANYON AND TABLELAND
Division 304, Barren, CES304.765
Spatial Scale & Pattern: Matrix **Classification Confidence:** low
Required Classifiers: Natural/Semi-natural, Non-vegetated (<10% vasc.), Upland
Diagnostic Classifiers: Montane [Lower Montane], Lowland [Foothill], Shrubland (Shrub-dominated), Ridge/Summit/Upper Slope, Sedimentary Rock, Temperate [Temperate Xeric], Alkaline Soil, Aridic

Non-Diagnostic Classifiers: Moss/Lichen (Nonvascular), Cliff (Substrate), Talus (Substrate)

Ecological Systems: Copyright © 2003 NatureServe 13
Concept Summary: The distribution of this ecological system is centered on the Colorado Plateau where it is comprised of barren and sparsely vegetated landscapes (generally <10% plant cover) of steep cliff faces, narrow canyons, and open tablelands of predominantly sedimentary rocks, such as sandstone, shale, and limestone. Some eroding shale layers similar to Inter-Mountain Basins Shale Badland (CES304.789) may be interbedded between the harder rocks. The vegetation is characterized by very open tree canopy or scattered trees and shrubs with a sparse herbaceous layer. Common species includes *Pinus edulis, Pinus ponderosa, Juniperus* spp., *Cercocarpus intricatus*, and other short-shrub and herbaceous species, utilizing moisture from cracks and pockets where soil accumulates.

Comments: Geographically restricted and distinct from the related, but broader Inter-Mountain Basins Cliff and Canyon (CES304.779). Shale areas are not extensive as in shale badlands.

DISTRIBUTION

Range: Colorado Plateau.
Ecological Divisions: 304
TNC Ecoregions: 18:C, 19:C, 20:?
Subnations/Nations: AZ:c, CO:c, NM:c, UT:c

CONCEPT

Alliances and Associations:

- CERCOCARPUS INTRICATUS SPARSELY VEGETATED ALLIANCE (A.2543) Cercocarpus intricatus Slickrock Sparse Vegetation (CEGL002977)
- CERCOCARPUS MONTANUS SPARSELY VEGETATED ALLIANCE (A.2544) Cercocarpus montanus Rock Pavement Sparse Vegetation (CEGL002978)
- EPHEDRA TORREYANA SPARSELY VEGETATED ALLIANCE (A.2571) Ephedra torreyana - (Atriplex canescens, Atriplex confertifolia) Sparse Vegetation (CEGL005801)
- JUNIPERUS OSTEOSPERMA WOODLAND ALLIANCE (A.536) Juniperus osteosperma / Artemisia nova / Rock Woodland (CEGL000729) Juniperus osteosperma / Cercocarpus intricatus Woodland (CEGL000733)
- PINUS EDULIS - (JUNIPERUS SPP.) WOODLAND ALLIANCE (A.516) Pinus edulis - Juniperus osteosperma / Cercocarpus intricatus Woodland (CEGL000779)
- SANDSTONE SPARSELY VEGETATED ALLIANCE (A.2568) Atriplex canescens - (Ephedra viridis) / (Muhlenbergia porteri) Sandstone Sparse Vegetation [Provisional] (CEGL002927)
- WOODED BEDROCK SPARSELY VEGETATED ALLIANCE (A.2546) Pinus ponderosa Slickrock Sparse Vegetation (CEGL002972)

Environment: This system includes limestone escarpments and plateaus occurring in a relatively narrow band of unvegetated or sparsely vegetated badlands formed by the red beds of Claron (Wasatch) Formation along the eastern edge of the Pausaugunt Plateau (Bryce Canyon) and the western edge of the Markagunt Plateau (Cedar Breaks National Monument) (Graybosch and Buchanan 1983). It includes areas of which often 90% of the exposed surface consists of barren rock. It forms, or includes, areas of fixed bedrock forming the vertical or near-vertical parts on the plateau faces. The rocks forming such areas are predominantly limestone-capped plateaus. These areas are highly erodible and form the basic scenic structure of Bryce Canyon and Cedar Breaks national parks. The area is generally too steep to allow any significant soil development. Scattered plants obtain a precarious foothold in the crevices of the rocks. Knolls may form at the base of the cliffs.

This ecological system also includes sandstone and shale escarpments, which form, or include, areas of fixed bedrock forming the vertical or near-vertical parts of canyon walls and plateau faces. The scenic cliffs of the East Tavaputs area, e.g., the Book Cliffs are excellent examples of this. The rocks forming such areas are dominantly sandstone and shale with some limestone and marlstone. These areas are unstable and rocks are frequently rolling down onto the talus slopes below (often forming Inter-Mountain Basins Shale Badland (CES304.789)). The area is generally too steep to allow any significant soil development. Scattered plants obtain a precarious foothold in the crevices of the rocks. Knolls may form at the base of the cliffs. The larger drainages (e.g., East Fork Parachute Creek) plunge several hundred feet (meters) at this escarpment, which creates scenic and lush hanging gardens. Many of these escarpments are over 1000 feet (304.8 meters) in height and provide excellent habitat for cliff-nesting birds such as peregrine falcons and golden eagles.

The Claron limestone, a Tertiary deposit, is divisible into Red Eocene beds and White Oligocene beds, which differ somewhat in presence or absence of pigmentation in the form of iron and manganese oxides, and in amounts of sand and conglomerates in the limestone (Graybosch and Buchanan 1983). The Claron Formation is characterized by a rapid rate of erosion, largely a function of creep resulting from winter freeze-thaw activity and wash away by summer thunderstorm runoff (Graybosch and Buchanan 1983). Freeze-thaw cycles are most pronounced on south-facing slopes. Soil development is limited. Infiltration rates are low and runoff high.

Vegetation: For the most part, this system is sparsely vegetated. Small patches of scattered trees and shrubs may occur. These small vegetated patches are usually dominated by conifer trees, and may include *Abies concolor, Juniperus scopulorum, Picea pungens, Pinus flexilis, Pinus longaeva, Pinus ponderosa*, and *Pseudotsuga menziesii*. If a shrub layer exists it may include *Acer glabrum, Amelanchier utahensis, Arctostaphylos patula, Ceanothus martinii, Cercocarpus montanus, Cercocarpus intricatus, Juniperus communis, Mahonia repens, Purshia tridentata, Ribes cereum*, and *Gutierrezia sarothrae*. Grasses and forbs, if present, may include *Astragalus kentrophyta, Cirsium arizonicum, Clematis columbiana, Leymus salinus, Eriogonum panguicense, Achnatherum hymenoides*, and *Linum kingii*.

This ecological system is noted for its high rate of endemic species of forbs, especially in Bryce Canyon. Nine of the eleven endemic species occur in the *Pinus longaeva* community, three are found in the *Pinus ponderosa - Arctostaphylos patula* plant association, and two occur in the mixed conifer type. Species that occur only in the *Pinus longaeva* type have the narrowest geographic distributions, although *Eriogonum panguicense var. panguicense* is an exception (Graybosch and Buchanan 1983). Within Bryce Canyon, most of these endemics are restricted to the Claron Formation (Graybosch and Buchanan 1983). The majority of endemic species found in southern Utah are restricted to substrates derived from a specific geologic formation (Welsh 1979). Welsh notes that most of these taxa are found in areas of exposed parent material. The distribution of endemic species in Utah is not a random one; fine-textured substrates support more species than coarser ones, and desert and foothill vegetation is richer in endemic species than montane communities (Welsh 1978, 1979).

Dynamics: This ecological system has a naturally high rate of erosion. Fires are infrequent and not an important ecological process.

SOURCES

References: Graybosch and Buchanan 1983, LaMarche and Mooney 1972, Shute and West 1977, Thorne Ecological Institute 1973a, Welsh 1979, Welsh and Chatterly 1985

Last updated: 20 Feb 2003 **Stakeholders:** WCS

Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S016 NORTH AMERICAN WARM DESERT BEDROCK CLIFF AND OUTCROP
Division 302, Barren, CES302.745
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Non-vegetated (<10% vasc.), Upland
Diagnostic Classifiers: Canyon, Cliff (Landform), Rock Outcrops/Barrens/Glades, Temperate [Temperate Xeric]

Non-Diagnostic Classifiers: Montane [Upper Montane], Montane [Montane], Montane [Lower Montane], Lowland [Foothill], Lowland [Lowland], Rockfall avalanche, Ridge/Summit/Upper Slope, Sideslope,

Toeslope/Valley Bottom, Granitic Rock, Sedimentary Rock, Metamorphic Rock, Igneous Rock, Tropical/Subtropical [Tropical Xeric], Very Shallow Soil

Concept Summary: This ecological system is found from subalpine to foothill elevations and includes barren and sparsely vegetated landscapes (generally <10% plant cover) of steep cliff faces, narrow canyons, and smaller rock outcrops of various igneous, sedimentary, and metamorphic bedrock types. Also included are unstable scree and talus slopes that typically occur bellow cliff faces. Species present are diverse and may include *Bursera microphylla, Fouquieria splendens, Nolina bigelovii, Opuntia bigelovii*, and other desert species, especially succulents. Lichens are predominant lifeforms in some areas. May include a variety of desert shrublands less than 5 acres (2 hectares) in size from adjacent areas.

DISTRIBUTION

Ecological Divisions: 302
TNC Ecoregions: 17:C, 22:C, 23:C, 24:C
Subnations/Nations: AZ:c, CA:c, MXBC:c, MXBS:c, MXCH:c, MXSO:c, NM:c, NV:c, TX:c

CONCEPT

Alliances and Associations:
- FOUQUIERIA SPLENDENS SHRUBLAND ALLIANCE (A.863) Fouquieria splendens / Bouteloua hirsuta Shrubland (CEGL001377) Fouquieria splendens Shrubland [Placeholder] (CEGL004452)
- LARREA TRIDENTATA SHRUBLAND ALLIANCE (A.851) Larrea tridentata - Jatropha dioica var. graminea Shrubland (CEGL004566) Larrea tridentata - Opuntia schottii Shrubland (CEGL004567)
- OPUNTIA BIGELOVII SHRUBLAND ALLIANCE (A.877) Opuntia bigelovii Shrubland [Placeholder] (CEGL003065)

SOURCES

References: Barbour and Major 1988, Dick-Peddie 1993, MacMahon 1988, MacMahon and Wagner 1985, Shreve and Wiggins 1964, Thomas et al. 2003a
Last updated: 20 Feb 2003 **Stakeholders:** WCS, SCS, LACD
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S017 NORTH AMERICAN WARM DESERT BADLAND
Division 302, Barren, CES302.743
Spatial Scale & Pattern: Small Patch **Classification Confidence:** low
Required Classifiers: Natural/Semi-natural, Non-vegetated (<10% vasc.), Upland
Diagnostic Classifiers: Badlands, Badland, Alkaline Soil, Shale and Mudstone, Silt Soil Texture, Clay Soil Texture

Non-Diagnostic Classifiers: Lowland [Lowland], Shrubland (Shrub-dominated), Moss/Lichen (Nonvascular), Tropical/Subtropical [Tropical Xeric], Temperate [Temperate Xeric], Aridic, Very Short Disturbance Interval

Concept Summary: This ecological system is restricted to barren and sparsely vegetated (generally <10% plant cover) substrates typically derived from marine shale or mudstone (badlands and mudhills). The harsh soil properties and high rate of erosion and deposition are driving environmental variables supporting sparse shrubs and dwarf-shrubs e.g., *Atriplex hymenelytra*, and herbaceous vegetation.

DISTRIBUTION

Ecological Divisions: 302
TNC Ecoregions: 17:C, 22:P, 23:P, 24:C
Subnations/Nations: AZ:c, MXCH:p, MXSO:p, NM:c, TX:p

CONCEPT

Alliances and Associations:

- ATRIPLEX HYMENELYTRA SHRUBLAND ALLIANCE (A.872) Atriplex hymenelytra Shrubland (CEGL001317)

CLEOME ISOMERIS - EPHEDRA CALIFORNICA - ERICAMERIA LINEARIFOLIA SHRUBLAND ALLIANCE (A.819) Cleome isomeris - Ephedra californica - Ericameria linearifolia Shrubland [Placeholder] (CEGL003056)

California community types:

- Gypsum (99.900.02)
- Mud hills (99.900.03)

SOURCES

References: Thomas et al. 2003a
Last updated: 20 Feb 2003 **Stakeholders:** WCS, SCS, LACD
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S019 NORTH AMERICAN WARM DESERT VOLCANIC ROCKLAND
Division 302, Barren, CES302.754
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Non-vegetated (<10% vasc.), Upland
Diagnostic Classifiers: Lava, Cinder, Basalt, Tropical/Subtropical [Tropical Xeric], Temperate [Temperate Xeric]

Non-Diagnostic Classifiers: Montane [Upper Montane], Montane [Montane], Montane [Lower Montane], Lowland [Foothill], Lowland [Lowland], Shrubland (Shrub-dominated), Ridge/Summit/Upper Slope, Sideslope, Toeslope/Valley Bottom, Aridic

Concept Summary: This ecological system occurs across the warm deserts of North America and is restricted to barren and sparsely vegetated (<10% plant cover) volcanic substrates such as basalt lava (malpais) and tuff. Vegetation is variable and includes a variety of species depending on local environmental conditions, e.g., elevation, age and type of substrate. Typically scattered *Larrea tridentata, Atriplex hymenelytra*, or other desert shrubs are present.

DISTRIBUTION

Range: Occurs across the warm deserts of North America.
Ecological Divisions: 302
TNC Ecoregions: 17:C, 22:C, 23:C, 24:C
Subnations/Nations: AZ:c, CA:c, MXBC:c, MXCH:c, MXSO:c, NM:c, NV:c, TX:c

CONCEPT

Alliances and Associations:
- ALOYSIA WRIGHTII SHRUBLAND ALLIANCE (A.1035) Aloysia wrightii / Perityle staurophylla Shrubland (CEGL001280)
- OPUNTIA BIGELOVII SHRUBLAND ALLIANCE (A.877) Opuntia bigelovii Shrubland [Placeholder] (CEGL003065)

SOURCES

References: Barbour and Major 1988, Brown 1982, Dick-Peddie 1993, Thomas et al. 2003a
Last updated: 20 Feb 2003 **Stakeholders:** WCS, SCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S020 NORTH AMERICAN WARM DESERT WASH
Division 302, Woody Wetland, CES302.755
Spatial Scale & Pattern: Linear **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Wetland
Diagnostic Classifiers: Lowland [Lowland], Shrubland (Shrub-dominated), Toeslope/Valley Bottom, Tropical/Subtropical [Tropical Xeric], Temperate [Temperate Xeric], Riverine / Alluvial, Intermittent Flooding

Non-Diagnostic Classifiers: Sideslope, Short (50-100 yrs) Persistence

Concept Summary: This ecological system is restricted to intermittently flooded washes or arroyos that dissect bajadas, mesas, plains and basin floors throughout the warm deserts of North America. Although often dry, the intermittent fluvial processes define this system, which are often associated with rapid sheet and gully flow. This system occurs as linear or braided strips within desert scrub- or desert grassland-dominated landscapes. The vegetation of desert washes is quite variable ranging from sparse and patchy to moderately dense and typically occurs along the banks, but may occur within the channel. The woody layer is typically intermittent to open and may be dominated by shrubs and small trees such as *Acacia greggii, Brickellia laciniata, Baccharis sarothroides, Chilopsis linearis, Fallugia paradoxa, Hymenoclea salsola, Hymenoclea monogyra, Juglans microcarpa, Prosopis* spp., *Psorothamnus spinosus, Prunus fasciculata, Rhus microphylla, Salazaria mexicana*, or *Sarcobatus vermiculatus*.

DISTRIBUTION

Range: Restricted to intermittently flooded washes or arroyos that dissect bajadas, mesas, plains and basin floors throughout the warm deserts of North America.
Ecological Divisions: 302
TNC Ecoregions: 17:C, 22:C, 23:C, 24:C

Subnations/Nations: AZ:c, CA:c, MXBC:c, MXCH:c, MXSO:c, NM:c, NV:c, TX:c

CONCEPT

Alliances and Associations:

• (A.0) Baccharis emoryi Shrubland [Provisional] (CEGL002974)
• ACACIA GREGGII SHRUBLAND ALLIANCE (A.1036) Acacia greggii - Parkinsonia microphylla Shrubland (CEGL001340)
• BACCHARIS SALICIFOLIA - BACCHARIS NEGLECTA SEASONALLY FLOODED SHRUBLAND ALLIANCE (A.987) Baccharis salicifolia - Baccharis neglecta / Eustoma exaltatum Shrubland (CEGL004590)
• BACCHARIS SALICIFOLIA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.933) Baccharis salicifolia / Muhlenbergia rigens Shrubland (CEGL004572)
• BACCHARIS SAROTHROIDES INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.840) Baccharis sarothroides - Baccharis salicifolia Shrubland (CEGL001160) Baccharis sarothroides - Parkinsonia microphylla Shrubland (CEGL001159)
• BACCHARIS SERGILOIDES INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.2531) Baccharis sergiloides Shrubland [Placeholder] (CEGL002953)
• BRICKELLIA LACINIATA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.940) Brickellia laciniata - Hymenoclea monogyra Shrubland (CEGL001953)
• CHILOPSIS LINEARIS INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.1044) Chilopsis linearis / Brickellia laciniata Shrubland (CEGL004933) Chilopsis linearis Shrubland (CEGL001164)
• ENCELIA VIRGINENSIS SHRUBLAND ALLIANCE (A.860) Encelia virginensis Shrubland (CEGL001335)
• EPHEDRA CALIFORNICA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.2536) Ephedra californica Shrubland [Placeholder] (CEGL002958)
• ERICAMERIA PANICULATA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.2509) Ericameria paniculata Shrubland [Placeholder] (CEGL002706)
• FORESTIERA PUBESCENS TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.969) Forestiera pubescens Mojave Desert Shrubland [Provisional] (CEGL002959)
• GRAYIA SPINOSA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.1045) Grayia spinosa - Lycium andersonii Shrubland (CEGL001347) Grayia spinosa - Lycium pallidum Shrubland (CEGL001348)
• HYMENOCLEA MONOGYRA SHRUBLAND ALLIANCE (A.1034) Hymenoclea monogyra Thicket Shrubland (CEGL001169)
• HYMENOCLEA SALSOLA SHRUBLAND ALLIANCE (A.2512) Hymenoclea salsola - (Ambrosia eriocentra) Shrubland (CEGL002702) Hymenoclea salsola - Salazaria mexicana Shrubland (CEGL002703)
• HYPTIS EMORYI INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.2537) Hyptis emoryi Shrubland [Placeholder] (CEGL002960)
• JUGLANS MICROCARPA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.945) Juglans microcarpa / Cladium mariscus ssp. jamaicense Shrubland (CEGL004593) Juglans microcarpa / Sorghastrum nutans Shrubland (CEGL004594) Juglans microcarpa Shrubland (CEGL001103)
• LEPIDOSPARTUM SQUAMATUM INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.838) Lepidospartum squamatum Intermittently Flooded Shrubland [Placeholder] (CEGL003060)
• PANICUM BULBOSUM TEMPORARILY FLOODED HERBACEOUS ALLIANCE (A.1356) Panicum bulbosum - Alopecurus aequalis Herbaceous Vegetation (CEGL001653) Panicum bulbosum - Lycurus phleoides Herbaceous Vegetation (CEGL001654)
• PROSOPIS (GLANDULOSA, VELUTINA) WOODLAND ALLIANCE (A.661) Prosopis (glandulosa var. torreyana, velutina) Woodland [Placeholder] (CEGL003082)
• PROSOPIS GLANDULOSA SHRUB HERBACEOUS ALLIANCE (A.1550) Prosopis glandulosa / Bouteloua eriopoda Shrub Herbaceous Vegetation (CEGL001510)
• PROSOPIS GLANDULOSA SHRUBLAND ALLIANCE (A.1031) Prosopis glandulosa - Atriplex spp. Shrubland (CEGL002193) Prosopis glandulosa / Atriplex canescens Shrubland (CEGL001382) Prosopis glandulosa / Bouteloua gracilis Shrubland (CEGL001383) Prosopis glandulosa / Mixed Grasses Shrubland (CEGL001384) Prosopis glandulosa / Muhlenbergia porteri Shrubland (CEGL001511) Prosopis glandulosa / Sporobolus airoides Shrubland (CEGL001385) Prosopis glandulosa var. glandulosa / Bouteloua gracilis - Buchloe dactyloides Shrubland (CEGL003877) Prosopis glandulosa var. torreyana Shrubland (CEGL001381)
• PROSOPIS GLANDULOSA TEMPORARILY FLOODED WOODLAND ALLIANCE (A.637) Prosopis glandulosa Temporarily Flooded Woodland (CEGL004934)
• PROSOPIS GLANDULOSA WOODLAND ALLIANCE (A.611) Prosopis glandulosa / Bouteloua curtipendula - Nassella leucotricha Woodland (CEGL002133)
• PROSOPIS PUBESCENS SHRUBLAND ALLIANCE (A.1042) Prosopis pubescens Shrubland (CEGL001387)

• PROSOPIS VELUTINA SHRUBLAND ALLIANCE (A.1043) Prosopis velutina - Acacia greggii Shrubland (CEGL001388)
• PRUNUS FASCICULATA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.2519) Prunus fasciculata Shrubland [Placeholder] (CEGL002704)
• PSOROTHAMNUS SPINOSUS INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.2520) Psorothamnus spinosus Shrubland [Placeholder] (CEGL002701)
• RHUS MICROPHYLLA SHRUBLAND ALLIANCE (A.1040) Rhus microphylla / Bouteloua curtipendula Shrubland (CEGL001354)
• SAPINDUS SAPONARIA TEMPORARILY FLOODED FOREST ALLIANCE (A.303) Sapindus saponaria - Juglans major Forest (CEGL000557)
• VIGUIERA RETICULATA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.2539) Viguiera reticulata Shrubland [Placeholder] (CEGL002962)

• **California community types:**
• Scalebroom Scrub (32.070.00)
• California Buckwheat - Scalebroom (32.070.01)
• Scalebroom - Hairy Yerba Santa - Chaparral Yucca (32.070.02)
• Scalebroom / Mixed Ephemeral Herbs (32.070.03)
• Creosote Bush Wash Scrub (33.010.06)
• Creosote Bush - Cheesebush (33.010.08)
• Creosote Bush - Cheesebush - Woolly Brickellia (33.010.15)
• Catclaw Acacia Thorn Scrub (33.040.00)
• Catclaw Acacia-wash association (33.040.01)
• Catclaw Acacia Savanna (33.040.02)
• Catclaw Acacia / Desert Lavender (33.040.03)
• Catclaw Acacia / Cheesebush (33.040.04)
• Catclaw Acacia - Cheesebush - Virgin River Encelia (33.040.05)
• Catclaw Acacia - Desert Sunflower (33.040.06)
• Catclaw Acacia - Desert Almond (33.040.07)
• Catclaw Acacia - Woolly Bursage (33.040.08)

• Catclaw Acacia - Blue Sage (33.040.09)
• Catclaw Acacia - Sweetbush (33.040.10)
• Catclaw Acacia/Naked buckwheat (33.040.11)
• Desert Lavender Wash Scrub (33.190.00)
• Cheesebush - wash association (33.200.01)
• Cheesebush - California Buckwheat (33.200.02)
• Cheesebush - Blackstem Rabbitbrush (33.200.03)
• Cheesebush - Shadscale (33.200.04)
• Cheesebush - Sweetbush (33.200.05)
• Cheesebush - Woolly Bursage (33.200.06)
• Cheesebush - Woolly Brickellia (33.200.07)
• Cheesebush - Spiny Senna (33.200.08)
• Mojave Wash Scrub (33.213.00)
• Desert Almond Scrub (33.300.00)
• Desert Almond (33.300.01)
• Desert Almond - Bladder Sage (33.300.02)
• Desert Almond - Skunkbrush (33.300.03)
• Desert Almond - Stansbury's Antelope Bush (33.300.04)
• Desert Almond - Woolly Bursage (33.300.05)
• Desert Almond - Net-veined Viguiera - (Utah Mortonia) (33.300.06)
• Bladder Sage (33.310.01)
• Blue Palo Verde - Ironwood - Smoke Tree Woodland (61.530.00)
• Blue Palo Verde Woodland (61.540.00)
• Blue Palo Verde Wash Woodland (61.540.01)
• Blue Palo Verde / Desert Lavender (61.540.02)
• Desert-willow Woodland (61.550.00)

- Desert-willow / Cheesebush (61.550.02)
- Desert-willow - Desert Almond - Cheesebush (61.550.03)
- Desert-willow - Desert Almond (61.550.04)
- Desert-willow - Blue Sage (61.550.05)
- Desert-willow - Desert Sunflower (61.550.06)
- Desert-willow - Blackstem Rabbitbrush (61.550.07)
- Ironwood Woodland (61.560.01)
- Ironwood / Desert Lavender (61.560.02)
- Smoke Tree Woodland and Scrub (61.570.00)
- Smoketree Wash Woodland (61.570.01)
- Smoketree - Cheesebush - Sweetbush (61.570.02)
- Smoketree / California Ephedra (61.570.03)
- Smoketree - Desert Lavender - Catclaw Acacia (61.570.04)
- Mulefat Scrub (63.510.00)
- Arrow Weed Scrub (63.710.00)
- Sandy to Cobbly wash bottom (99.900.01)

SOURCES

References: Barbour and Major 1988, Brown 1982, Dick-Peddie 1993, MacMahon 1988, Muldavin et al. 2000b, Szaro 1989, Thomas et al. 2003a
Last updated: 20 Feb 2003 **Stakeholders:** WCS, SCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S021 NORTH AMERICAN WARM DESERT PAVEMENT
Division 302, Barren, CES302.750
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Non-vegetated (<10% vasc.), Upland
Diagnostic Classifiers: Lowland [Lowland], Desert Pavement, Tropical/Subtropical [Tropical Xeric], Temperate [Temperate Xeric], W-Landscape/High Intensity

Non-Diagnostic Classifiers: Shrubland (Shrub-dominated), Toeslope/Valley Bottom, Aridic

Concept Summary: This ecological system occurs throughout much of the warm deserts of North America and is composed of unvegetated to very sparsely vegetated (<2% plant cover) landscapes, typically flat basins where extreme temperature and wind develop ground surfaces of fine to medium gravel coated with “desert varnish.” Very low cover of desert scrub species such as *Larrea tridentata* or *Eriogonum fasciculatum* is usually present. However, ephemeral herbaceous species may have high cover in response to seasonal precipitation, including *Chorizanthe rigida, Eriogonum inflatum*, and *Geraea canescens*.

DISTRIBUTION

Range: Occurs throughout much of the warm deserts of North America.
Ecological Divisions: 302
TNC Ecoregions: 17:C, 23:C, 24:C
Subnations/Nations: AZ:c, CA:c, MXCH:c, MXSO:c, NM:c, NV:c, TX:c

CONCEPT

Alliances and Associations:
- AMBROSIA DELTOIDEA SHRUBLAND ALLIANCE (A.852) Ambrosia deltoidea / Simmondsia chinensis Shrubland (CEGL000953)
- AMBROSIA DUMOSA DWARF-SHRUBLAND ALLIANCE (A.1102) Ambrosia dumosa - Larrea tridentata var. tridentata Dwarf-shrubland (CEGL000956)
- ERIOGONUM FASCICULATUM SHRUBLAND ALLIANCE (A.868) Eriogonum fasciculatum - Purshia glandulosa Shrubland (CEGL001259) Eriogonum fasciculatum Shrubland (CEGL001258)

SOURCES

References: Barbour and Major 1988, MacMahon 1988, Thomas et al. 2003a
Last updated: 20 Feb 2003 **Stakeholders:** WCS, SCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S022 NORTH AMERICAN WARM DESERT PLAYA
Division 302, Barren, CES302.751
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Non-vegetated (<10% vasc.), Upland, Wetland
Diagnostic Classifiers: Lowland [Lowland], Playa, Tropical/Subtropical [Tropical Xeric], Temperate [Temperate Xeric], Alkaline Soil, Aridic, Depressional, Alkaline Water, Saline Water Chemistry, Caliche Layer, Impermeable Layer, Intermittent Flooding

Non-Diagnostic Classifiers: Shrubland (Shrub-dominated), Woody-Herbaceous, Dwarf-Shrub, Forb, Graminoid, Clay Subsoil Texture

Concept Summary: This system is composed of barren and sparsely vegetated playas (generally <10% plant cover) found across the warm deserts of North America, extending into the extreme southern end of the San Joaquin Valley in California. Playas form with intermittent flooding, followed by evaporation, leaving behind a saline residue. Salt crusts are common throughout, with small saltgrass beds in depressions and sparse shrubs around the margins. Subsoils often include an impermeable layer of clay or caliche. Large desert playas tend to be defined by vegetation rings formed in response to salinity. Given their common location in wind-swept desert basins, dune fields often form downwind of large playas. In turn, playas associated with dunes often have a deeper water supply. Species may include *Allenrolfea occidentalis, Suaeda* spp., *Distichlis spicata, Eleocharis palustris, Oryzopsis* spp., *Sporobolus* spp., *Tiquilia* spp., or *Atriplex* spp. Ephemeral herbaceous species may have high cover periodically. Adjacent vegetation is typically Sonora-Mojave Mixed Salt Desert Scrub (CES302.749), Chihuahuan Mixed Salt Desert Scrub (CES302.017), Gulf of California Coastal Mixed Salt Desert Scrub (CES302.015), Baja California del Norte Gulf Coast Ocotillo-Limberbush-Creosotebush Desert Scrub (CES302.014), or Chihuahuan Creosotebush Basin Desert Scrub (CES302.731).

DISTRIBUTION

Range: Found across the warm deserts of North America, extending into the extreme southern end of the San Joaquin Valley in California.
Ecological Divisions: 302
TNC Ecoregions: 17:C, 22:C, 23:C, 24:C
Subnations/Nations: AZ:c, CA:c, MXBC:c, MXCH:c, MXSO:c, NM:c, NV:c, TX:c

CONCEPT

Alliances and Associations:

- (SARCOCORNIA UTAHENSIS) - (ARTHROCNEMUM SUBTERMINALE) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1676) (Sarcocornia utahensis) - (Arthrocnemum subterminale) Seasonally Flooded Herbaceous Vegetation [Placeholder] (CEGL003120)
- ALLENROLFEA OCCIDENTALIS SHRUBLAND ALLIANCE (A.866) Allenrolfea occidentalis Shrubland (CEGL000988)
- ATRIPLEX (LENTIFORMIS, POLYCARPA) SHRUBLAND ALLIANCE (A.864) Atriplex (lentiformis, polycarpa) Shrubland [Placeholder] (CEGL003016)
- ATRIPLEX POLYCARPA SHRUBLAND ALLIANCE (A.873) Atriplex polycarpa / Pleuraphis mutica Shrubland (CEGL001319) Atriplex polycarpa Shrubland (CEGL001318)
- ATRIPLEX SPINIFERA SHRUBLAND ALLIANCE (A.865) Atriplex spinifera Shrubland [Placeholder] (CEGL003015)
- BOUTELOUA BREVISETA SPARSELY VEGETATED ALLIANCE (A.1870) Bouteloua breviseta Sparse Vegetation (CEGL004609)
- SESUVIUM VERRUCOSUM TEMPORARILY FLOODED SPARSELY VEGETATED ALLIANCE (A.1865) Sesuvium verrucosum Sparse Vegetation (CEGL004595)

- **California community types:**
- Great Valley Iodine Bush Scrub (36.110.00)
- Saltgrass - Iodine Bush (36.120.01)
- Bush Seepweed - Iodine Bush (36.120.02)
- Alkali Sacaton - Iodine Bush (36.120.03)
- Iodine Bush (36.120.04)
- Great Valley Bush Seepweed Scrub (36.200.01)
- Desert Bush Seepweed Scrub (36.200.02)
- Bush Seepweed - Fourwing Saltbush (36.200.04)
- Desert Sink Scrub (36.700.00)

- Saltgrass - Alkali Rabbitbrush (41.200.04)
- Saltgrass - Alkali Heath - Jaumea (41.200.07)
- Mesquite Dry Lake (61.510.03)
- Playa (99.900.07)

SOURCES

References: Barbour and Major 1988, Brown 1982, Dick-Peddie 1993, Holland and Keil 1995, Muldavin et al. 2000b, Thomas et al. 2003a
Last updated: 20 Feb 2003 **Stakeholders:** WCS, SCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S023 ROCKY MOUNTAIN ASPEN FOREST AND WOODLAND
Division 306, Forest and Woodland, CES306.813
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Forest and Woodland (Treed), Long Disturbance Interval, F-Patch/Medium Intensity, F-Landscape/Medium Intensity, Broad-Leaved Deciduous Tree, Populus tremuloides

Non-Diagnostic Classifiers: Montane [Upper Montane], Montane [Montane], Temperate [Temperate Continental], Mesotrophic Soil, Shallow Soil, Mineral: W/ A-Horizon < 3.9 inches (10 centimeters), Ustic

Concept Summary: This widespread ecological system is more common in the southern and central Rocky Mountains, but occurs throughout much of the western U.S. and north into Canada, in the montane and subalpine zones. Elevations generally range from 5,000 to 10,000 feet (1,525 to 3,050 meters), but occurrences can be found at lower elevations in some regions. Distribution of this ecological system is primarily limited by adequate soil moisture required to meet its high evapotranspiration demand, and secondarily is limited by the length of the growing season or low temperatures. These are upland forests and woodlands dominated by *Populus tremuloides* without a significant conifer component (<25% relative tree cover). The understory structure may be complex with multiple shrub and herbaceous layers, or simple with just an herbaceous layer. The herbaceous layer may be dense or sparse, dominated by graminoids or forbs. Associated shrub species include *Symphoricarpos* spp., *Rubus parviflorus, Amelanchier alnifolia*, and *Arctostaphylos uva-ursi*. Occurrences of this system originate and are maintained by stand-replacing disturbances such as avalanches, crown fire, insect outbreak, disease and windthrow, or clearcutting by man or beaver, within the matrix of conifer forests.

DISTRIBUTION

Range: More common in the southern and central Rocky Mountains, but occurs throughout much of the western U.S. and north into Canada, in the montane and subalpine zones. Elevations generally range from 5,000 to 10,000 feet (1,525 to 3,050 meters), but occurrences can be found at lower elevations in some regions.
Ecological Divisions: 204, 206, 304, 306
TNC Ecoregions: 1:P, 11:C, 12:P, 18:C, 19:C, 20:C, 21:P, 25:C, 3:C, 4:P, 5:P, 7:C, 8:C, 81:P, 9:C
Subnations/Nations: AB:c, AZ:c, BC:c, CA:c, CO:c, ID:c, MT:c, NM:c, NV:c, OR:c, SD:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:

- POPULUS TREMULOIDES FOREST ALLIANCE (A.274) Populus tremuloides / Acer glabrum Forest (CEGL000563) Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus / Bromus carinatus Forest (CEGL000566) Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus / Calamagrostis rubescens Forest (CEGL000567) Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus / Tall Forbs Forest (CEGL000568) Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus / Thalictrum fendleri Forest (CEGL000569) Populus tremuloides / Amelanchier alnifolia / Pteridium aquilinum Forest (CEGL000565) Populus tremuloides / Amelanchier alnifolia / Tall Forbs Forest (CEGL000570) Populus tremuloides / Amelanchier alnifolia / Thalictrum fendleri Forest (CEGL000571) Populus tremuloides / Amelanchier alnifolia Forest (CEGL000564) Populus tremuloides / Artemisia tridentata Forest (CEGL000572) Populus tremuloides / Bromus carinatus Forest (CEGL000573) Populus tremuloides / Calamagrostis rubescens Forest (CEGL000575) Populus tremuloides / Carex geyeri Forest (CEGL000579) Populus tremuloides / Carex rossii Forest (CEGL000580) Populus tremuloides / Carex siccata Forest (CEGL000578) Populus tremuloides / Ceanothus velutinus Forest (CEGL000581) Populus tremuloides / Corylus cornuta Forest (CEGL000583) Populus tremuloides / Festuca thurberi Forest (CEGL000585) Populus tremuloides / Heracleum sphondylium Forest (CEGL000586) Populus tremuloides / Hesperostipa comata Forest (CEGL000608) Populus tremuloides / Juniperus communis / Carex geyeri Forest (CEGL000588) Populus tremuloides / Juniperus communis / Lupinus argenteus Forest (CEGL000589) Populus tremuloides / Juniperus communis Forest (CEGL000587) Populus tremuloides / Ligusticum filicinum Forest (CEGL000591) Populus tremuloides / Lonicera involucrata Forest (CEGL000592) Populus tremuloides / Lupinus argenteus Forest (CEGL000593) Populus tremuloides / Mahonia repens Forest (CEGL000594) Populus tremuloides / Osmorhiza occidentalis Forest (CEGL000595) Populus tremuloides / Prunus virginiana Forest (CEGL000596) Populus tremuloides / Pteridium aquilinum Forest (CEGL000597) Populus tremuloides / Rubus parviflorus Forest (CEGL000602) Populus tremuloides / Rudbeckia occidentalis Forest (CEGL000603) Populus tremuloides / Salix scouleriana Forest (CEGL000604) Populus tremuloides / Sambucus racemosa Forest (CEGL000605) Populus tremuloides / Shepherdia canadensis Forest (CEGL000606) Populus tremuloides / Spiraea betulifolia Forest (CEGL000607) Populus tremuloides / Symphoricarpos albus Forest (CEGL000609) Populus tremuloides / Symphoricarpos oreophilus / Bromus carinatus Forest (CEGL000611) Populus tremuloides / Symphoricarpos oreophilus / Calamagrostis rubescens Forest (CEGL000612) Populus tremuloides / Symphoricarpos oreophilus / Carex rossii Forest (CEGL000613) Populus tremuloides / Symphoricarpos oreophilus / Festuca thurberi Forest (CEGL000614) Populus tremuloides / Symphoricarpos oreophilus / Tall Forbs Forest (CEGL000615) Populus tremuloides / Symphoricarpos oreophilus / Thalictrum fendleri Forest (CEGL000616) Populus tremuloides / Symphoricarpos oreophilus / Wyethia amplexicaulis Forest (CEGL000617) Populus tremuloides / Symphoricarpos oreophilus Forest (CEGL000610) Populus tremuloides / Tall Forbs Forest (CEGL000618) Populus tremuloides / Thalictrum fendleri Forest (CEGL000619) Populus tremuloides / Vaccinium myrtillus Forest (CEGL000620) Populus tremuloides / Wyethia amplexicaulis Forest (CEGL000622)

• POPULUS TREMULOIDES TEMPORARILY FLOODED FOREST ALLIANCE (A.300) Populus tremuloides / Quercus gambelii / Symphoricarpos oreophilus Forest (CEGL000598) Populus tremuloides / Ribes montigenum Forest (CEGL000600)

• POPULUS TREMULOIDES WOODLAND ALLIANCE (A.610) Populus tremuloides / Symphoricarpos albus / Elymus glaucus Woodland (CEGL000946)

Environment: Climate is temperate with a relatively long growing season, typically cold winters and deep snow. Mean annual precipitation is greater than 15 inches (3.8 centimeters) and typically greater than 20 inches (50.8 centimeters), except in semi-arid environments where occurrences are restricted to mesic microsites such as seeps or large snow drifts. Distribution of this ecological system is primarily limited by adequate soil moisture required to meet its high evapotranspiration demand (Mueggler 1988). Secondarily, its range is limited by the length of the growing season or low temperatures (Mueggler 1988). Topography is variable, sites range from level to steep slopes. Aspect varies according to the limiting factors. Occurrences at high elevations are restricted by cold temperatures and are found on warmer southern aspects. At lower elevations occurrences are restricted by lack of moisture and are found on cooler north aspects and mesic microsites. The soils are typically deep and well developed with rock often absent from the soil. Soil texture ranges from sandy loam to clay loams. Parent materials are variable and may include sedimentary, metamorphic or igneous rocks, but it appears to grow best on limestone, basalt, and calcareous or neutral shales (Mueggler 1988).

Vegetation: Occurrences have a somewhat closed canopy of trees of 5-20 m tall that is dominated by the cold-deciduous, broad-leaved tree *Populus tremuloides*. Conifers that may be present but never codominant include *Abies concolor, Abies lasiocarpa, Picea engelmannii, Picea pungens, Pinus ponderosa*, and *Pseudotsuga menziesii*. Conifer species may contribute up to 15% of the tree canopy before the occurrence is reclassified as a mixed occurrence. Because of the open growth form of *Populus tremuloides*, enough light can penetrate for lush understory development. Depending on available soil moisture and other factors like disturbance, the understory structure may be complex with multiple shrub and herbaceous layers, or simple with just an herbaceous layer. The herbaceous layer may be dense or sparse, dominated by graminoids or forbs.

Common shrubs include *Acer glabrum, Amelanchier alnifolia, Artemisia tridentata, Juniperus communis, Prunus virginiana, Rosa woodsii, Shepherdia canadensis, Symphoricarpos oreophilus*, and the dwarf-shrubs *Mahonia repens* and *Vaccinium* spp. The herbaceous layers may be lush and diverse. Common graminoids may include *Bromus carinatus, Calamagrostis rubescens, Carex siccata (= Carex foenea), Carex geyeri, Carex rossii, Elymus glaucus, Elymus trachycaulus, Festuca thurberi*, and *Hesperostipa comata*. Associated forbs may include *Achillea millefolium, Eucephalus engelmannii (= Aster engelmannii), Delphinium* spp., *Geranium viscosissimum, Heracleum sphondylium, Ligusticum filicinum, Lupinus argenteus, Osmorhiza berteroi (= Osmorhiza chilensis), Pteridium aquilinum, Rudbeckia occidentalis, Thalictrum fendleri, Valeriana occidentalis, Wyethia amplexicaulis*, and many others. Exotic grasses such as the perennials *Poa pratensis* and *Bromus inermis* and the annual *Bromus tectorum* are often common in occurrences disturbed by grazing.

Dynamics: Occurrences in this ecological system often originate, and are likely maintained, by stand-replacing disturbances such as crown fire, disease and windthrow, or clearcutting by man or beaver. The stems of these thin-barked, clonal trees are easily killed by ground fires, but they can quickly and vigorously resprout in densities of up to 30,000 stems per hectare (Knight 1993). The stems are relatively short-lived (100-150 years), and the occurrence will succeed to longer-lived conifer forest if undisturbed. Occurrences are favored by fire in the conifer zone (Mueggler 1988). With adequate disturbance a clone may live many centuries. Although *Populus tremuloides* produces abundant seeds, seedling survival is rare because of the long moist conditions required to establish are rare in the habitats that it occurs in. Superficial soil drying will kill seedlings (Knight 1993).

SOURCES

References: Bartos 1979, Bartos and Cambell 1998, Bartos and Mueggler 1979, Canadian Rockies Ecoregional Plan 2002, Comer et al. 2002, DeByle and Winokur 1985, DeVelice et al. 1986, Henderson et al. 1977, Hess and

Wasser 1982, Johnston and Hendzel 1985, Keammerer 1974a, Mueggler 1988, Neely et al. 2001, Powell 1988a, Tuhy et al. 2002, Youngblood and Mauk 1985
Last updated: 20 Feb 2003 **Stakeholders:** WCS, MCS, CAN
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S032 ROCKY MOUNTAIN MONTANE DRY-MESIC MIXED CONIFER FOREST AND WOODLAND
Division 306, Forest and Woodland, CES306.823
Spatial Scale & Pattern: Matrix **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Montane [Montane], Montane [Lower Montane], Forest and Woodland (Treed), Aridic, Intermediate Disturbance Interval, F-Patch/Medium Intensity, F-Landscape/Medium Intensity, Needle-Leaved Tree, RM Montane Mesic Mixed Conifer, Moderate (100-500 yrs) Persistence

Non-Diagnostic Classifiers: Ridge/Summit/Upper Slope, Sideslope, Temperate [Temperate Continental], Mesotrophic Soil, Shallow Soil, Mineral: W/ A-Horizon <10 cm

Concept Summary: This is a highly variable ecological system of the montane zone of the Rocky Mountains. It occurs throughout the southern Rockies, north and west into Utah, Nevada, western Wyoming and Idaho. These are mixed-conifer forests occurring on all aspects at elevations ranging from 1200 to 3300 m. Rainfall averages less than 75 cm per year (40-60 cm) with summer “monsoons” during the growing season contributing substantial moisture. The composition and structure of overstory is dependent upon the temperature and moisture relationships of the site, and the successional status of the occurrence. *Pseudotsuga menziesii* and *Abies concolor* are most frequent, but *Pinus ponderosa* may be present to codominant. *Pinus flexilis* is common in Nevada. *Pseudotsuga menziesii* forests occupy drier sites, and *Pinus ponderosa* is a common codominant. *Abies concolor*-dominated forests occupy cooler sites, such as upper slopes at higher elevations, canyon sideslopes, ridgetops, and north- and east-facing slopes which burn somewhat infrequently. *Picea pungens* is most often found in cool, moist locations, often occurring as smaller patches within a matrix of other associations. As many as seven conifers can be found growing in the same occurrence, and there are a number of cold-deciduous shrub and graminoid species common, including *Arctostaphylos uva-ursi, Mahonia repens, Paxistima myrsinites, Symphoricarpos oreophilus, Jamesia americana, Quercus gambelii*, and *Festuca arizonica*. This system was undoubtedly characterized by a mixed severity fire regime in its “natural condition,” characterized by a high degree of variability in lethality and return interval.

DISTRIBUTION

Range: Occurs throughout the southern Rockies, north and west into Utah, Nevada, western Wyoming and Idaho.
Ecological Divisions: 304, 306
TNC Ecoregions: 11:C, 18:C, 19:C, 20:C, 21:C, 26:C, 6:C, 68:C, 7:C, 8:C, 9:C
Subnations/Nations: AB:p, AZ:c, BC:p, CO:c, ID:c, MT:c, NV:c, OR:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:
- ABIES CONCOLOR FOREST ALLIANCE (A.152) Abies concolor - Pinus ponderosa / Carex inops ssp. inops Forest (CEGL000257) Abies concolor - Pinus ponderosa / Cercocarpus ledifolius Forest (CEGL002732) Abies concolor - Pinus ponderosa / Symphoricarpos spp. Forest (CEGL000018) Abies concolor - Pseudotsuga menziesii / Acer glabrum Forest (CEGL000240) Abies concolor - Pseudotsuga menziesii / Erigeron eximius Forest (CEGL000247) Abies concolor - Pseudotsuga menziesii / Lathyrus lanszwertii var. leucanthus Forest (CEGL000250) Abies concolor - Pseudotsuga menziesii / Vaccinium myrtillus Forest (CEGL000265) Abies concolor / Arctostaphylos patula Forest (CEGL000242) Abies concolor / Arctostaphylos uva-ursi Forest (CEGL000243) Abies concolor / Carex siccata Forest (CEGL000244) Abies concolor / Juniperus communis Forest (CEGL000249) Abies concolor / Mahonia repens Forest (CEGL000251) Abies concolor / Muhlenbergia virescens Forest (CEGL000252) Abies concolor / Osmorhiza berteroi Forest (CEGL000253) Abies concolor / Physocarpus malvaceus Forest (CEGL000254) Abies concolor / Quercus gambelii Forest (CEGL000261) Abies concolor / Symphoricarpos oreophilus Forest (CEGL000263)
- ABIES CONCOLOR WOODLAND ALLIANCE (A.553) Abies concolor / Cercocarpus ledifolius Woodland (CEGL000885) Abies concolor / Festuca arizonica Woodland (CEGL000887) Abies concolor / Galium triflorum Woodland (CEGL000888) Abies concolor / Leymus triticoides Woodland (CEGL000886) Abies concolor / Robinia neomexicana Woodland (CEGL000891)
- PICEA PUNGENS FOREST ALLIANCE (A.165) Picea pungens / Arctostaphylos uva-ursi Forest (CEGL000385)
- PICEA PUNGENS WOODLAND ALLIANCE (A.557) Picea pungens / Festuca arizonica Woodland (CEGL000895)
- PINUS PONDEROSA - PSEUDOTSUGA MENZIESII FOREST ALLIANCE (A.134) Pinus ponderosa - Pseudotsuga menziesii / Carex geyeri Forest (CEGL000211) Pinus ponderosa - Pseudotsuga menziesii / Physocarpus malvaceus Forest (CEGL000213)

• PINUS PONDEROSA - PSEUDOTSUGA MENZIESII WOODLAND ALLIANCE (A.533) Pinus ponderosa - Pseudotsuga menziesii / Arctostaphylos nevadensis Woodland (CEGL000208) Pinus ponderosa - Pseudotsuga menziesii / Arctostaphylos patula Woodland (CEGL000209) Pinus ponderosa - Pseudotsuga menziesii / Calamagrostis rubescens Woodland (CEGL000210) Pinus ponderosa - Pseudotsuga menziesii / Penstemon fruticosus Woodland (CEGL000212) Pinus ponderosa - Pseudotsuga menziesii / Pseudoroegneria spicata ssp. inermis Woodland (CEGL000207) Pinus ponderosa - Pseudotsuga menziesii / Purshia tridentata Woodland (CEGL000214)
• PSEUDOTSUGA MENZIESII FOREST ALLIANCE (A.157) Pseudotsuga menziesii / Amelanchier alnifolia Forest (CEGL000420) Pseudotsuga menziesii / Arctostaphylos patula Forest (CEGL000423) Pseudotsuga menziesii / Arctostaphylos uva-ursi - Purshia tridentata Forest (CEGL000426) Pseudotsuga menziesii / Arctostaphylos uva-ursi Forest (CEGL000424) Pseudotsuga menziesii / Arnica cordifolia Forest (CEGL000427) Pseudotsuga menziesii / Bromus ciliatus Forest (CEGL000428) Pseudotsuga menziesii / Calamagrostis rubescens Forest (CEGL000429) Pseudotsuga menziesii / Carex geyeri Forest (CEGL000430) Pseudotsuga menziesii / Carex rossii Forest (CEGL000431) Pseudotsuga menziesii / Festuca arizonica Forest (CEGL000433) Pseudotsuga menziesii / Jamesia americana Forest (CEGL000438) Pseudotsuga menziesii / Juniperus communis Forest (CEGL000439) Pseudotsuga menziesii / Juniperus osteosperma Forest (CEGL000440) Pseudotsuga menziesii / Linnaea borealis Forest (CEGL000441) Pseudotsuga menziesii / Mahonia repens Forest (CEGL000442) Pseudotsuga menziesii / Muhlenbergia montana Forest (CEGL000443) Pseudotsuga menziesii / Muhlenbergia virescens Forest (CEGL000444) Pseudotsuga menziesii / Osmorhiza berteroi Forest (CEGL000445) Pseudotsuga menziesii / Paxistima myrsinites Forest (CEGL000446) Pseudotsuga menziesii / Physocarpus malvaceus - Linnaea borealis Forest (CEGL000448) Pseudotsuga menziesii / Physocarpus malvaceus Forest (CEGL000447) Pseudotsuga menziesii / Physocarpus monogynus Forest (CEGL000449) Pseudotsuga menziesii / Quercus arizonica Forest (CEGL000451) Pseudotsuga menziesii / Quercus gambelii Forest (CEGL000452) Pseudotsuga menziesii / Quercus hypoleucoides Forest (CEGL000453) Pseudotsuga menziesii / Quercus rugosa Forest (CEGL000454) Pseudotsuga menziesii / Quercus X pauciloba Forest (CEGL000455) Pseudotsuga menziesii / Spiraea betulifolia Forest (CEGL000457) Pseudotsuga menziesii / Symphoricarpos albus Forest (CEGL000459) Pseudotsuga menziesii / Symphoricarpos occidentalis Forest (CEGL000461) Pseudotsuga menziesii / Symphoricarpos oreophilus Forest (CEGL000462) Pseudotsuga menziesii / Vaccinium caespitosum Forest (CEGL000465) Pseudotsuga menziesii / Vaccinium spp. Forest (CEGL000464)
• PSEUDOTSUGA MENZIESII WOODLAND ALLIANCE (A.552) Pseudotsuga menziesii - Pinus flexilis / Leucopoa kingii Woodland (CEGL000906) Pseudotsuga menziesii / Cercocarpus ledifolius Woodland (CEGL000897) Pseudotsuga menziesii / Cercocarpus montanus Woodland (CEGL000898) Pseudotsuga menziesii / Festuca campestris Woodland (CEGL000901) Pseudotsuga menziesii / Festuca idahoensis Woodland (CEGL000900) Pseudotsuga menziesii / Holodiscus dumosus Scree Woodland (CEGL000902) Pseudotsuga menziesii / Juniperus scopulorum Woodland (CEGL000903) Pseudotsuga menziesii / Leucopoa kingii Woodland (CEGL000904) Pseudotsuga menziesii / Pseudoroegneria spicata Woodland (CEGL000908) Pseudotsuga menziesii / Purshia tridentata Woodland (CEGL000909)

Vegetation: This highly variable ecological system is comprised of mixed conifer forests at montane elevations throughout the Intermountain region. The four main alliances in this system are found on slightly different, but intermingled, biophysical environments: *Abies concolor* dominates at higher, colder locations; *Picea pungens* represents mesic conditions; *Pseudotsuga menziesii* dominates intermediate zones. As many as seven conifers can be found growing in the same occurrences, with the successful reproduction of the diagnostic species determining the association type. Common conifers include *Pinus ponderosa, Pinus flexilis, Abies lasiocarpa var. lasiocarpa, Abies lasiocarpa var. arizonica, Juniperus scopulorum*, and *Picea engelmannii*. *Populus tremuloides* is often present as intermingled individuals in remnant aspen clones, or in adjacent patches. The composition and structure of overstory is dependent upon the temperature and moisture relationships of the site, and the successional status of the occurrence (DeVelice et al. 1986, Muldavin et al. 1996).

A number of cold-deciduous shrub and graminoid species are found in many occurrences (e.g., *Arctostaphylos uva-ursi, Mahonia repens, Paxistima myrsinites, Symphoricarpos oreophilus, Jamesia americana, Quercus gambelii*, and *Festuca arizonica*). Other important species include *Acer glabrum, Acer grandidentatum, Amelanchier alnifolia, Arctostaphylos patula, Holodiscus dumosus, Jamesia americana, Juniperus communis, Physocarpus monogynus, Quercus arizonica, Quercus rugosa, Quercus X pauciloba, Quercus hypoleucoides, Robinia neomexicana, Rubus parviflorus*, and *Vaccinium myrtillus*. Where soil moisture is favorable, the herbaceous layer may be quite diverse, including graminoids *Bromus ciliatus (= Bromus canadensis), Calamagrostis rubescens, Carex geyeri, Carex rossii, Carex siccata (= Carex foenea), Festuca occidentalis, Koeleria macrantha, Muhlenbergia montana, Muhlenbergia virescens, Poa fendleriana, Pseudoroegneria spicata*, and forbs *Achillea millefolium, Arnica cordifolia, Erigeron* *eximius, Fragaria virginiana, Linnaea borealis, Luzula parviflora, Osmorhiza berteroi, Packera cardamine (= Senecio cardamine), Thalictrum occidentale, Thalictrum fendleri, Thermopsis rhombifolia, Viola adunca*, and species of many other genera, including *Lathyrus, Penstemon, Lupinus, Vicia, Arenaria, Galium*, and others.

Dynamics: Forests in this ecological system represent the gamut of fire tolerance. Formerly, *Abies concolor* in the Utah High Plateaus were restricted to rather moist or less fire-prone areas by frequent ground fires. These areas experienced mixed fire severities, with patches of crowning in which all trees are killed, intermingled with patches of underburn in which larger *Abies concolor* survived (www.fs.fed.us/database/feis/). With fire suppression, *Abies concolor* has vigorously colonized many sites formerly occupied by open *Pinus ponderosa* woodlands. These invasions have dramatically changed the fuel load and potential behavior of fire in these forests. In particular, the potential for high-intensity crown fires on drier sites now codominated by *Pinus ponderosa* and *Abies concolor* has increased. Increased landscape connectivity, in terms of fuel loadings and crown closure, has also increased the potential size of crown fires.

Pseudotsuga menziesii forests are the only true 'fire-tolerant' occurrences in this ecological system. *Pseudotsuga menziesii* forests were probably subject to a moderate-severity fire regime in presettlement times, with fire-return intervals of 30-100 years. Many of the important tree species in these forests are fire-adapted (*Populus tremuloides, Pinus ponderosa, Pinus contorta*) (Pfister et al. 1977), and fire-induced reproduction of *Pinus ponderosa* can result in its continued codominance in *Pseudotsuga menziesii* forests (Steele et al. 1981). Seeds of the shrub *Ceanothus velutinus* can remain dormant in forest occurrences for 200 years (Steele et al. 1981) and germinate abundantly after fire, competitively suppressing conifer seedlings. Successional relationships in this system are complex. *Pseudotsuga menziesii* is less shade-tolerant than many northern or montane trees such as *Tsuga heterophylla, Abies concolor, Picea engelmannii*, and seedlings compete poorly in deep shade. At drier locales, seedlings may be favored by moderate shading, such as by a canopy of *Pinus ponderosa*, which helps to minimize drought stress. In some locations, much of these forests have been logged or burned during European settlement, and present-day occurrences are second-growth forests dating from fire, logging, or other occurrence-replacing disturbances (Mauk and Henderson 1984, Chappell et al. 1997).

Picea pungens is a slow-growing, long-lived tree which regenerates from seed (Burns and Honkala 1990a). Seedlings are shallow-rooted and require perennially moist soils for establishment and optimal growth. *Picea pungens* is intermediate in shade tolerance, being somewhat more tolerant than *Pinus ponderosa* or *Pseudotsuga menziesii*, and less tolerant than *Abies lasiocarpa* or *Picea engelmannii*. It forms late-seral occurrences in the subhumid regions of the Utah High Plateaus. It is common for these forests to be heavily disturbed by grazing or fire.

In general, fire suppression has lead to the encroachment of more shade-tolerant, less fire-tolerant species (e.g., climax) into occurrences and an attendant increase in landscape homogeneity and connectivity (from a fuels perspective). This has increased the lethality and potential size of fires.

SOURCES

References: Alexander et al. 1984b, Alexander et al. 1987, Boyce 1977, Bunin 1975c, Burns and Honkala 1990a, Canadian Rockies Ecoregional Plan 2002, Chappell et al. 1997, Comer et al. 2002, Cooper et al. 1987, DeVelice et al. 1986, Fitzhugh et al. 1987, Giese 1975, Heinze et al. 1962, Hess 1981, Hess and Alexander 1986, Hess and Wasser 1982, Hoffman and Alexander 1980, Hoffman and Alexander 1983, Komarkova et al. 1988b, Mauk and Henderson 1984, Muldavin et al. 1996, Nachlinger et al. 2001, Neely et al. 2001, Pfister 1972, Pfister et al. 1977, Steele et al. 1981, Tuhy et al. 2002, Youngblood and Mauk 1985
Last updated: 20 Feb 2003 **Stakeholders:** WCS, MCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S034 ROCKY MOUNTAIN MONTANE MESIC MIXED CONIFER FOREST AND WOODLAND
Division 306, Forest and Woodland, CES306.825
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Forest and Woodland (Treed), Ravine, Stream terrace (undifferentiated), Toeslope, Mesotrophic Soil, Ustic, Long Disturbance Interval, F-Patch/Low Intensity, F-Landscape/Low Intensity, Needle-Leaved Tree, RM Montane Dry-Mesic Mixed Conifer

Non-Diagnostic Classifiers: Montane [Montane], Montane [Lower Montane], Temperate [Temperate Continental], Shallow Soil, Mineral: W/ A-Horizon <10 cm, Moderate (100-500 yrs) Persistence

Concept Summary: These are mixed-conifer forests of the Rocky Mountains west into the ranges of the Great Basin, occurring predominantly in cool ravines and on north-facing slopes. Elevations range from 1200 to 3300 m. Occurrences of this system are found on cooler and more mesic sites than Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland (CES306.823). Such sites include lower and middle slopes of ravines, along stream terraces, moist, concave topographic positions and north- and east-facing slopes which burn somewhat infrequently. *Pseudotsuga menziesii* and *Abies concolor* are most common canopy dominants, but *Picea engelmannii, Picea pungens*, or *Pinus ponderosa* may be present. This system includes mixed conifer/*Populus tremuloides* stands. A number of cold-deciduous shrub species can occur, including *Acer glabrum, Acer grandidentatum, Alnus incana, Betula occidentalis, Cornus sericea, Jamesia americana, Physocarpus malvaceus, Robinia neomexicana, Vaccinium membranaceum*, and *Vaccinium myrtillus*. Herbaceous species include *Bromus ciliatus, Carex geyeri, Carex rossii, Carex siccata, Muhlenbergia virescens, Pseudoroegneria spicata, Erigeron eximius, Fragaria virginiana, Luzula parviflora, Osmorhiza berteroi, Packera cardamine, Thalictrum occidentale*, and *Thalictrum fendleri*. Naturally occurring fires are of variable return intervals, and mostly light, erratic, and infrequent due to the cool, moist conditions.

Comments: This system will need to be modeled to separate from similar dry-mesic system.

DISTRIBUTION

Range: Rocky Mountains west into the ranges of the Great Basin, occurring predominantly in cool ravines and on north-facing slopes. Elevations range from 1200 to 3300 m.
Ecological Divisions: 304, 306
TNC Ecoregions: 11:C, 18:C, 19:C, 20:C, 21:C, 68:P, 7:C, 8:C, 9:C
Subnations/Nations: AB:p, AZ:c, BC:p, CO:c, ID:c, MT:c, NM:c, NV:c, OR:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:

• ABIES CONCOLOR FOREST ALLIANCE (A.152) Abies concolor - Picea pungens - Populus angustifolia / Acer glabrum Forest (CEGL000255) Abies concolor - Pinus ponderosa / Cercocarpus ledifolius Forest (CEGL002732) Abies concolor - Pseudotsuga menziesii / Acer glabrum Forest (CEGL000240) Abies concolor - Pseudotsuga menziesii / Erigeron eximius Forest (CEGL000247) Abies concolor - Pseudotsuga menziesii / Lathyrus lanszwertii var. leucanthus Forest (CEGL000250) Abies concolor - Pseudotsuga menziesii / Vaccinium myrtillus Forest (CEGL000265) Abies concolor / Acer grandidentatum Forest (CEGL000241) Abies concolor / Arctostaphylos patula Forest (CEGL000242) Abies concolor / Arctostaphylos uva-ursi Forest (CEGL000243) Abies concolor / Carex siccata Forest (CEGL000244) Abies concolor / Juglans major Forest (CEGL000248) Abies concolor / Mahonia repens Forest (CEGL000251) Abies concolor / Muhlenbergia virescens Forest (CEGL000252) Abies concolor / Osmorhiza berteroi Forest (CEGL000253) Abies concolor / Physocarpus malvaceus Forest (CEGL000254) Abies concolor / Quercus gambelii Forest (CEGL000261) Abies concolor / Symphoricarpos oreophilus Forest (CEGL000263)

• ABIES CONCOLOR WOODLAND ALLIANCE (A.553) Abies concolor / Festuca arizonica Woodland (CEGL000887) Abies concolor / Galium triflorum Woodland (CEGL000888) Abies concolor / Holodiscus dumosus Scree Woodland (CEGL000889) Abies concolor / Jamesia americana Scree Woodland (CEGL000890) Abies concolor / Leymus triticoides Woodland (CEGL000886) Abies concolor / Robinia neomexicana Woodland (CEGL000891)

• PICEA PUNGENS FOREST ALLIANCE (A.165) Picea pungens / Arctostaphylos uva-ursi Forest (CEGL000385) Picea pungens / Arnica cordifolia Forest (CEGL000386) Picea pungens / Carex siccata Forest (CEGL000387) Picea pungens / Erigeron eximius Forest (CEGL000390) Picea pungens / Fragaria virginiana ssp. virginiana Forest (CEGL000391) Picea pungens / Juniperus communis Forest (CEGL000392) Picea pungens / Linnaea borealis Forest (CEGL000393) Picea pungens / Lonicera involucrata Forest (CEGL000394) Picea

pungens / Mahonia repens Forest (CEGL000395) Picea pungens / Packera cardamine Forest (CEGL000399) Picea pungens / Pseudoroegneria spicata Forest (CEGL000397)
• PICEA PUNGENS TEMPORARILY FLOODED WOODLAND ALLIANCE (A.567) Picea pungens / Alnus incana Woodland (CEGL000894) Picea pungens / Betula occidentalis Woodland (CEGL002637) Picea pungens / Cornus sericea Woodland (CEGL000388) Picea pungens / Dasiphora fruticosa ssp. floribunda Woodland (CEGL000396) Picea pungens / Equisetum arvense Woodland (CEGL000389) Picea pungens / Rosa woodsii Woodland (CEGL000398)
• PICEA PUNGENS WOODLAND ALLIANCE (A.557) Picea pungens / Festuca arizonica Woodland (CEGL000895)
• PSEUDOTSUGA MENZIESII FOREST ALLIANCE (A.157) Pseudotsuga menziesii / Acer glabrum Forest (CEGL000418) Pseudotsuga menziesii / Acer grandidentatum Forest (CEGL000419) Pseudotsuga menziesii / Bromus ciliatus Forest (CEGL000428) Pseudotsuga menziesii / Vaccinium membranaceum Forest (CEGL000466) Pseudotsuga menziesii / Viola adunca var. adunca Forest (CEGL000467)
• PSEUDOTSUGA MENZIESII TEMPORARILY FLOODED WOODLAND ALLIANCE (A.568) Pseudotsuga menziesii / Betula occidentalis Woodland (CEGL002639) Pseudotsuga menziesii / Cornus sericea Woodland (CEGL000899)

SOURCES

References: Agree 1982, Alexander et al. 1984a, Alexander et al. 1984b, Alexander et al. 1987, Anderson 1999, Boyce 1977, Bunin 1975c, Comer et al. 2002, Cooper et al. 1987, DeVelice and Ludwig 1983c, DeVelice et al. 1986, Dieterich 1979, Fitzhugh et al. 1987, Fowells 1965, Giese 1975, Heinze et al. 1962, Hess 1981, Hess and Alexander 1986, Hess and Wasser 1982, Hoffman and Alexander 1980, Hoffman and Alexander 1983, Hopkins 1982, Komarkova et al. 1988b, Mauk and Henderson 1984, Moir and Ludwig 1979, Nachlinger et al. 2001, Neely et al. 2001, Parson and DeBenedetti 1979, Pfister 1972, Tuhy et al. 2002, Youngblood and Mauk 1985
Last updated: 20 Feb 2003 **Stakeholders:** WCS, MCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S036 ROCKY MOUNTAIN PONDEROSA PINE WOODLAND
Division 306, Forest and Woodland, CES306.827
Spatial Scale & Pattern: Matrix **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Ridge/Summit/Upper Slope, Very Shallow Soil, Mineral: W/ A-Horizon <10 cm, Sand Soil Texture, Aridic, Intermediate Disturbance Interval [Periodicity/Polycyclic Disturbance], F-Patch/Medium Intensity, Needle-Leaved Tree, Pinus ponderosa with shrubby understory

Non-Diagnostic Classifiers: Montane [Montane], Montane [Lower Montane], Forest and Woodland (Treed), Temperate [Temperate Continental], Circumneutral Soil, F-Landscape/Low Intensity, Short (50-100 yrs) Persistence

Concept Summary: This very widespread ecological system is most common throughout the cordillera of the Rocky Mountains. It is also found in the Colorado Plateau region, west into scattered locations in the Great Basin, and north into southern British Columbia. These woodlands occur at the lower treeline/ecotone between grassland or shrubland and more mesic coniferous forests typically in warm, dry, exposed sites. Elevations range from less than 500 m in British Columbia to 2800 m in the New Mexico mountains. Occurrences are found on all slopes and aspects, however, moderately steep to very steep slopes or ridgetops are most common. This ecological system generally occurs on igneous, metamorphic, and sedimentary material derived soils, with characteristic features of good aeration and drainage, coarse textures, circumneutral to slightly acid pH, an abundance of mineral material, rockiness, and periods of drought during the growing season. These woodlands in the eastern Cascades, Okanagan and northern Rockies regions receive winter and spring rains, and thus have a greater spring “green-up” than the drier woodlands in the central Rockies. *Pinus ponderosa* is the predominant conifer; *Pseudotsuga menziesii, Pinus edulis*, and *Juniperus* spp. may be present in the tree canopy. The understory is usually shrubby, with *Artemisia nova, Artemisia tridentata, Arctostaphylos patula, Arctostaphylos uva-ursi, Cercocarpus montanus, Cercocarpus ledifolius, Purshia stansburiana, Purshia tridentata, Quercus gambelii, Symphoricarpos oreophilus, Prunus virginiana, Amelanchier alnifolia*, and *Rosa* spp. common species. *Pseudoroegneria spicata* and species of *Hesperostipa, Achnatherum, Festuca, Muhlenbergia*, and *Bouteloua* are some of the common grasses. Mixed fire regimes and ground fires of variable return interval maintain these woodlands, depending on climate, degree of soil development, and understory density.

Comments: This system intergrades with Rocky Mountain Ponderosa Pine Savanna (CES306.826). They are distinguished by the high frequency, surface-fire regime, less steep or rocky environmental setting, and more open grassy understory structure of the savanna system.

DISTRIBUTION

Range: Throughout the cordillera of the Rocky Mountains, Colorado Plateau region, west into scattered locations in the Great Basin, and north into southern British Columbia.
Ecological Divisions: 204, 303, 304, 306
TNC Ecoregions: 10:C, 11:C, 18:C, 19:C, 20:C, 21:C, 25:C, 26:?, 33:?, 4:C, 6:C, 68:C, 7:C, 8:C, 9:C
Subnations/Nations: AB:c, AZ:c, BC:c, CO:c, ID:c, MT:c, ND:c, NE:?, NM:c, NV:c, OR:c, SD:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:

- PINUS PONDEROSA FOREST ALLIANCE (A.124) Pinus ponderosa - Pinus strobiformis Forest (CEGL007091) Pinus ponderosa / Arctostaphylos patula - Arctostaphylos viscida Forest (CEGL000061) Pinus ponderosa / Calamagrostis rubescens Forest (CEGL000181) Pinus ponderosa / Carex rossii Forest (CEGL000183) Pinus ponderosa / Elymus glaucus Forest (CEGL000184) Pinus ponderosa / Mahonia repens Forest (CEGL000187) Pinus ponderosa / Physocarpus malvaceus Forest (CEGL000189) Pinus ponderosa / Physocarpus monogynus Forest (CEGL000190) Pinus ponderosa / Prunus virginiana Forest (CEGL000192) Pinus ponderosa / Ribes cereum Forest (CEGL000199) Pinus ponderosa / Spiraea betulifolia Forest (CEGL000202) Pinus ponderosa / Symphoricarpos albus Forest (CEGL000203) Pinus ponderosa / Symphoricarpos occidentalis Forest (CEGL000204) Pinus ponderosa / Symphoricarpos oreophilus Forest (CEGL000205)
- PINUS PONDEROSA WOODLAND ALLIANCE (A.530) Pinus ponderosa / Amelanchier alnifolia Woodland (CEGL000840) Pinus ponderosa / Arctostaphylos patula - Ceanothus velutinus Woodland (CEGL000062) Pinus ponderosa / Arctostaphylos patula - Purshia tridentata Woodland (CEGL000063) Pinus ponderosa / Arctostaphylos patula Woodland (CEGL000842) Pinus ponderosa / Arctostaphylos pungens Woodland (CEGL000843) Pinus ponderosa / Arctostaphylos uva-ursi Woodland (CEGL000844) Pinus ponderosa / Artemisia arbuscula Woodland (CEGL000845) Pinus ponderosa / Artemisia nova Woodland (CEGL000846) Pinus ponderosa / Artemisia tridentata - Purshia tridentata Woodland (CEGL000178) Pinus ponderosa / Artemisia

tridentata ssp. vaseyana / Poa nervosa Woodland (CEGL000180) Pinus ponderosa / Artemisia tridentata ssp. wyomingensis / Hesperostipa comata Woodland (CEGL000179) Pinus ponderosa / Bouteloua gracilis Woodland (CEGL000848) Pinus ponderosa / Bromus inermis Semi-natural Woodland (CEGL002943) Pinus ponderosa / Carex geyeri Woodland (CEGL000182) Pinus ponderosa / Carex inops ssp. heliophila Woodland (CEGL000849) Pinus ponderosa / Ceanothus velutinus - Purshia tridentata Woodland (CEGL000064) Pinus ponderosa / Cercocarpus ledifolius Woodland (CEGL000850) Pinus ponderosa / Cercocarpus montanus Woodland (CEGL000851) Pinus ponderosa / Fallugia paradoxa Woodland (CEGL002999) Pinus ponderosa / Festuca arizonica Woodland (CEGL000856) Pinus ponderosa / Festuca campestris Woodland (CEGL000185) Pinus ponderosa / Festuca idahoensis Woodland (CEGL000857) Pinus ponderosa / Hesperostipa comata Woodland (CEGL000879) Pinus ponderosa / Juniperus communis Woodland (CEGL000859) Pinus ponderosa / Juniperus horizontalis Woodland (CEGL000860) Pinus ponderosa / Juniperus scopulorum Woodland (CEGL000861) Pinus ponderosa / Leucopoa kingii Woodland (CEGL000186) Pinus ponderosa / Muhlenbergia montana Woodland (CEGL000862) Pinus ponderosa / Muhlenbergia virescens - Festuca arizonica Woodland (CEGL000864) Pinus ponderosa / Muhlenbergia virescens Woodland (CEGL000863) Pinus ponderosa / Oryzopsis asperifolia Woodland (CEGL002123) Pinus ponderosa / Pascopyrum smithii Woodland (CEGL000188) Pinus ponderosa / Pseudoroegneria spicata Woodland (CEGL000865) Pinus ponderosa / Pteridium aquilinum Woodland (CEGL002944) Pinus ponderosa / Purshia stansburiana Woodland (CEGL000854) Pinus ponderosa / Purshia tridentata / Achnatherum hymenoides Woodland (CEGL000196) Pinus ponderosa / Purshia tridentata / Carex geyeri Woodland (CEGL002606) Pinus ponderosa / Purshia tridentata / Carex rossii Woodland (CEGL000194) Pinus ponderosa / Purshia tridentata / Festuca idahoensis Woodland (CEGL000195) Pinus ponderosa / Purshia tridentata / Pseudoroegneria spicata Woodland (CEGL000197) Pinus ponderosa / Purshia tridentata Woodland (CEGL000867) Pinus ponderosa / Quercus gambelii Woodland (CEGL000870) Pinus ponderosa / Quercus macrocarpa Woodland (CEGL000873) Pinus ponderosa / Quercus X pauciloba Woodland (CEGL000874) Pinus ponderosa / Ribes inerme Scree Woodland (CEGL000876) Pinus ponderosa / Rockland Woodland (CEGL000877) Pinus ponderosa / Schizachyrium scoparium Woodland (CEGL000201) Pinus ponderosa Scree Woodland (CEGL000878)

Environment: This ecological system within the region occurs at the lower treeline/ecotone between grassland or shrubland and more mesic coniferous forests typically in warm, dry, exposed sites at elevations ranging from 6,500 to 9,200 feet (1,980 to 2,800 meters).. It can occur on all slopes and aspects, however, it commonly occurs on moderately steep to very steep slopes or ridgetops. This ecological system generally occurs on igneous, metamorphic, and sedimentary material derived soils, including basalt, basaltic, andesitic flows, intrusive granitoids and porphyrites, and tuffs (Youngblood and Mauk 1985). Characteristic soil features include good aeration and drainage, coarse textures, circumneutral to slightly acid pH, an abundance of mineral material, and periods of drought during the growing season. Some occurrences may occur as edaphic climax communities on very skeletal, infertile, and/or excessively drained soils, such as pumice, cinder or lava fields, and scree slopes.

Surface textures are highly variable in this ecological system ranging from sand to loam and silt loam. Exposed rock and bare soil consistently occur to some degree in all the associations. *Pinus ponderosa / Arctostaphylos patula* represents the extreme with typically a high percentage of rock and bare soil present.

Precipitation generally contributes 25-60 cm annually to this system, mostly through winter storms and some monsoonal summer rains. Typically a seasonal drought period occurs throughout this system as well. Fire plays an important role in maintaining the characteristics of these open canopy woodlands. However, soil infertility and drought may contribute significantly in some areas as well.

Dynamics: *Pinus ponderosa* is a drought-resistant, shade-intolerant conifer which usually occurs at lower treeline in the major ranges of the western United States. Historically, ground fires and drought were influential in maintaining open-canopy conditions in these woodlands. With settlement and subsequent fire suppression, occurrences have become denser. Presently, many occurrences contain understories of more shade-tolerant species, such as *Pseudotsuga menziesii* and/or *Abies* spp., as well as younger cohorts of *Pinus ponderosa*. These altered occurrence structures have affected fuel loads and alter fire regimes. Presettlement fire regimes were primarily frequent (5-15 year return intervals), low-intensity ground fires triggered by lightning strikes or deliberately set fires by Native Americans. With fire suppression and increased fuel loads, fire regimes are now less frequent and often become intense crown fires, which can kill mature *Pinus ponderosa* (Reid et al. 1999).

Establishment is erratic and believed to be linked to periods of adequate soil moisture and good seed crops as well as fire frequencies, which allow seedlings to reach sapling size. Longer fire-return intervals have resulted in many occurrences having dense subcanopies of overstocked and unhealthy young *Pinus ponderosa* (Reid et al. 1999).

Mehl (1992) states the following: "Where fire has been present, occurrences will be climax and contain groups of large, old trees with little understory vegetation or down woody material and few occurring dead trees. The age difference of the groups of trees would be large. Where fire is less frequent there will also be smaller size trees in the understory giving the occurrence some structure with various canopy layers. Dead, down material will be present in varying amounts along with some occurring dead trees. In both cases the large old trees will have irregular open, large branched crowns. The bark will be lighter in color, almost yellow, thick and some will like have basal fire scars."

Grace's warbler, Pygmy nuthatch, and flammulated owl are indicators of a healthy ponderosa pine woodland. All of these birds prefer mature trees in an open woodland setting (Winn 1998, Jones 1998, Levad 1998 as cited in Rondeau 2001).

SOURCES

References: Canadian Rockies Ecoregional Plan 2002, Comer et al. 2002, Cooper et al. 1987, Daubenmire and Daubenmire 1968, DeVelice et al. 1986, Hess and Alexander 1986, Hoffman and Alexander 1976, Komarkova et al. 1988b, Marriott and Faber-Langendoen 2000, Mauk and Henderson 1984, Mehl 1992, Meidinger and Pojar 1991, Muldavin et al. 1987, Muldavin et al. 1996, Nachlinger et al. 2001, Neely et al. 2001, Pfister et al. 1977, Reid et al. 1999, Rondeau 2001, Tuhy et al. 2002, Youngblood and Mauk 1985
Last updated: 20 Feb 2003 **Stakeholders:** WCS, MCS, CAN
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S040 GREAT BASIN PINYON-JUNIPER WOODLAND
Division 304, Forest and Woodland, CES304.773
Spatial Scale & Pattern: Matrix **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Montane [Lower Montane], Lowland [Foothill], Forest and Woodland (Treed), Foothill(s), Piedmont, Plateau, Ridge/Summit/Upper Slope, Aridic, Pinus monophylla, Juniperus osteosperma

Non-Diagnostic Classifiers: Sideslope, Temperate [Temperate Continental], Alkaline Soil, Long Disturbance Interval, F-Patch/Medium Intensity

Concept Summary: This ecological system occurs on dry mountain ranges of the Great Basin region and eastern foothills of the Sierra Nevada. It is typically found at lower elevations ranging from 1600-2600 m. These woodlands occur on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides. Woodlands dominated by a mix of *Pinus monophylla* and. *Juniperus osteosperma*, pure or nearly pure occurrences of *Pinus monophylla*, or woodlands dominated solely by *Juniperus osteosperma* comprise this system. *Cercocarpus ledifolius* is a common associate. Understory layers are variable. Associated species include shrubs such as *Arctostaphylos patula, Artemisia arbuscula, Artemisia nova, Artemisia tridentata, Cercocarpus ledifolius, Cercocarpus intricatus, Coleogyne ramosissima, Quercus gambelii, Quercus turbinella*, and bunch grasses *Hesperostipa comata, Festuca idahoensis, Pseudoroegneria spicata, Leymus cinereus (= Elymus cinereus)*, and *Poa fendleriana*. This system occurs at lower elevations than Colorado Plateau Pinyon-Juniper Woodland (CES304.767) where sympatric.

DISTRIBUTION

Range: Occurs on dry mountain ranges of the Great Basin region and eastern foothills of the Sierra Nevada, typically at lower elevations ranging from 1600-2600 m.
Ecological Divisions: 206, 304
TNC Ecoregions: 11:C, 12:C, 18:C
Subnations/Nations: CA:c, NV:c, UT:c

CONCEPT

Alliances and Associations:

• JUNIPERUS OSTEOSPERMA WOODLAND ALLIANCE (A.536) Juniperus osteosperma / Artemisia arbuscula Woodland (CEGL002757) Juniperus osteosperma / Artemisia nova / Rock Woodland (CEGL000729) Juniperus osteosperma / Artemisia nova Woodland (CEGL000728) Juniperus osteosperma / Artemisia tridentata / Achnatherum hymenoides Woodland (CEGL000731) Juniperus osteosperma / Cercocarpus intricatus Woodland (CEGL000733) Juniperus osteosperma / Pseudoroegneria spicata Woodland (CEGL000738) Juniperus osteosperma / Sparse Understory Woodland (CEGL000732)

• JUNIPERUS SCOPULORUM TEMPORARILY FLOODED WOODLAND ALLIANCE (A.563) Juniperus scopulorum Temporarily Flooded Woodland [Placeholder] (CEGL002777)

• PINUS MONOPHYLLA - (JUNIPERUS OSTEOSPERMA) WOODLAND ALLIANCE (A.543) Pinus monophylla - Juniperus osteosperma - Quercus gambelii / Artemisia tridentata Woodland (CEGL000837) Pinus monophylla - Juniperus osteosperma / (Shepherdia rotundifolia, Amelanchier utahensis) Woodland (CEGL002942) Pinus monophylla - Juniperus osteosperma / Artemisia arbuscula Woodland (CEGL000830) Pinus monophylla - Juniperus osteosperma / Artemisia nova Woodland (CEGL000831) Pinus monophylla - Juniperus osteosperma / Artemisia tridentata ssp. vaseyana / Pseudoroegneria spicata Woodland (CEGL000833) Pinus monophylla - Juniperus osteosperma / Artemisia tridentata Woodland (CEGL000832) Pinus monophylla - Juniperus osteosperma / Cercocarpus ledifolius / Pseudoroegneria spicata Woodland (CEGL000834) Pinus monophylla - Juniperus osteosperma / Cercocarpus montanus - Quercus gambelii Woodland [Provisional] (CEGL002968) Pinus monophylla - Juniperus osteosperma / Coleogyne ramosissima Woodland [Provisional] (CEGL002971) Pinus monophylla - Juniperus osteosperma / Gutierrezia sarothrae / Pleuraphis jamesii Woodland [Provisional] (CEGL002970) Pinus monophylla - Juniperus osteosperma / Hesperostipa comata Woodland (CEGL002969) Pinus monophylla - Juniperus osteosperma / Prunus virginiana Woodland (CEGL000836) Pinus monophylla - Juniperus osteosperma / Quercus turbinella Woodland (CEGL002941) Pinus monophylla - Juniperus osteosperma / Sparse Understory Woodland (CEGL000829) Pinus monophylla - Quercus gambelii / Artemisia tridentata Woodland (CEGL000838) Pinus monophylla / Amelanchier alnifolia / Arctostaphylos patula Woodland (CEGL000826) Pinus monophylla / Artemisia tridentata Woodland (CEGL000827) Pinus monophylla / Cercocarpus ledifolius Woodland (CEGL000828) Pinus monophylla / Symphoricarpos oreophilus - Artemisia tridentata Woodland (CEGL000839) Pinus monophylla Woodland (CEGL000825)

• PINUS MONOPHYLLA WOODED TALL HERBACEOUS ALLIANCE (A.1487) Pinus monophylla - Juniperus osteosperma / Leymus cinereus Wooded Herbaceous Vegetation (CEGL000835)
• QUERCUS TURBINELLA SHRUBLAND ALLIANCE (A.793) Quercus turbinella - Juniperus osteosperma Shrubland (CEGL000981)

• **California community types:**
• Singleleaf Pinyon Woodland (87.040.00)
• Singleleaf Pinyon / Big Sagebrush (87.040.02)
• Singleleaf Pinyon / Green Ephedra (87.040.03)
• Singleleaf Pinyon / Waxberry - Desert Gooseberry (87.040.04)
• Singleleaf Pinyon / Silk Tassle Bush (87.040.05)

• Singleleaf Pinyon / Utah Juniper / Big Sagebrush - Blackbush (87.040.06)
• Singleleaf Pinyon / Utah Juniper / Black Sagebrush (87.040.07)
• Singleleaf Pinyon / Utah Juniper / Antelope Brush (87.040.07)
• Singleleaf Pinyon / Muller Oak (87.040.08)
• Singleleaf Pinyon / Muller Oak / California Fiddleleaf (87.040.09)
• Singleleaf Pinyon / Desert Almond (87.040.10)
• Singleleaf Pinyon / Desert Gooseberry (87.040.11)
• Singleleaf Pinyon / Curl-leaf Mountain Mahogany / Big Sagebrush - Antelope Bitterbrush (87.040.12)
• Juniper Woodlands (89.000.00)
• Utah Juniper (89.300.01)
• Utah Juniper / Big Sagebrush - Green Ephedra (89.300.02)
• Utah Juniper / Big Sagebrush - Desert Bitterbrush - Nevada Ephedra (89.300.03)
• Utah Juniper / California Buckwheat (89.300.04)
• Utah Juniper / Sticky Snakeweed (89.300.05)
• Utah Juniper / Shadscale (89.300.06)
• Utah Juniper / White Bursage (89.300.07)
• Utah Juniper / Blackbush (89.300.08)
• Utah Juniper / Blackbush / Galleta (89.300.09)
• Utah Juniper / Spanish Bayonet (89.300.10)
• Utah Juniper / Nevada Ephedra / Desert Needlegrass (89.300.11)
• Singleleaf Pinyon - Utah Juniper Woodland (89.500.00)

SOURCES

References: Barbour and Major 1977, Holland and Keil 1995
Last updated: 20 Feb 2003 **Stakeholders:** WCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S046 ROCKY MOUNTAIN GAMBEL OAK-MIXED MONTANE SHRUBLAND
Division 306, Shrubland, CES306.818
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Shrubland (Shrub-dominated), Shallow Soil, Mineral: W/ A-Horizon <10 cm, Sand Soil Texture, Loam Soil Texture, Ustic, Unconsolidated, Intermediate Disturbance Interval [Periodicity/Polycyclic Disturbance], Broad-Leaved Deciduous Shrub

Non-Diagnostic Classifiers: Montane [Montane], Montane [Lower Montane], Lowland [Foothill], Ridge/Summit/Upper Slope, Sideslope, Temperate [Temperate Continental], F-Patch/Medium Intensity, F-Landscape/Medium Intensity, Short (50-100 yrs) Persistence

Concept Summary: This ecological system occurs in the mountains, plateaus and foothills in the southern Rocky Mountains and Colorado Plateau including the Uinta and Wasatch ranges and the Mogollon Rim. These shrublands are most commonly found along dry foothills, lower mountain slopes, and at the edge of the western Great Plains from approximately 2000 to 2900 m in elevation, and are often situated above pinyon-juniper woodlands. Substrates are variable and include soil types ranging from calcareous, heavy, fine-grained loams to sandy loams, gravelly loams, clay loams, deep alluvial sand, or coarse gravel. The vegetation is typically dominated by *Quercus gambelii* alone or codominant with *Amelanchier alnifolia, Amelanchier utahensis, Artemisia tridentata, Cercocarpus montanus, Prunus virginiana, Purshia stansburiana, Purshia tridentata, Robinia neomexicana, Symphoricarpos oreophilus*, or *Symphoricarpos rotundifolius*. There may be inclusions of other mesic montane shrublands with *Quercus gambelii* absent or as a relatively minor component. This ecological system intergrades with the lower montane-foothills shrubland system and shares many of the same site characteristics. Density and cover of *Quercus gambelii* and *Amelanchier* spp. often increase after fire.

DISTRIBUTION

Range: Occurs in the mountains, plateaus and foothills in the southern Rocky Mountains and Colorado Plateau including the Uinta and Wasatch ranges and the Mogollon Rim.
Ecological Divisions: 304, 306
TNC Ecoregions: 10:P, 18:C, 19:C, 20:C, 21:C
Subnations/Nations: AZ:c, CO:c, NM:c, UT:c, WY:p

CONCEPT

Alliances and Associations:
- AMELANCHIER ALNIFOLIA SHRUBLAND ALLIANCE (A.913) Amelanchier alnifolia / Artemisia tridentata / Festuca idahoensis Shrubland (CEGL001064) Amelanchier alnifolia / Pseudoroegneria spicata Shrubland (CEGL001065)
- AMELANCHIER UTAHENSIS SHRUBLAND ALLIANCE (A.916) Amelanchier utahensis - Cercocarpus montanus Shrubland (CEGL001070) Amelanchier utahensis / Carex geyeri Shrubland (CEGL001068) Amelanchier utahensis / Pseudoroegneria spicata Shrubland (CEGL001069) Amelanchier utahensis Shrubland (CEGL001067)
- ARCTOSTAPHYLOS PATULA SHRUBLAND ALLIANCE (A.788) Arctostaphylos patula - Quercus gambelii - (Amelanchier utahensis) Shrubland (CEGL002695)
- JUNIPERUS SCOPULORUM WOODLAND ALLIANCE (A.506) Juniperus scopulorum - Quercus gambelii Woodland [Provisional] (CEGL002967)
- QUERCUS GAMBELII SHRUBLAND ALLIANCE (A.920) Quercus gambelii - Cercocarpus montanus / (Carex geyeri) Shrubland (CEGL001113) Quercus gambelii / Amelanchier alnifolia Shrubland (CEGL001109) Quercus gambelii / Amelanchier utahensis Shrubland (CEGL001110) Quercus gambelii / Artemisia tridentata Shrubland (CEGL001111) Quercus gambelii / Carex inops Shrubland (CEGL001112) Quercus gambelii / Hesperostipa comata Shrubland [Provisional] (CEGL002915) Quercus gambelii / Paxistima myrsinites Shrubland (CEGL001114) Quercus gambelii / Poa fendleriana Shrubland [Provisional] (CEGL002949) Quercus gambelii / Robinia neomexicana / Symphoricarpos rotundifolius Shrubland (CEGL001116) Quercus gambelii / Robinia neomexicana Shrubland (CEGL001115) Quercus gambelii / Symphoricarpos oreophilus Shrubland (CEGL001117)

Environment: This ecological system typically occupies the lower slope positions of the foothill and lower montane zones. They may occur on level to steep slopes, cliffs, escarpments, rimrock slopes, rocky outcrops, and scree slopes. Climate is semi-arid and characterized by mostly hot-dry summers with mild to cold winters and annual precipitation of 25 to 70 cm. Precipitation mostly occurs as winter snows but may also consist of some late summer rains. Soils are typically poorly developed, rocky to very rocky, and well-drained. Parent materials include alluvium, colluvium, and residuum derived from igneous, metamorphic, or sedimentary rocks such as granite, gneiss, limestone, quartz, monzonite, rhyolite, sandstone, schist, and shale. Although this is a shrub-dominated system, some trees may be present. In older occurrences, or occurrences on mesic sites, some of the shrubs may acquire tree-like sizes. Adjacent communities often include woodlands or forests of *Abies concolor, Pinus ponderosa, Pseudotsuga menziesii*, or *Populus tremuloides* at higher elevations, and *Pinus edulis* and *Juniperus osteosperma* on the lower and adjacent elevations. Shrublands of *Artemisia tridentata* or grasslands of *Festuca* sp., *Stipa* sp., or *Pseudoroegneria* sp. may also be present at the lower elevations.

Vegetation: Vegetation types in this system may occur as sparse to dense shrublands composed of moderate to tall shrubs. Occurrences may be multi-layered, with some short shrubby species occurring in the understory of the dominant overstory species. In many occurrences of this system, the canopy is dominated by the broad-leaved deciduous shrub *Quercus gambelii*, which occasionally reaches small tree size. Occurrences can range from dense thickets with little understory to relatively mesic mixed-shrublands with a rich understory of shrubs, grasses and forbs. These shrubs often have a patchy distribution with grass growing in between. Scattered trees are occasionally present in stands and typically include species of *Pinus* or *Juniperus*. Characteristic shrubs that may co-occur, or be singularly dominant, include *Amelanchier alnifolia, Amelanchier utahensis, Arctostaphylos patula, Artemisia tridentata, Cercocarpus montanus, Ptelea trifoliata, Prunus virginiana, Purshia stansburiana, Robinia neomexicana, Rosa* spp., *Symphoricarpos oreophilus*, and *Symphoricarpos rotundifolius*. The herbaceous layer is sparse to moderately dense, ranging from 1-40% cover. Perennial graminoids are the most abundant species, particularly *Bouteloua curtipendula, Bouteloua eriopoda, Bouteloua gracilis, Aristida* spp., *Carex inops, Carex geyeri, Elymus arizonicus, Eragrostis* spp., *Festuca* spp., *Koeleria macrantha, Muhlenbergia* spp., and *Stipa* spp.

Many forb and fern species can occur, but none have much cover. Commonly present forbs include *Achillea millefolium, Artemisia* spp., *Geranium* spp., *Maianthemum stellatum, Thalictrum fendleri*, and *Vicia americana*. Ferns include species of *Cheilanthes* and *Woodsia*. Annual grasses and forbs are seasonally present, and weedy annuals are often present, at least seasonally.

Dynamics: Fire typically plays an important role in this system, causing die-back of the dominant shrub species in some areas, promoting stump sprouting of the dominant shrubs in other areas, and controlling the invasion of trees into the shrubland system. Natural fires typically result in a system with a mosaic of dense shrub clusters and openings dominated by herbaceous species. In some instances these associations may be seral to the adjacent *Pinus ponderosa, Abies concolor*, and *Pseudotsuga menziesii* woodlands and forests. Ream (1964) noted that on many sites in Utah, Gambel oak may be successional and replaced by bigtooth maple (*Acer grandidentatum)*.

SOURCES

References: Christensen 1955, Comer et al. 2002, Johnston and Hendzel 1985, Kunzler and Harper 1980, Kunzler et al. 1981, McKell 1950, Neely et al. 2001, Price and Brotherson 1987, Ream 1960, Ream 1964, Rondeau 2001, Shepperd 1990, Tuhy et al. 2002
Last updated: 20 Feb 2003 **Stakeholders:** WCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

Division 304, Forest and Woodland, CES304.772
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Montane [Lower Montane], Lowland [Foothill], Aridic, Cercocarpus ledifolius

Non-Diagnostic Classifiers: Forest and Woodland (Treed), Shrubland (Shrub-dominated), Foothill(s), Piedmont, Plateau, Ridge/Summit/Upper Slope, Sideslope, Temperate [Temperate Continental], Long Disturbance Interval, F-Patch/Medium Intensity **Concept Summary:** This ecological system occurs in hills and mountain ranges of the Intermountain basins from the eastern foothills of the Sierra Nevada northeast to the foothills of the Big Horn Mountains. It typically occurs from 600 m to over 2650 m in elevation on rocky outcrops or escarpments and forms small- to large-patch stands in forested areas. Most stands occur as shrublands on ridges and steep rimrock slopes, but it may occur as a small tree in steppe areas. This system includes both woodlands and shrublands dominated by *Cercocarpus ledifolius*. *Artemisia tridentata ssp. vaseyana, Purshia tridentata*, with species of *Arctostaphylos, Ribes*, or *Symphoricarpos* are often present. Scattered junipers or pines may also occur. *Cercocarpus ledifolius* is a slow-growing, drought-tolerant species that generally does not resprout after burning and needs the protection from fire that rocky sites provide.

DISTRIBUTION

Range: Occurs in hills and mountain ranges of the Intermountain basins from the eastern foothills of the Sierra Nevada northeast to the foothills of the Big Horn Mountains.
Ecological Divisions: 206?, 304, 306
TNC Ecoregions: 10:P, 11:C, 12:C, 6:P, 9:C
Subnations/Nations: CA:c, CO:c, ID:?, MT:c, NV:c, OR:?, UT:c, WY:c

CONCEPT

Alliances and Associations:

- CERCOCARPUS LEDIFOLIUS SHRUBLAND ALLIANCE (A.828) Artemisia arbuscula - Cercocarpus ledifolius / Pseudoroegneria spicata - Poa secunda Shrubland (CEGL001487) Cercocarpus ledifolius / Mahonia repens Shrubland (CEGL000965) Cercocarpus ledifolius / Prunus virginiana Shrubland (CEGL000966) Cercocarpus ledifolius / Pseudoroegneria spicata Shrubland (CEGL000967) Cercocarpus ledifolius / Symphoricarpos longiflorus Shrubland (CEGL000969)
- CERCOCARPUS LEDIFOLIUS WOODLAND ALLIANCE (A.586) Cercocarpus ledifolius / Artemisia tridentata ssp. vaseyana Woodland (CEGL001022) Cercocarpus ledifolius / Artemisia tridentata Woodland (CEGL000960) Cercocarpus ledifolius / Calamagrostis rubescens Woodland (CEGL000961) Cercocarpus ledifolius / Festuca idahoensis Woodland (CEGL000962) Cercocarpus ledifolius / Holodiscus dumosus Woodland (CEGL000963) Cercocarpus ledifolius / Leymus salinus ssp. salmonis Woodland (CEGL000964) Cercocarpus ledifolius / Pseudoroegneria spicata - Festuca idahoensis Woodland (CEGL000968) Cercocarpus ledifolius / Symphoricarpos oreophilus Woodland (CEGL000970) Cercocarpus ledifolius Woodland [Placeholder] (CEGL003038)

SOURCES

References: Knight 1994, Knight et al. 1987, Lewis 1975, Mueggler and Stewart 1980
Last updated: 20 Feb 2003 **Stakeholders:** WCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S054 INTER-MOUNTAIN BASINS BIG SAGEBRUSH SHRUBLAND
Division 304, Shrubland, CES304.777
Spatial Scale & Pattern: Matrix **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Lowland [Lowland], Shrubland (Shrub-dominated), Toeslope/Valley Bottom, Deep Soil, Aridic, Artemisia tridentata ssp. tridentata

Non-Diagnostic Classifiers: Alluvial plain, Plain, Temperate [Temperate Continental], Alkaline Soil, Xeromorphic Shrub

Concept Summary: This ecological system occurs throughout much of the western U.S., typically in broad basins between mountain ranges, plains and foothills between 1500-2300 m elevation. Soils are typically deep, well-drained and non-saline. These shrublands are dominated by *Artemisia tridentata ssp. tridentata* and/or *Artemisia tridentata ssp. wyomingensis*. Scattered Juniper spp., *Sarcobatus vermiculatus* and *Atriplex* spp. may be present in some stands. *Ericameria nauseosa, Chrysothamnus viscidiflorus, Purshia tridentata,* or *Symphoricarpos oreophilus* may codominate disturbed stands. Perennial herbaceous components typically contribute less than 25% vegetative cover. Common graminoid species include *Achnatherum hymenoides, Bouteloua gracilis, Elymus lanceolatus, Festuca idahoensis, Hesperostipa comata, Leymus cinereus, Pleuraphis jamesii, Pascopyrum smithii, Poa secunda*, or *Pseudoroegneria spicata*.

DISTRIBUTION

Range: Occurs throughout much of the western U.S., typically in broad basins between mountain ranges, plains and foothills between 1500-2300 m elevation.
Ecological Divisions: 303, 304, 306
TNC Ecoregions: 10:C, 11:C, 18:C, 19:C, 20:C, 26:C, 27:C, 4:C, 6:C, 8:C, 9:C
Subnations/Nations: CA:c, CO:c, ID:c, MT:c, NV:c, OR:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:

- ARTEMISIA TRIDENTATA (SSP. TRIDENTATA, SSP. XERICENSIS) SHRUB HERBACEOUS ALLIANCE (A.1522) Artemisia tridentata (ssp. tridentata, ssp. xericensis) / Pseudoroegneria spicata - Poa secunda Shrub Herbaceous Vegetation (CEGL001019) Artemisia tridentata (ssp. tridentata, ssp. xericensis) / Pseudoroegneria spicata Shrub Herbaceous Vegetation (CEGL001018)
- ARTEMISIA TRIDENTATA (SSP. TRIDENTATA, SSP. XERICENSIS) SHRUBLAND ALLIANCE (A.830) Artemisia tridentata ssp. tridentata - Grayia spinosa Shrubland (CEGL001004) Artemisia tridentata ssp. tridentata / Distichlis spicata Shrubland (CEGL001000) Artemisia tridentata ssp. tridentata / Festuca idahoensis Shrubland (CEGL001014) Artemisia tridentata ssp. tridentata / Hesperostipa comata Shrubland (CEGL002966) Artemisia tridentata ssp. tridentata / Leymus cinereus Shrubland (CEGL001016) Artemisia tridentata ssp. tridentata / Pascopyrum smithii - (Elymus lanceolatus) Shrubland (CEGL001017) Artemisia tridentata ssp. tridentata / Pleuraphis jamesii Shrubland (CEGL001015) Artemisia tridentata ssp. tridentata / Poa secunda Shrubland (CEGL001008)
- ARTEMISIA TRIDENTATA SHRUB HERBACEOUS ALLIANCE (A.1521) Artemisia tridentata / Festuca idahoensis Shrub Herbaceous Vegetation (CEGL001530) Artemisia tridentata / Leymus cinereus Shrub Herbaceous Vegetation (CEGL001458)
- ARTEMISIA TRIDENTATA SHRUBLAND ALLIANCE (A.829) Artemisia tridentata - (Ericameria nauseosa) / Bromus tectorum Semi-natural Shrubland (CEGL002699) Artemisia tridentata / Achnatherum hymenoides Shrubland (CEGL001006) Artemisia tridentata / Achnatherum lettermanii Shrubland (CEGL001011) Artemisia tridentata / Bouteloua gracilis - Pascopyrum smithii Shrubland (CEGL000997) Artemisia tridentata / Bouteloua gracilis - Pleuraphis jamesii Shrubland (CEGL000996) Artemisia tridentata / Bouteloua gracilis Shrubland (CEGL000995) Artemisia tridentata / Chrysothamnus viscidiflorus / Poa secunda Shrubland (CEGL000999) Artemisia tridentata / Elymus elymoides Shrubland (CEGL001001) Artemisia tridentata / Ericameria nauseosa Shrubland (CEGL000998) Artemisia tridentata / Pleuraphis jamesii Shrubland (CEGL001005) Artemisia tridentata / Symphoricarpos longiflorus Shrubland (CEGL001012) Artemisia tridentata Shrubland (CEGL000991) Artemisia tridentata Upperzone Community Shrubland (CEGL001013)
- ARTEMISIA TRIDENTATA SSP. WYOMINGENSIS SHRUB HERBACEOUS ALLIANCE (A.1527) Artemisia tridentata ssp. wyomingensis / Mixed Grasses Shrub Herbaceous Vegetation (CEGL001534) Artemisia tridentata ssp. wyomingensis / Pascopyrum smithii Shrub Herbaceous Vegetation (CEGL001047) Artemisia tridentata ssp. wyomingensis / Pseudoroegneria spicata Shrub Herbaceous Vegetation (CEGL001535)

• ARTEMISIA TRIDENTATA SSP. WYOMINGENSIS SHRUBLAND ALLIANCE (A.832) Artemisia tridentata ssp. wyomingensis - Atriplex confertifolia Shrubland (CEGL001040) Artemisia tridentata ssp. wyomingensis - Peraphyllum ramosissimum / Festuca idahoensis Shrubland (CEGL001048) Artemisia tridentata ssp. wyomingensis - Purshia tridentata / Pseudoroegneria spicata Shrubland (CEGL001050) Artemisia tridentata ssp. wyomingensis / Achnatherum hymenoides Shrubland (CEGL001046) Artemisia tridentata ssp. wyomingensis / Achnatherum thurberianum Shrubland (CEGL001052) Artemisia tridentata ssp. wyomingensis / Balsamorhiza sagittata Shrubland (CEGL000994) Artemisia tridentata ssp. wyomingensis / Carex filifolia Shrubland (CEGL001042) Artemisia tridentata ssp. wyomingensis / Elymus albicans Shrubland (CEGL001044) Artemisia tridentata ssp. wyomingensis / Elymus elymoides Shrubland (CEGL001043) Artemisia tridentata ssp. wyomingensis / Hesperostipa comata Shrubland (CEGL001051) Artemisia tridentata ssp. wyomingensis / Leymus ambiguus Shrubland (CEGL001045) Artemisia tridentata ssp. wyomingensis / Poa secunda Shrubland (CEGL001049) Artemisia tridentata ssp. wyomingensis / Pseudoroegneria spicata Shrubland (CEGL001009)
• ATRIPLEX CANESCENS SHRUBLAND ALLIANCE (A.869) Artemisia tridentata - Atriplex canescens - Sarcobatus vermiculatus / (Achnatherum hymenoides) Shrubland (CEGL001355)
• EPHEDRA NEVADENSIS SHRUBLAND ALLIANCE (A.857) Artemisia tridentata - Ephedra nevadensis Shrubland (CEGL001002)
• EPHEDRA VIRIDIS SHRUBLAND ALLIANCE (A.858) Artemisia tridentata - Ephedra viridis Shrubland (CEGL001003)
• ERICAMERIA NAUSEOSA SHRUBLAND ALLIANCE (A.835) Ericameria nauseosa Shrubland [Provisional] (CEGL002713)

• **California community types:**
• Big Sagebrush - Desert Snowberry (35.110.04)
• Big Sagebrush - Antelope Bitterbrush (35.110.07)
• Antelope Bitterbrush Scrub (35.200.00)
• Antelope Bitterbrush - Big Sagebrush - Horesebush (35.200.01)
• Antelope Bitterbrush - Big Sagebrush / Indian Ricegrass (35.200.02)
• Antelope Bitterbrush - Big Sagebrush - Round-leaf Snowberry (35.200.03)
• Antelope Bitterbrush / Nelson’s Needlegrass (35.200.04)
• Antelope Bitterbrush / Sulphur-flower Buckwheat (35.200.05)
• Rubber Rabbitbrush Scrub (35.310.00)
• Parry Rabbitbrush Dwarf Scrub (35.320.00)
• Needle-leaved Rabbitbrush (35.330.00)
• Blackstem Rabbitbrush (35.340.00)

SOURCES

References: Barbour and Billings 1988, Barbour and Major 1977, Holland and Keil 1995, West 1983a
Last updated: 20 Feb 2003 **Stakeholders:** WCS, MCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S055 GREAT BASIN XERIC MIXED SAGEBRUSH SHRUBLAND
Division 304, Shrubland, CES304.774
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Lowland [Foothill], Shrubland (Shrub-dominated), Ridge/Summit/Upper Slope, Aridic, Low Artemisia spp.

Non-Diagnostic Classifiers: Montane [Montane], Montane [Lower Montane], Alluvial fan, Alluvial plain, Foothill(s), Hill(s), Piedmont, Plain, Plateau, Sideslope, Temperate [Temperate Continental], Alkaline Soil, Shallow Soil

Concept Summary: This ecological system occurs in the Great Basin on dry flats and plains, alluvial fans, rolling hills, rocky hill slopes, saddles and ridges at elevations between 1000-2600 m. Sites are dry, often exposed to desiccating winds, with typically shallow, rocky, non-saline soils. Shrublands are dominated by *Artemisia nova* (mid and low elevations), *Artemisia arbuscula* (higher elevation), and may be codominated by *Artemisia tridentata ssp. wyomingensis* or *Chrysothamnus viscidiflorus*. Other shrubs that may be present include *Atriplex confertifolia, Ephedra* spp., *Ericameria* spp., *Grayia spinosa, Lycium shockleyi, Picrothamnus desertorum, Sarcobatus vermiculatus*, and *Tetradymia* spp. The herbaceous layer is likely sparse and composed of perennial bunch grasses such as *Achnatherum hymenoides, Achnatherum speciosum, Achnatherum thurberianum, Elymus elymoides*, or *Poa secunda*.

DISTRIBUTION

Range: Occurs in the Great Basin on dry flats and plains, alluvial fans, rolling hills, rocky hill slopes, saddles and ridges at elevations between 1000-2600 m.
Ecological Divisions: 206, 304
TNC Ecoregions: 11:C, 12:C, 18:C, 6:C
Subnations/Nations: CA:c, ID:c, NV:c, OR:c, UT:c

CONCEPT

Alliances and Associations:

• ARTEMISIA ARBUSCULA SSP. ARBUSCULA SHRUB HERBACEOUS ALLIANCE (A.1566) Artemisia arbuscula ssp. arbuscula - Purshia tridentata / Pseudoroegneria spicata - Festuca idahoensis Shrub Herbaceous Vegetation (CEGL001518) Artemisia arbuscula ssp. arbuscula / Achnatherum thurberianum Shrub Herbaceous Vegetation (CEGL001413) Artemisia arbuscula ssp. arbuscula / Festuca idahoensis Shrub Herbaceous Vegetation (CEGL001409) Artemisia arbuscula ssp. arbuscula / Leymus salinus ssp. salmonis Shrub Herbaceous Vegetation (CEGL001410) Artemisia arbuscula ssp. arbuscula / Poa secunda Shrub Herbaceous Vegetation (CEGL001411) Artemisia arbuscula ssp. arbuscula / Pseudoroegneria spicata Shrub Herbaceous Vegetation (CEGL001412)

• ARTEMISIA ARBUSCULA SSP. ARBUSCULA SHRUBLAND ALLIANCE (A.2547) Artemisia arbuscula ssp. arbuscula - Artemisia tridentata ssp. wyomingensis / Festuca idahoensis Shrubland [Provisional] (CEGL002983)

• ARTEMISIA ARBUSCULA SSP. LONGICAULIS SHRUBLAND ALLIANCE (A.2548) Artemisia arbuscula ssp. longicaulis - Grayia spinosa Shrubland (CEGL002984) Artemisia arbuscula ssp. longicaulis / Bromus tectorum Semi-natural Shrubland (CEGL002985) Artemisia arbuscula ssp. longicaulis / Elymus elymoides Shrubland (CEGL002986)

• ARTEMISIA ARBUSCULA SSP. LONGILOBA SHRUB HERBACEOUS ALLIANCE (A.2552) Artemisia arbuscula ssp. longiloba / Festuca idahoensis Shrub Herbaceous Vegetation (CEGL001522) Artemisia arbuscula ssp. longiloba / Pascopyrum smithii Shrub Herbaceous Vegetation (CEGL001415) Artemisia arbuscula ssp. longiloba / Poa secunda Shrub Herbaceous Vegetation (CEGL001523) Artemisia arbuscula ssp. longiloba / Pseudoroegneria spicata Shrub Herbaceous Vegetation (CEGL001416)

• ARTEMISIA ARBUSCULA SSP. LONGILOBA SHRUBLAND ALLIANCE (A.2549) Artemisia arbuscula ssp. longiloba Shrubland (CEGL001414)

• ARTEMISIA NOVA SHRUBLAND ALLIANCE (A.1105) Artemisia nova - Ericameria nana Shrubland (CEGL002773) Artemisia nova - Gutierrezia sarothrae / Bouteloua gracilis - Pleuraphis jamesii Shrubland (CEGL001419) Artemisia nova / Achnatherum hymenoides Shrubland (CEGL001422) Artemisia nova / Elymus elymoides Shrubland (CEGL001418) Artemisia nova / Hesperostipa comata Shrubland (CEGL001425) Artemisia nova / Pleuraphis jamesii Shrubland (CEGL001420) Artemisia nova / Poa fendleriana Shrubland (CEGL002698) Artemisia nova / Poa secunda Shrubland (CEGL001423) Artemisia nova / Pseudoroegneria spicata Shrubland (CEGL001424) Artemisia nova Shrubland (CEGL001417)

• ARTEMISIA TRIDENTATA SSP. WYOMINGENSIS SHRUB HERBACEOUS ALLIANCE (A.1527) Artemisia tridentata ssp. wyomingensis / Mixed Grasses Shrub Herbaceous Vegetation (CEGL001534) Artemisia tridentata ssp. wyomingensis / Pseudoroegneria spicata Shrub Herbaceous Vegetation (CEGL001535)
• ARTEMISIA TRIDENTATA SSP. WYOMINGENSIS SHRUBLAND ALLIANCE (A.832) Artemisia tridentata ssp. wyomingensis - Atriplex confertifolia Shrubland (CEGL001040) Artemisia tridentata ssp. wyomingensis - Purshia tridentata / Pseudoroegneria spicata Shrubland (CEGL001050) Artemisia tridentata ssp. wyomingensis / Achnatherum hymenoides Shrubland (CEGL001046) Artemisia tridentata ssp. wyomingensis / Achnatherum thurberianum Shrubland (CEGL001052) Artemisia tridentata ssp. wyomingensis / Balsamorhiza sagittata Shrubland (CEGL000994) Artemisia tridentata ssp. wyomingensis / Bouteloua gracilis Shrubland (CEGL001041) Artemisia tridentata ssp. wyomingensis / Elymus elymoides Shrubland (CEGL001043) Artemisia tridentata ssp. wyomingensis / Hesperostipa comata Shrubland (CEGL001051) Artemisia tridentata ssp. wyomingensis / Poa secunda Shrubland (CEGL001049) Artemisia tridentata ssp. wyomingensis / Pseudoroegneria spicata Shrubland (CEGL001009)
• GRAYIA SPINOSA SHRUBLAND ALLIANCE (A.1038) Grayia spinosa / Artemisia nova / Achnatherum speciosum Shrubland (CEGL001344)

• **California community types:**
• Black Sagebrush Dwarf Scrub (35.130.00)
• Southern Montane Black Sagebrush Pebble Plains (35.130.01)
• Black Sagebrush - Engelmann’s Hedgehog Cactus (35.130.02)
• Black Sagebrush - Cheesebush (35.130.03)

Environment: This ecological system is widely distributed in the western United States. Climate is generally arid with 20 to 30 cm of annual precipitation and warm summers and cold winters. This shrubland system occurs at elevations from 1000 to 2600 m in the southwestern United States. It occupies flat to steeply sloping upland sites, on a wide variety of landform positions. These include toeslopes, lower and middle slopes, badly eroded badland slopes, and foothills. Sites with little slope tend to have deep soils, while those with steeper slopes have shallow to moderately deep soils that are well-drained. Sloping sites tend to have southerly aspects. Soil texture is loam, sandy loam, or clay loam (Hansen and Hoffman 1988), and there is often a significant amount of coarse fragments in the soil profile. Hironaka et al. (1983) reported that most of the habitat occurred on calcareous soils, often with a cemented duripan or silica hardpan at about 1 m in depth.

Dynamics: This shrubland system is associated with shallow, rocky soils which experience extreme drought in summer. The plants are low and widely spaced, which tends to decrease the risk of fire (Chappell et al. 1997). Barbour and Major (1988) report that *Artemisia nova* is utilized by livestock to a much greater degree than other species of *Artemisia*, resulting in low, pruned plants. *Artemisia nova* dwarf-shrublands grow in more xeric sites than other *Artemisia* shrublands. Blackburn and Tueller (1970) noted rapid invasion of these communities by *Juniperus osteosperma* and *Pinus monosperma* in Nevada, citing overgrazing coupled with fire suppression, and possibly climate change as causative variables.

SOURCES

References: Baker and Kennedy 1985, Barbour and Major 1988, Blackburn and Tueller 1970, Chappell et al. 1997, Hansen and Hoffman 1988, Hironaka et al. 1983, West 1983a
Last updated: 20 Feb 2003 **Stakeholders:** WCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S057 MOGOLLON CHAPARRAL
Division 302, Shrubland, CES302.741
Spatial Scale & Pattern: Matrix **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Montane [Lower Montane], Lowland [Foothill], Intermediate Disturbance Interval, F-Patch/High Intensity, Evergreen Sclerophyllous Shrub

Non-Diagnostic Classifiers: Montane [Montane], Shrubland (Shrub-dominated), Temperate [Temperate Continental], Temperate [Temperate Xeric], Aridic, Xeric, Broad-Leaved Evergreen Shrub

Concept Summary: This ecological system occurs across central Arizona (Mogollon Rim), western New Mexico and southwestern Utah and southeast Nevada. It often dominants along the mid-elevation transition from the Mojave, Sonoran, and northern Chihuahuan deserts into mountains (1000-2200 m). It occurs on foothills, mountain slopes and canyons in dryer habitats below the encinal and *Pinus ponderosa* woodlands. Stands are often associated with more xeric and coarse-textured substrates such as limestone, basalt or alluvium, especially in transition areas with more mesic woodlands. The moderate to dense shrub canopy includes species such as *Quercus turbinella, Quercus toumeyi, Cercocarpus montanus, Canotia holacantha, Ceanothus greggii, Forestiera pubescens (= Forestiera neomexicana), Garrya wrightii, Juniperus deppeana, Purshia stansburiana, Rhus ovata, Rhus trilobata*, and *Arctostaphylos pungens* and *Arctostaphylos pringlei* at higher elevations. Most chaparral species are fire-adapted, resprouting vigorously after burning or producing fire-resistant seeds. Stands occurring within montane woodlands are seral and a result of recent fires.

DISTRIBUTION

Range: Occurs across central Arizona (Mogollon Rim), western New Mexico and southern Utah. It often dominants along the mid-elevation transition from the Mojave, Sonoran, and northern Chihuahuan deserts into mountains (1000-2200 m).
Ecological Divisions: 302, 304, 306
TNC Ecoregions: 17:C, 19:C, 21:C, 22:C, 23:C, 24:C
Subnations/Nations: AZ:c, CA:?, MXSO:?, NM:c, NV:c, UT:c

CONCEPT

Alliances and Associations:
- ARCTOSTAPHYLOS PATULA SHRUBLAND ALLIANCE (A.788) Arctostaphylos patula - Quercus gambelii - (Amelanchier utahensis) Shrubland (CEGL002695) Arctostaphylos patula Shrubland (CEGL002696)
- ARCTOSTAPHYLOS PUNGENS SHRUBLAND ALLIANCE (A.789) Arctostaphylos pungens Shrubland (CEGL000958)
- CERCOCARPUS MONTANUS SHRUBLAND ALLIANCE (A.896) Cercocarpus montanus / Garrya flavescens Shrubland (CEGL001088) Cercocarpus montanus / Muhlenbergia pauciflora Shrubland (CEGL001089)
- MORTONIA SEMPERVIRENS SHRUBLAND ALLIANCE (A.859) Mortonia scabrella / Dasylirion wheeleri Shrubland (CEGL001279)
- PURSHIA (STANSBURIANA, MEXICANA) SHRUBLAND ALLIANCE (A.833) Purshia stansburiana - Arctostaphylos patula Shrubland (CEGL002948)
- QUERCUS PUNGENS SHRUBLAND ALLIANCE (A.783) Quercus pungens - Cercocarpus montanus Shrubland (CEGL003832)
- QUERCUS TOUMEYI SHRUBLAND ALLIANCE (A.792) Quercus toumeyi / Bouteloua curtipendula Shrubland (CEGL000975)
- QUERCUS TURBINELLA SHRUBLAND ALLIANCE (A.793) Quercus turbinella - (Amelanchier utahensis) Colluvial Shrubland (CEGL002950) Quercus turbinella - Cercocarpus montanus Shrubland (CEGL000979) Quercus turbinella - Coleogyne ramosissima Shrubland (CEGL000982) Quercus turbinella - Ephedra viridis Shrubland (CEGL000980) Quercus turbinella - Garrya flavescens - Arctostaphylos pungens Shrubland (CEGL000977) Quercus turbinella - Juniperus osteosperma Shrubland (CEGL000981) Quercus turbinella / Bouteloua eriopoda Shrubland (CEGL000978)

SOURCES

References: Carmichael et al. 1978, Dick-Peddie 1993, Muldavin et al. 1994a, Muldavin et al. 2000b
Last updated: 20 Feb 2003 **Stakeholders:** WCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S059 COLORADO PLATEAU BLACKBRUSH-MORMON-TEA SHRUBLAND
Division 304, Shrubland, CES304.763
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Lowland [Foothill], Shrubland (Shrub-dominated), Temperate [Temperate Xeric], Aridic

Non-Diagnostic Classifiers: Ridge/Summit/Upper Slope, Sideslope, Alkaline Soil, Sand Soil Texture, Very Long Disturbance Interval, F-Patch/High Intensity

Concept Summary: This ecological system occurs in the Colorado Plateau on benchlands, colluvial slopes, pediments or bajadas. Elevation ranges from 560-1650 m. Substrates are shallow, typically calcareous, non-saline and gravelly or sandy soils over sandstone or limestone bedrock, caliche or limestone alluvium. It also occurs in deeper soils on sandy plains where it may have invaded desert grasslands. The vegetation is characterized by extensive open shrublands dominated by *Coleogyne ramosissima* often with *Ephedra viridis, Ephedra torreyana*, or *Grayia spinosa*. Sandy portions may include *Artemisia filifolia* as codominant. Within a blackbrush shrubland disturbed patches are dominated by shrubs such as *Chrysothamnus viscidiflorus, Ericameria* spp.*, Ephedra* spp.*, Grayia spinosa, Poliomintha incana* or exotic annual grasses. The herbaceous layer is sparse and composed of graminoids such as *Achnatherum hymenoides, Pleuraphis jamesii*, or *Sporobolus cryptandrus*.

DISTRIBUTION

Range: Occurs in the Colorado Plateau on benchlands, colluvial slopes, pediments or bajadas. Elevation ranges from 560-1600 m.
Ecological Divisions: 304
TNC Ecoregions: 18:C, 19:C
Subnations/Nations: AZ:c, CO:c, NM:c, UT:c

CONCEPT

Alliances and Associations:

- ACHNATHERUM HYMENOIDES SHRUB HERBACEOUS ALLIANCE (A.1543) Ephedra viridis / Achnatherum hymenoides - Bouteloua gracilis Shrub Herbaceous Vegetation (CEGL001648) Ephedra viridis / Achnatherum hymenoides - Sporobolus cryptandrus Shrub Herbaceous Vegetation (CEGL001649)
- ARTEMISIA FILIFOLIA SHRUBLAND ALLIANCE (A.816) Artemisia filifolia / Bouteloua eriopoda Shrubland (CEGL001077) Artemisia filifolia Colorado Plateau Shrubland (CEGL002697)
- BOUTELOUA ERIOPODA XEROMORPHIC SHRUB HERBACEOUS ALLIANCE (A.1553) Ephedra torreyana / Bouteloua eriopoda Shrub Herbaceous Vegetation (CEGL001731)
- COLEOGYNE RAMOSISSIMA SHRUBLAND ALLIANCE (A.874) Coleogyne ramosissima / Pleuraphis jamesii Shrubland (CEGL001334) Coleogyne ramosissima Shrubland (CEGL001332)
- EPHEDRA NEVADENSIS - EPHEDRA VIRIDIS SHRUBLAND ALLIANCE (A.856) Ephedra nevadensis - Ephedra viridis - Salvia dorrii - Lycium andersonii Shrubland (CEGL001256)
- EPHEDRA NEVADENSIS SHRUBLAND ALLIANCE (A.857) Ephedra nevadensis / Achnatherum hymenoides Shrubland (CEGL001255)
- EPHEDRA VIRIDIS SHRUBLAND ALLIANCE (A.858) Ephedra viridis / Pleuraphis rigida Shrubland (CEGL001257)
- POLIOMINTHA INCANA SHRUBLAND ALLIANCE (A.862) Poliomintha incana / (Pleuraphis jamesii) Shrubland (CEGL002930)

Environment: This ecological system typically occurs on gentle to steep, bouldery or rocky slopes of mountains, canyons, and mesas with varying aspects. This system is an evergreen, microphyllous desert scrub with succulents, half-shrubs, and scattered deciduous shrubs typically found at elevations ranging from ,1,903 to 5,249 feet (580 to 1,600 meters).. This shrubland system occurs in an arid to semi-arid climate with annual precipitation in the form of summer monsoons and winter storms averaging approximately 20 cm. Soils are highly variable and parent materials may include shale, sandstone, limestone, quartzites, and igneous rocks. Soils are generally coarse-textured, often roc,ky, shallow and well-drained. Effective soil moisture appears to be primarily controlled by regolith depth and position in relation to the water table. This brushland system occupies most sites where regolith is uniformly shallow. In association with blackbrush (*Coleogyne ramosissima*) sites, the soil moisture is concentrated on top of impermeable bedrock at a shallow depth. This perching effect allows for gradual uptake of moisture by the plants roots (Loope and West 1979). This permits growth of plants with more mesic habitat requirements (Warren et al. 1982). On sites with deep soil, blackbrush may occur in almost pure occurrences with only a few associated species (Warren et al. 1982). Dark-colored cryptogamic soil crusts, composed of lichens, mosses, fungi, and algae, are often present in this system in fairly undisturbed areas. Sandy soils may have more cryptogamic crusts than clayish or silty soil surfaces.

Vegetation: This ecological system is dominated by sparse to moderately dense shrubs. Dominant shrubs include *Coleogyne ramosissima, Ephedra nevadensis*, and *Ephedra viridis* (which may codominate with *Grayia spinosa, Salvia dorrii*, and *Lycium andersonii*). There is usually a sparse herbaceous layer with some perennial grasses and forbs. Annual grasses and forbs are present seasonally. Some characteristic species associated with this system include the shrubs *Gutierrezia sarothrae, Chrysothamnus viscidiflorus, Yucca baccata*, and *Krameria grayi*, succulents such as *Ferocactus cylindraceus (= Ferocactus acanthodes), Opuntia* spp., *Echinocereus* spp., *Echinocactus* spp., and *Agave* spp., the graminoid *Pleuraphis rigida*, and perennial forbs such as *Machaeranthera pinnatifida* and *Sphaeralcea ambigua*.

Dynamics: Fire does not appear to play a role in maintenance of shrublands within this system. Topographic breaks dissect the landscape, and isolated pockets of vegetation are separated by rock walls or steep canyons. Blackbrush is fire-intolerant (Loope and West 1979). Following fires, these communities are often colonized by non-native grasses, which serve to encourage recurrent fires and delay shrub regeneration (IVC 1999). In shallow regolith situations, secondary succession, in the sense of site preparation by seral plants, may not occur at all (Loope and West 1979).

SPATIAL CHARACTERISTICS

Adjacent Ecological Systems: Adjacent vegetation often includes *Atriplex* dominated shrubland communities and upland areas of pinyon-juniper woodlands. Grasslands dominated by *Pleuraphis jamesii, Hesperostipa comata*, and *Achnatherum hymenoides* also occur.

SOURCES

References: Loope and West 1979, Thatcher 1975, Tuhy and MacMahon 1988, Tuhy et al. 2002, Warren et al. 1982, West 1983d
Last updated: 20 Feb 2003 **Stakeholders:** WCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S060 MOJAVE MID-ELEVATION MIXED DESERT SCRUB
Division 302, Shrubland, CES302.742
Spatial Scale & Pattern: Large Patch **Classification Confidence:** low
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Lowland [Foothill], Shrubland (Shrub-dominated), Evergreen Sclerophyllous Tree

Non-Diagnostic Classifiers: Sideslope, Temperate [Temperate Xeric], Aridic, Xeromorphic Shrub, Succulent Shrub

Concept Summary: This ecological system represents the extensive desert scrub in the transition zone above *Larrea tridentata - Ambrosia dumosa* desert scrub and below the lower montane woodlands (700-1800 m elevations) that occurs in the eastern and central Mojave Desert. It is also common on lower piedmont slopes in the transition zone into the southern Great Basin. The vegetation in this ecological systems is quite variable. Codominants and diagnostic species include *Coleogyne ramosissima, Eriogonum fasciculatum, Ephedra nevadensis, Grayia spinosa, Menodora spinescens, Nolina* spp.*, Opuntia acanthocarpa, Salazaria mexicana, Viguiera parishii, Yucca brevifolia*, or *Yucca schidigera*. Desert grasses, including *Achnatherum hymenoides, Achnatherum speciosum, Muhlenbergia porteri, Pleuraphis jamesii, Pleuraphis rigida*, or *Poa secunda*, may form an herbaceous layer. Scattered *Juniperus osteosperma* or desert scrub species may also be present.

DISTRIBUTION

Range: Eastern and central Mojave Desert and on lower piedmont slopes in the transition zone into the southern Great Basin.
Ecological Divisions: 206, 302, 304
TNC Ecoregions: 11:C, 12:P, 17:C, 23:P
Subnations/Nations: AZ:c, CA:c, NV:c, UT:c

CONCEPT

Alliances and Associations:

- ARTEMISIA TRIDENTATA (SSP. TRIDENTATA, SSP. XERICENSIS) SHRUBLAND ALLIANCE (A.830) Artemisia tridentata ssp. tridentata - Grayia spinosa Shrubland (CEGL001004)
- COLEOGYNE RAMOSISSIMA SHRUBLAND ALLIANCE (A.874) Coleogyne ramosissima - Eriogonum fasciculatum Shrubland (CEGL001333) Coleogyne ramosissima - Purshia stansburiana Shrubland (CEGL002720) Coleogyne ramosissima - Thamnosma montana Shrubland (CEGL002718) Coleogyne ramosissima Shrubland (CEGL001332)
- EPHEDRA NEVADENSIS SHRUBLAND ALLIANCE (A.857) Ephedra nevadensis - Ericameria cooperi Shrubland (CEGL001253) Ephedra nevadensis - Eriogonum fasciculatum Shrubland (CEGL001254) Ephedra nevadensis / Achnatherum hymenoides Shrubland (CEGL001255)
- EPHEDRA VIRIDIS SHRUBLAND ALLIANCE (A.858) Ephedra viridis / Pleuraphis rigida Shrubland (CEGL001257)
- ERICAMERIA PARRYI SHRUBLAND ALLIANCE (A.818) Ericameria parryi Shrubland [Provisional] (CEGL003040)
- ERICAMERIA TERETIFOLIA SHRUBLAND ALLIANCE (A.2540) Ericameria teretifolia Shrubland [Placeholder] (CEGL002963)
- ERIOGONUM FASCICULATUM SHRUBLAND ALLIANCE (A.868) Eriogonum fasciculatum Rock Outcrop Shrubland (CEGL001260) Eriogonum fasciculatum Shrubland (CEGL001258)
- GRAYIA SPINOSA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.1045) Grayia spinosa - Lycium andersonii Shrubland (CEGL001347) Grayia spinosa - Lycium pallidum Shrubland (CEGL001348)
- GRAYIA SPINOSA SHRUBLAND ALLIANCE (A.1038) Grayia spinosa - Menodora spinescens Shrubland (CEGL001349)
- JUNIPERUS CALIFORNICA WOODED SHRUBLAND ALLIANCE (A.502) Juniperus californica Wooded Shrubland (CEGL003058)
- MENODORA SPINESCENS DWARF-SHRUBLAND ALLIANCE (A.2515) Menodora spinescens Dwarf-shrubland [Placeholder] (CEGL002767)
- NOLINA BIGELOVII SHRUBLAND ALLIANCE (A.2534) Nolina bigelovii Shrubland [Placeholder] (CEGL003064)
- NOLINA PARRYI SHRUBLAND ALLIANCE (A.2535) Nolina parryi Shrubland [Placeholder] (CEGL002956)
- PEUCEPHYLLUM SCHOTTII SHRUBLAND ALLIANCE (A.2516) Peucephyllum schottii Shrubland [Placeholder] (CEGL002722)

• SALAZARIA MEXICANA SHRUBLAND ALLIANCE (A.2538) Salazaria mexicana Shrubland [Placeholder] (CEGL002961)
• VIGUIERA PARISHII SHRUBLAND ALLIANCE (A.2526) Viguiera parishii Shrubland [Placeholder] (CEGL002721)
• YUCCA BREVIFOLIA WOODED HERBACEOUS ALLIANCE (A.2527) Yucca brevifolia / Pleuraphis rigida Wooded Herbaceous Vegetation (CEGL002725)
• YUCCA BREVIFOLIA WOODED SHRUBLAND ALLIANCE (A.884) Yucca brevifolia - Juniperus osteosperma / Artemisia tridentata Wooded Shrubland (CEGL002744) Yucca brevifolia Wooded Shrubland [Placeholder] (CEGL003116)
• YUCCA SCHIDIGERA SHRUBLAND ALLIANCE (A.881) Yucca schidigera Shrubland [Placeholder] (CEGL003117)

• **California community types:**
• California Buckwheat Scrub (32.040.00)
• California Buckwheat - California Figwort - Phacelia (32.040.01)
• California Buckwheat (32.040.02)
• California Buckwheat - Big Sagebrush (32.040.03)
• California Buckwheat Alluvial Fan (32.040.04)
• California Buckwheat-White Bursage (32.040.05)
• California Buckwheat - Bladder Sage (32.040.06)
• Creosote Bush - Nevada Ephedra (33.010.10)
• Creosote Bush - Mojave Yucca - Desert Tea (33.010.11)
• Blackbush High Desert Scrub (33.020.00)
• Sonoran Blackbush (33.020.01)
• Blackbush - Shadscale (33.020.02)
• Blackbush - Nevada Ephedra (33.020.03)
• Blackbush - Nevada Ephedra - California Buckwheat (33.020.04)
• Blackbush - California Buckwheat (33.020.05)
• Blackbush - Creosote Bush - California Buckwheat (33.020.06)
• Blackbush - Creosote Bush - White Bursage (33.020.07)
• Blackbush - Anderson's Wolfberry (33.020.08)
• Blackbush - Bladder Sage (33.020.09)
• Virgin River Encelia Scrub (33.025.00)
• Virgin River Encelia (33.025.01)
• Virgin River Encelia - Blue Sage (33.025.02)
• Creosote Bush - Brittlebush Scrub (33.027.00)
• Creosote Bush - Brittlebush / Arizona Honeysweet (33.027.01)
• Creosote Bush - Brittlebush - Sweetbush (33.027.02)
• Creosote Bush - Brittlebush - White Bursage (33.027.03)
• Creosote Bush - Brittlebush - Ocotillo (33.027.04)
• Brittlebush Drought Deciduous Scrub (33.030.00)
• Brittlebush-succulent scrub (33.030.01)
• Brittlebush-Desert Fir (33.030.02)
• Brittlebush-California Buckwheat-Agave (33.030.03)
• Acton Encelia (33.031.00)
• Desert Sunflower Drought Deciduous Scrub (33.032.00)
• Desert Sunflower-Agave (33.032.01)
• Desert Sunflower-California Buckwheat (33.032.02)
• Net-veined Viguiera Scrub (33.033.00)
• Net-veined Viguiera (33.033.01)
• Mojave Yucca (33.070.01)
• Mojave Yucca - Blackbush (33.070.02)
• Mojave Yucca - Nevada Ephedra (33.070.02)
• Mojave Yucca - White Bursage (33.070.03)
• Mojave Yucca - Creosote Bush - White Bursage (33.070.05)
• Mojave Yucca - Creosote Bush - Nevada Ephedra (33.070.06)
• Mojave Yucca - California Buckwheat (33.070.07)
• Mojave Yucca - Buckhorn Cholla (33.070.08)

- Mojave Yucca - Desert Sunflower (33.070.09)
- Mojave Yucca - Creosote Bush - (Jojoba) (33.070.10)
- Desert Agave succulent-leaved scrub (33.075.00)
- Desert Agave wash terrace (33.075.01)
- Desert Agave-Mojave Yucca (33.075.02)
- Nolina (33.080.00)
- Parry's Nolina (33.080.01)
- Joshua Tree Woodland (33.170.01)
- Joshua Tree / Blackbush (33.170.02)
- Joshua Tree - California Juniper / Blackbush (33.170.03)
- Joshua Tree / Big Sagebrush - Shadscale (33.170.04)
- Joshua Tree / Creosote Bush - Nevada Ephedra (33.170.05)
- Joshua Tree / Buckhorn Cholla (33.170.06)
- Joshua Tree / Galleta spp. (33.170.07)
- Joshua Tree / Anderson's Wolfberry (33.170.08)
- Joshua Tree / Bladder Sage (33.170.09)
- Joshua Tree / Mojave Yucca - Creosote Bush (33.170.10)
- Joshua Tree / Creosote Bush - White Bursage - California Buckwheat (33.170.11)
- Hop-sage (33.180.01)
- Hop-sage - Shadscale (33.180.02)
- Hop-sage - Creosote Bush (33.180.03)
- Hop-sage - Anderson's Wolfberry (33.180.04)
- Hop-sage - Round-leaved Buckwheat (33.180.05)
- Mojave Mixed Woody Scrub (33.211.00)
- California Ephedra (33.270.00)
- California Ephedra - Cheesebush (33.270.01)
- Nevada Ephedra Scrub (33.280.00)
- Nevada Ephedra (33.280.01)
- Nevada Ephedra - Shadscale (33.280.02)
- Nevada Ephedra - Bladder Sage (33.280.03)
- Nevada Ephedra - Wolfberry (33.280.04)
- Spiny Menodora Scrub (33.290.00)
- Big Sagebrush - Blackbush (35.110.05)
- Big Sagebrush - Virgin River Encelia (35.110.06)
- Big Sagebrush - Green Ephedra (35.110.08)
- Mountain Big Sagebrush / Shorthair Sedge (35.110.10)
- Shadscale - Blackbush (36.320.04)
- Shadscale - Sticky Snakeweed - Catclaw Horsebrush (36.320.05)
- Shadscale - Virgin River Encelia - Hop-sage (36.320.09)

SPATIAL CHARACTERISTICS

Spatial Summary: Transition zone shrublands desert scrub above Mojave desert scrub and below the lower montane woodlands.

SOURCES

References: Barbour and Major 1988, Beatley 1976, Holland and Keil 1995, MacMahon 1988, Ostler et al. 2000, Sawyer and Keeler-Wolf 1995, Thomas et al. 2003a
Last updated: 20 Feb 2003 **Stakeholders:** WCS, LACD
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S065 INTER-MOUNTAIN BASINS MIXED SALT DESERT SCRUB
Division 304, Shrubland, CES304.784
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Lowland [Lowland], Shrubland (Shrub-dominated), Alluvial flat, Alluvial plain, Plain, Alkaline Soil, Saline Substrate Chemistry, Calcareous, Silt Soil Texture, Clay Soil Texture, Xeromorphic Shrub, Dwarf-Shrub, Atriplex spp.

Non-Diagnostic Classifiers: Basin floor, Temperate [Temperate Continental], Oligotrophic Soil

Concept Summary: This extensive ecological system includes open-canopied shrublands of typically saline basins, alluvial slopes and plains across the Intermountain western U.S. This type also extends in limited distribution into the southern Great Plains. Substrates are often saline and calcareous, medium- to fine-textured, alkaline soils, but include some coarser-textured soils. The vegetation is characterized by a typically open to moderately dense shrubland composed of one or more *Atriplex* species such as *Atriplex confertifolia, Atriplex canescens, Atriplex polycarpa*, or *Atriplex spinifera*. Other shrubs present to codominate may include *Artemisia tridentata ssp. wyomingensis, Chrysothamnus viscidiflorus, Ericameria nauseosa, Ephedra nevadensis, Grayia spinosa, Krascheninnikovia lanata, Lycium* spp., *Picrothamnus desertorum*, or *Tetradymia* spp. *Sarcobatus vermiculatus* is generally absent, but if present does not codominate. The herbaceous layer varies from sparse to moderately dense and is dominated by perennial graminoids such as *Achnatherum hymenoides, Bouteloua gracilis, Elymus lanceolatus ssp. lanceolatus, Pascopyrum smithii, Pleuraphis jamesii, Pleuraphis rigida, Poa secunda*, or *Sporobolus airoides*. Various forbs are also present.

DISTRIBUTION

Range: Intermountain western U.S., extending in limited distribution into the southern Great Plains.
Ecological Divisions: 303, 304, 306
TNC Ecoregions: 10:C, 11:C, 18:C, 19:C, 20:C, 21:C, 26:C, 27:C, 28:C, 4:?, 6:C, 8:?, 9:C
Subnations/Nations: AZ:c, CA:c, CO:c, ID:c, MT:c, NM:c, NV:c, OR:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:

• ATRIPLEX (LENTIFORMIS, POLYCARPA) SHRUBLAND ALLIANCE (A.864) Atriplex (lentiformis, polycarpa) Shrubland [Placeholder] (CEGL003016)
• ATRIPLEX CANESCENS SHRUBLAND ALLIANCE (A.869) Atriplex canescens - Artemisia tridentata Shrubland (CEGL001282) Atriplex canescens - Ephedra viridis Shrubland (CEGL001287) Atriplex canescens - Krascheninnikovia lanata Shrubland (CEGL001285) Atriplex canescens / Achnatherum hymenoides Shrubland (CEGL001289) Atriplex canescens / Bouteloua gracilis Shrubland (CEGL001283) Atriplex canescens / Calycoseris parryi Shrubland (CEGL001284) Atriplex canescens / Parthenium confertum Shrubland (CEGL001290) Atriplex canescens / Pleuraphis jamesii Shrubland (CEGL001288) Atriplex canescens / Purshia stansburiana Shrubland (CEGL001286) Atriplex canescens / Sporobolus airoides Shrubland (CEGL001291) Atriplex canescens / Sporobolus wrightii Shrubland (CEGL001292) Atriplex canescens Shrubland (CEGL001281)
• ATRIPLEX CONFERTIFOLIA SHRUBLAND ALLIANCE (A.870) Atriplex confertifolia - Ephedra nevadensis Shrubland (CEGL001303) Atriplex confertifolia - Krascheninnikovia lanata Shrubland (CEGL001301) Atriplex confertifolia - Lycium andersonii Shrubland (CEGL001308) Atriplex confertifolia - Lycium pallidum / Mirabilis pudica Shrubland (CEGL001309) Atriplex confertifolia - Lycium shockleyi Shrubland (CEGL001310) Atriplex confertifolia - Picrothamnus desertorum / Achnatherum hymenoides Shrubland (CEGL001297) Atriplex confertifolia - Picrothamnus desertorum / Krascheninnikovia lanata Shrubland (CEGL001296) Atriplex confertifolia - Picrothamnus desertorum / Sarcobatus vermiculatus Shrubland (CEGL001298) Atriplex confertifolia - Picrothamnus desertorum Shrubland (CEGL001295) Atriplex confertifolia - Sarcobatus vermiculatus Shrubland (CEGL001313) Atriplex confertifolia / Achnatherum hymenoides Shrubland (CEGL001311) Atriplex confertifolia / Elymus elymoides Shrubland (CEGL001302) Atriplex confertifolia / Ericameria nauseosa Shrubland (CEGL001300) Atriplex confertifolia / Hesperostipa comata Shrubland (CEGL001314) Atriplex confertifolia / Kochia americana Shrubland (CEGL001305) Atriplex confertifolia / Leymus salinus Shrubland (CEGL001307) Atriplex confertifolia / Leymus salinus ssp. salmonis Shrubland (CEGL001306) Atriplex confertifolia / Pleuraphis jamesii Shrubland (CEGL001304) Atriplex confertifolia / Pseudoroegneria spicata Shrubland (CEGL001312) Atriplex confertifolia / Tetradymia glabrata Shrubland (CEGL001315) Atriplex confertifolia Great Basin Shrubland (CEGL001294) Atriplex confertifolia Wyoming Basins Shrubland (CEGL001293)

- ATRIPLEX OBOVATA DWARF-SHRUBLAND ALLIANCE (A.1108) Atriplex obovata / Sporobolus airoides - Sporobolus cryptandrus Dwarf-shrubland (CEGL001447) Atriplex obovata / Tidestromia carnosa Dwarf-shrubland (CEGL004575)
- ATRIPLEX PARRYI SHRUBLAND ALLIANCE (A.2507) Atriplex parryi Shrubland [Placeholder] (CEGL002711)
- ATRIPLEX POLYCARPA SHRUBLAND ALLIANCE (A.873) Atriplex polycarpa / Pleuraphis mutica Shrubland (CEGL001319) Atriplex polycarpa Shrubland (CEGL001318)
- ATRIPLEX SPINIFERA SHRUBLAND ALLIANCE (A.865) Atriplex spinifera Shrubland [Placeholder] (CEGL003015)
- KRASCHENINNIKOVIA LANATA DWARF-SHRUBLAND ALLIANCE (A.1104) Krascheninnikovia lanata / Achnatherum hymenoides Dwarf-shrubland (CEGL001323) Krascheninnikovia lanata / Hesperostipa comata Dwarf-shrubland (CEGL001327) Krascheninnikovia lanata Dwarf-shrubland [Provisional] (CEGL001320)
- PICROTHAMNUS DESERTORUM SHRUBLAND ALLIANCE (A.1128) Picrothamnus desertorum / Elymus elymoides Shrubland [Provisional] (CEGL002992) Picrothamnus desertorum Shrubland (CEGL001452)
- PLEURAPHIS JAMESII SHRUB HERBACEOUS ALLIANCE (A.1532) Atriplex obovata / Pleuraphis jamesii - Sporobolus airoides Shrub Herbaceous Vegetation (CEGL001775)

- **California community types:**
- Fourwing Saltbush Scrub (36.310.00)
- Fourwing Saltbush (36.310.01)
- Shadscale - Fourwing Saltbush (36.320.06)
- Shadscale - Winter Fat (36.320.08)
- Spinescale Scrub (36.350.00)
- Great Valley Spinescale Scrub (36.351.00)
- Winter Fat dwarf scrub (36.500.00)

Environment: This salt-desert shrubland system is a matrix system in the Intermountain West. This system is comprised of arid to semi-arid shrublands on lowland and upland sites usually at elevations between 4,987 to ,7,218 feet (1,520 to 2,200 meters). Sites can be found on all aspects and include valley bottoms, alluvial and alkaline flats, mesas and plateaus, playas, drainage terraces, washes and interdune basins, bluffs, and gentle to moderately steep sandy or rocky slopes. Slopes are typically gentle to moderately steep, but are sometimes unstable and prone to surface movement. Many areas within this system are degraded due to erosion and may resemble “badlands.” Soil surface is often very barren in occurrences of this system. The interspaces between the characteristic plant clusters are commonly covered by a microphytic crust (West 1982).

This is typically a system of extreme climatic conditions, with warm to hot summers and freezing winters. Annual precipitation ranges from approximately 13-33 cm. In much of the ecological system, the period of greatest moisture will be mid- to late summer, although in the more northern areas a moist period is to be expected in the cold part of the year. However, plotted seasonality of occurrence is probably of less importance on this desert system than in other ecosystems because desert precipitation comes with an extreme irregularity that does not appear in graphs of long-term seasonal or monthly averages (Blaisdell and Holmgren 1984). Soils are shallow to moderately deep, poorly developed, and a product of an arid climate and little precipitation. Soils are often alkaline or saline. Vegetation within this system is tolerant of these soil conditions but not restricted to it. The shallow soils of much of the area are poorly developed Entisols. Vegetation within this system can occur on level pediment remnants where coarse-textured and well-developed soil profiles have been derived from sandstone gravel and are alkaline, or on Mancos shale badlands, where soil profiles are typically fine-textured and non-alkaline throughout (West and Ibrahim 1968). They can also occur in alluvial basins where parent materials from the other habitats have been deposited over Mancos shale and the soils are heavy-textured and saline-alkaline throughout the profile (West and Ibrahim 1968).

Vegetation: Occurrences of this ecological system vary from almost pure occurrences of single species to fairly complex mixtures. The characteristic mix of low shrubs and grasses is sparse, with large open spaces between the plants (Blaisdell and Holmgren 1984). Occurrences have a sparse to moderately dense cover of woody species that is dominated by *Atriplex canescens* (may codominate with *Artemisia tridentata*), *Atriplex confertifolia* (may codominate with *Lycium andersonii*), *Atriplex obovata, Picrothamnus desertorum*, or *Krascheninnikovia lanata*. Other shrubs that may occur within these occurrences include *Purshia stansburiana, Psorothamnus polydenius, Ephedra* spp., *Acacia greggii, Encelia frutescens, Tiquilia latior, Parthenium confertum, Atriplex polycarpa, Atriplex lentiformis, Atriplex spinifera, Picrothamnus desertorum (= Artemisia spinescens), Frankenia salina, Artemisia frigida, Chrysothamnus* spp., *Lycium* ssp., *Suaeda* spp., *Yucca glauca*, and *Tetradymia spinosa*. Dwarf-shrubs include *Gutierrezia sarothrae* and *Eriogonum* spp. Warm-season medium-tall and short perennial grasses dominate in the sparse to moderately dense graminoid layer. The species present depend on the geographic range of the grasses, alkalinity/salinity and past land use. Species may include *Pleuraphis jamesii, Bouteloua gracilis, Sporobolus airoides, Sporobolus cryptandrus, Achnatherum hymenoides, Elymus elymoides, Distichlis spicata, Leymus salinus, Pascopyrum smithii, Hesperostipa comata, Pseudoroegneria spicata, Poa secunda, Leymus ambiguus*, and *Muhlenbergia torreyi*. A number of annual species may also grow in association with the shrubs and grasses of this system, although they are usually rare and confined to areas of recent disturbance (Blaisdell and Holmgren 1984). Forb cover is generally sparse. Perennial forbs that might occur include *Sphaeralcea coccinea, Chaetopappa ericoides, Xylorhiza venusta, Descurainia sophia*, and *Mentzelia* species. Annual natives include *Plantago* spp., *Vulpia octoflora*, or *Monolepis nuttalliana*. Associated halophytic annuals include *Salicornia rubra, Salicornia bigelovii*, and *Suaeda* species. Exotic annuals that may occur include *Salsola kali, Bromus rubens*, and *Bromus tectorum*. Cacti like *Opuntia* spp. and *Echinocereus* spp. may be present in some occurrences. Trees are not usually present but some scattered *Juniperus* spp. may be found.

Dynamics: West (1982) stated that “salt desert shrub vegetation occurs mostly in two kinds of situations that promote soil salinity, alkalinity, or both. These are either at the bottom of drainages in enclosed basins or where marine shales outcrop.” However, salt-desert shrub vegetation may be an indication of climatically dry as well as physiologically dry soils (Blaisdell and Holmgren 1984). Not all salt-desert shrub soils are salty, and their hydrologic characteristics may often be responsible for the associated vegetation (Naphan 1966). Species of the salt-desert shrub complex have different degrees of tolerance to salinity and aridity, and they tend to sort themselves out along a moisture/salinity gradient (West 1982). Species and communities are apparently sorted out along physical, chemical, moisture, and topographic gradients through complex relations that are not understood and are in need of further study (Blaisdell and Holmgren 1984).

The winter months within this system are a good time for soil moisture accumulation and storage. There is generally at least one good snow storm per season that will provide sufficient moisture to the vegetation. The winter moisture accumulation amounts will affect spring plant growth. Plants may grow as little as a few inches (centimeters) to three feet (one meter). Unless more rains come in the spring, the soil moisture will be depleted in a few weeks, growth will slow and ultimately cease, and the perennial plants will assume their various forms of dormancy (Blaisdell and Holmgren 1984). If effective rain comes later in the warm season, some of the species will renew their growth from the stage at which it had stopped. Others, having died back, will start over as if emerging from winter dormancy (Blaisdell and Holmgren 1984). *Atriplex confertifolia* shrubs often develop large leaves in the spring, which increase the rate of photosynthesis. As soil moisture decreases, the leaves are lost, and the plant takes on a dead appearance. During late fall, very small overwintering leaves appear which provide some photosynthetic capability through the remainder of the year (IVC 1999). Other communities are maintained by intra- or inter-annual cycles of flooding followed by extended drought, which favor accumulation of transported salts. The moisture supporting these intermittently flooded wetlands is usually derived off-site, and they are dependent upon natural watershed function for persistence (Reid et al. 1999).

In summary, desert communities of perennial plants are dynamic and changing. The composition within this system may change dramatically and may be both cyclic and unidirectional. Superimposed on the compositional change is great variation from year to year in growth of all the vegetation – the sum of varying growth responses of individual species to specific conditions of different years (Blaisdell and Holmgren 1984). Desert plants grow when temperature is satisfactory, but only if soil moisture is available at the same time. Because amount of moisture is variable from year to year and because different species flourish under different seasons of soil moisture, seldom do all components of the vegetation thrive in the same year (Blaisdell and Holmgren 1984).

SOURCES

References: Barbour and Major 1988, Blaisdell and Holmgren 1984, Branson et al. 1967, Branson et al. 1976, Brown 1982, Campbell 1977, Francis 1986, Holland and Keil 1995, Reid et al. 1999, West 1979, West 1982, West 1983b, West and Ibrahim 1968

Last updated: 20 Feb 2003 **Stakeholders:** WCS, MCS

Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S069 SONORA-MOJAVE CREOSOTEBUSH-WHITE BURSAGE DESERT SCRUB
Division 302, Shrubland, CES302.756
Spatial Scale & Pattern: Matrix **Classification Confidence:** high
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Lowland [Lowland], Shrubland (Shrub-dominated), Tropical/Subtropical [Tropical Xeric], Temperate [Temperate Xeric], Aridic, Xeromorphic Shrub

Non-Diagnostic Classifiers: Toeslope/Valley Bottom, Alkaline Soil, W-Landscape/Medium Intensity

Concept Summary: This ecological system forms the vegetation matrix in broad valleys, lower bajadas, plains and low hills in the Mojave and lower Sonoran deserts. This desert scrub is characterized by a sparse to moderately dense layer (2-50% cover) of xeromorphic microphyllous and broad-leaved shrubs. *Larrea tridentata* and *Ambrosia dumosa* are typically dominants, but many different shrubs, dwarf-shrubs, and cacti may codominate or form typically sparse understories. Associated species may include *Atriplex canescens, Atriplex hymenelytra, Encelia farinosa, Ephedra nevadensis, Fouquieria splendens, Lycium andersonii*, and *Opuntia basilaris*. The herbaceous layer is typically sparse, but may be seasonally abundant with ephemerals. Herbaceous species such as *Chamaesyce* spp., *Eriogonum inflatum, Dasyochloa pulchella, Aristida* spp., *Cryptantha* spp., *Nama* spp., and *Phacelia* spp. are common.

DISTRIBUTION

Range: Broad valleys, lower bajadas, plains and low hills in the Mojave and lower Sonoran deserts.
Ecological Divisions: 302
TNC Ecoregions: 17:C, 23:C
Subnations/Nations: AZ:c, CA:c, MXBC:c, MXSO:c, NV:c, UT:c

CONCEPT

Alliances and Associations:

• AMBROSIA DELTOIDEA SHRUBLAND ALLIANCE (A.852) Ambrosia deltoidea / Simmondsia chinensis Shrubland (CEGL000953)
• AMBROSIA DUMOSA DWARF-SHRUBLAND ALLIANCE (A.1102) Ambrosia dumosa - Ephedra nevadensis Dwarf-shrubland (CEGL000954) Ambrosia dumosa - Larrea tridentata var. tridentata Dwarf-shrubland (CEGL000956) Ambrosia dumosa / Pleuraphis rigida Dwarf-shrubland (CEGL000955)
• ERIOGONUM FASCICULATUM SHRUBLAND ALLIANCE (A.868) Eriogonum fasciculatum - Purshia glandulosa Shrubland (CEGL001259) Eriogonum fasciculatum Rock Outcrop Shrubland (CEGL001260) Eriogonum fasciculatum Shrubland (CEGL001258)
• GRAYIA SPINOSA - EPHEDRA VIRIDIS SHRUBLAND ALLIANCE (A.1057) Grayia spinosa - Ephedra viridis Shrubland (CEGL001346)
• GRAYIA SPINOSA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.1045) Grayia spinosa - Lycium andersonii Shrubland (CEGL001347) Grayia spinosa - Lycium pallidum Shrubland (CEGL001348)
• GRAYIA SPINOSA SHRUBLAND ALLIANCE (A.1038) Grayia spinosa - Menodora spinescens Shrubland (CEGL001349) Grayia spinosa - Prunus andersonii Shrubland (CEGL001352) Grayia spinosa / Achnatherum hymenoides Shrubland (CEGL001350) Grayia spinosa / Achnatherum thurberianum Shrubland (CEGL002681) Grayia spinosa / Picrothamnus desertorum Shrubland (CEGL001345)
• LARREA TRIDENTATA - AMBROSIA DUMOSA SHRUBLAND ALLIANCE (A.2532) Larrea tridentata - Ambrosia dumosa Shrubland [Placeholder] (CEGL002954)
• LARREA TRIDENTATA - ENCELIA FARINOSA SHRUBLAND ALLIANCE (A.2533) Larrea tridentata - Encelia farinosa Shrubland [Placeholder] (CEGL002955)
• LARREA TRIDENTATA SHRUBLAND ALLIANCE (A.851) Larrea tridentata - Atriplex confertifolia Shrubland (CEGL001263) Larrea tridentata - Atriplex hymenelytra Shrubland (CEGL001264) Larrea tridentata - Coleogyne ramosissima Shrubland (CEGL002717) Larrea tridentata - Ephedra nevadensis Shrubland (CEGL001268) Larrea tridentata - Opuntia basilaris - Fouquieria splendens Shrubland (CEGL001273) Larrea tridentata / Lycium andersonii - Grayia spinosa Shrubland (CEGL001271) Larrea tridentata / Yucca spp. Shrubland (CEGL001278) Larrea tridentata Monotype Shrubland (CEGL001261)

• **California community types:**
• Creosote Bush Scrub (33.010.00)
• Creosote Bush with disturbance (33.010.01)
• High Diversity Creosote Scrub (33.010.03)
• Creosote Bush - Shockley's Goldenhead (33.010.18)
• White Bursage -Rayless Goldenhead (33.060.01)

• White Bursage (33.060.02)
• White Bursage - Big Galleta (33.060.04)
• White Bursage - California Buckwheat (33.060.05)
• Creosote Bush - White Bursage Scrub (33.140.00)
• Sonoran Creosote Bush Scrub (33.140.04)
• Uniform Creosote Scrub (33.140.05)
• Mojave Creosote Bush Scrub (33.140.06)
• Creosote Bush - White Bursage - Indigo Bush (33.140.07)
• Creosote Bush - White Bursage - California Croton (33.140.08)
• Creosote Bush - White Bursage - Galium - Lyrocarpa (33.140.10)
• Creosote Bush - White Bursage - Mojave Yucca (33.140.11)
• Creosote Bush - White Bursage - Desert Sunflower (33.140.12)
• Creosote Bush - White Bursage - Spiny Senna (33.140.13)
• Creosote Bush - White Bursage - Bladder Sage (33.140.14)
• Creosote Bush - White Bursage - Mojave indigo-bush (33.140.15)
• Creosote Bush - White Bursage - Fremont's indigo-bush (33.140.16)
• Creosote Bush - White Bursage - Big Galleta (33.140.17)
• Creosote Bush - White Bursage - Pencil Cactus (33.140.18)
• Creosote Bush - White Bursage - Anderson's Wolfberry (33.140.19)
• Creosote Bush - White Bursage - Nevada Ephedra (33.140.20)
• Creosote Bush - White Bursage - Desert Peppergrass (33.140.21)
• Creosote Bush - White Bursage - White Ratany (33.140.22)
• Creosote Bush - White Bursage - Pima Ratany (33.140.23)
• Creosote Bush - White Bursage - Thurber's Sandpaper Plant (33.140.24)
• Creosote Bush - White Bursage - Matchweed spp. (33.140.25)
• Creosote Bush - White Bursage - Hop-sage (33.140.26)
• Creosote Bush - White Bursage - Desert Trumpet (33.140.27)
• Creosote Bush - White Bursage - California Buckwheat (33.140.28)
• Creosote Bush - White Bursage - Death Valley Ephedra (33.140.29) • Creosote Bush - White Bursage - Desert Tea (33.140.30)
• Creosote Bush - White Bursage - Virgin River Encelia (33.140.31)
• Creosote Bush - White Bursage - Brittlebush (33.140.32)
• Creosote Bush - White Bursage - Barrel Cactus (33.140.33)
• Creosote Bush - White Bursage - Downy Dalea (33.140.34)
• Creosote Bush - White Bursage - Cryptogamic crust (33.140.35)
• Creosote Bush - White Bursage - Sweetbush (33.140.36)
• Creosote Bush - White Bursage - Fremont's Chaff-bush (33.140.40)
• Creosote Bush - White Bursage - Fagonia (33.140.41)

SOURCES

References: Barbour and Major 1988, Brown 1982, Holland and Keil 1995, MacMahon 1988, Thomas et al. 2003a
Last updated: 20 Feb 2003 **Stakeholders:** WCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S070 SONORA-MOJAVE MIXED SALT DESERT SCRUB
Division 302, Shrubland, CES302.749
Spatial Scale & Pattern: Large Patch **Classification Confidence:** low
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Lowland [Lowland], Shrubland (Shrub-dominated), Basin floor, Toeslope/Valley Bottom, Temperate [Temperate Xeric], Alkaline Soil, Atriplex spp.

Non-Diagnostic Classifiers: Tropical/Subtropical [Tropical Xeric], Saline Substrate Chemistry, Aridic

Concept Summary: This system includes extensive open-canopied shrublands of typically saline basins in the Mojave and Sonoran deserts. Stands often occur around playas. Substrates are generally fine-textured, saline soils. Vegetation is typically composed of one or more *Atriplex* species such as *Atriplex canescens* or *Atriplex polycarpa* along with other species of *Atriplex*. Species of *Allenrolfea, Salicornia, Suaeda*, or other halophytic plants are often present to codominant. Graminoid species may include *Sporobolus airoides* or *Distichlis spicata* at varying densities.

Comments: This is a very broad concept. Possibly split Baja maritime salt flats out.

DISTRIBUTION

Range: Saline basins in the Mojave and Sonoran deserts.
Ecological Divisions: 302
TNC Ecoregions: 17:C, 22:C, 23:C
Subnations/Nations: AZ:c, CA:c, MXBC:c, MXSO:c, NV:c, UT:c

CONCEPT

Alliances and Associations:

- ATRIPLEX (LENTIFORMIS, POLYCARPA) SHRUBLAND ALLIANCE (A.864) Atriplex (lentiformis, polycarpa) Shrubland [Placeholder] (CEGL003016)
- ATRIPLEX CANESCENS SHRUBLAND ALLIANCE (A.869) Atriplex canescens - Artemisia tridentata Shrubland (CEGL001282) Atriplex canescens - Ephedra viridis Shrubland (CEGL001287) Atriplex canescens - Krascheninnikovia lanata Shrubland (CEGL001285) Atriplex canescens / Bouteloua gracilis Shrubland (CEGL001283) Atriplex canescens / Calycoseris parryi Shrubland (CEGL001284) Atriplex canescens / Pleuraphis jamesii Shrubland (CEGL001288) Atriplex canescens Shrubland (CEGL001281)
- ATRIPLEX CONFERTIFOLIA SHRUBLAND ALLIANCE (A.870) Atriplex confertifolia - Atriplex polycarpa Shrubland (CEGL001299) Atriplex confertifolia - Ephedra nevadensis Shrubland (CEGL001303) Atriplex confertifolia - Lycium andersonii Shrubland (CEGL001308) Atriplex confertifolia - Sarcobatus vermiculatus Shrubland (CEGL001313)
- ATRIPLEX HYMENELYTRA SHRUBLAND ALLIANCE (A.872) Atriplex hymenelytra Shrubland (CEGL001317)
- ATRIPLEX POLYCARPA SHRUBLAND ALLIANCE (A.873) Atriplex polycarpa Shrubland (CEGL001318)
- ATRIPLEX SPINIFERA SHRUBLAND ALLIANCE (A.865) Atriplex spinifera Shrubland [Placeholder] (CEGL003015)
- DISTICHLIS SPICATA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE (A.1332) Distichlis spicata Herbaceous Vegetation (CEGL001770)

- **California community types:**
- Saltbush - Creosote Bush (33.010.05)
- Creosote Bush - White Ratany - Big Galleta (33.010.07)
- Creosote Bush / Desert Trumpet (33.010.09)
- Creosote Bush - Allscale (33.010.12)
- Creosote Bush - Desert-holly (33.010.16)
- Creosote Bush - Shadscale (33.010.17)
- White Bursage - Desert-holly (33.060.03)
- Creosote Bush - White Bursage - Desert-holly (33.140.09)
- Creosote Bush - White Bursage - Fourwing Saltbush (33.140.37)
- Creosote Bush - White Bursage - Allscale (33.140.38)
- Creosote Bush - White Bursage - Shadscale (33.140.39)
- Anderson's Wolfberry (33.360.00)
- Anderson's Wolfberry - Jojoba - Big Galleta (33.360.01)
- Desert Saltbush Scrub (36.301.00)

- Valley Saltbush Scrub (36.302.00)
- Interior Coast Range Saltbush Scrub (36.303.00)
- Shadscale - Nevada Ephedra (36.320.02)
- Shadscale - White Bursage (36.320.03)
- Desert-holly (36.330.01)
- Desert-holly - White Bursage (36.330.02)
- Desert-holly - Creosote Bush - White Bursage (36.330.03)
- Desert-holly - Arizona Honeysweet (36.330.04)
- Allscale Scrub (36.340.00)
- Great Valley Allscale Scrub (36.341.00)
- Sierra-Tehachapi Saltbush Scrub (36.342.00)
- Allscale - Shadscale (36.360.02)
- Quailbush Scrub (36.370.00)
- Big Saltbush - Allscale Scrub (36.370.01)

SOURCES

References: Barbour and Major 1988, Brown 1982, Holland and Keil 1995, MacMahon 1988, Thomas et al. 2003a
Last updated: 20 Feb 2003 **Stakeholders:** WCS, SCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S071 INTER-MOUNTAIN BASINS MONTANE SAGEBRUSH STEPPE
Division 304, Steppe/Savanna, CES304.785
Spatial Scale & Pattern: Matrix **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Montane [Upper Montane], Montane [Montane], Montane [Lower Montane], Woody-Herbaceous

Non-Diagnostic Classifiers: Mountainside, Mountain valley, Plateau, Sideslope, Toeslope/Valley Bottom, Temperate [Temperate Continental], Long Disturbance Interval, F-Patch/Medium Intensity, Broad-Leaved Evergreen Shrub, Graminoid, Bunch grasses, Artemisia tridentata ssp. vaseyana

Concept Summary: This ecological system includes sagebrush communities occurring at montane and subalpine elevations across the western U.S. from 1000 m in eastern Oregon and Washington to over 3000 m in the southern Rockies. Climate is cool, semi-arid to subhumid. This system primarily occurs on deep-soiled to stony flats, ridges, nearly flat ridgetops, and mountain slopes. In general this system shows an affinity for mild topography, fine soils, and some source of subsurface moisture. It is composed primarily of mountain sagebrush (*Artemisia tridentata ssp. vaseyana*) and related taxa such as *Artemisia tridentata ssp. spiciformis (= Artemisia spiciformis)*, non-riparian *Artemisia cana ssp. viscidula*, and *Artemisia arbuscula ssp. arbuscula*. *Purshia tridentata* may codominate or even dominate some stands. Other common shrubs include *Symphoricarpos* spp., *Amelanchier* spp., *Ericameria nauseosa, Peraphyllum ramosissimum, Ribes cereum*, and *Chrysothamnus viscidiflorus*. Most stands have an abundant perennial herbaceous layer (over 25% cover), but this system also includes *Artemisia tridentata ssp. vaseyana* shrublands. Common graminoids include *Festuca arizonica, Festuca idahoensis, Hesperostipa comata, Poa fendleriana, Elymus trachycaulus, Bromus carinatus, Poa secunda, Leucopoa kingii, Deschampsia caespitosa*, and *Pseudoroegneria spicata*. Frequent wildfire maintains an open herbaceous-rich steppe condition.

DISTRIBUTION

Range: Montane and subalpine elevations across the western U.S. from 1000 m in eastern Oregon and Washington to over 3000 m in the southern Rockies.
Ecological Divisions: 304, 306
TNC Ecoregions: 12:C, 18:C, 19:C, 20:C, 6:C, 7:C, 8:C, 9:C
Subnations/Nations: AZ:?, CA:c, CO:c, ID:c, MT:c, NM:c, NV:p, OR:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:
- ARTEMISIA ARBUSCULA SSP. ARBUSCULA SHRUB HERBACEOUS ALLIANCE (A.1566) Artemisia arbuscula ssp. arbuscula - Purshia tridentata / Pseudoroegneria spicata - Festuca idahoensis Shrub Herbaceous Vegetation (CEGL001518) Artemisia arbuscula ssp. arbuscula / Achnatherum thurberianum Shrub Herbaceous Vegetation (CEGL001413) Artemisia arbuscula ssp. arbuscula / Festuca idahoensis Shrub Herbaceous Vegetation (CEGL001409) Artemisia arbuscula ssp. arbuscula / Leymus salinus ssp. salmonis Shrub Herbaceous Vegetation (CEGL001410) Artemisia arbuscula ssp. arbuscula / Poa secunda Shrub Herbaceous Vegetation (CEGL001411) Artemisia arbuscula ssp. arbuscula / Pseudoroegneria spicata Shrub Herbaceous Vegetation (CEGL001412)
- ARTEMISIA ARBUSCULA SSP. ARBUSCULA SHRUBLAND ALLIANCE (A.2547) Artemisia arbuscula ssp. arbuscula - Artemisia tridentata ssp. vaseyana / Festuca idahoensis Shrubland [Provisional] (CEGL002982)
- ARTEMISIA ARBUSCULA SSP. THERMOPOLA SHRUB HERBACEOUS ALLIANCE (A.2553) Artemisia arbuscula ssp. thermopola / Festuca idahoensis Shrub Herbaceous Vegetation (CEGL001519)
- ARTEMISIA CANA (SSP. BOLANDERI, SSP. VISCIDULA) SHRUB HERBACEOUS ALLIANCE (A.1531) Artemisia cana (ssp. bolanderi, ssp. viscidula) - Artemisia tridentata ssp. vaseyana / Poa cusickii Shrub Herbaceous Vegetation [Provisional] (CEGL001549) Artemisia cana (ssp. bolanderi, ssp. viscidula) / Poa fendleriana ssp. fendleriana Shrub Herbaceous Vegetation (CEGL001551) Artemisia cana ssp. bolanderi / Muhlenbergia richardsonis Shrub Herbaceous Vegetation (CEGL001743) Artemisia cana ssp. viscidula / Festuca idahoensis Shrub Herbaceous Vegetation (CEGL001552)
- ARTEMISIA CANA (SSP. BOLANDERI, SSP. VISCIDULA) SHRUBLAND ALLIANCE (A.2557) Artemisia cana (ssp. bolanderi, ssp. viscidula) / Leymus cinereus Shrubland (CEGL001460) Artemisia cana (ssp. bolanderi, ssp. viscidula) / Poa pratensis Semi-natural Shrubland (CEGL002988) Artemisia cana (ssp. bolanderi, ssp. viscidula) / Poa secunda Shrubland (CEGL001548) Artemisia cana ssp. bolanderi / Eleocharis palustris Shrubland (CEGL002987) Artemisia cana ssp. viscidula - (Salix spp.) / Festuca idahoensis Shrubland (CEGL001075) Artemisia cana ssp. viscidula / Deschampsia caespitosa Shrubland (CEGL001074) Artemisia cana ssp. viscidula / Festuca ovina Shrubland (CEGL001076) Artemisia cana ssp. viscidula / Festuca thurberi Shrubland (CEGL001071) Artemisia cana ssp. viscidula / Purshia tridentata Shrubland (CEGL001073)

• ARTEMISIA TRIDENTATA SHRUB HERBACEOUS ALLIANCE (A.1521) Artemisia tridentata / Festuca idahoensis Shrub Herbaceous Vegetation (CEGL001530)
• ARTEMISIA TRIDENTATA SHRUBLAND ALLIANCE (A.829) Artemisia tridentata Upperzone Community Shrubland (CEGL001013)
• ARTEMISIA TRIDENTATA SSP. SPICIFORMIS SHRUB HERBACEOUS ALLIANCE (A.2555) Artemisia tridentata ssp. spiciformis Shrub Herbaceous Vegetation [Provisional] (CEGL002993)
• ARTEMISIA TRIDENTATA SSP. SPICIFORMIS SHRUBLAND ALLIANCE (A.2550) Artemisia tridentata ssp. spiciformis / Bromus carinatus Shrubland (CEGL002989) Artemisia tridentata ssp. spiciformis / Carex geyeri Shrubland (CEGL002990)
• ARTEMISIA TRIDENTATA SSP. VASEYANA SHRUB HERBACEOUS ALLIANCE (A.1526) Artemisia tridentata ssp. vaseyana / Carex geyeri Shrub Herbaceous Vegetation (CEGL001532) Artemisia tridentata ssp. vaseyana / Festuca campestris Shrub Herbaceous Vegetation (CEGL001531) Artemisia tridentata ssp. vaseyana / Festuca idahoensis Shrub Herbaceous Vegetation (CEGL001533)
• ARTEMISIA TRIDENTATA SSP. VASEYANA SHRUBLAND ALLIANCE (A.831) Artemisia tridentata ssp. vaseyana - Purshia tridentata / Pseudoroegneria spicata Shrubland (CEGL001032) Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Bromus carinatus Shrubland (CEGL001035) Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Elymus trachycaulus ssp. trachycaulus Shrubland (CEGL001034) Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Festuca idahoensis Shrubland (CEGL001036) Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Hesperostipa comata Shrubland (CEGL001039) Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Poa secunda Shrubland (CEGL001037) Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Pseudoroegneria spicata Shrubland (CEGL001038) Artemisia tridentata ssp. vaseyana / Achnatherum occidentale Shrubland (CEGL001033) Artemisia tridentata ssp. vaseyana / Balsamorhiza sagittata Shrubland (CEGL001020) Artemisia tridentata ssp. vaseyana / Bromus carinatus Shrubland (CEGL001021) Artemisia tridentata ssp. vaseyana / Carex exserta Shrubland (CEGL008651) Artemisia tridentata ssp. vaseyana / Festuca idahoensis - Bromus carinatus Shrubland (CEGL001023) Artemisia tridentata ssp. vaseyana / Festuca thurberi Shrubland (CEGL001024) Artemisia tridentata ssp. vaseyana / Hesperostipa comata Shrubland (CEGL002931) Artemisia tridentata ssp. vaseyana / Leucopoa kingii - Koeleria macrantha Shrubland (CEGL001026) Artemisia tridentata ssp. vaseyana / Leucopoa kingii Shrubland (CEGL001025) Artemisia tridentata ssp. vaseyana / Leymus cinereus Shrubland (CEGL001027) Artemisia tridentata ssp. vaseyana / Pascopyrum smithii Shrubland (CEGL001028) Artemisia tridentata ssp. vaseyana / Phlox condensata Shrubland (CEGL002770) Artemisia tridentata ssp. vaseyana / Poa secunda Shrubland (CEGL001029) Artemisia tridentata ssp. vaseyana / Pseudoroegneria spicata - Poa fendleriana Shrubland (CEGL001031) Artemisia tridentata ssp. vaseyana / Pseudoroegneria spicata Shrubland (CEGL001030)
• ARTEMISIA TRIDENTATA SSP. WYOMINGENSIS SHRUBLAND ALLIANCE (A.832) Artemisia tridentata ssp. wyomingensis - Peraphyllum ramosissimum / Festuca idahoensis Shrubland (CEGL001048)
• SYMPHORICARPOS OREOPHILUS SHRUBLAND ALLIANCE (A.2530) Symphoricarpos oreophilus / Poa pratensis Semi-natural Shrubland [Provisional] (CEGL002951)

• **California community types:**
• Wright's Buckwheat Dwarf Scrub (32.041.00)
• Big Sagebrush - Rubber Rabbitbrush (35.110.01)
• Low Sagebrush / Mono Clover (35.120.01)
• Low Sagebrush / Stemless Haplopappus (35.120.02)
• Rothrock Sagebrush Scrub (35.140.00)
• Rothrock Sagebrush / Heretic Penstemon (35.140.01)
• Rothrock Sagebrush / Mountain Monardella (35.140.02)
• Silver Sagebrush Scrub (35.150.00)

Environment: This ecological system occurs in many of the western United States, usually at middle elevations (1000-2500 m). The climate regime is cool, semi-arid to subhumid, with yearly precipitation ranging from 25 to 90 cm/year. Much of this precipitation falls as snow. Temperatures are continental with large annual and diurnal variation. In general this system shows an affinity for mild topography, fine soils, and some source of subsurface moisture. Soils generally are moderately deep to deep, well-drained, and of loam, sandy loam, clay loam, or gravelly loam textural classes; soils often have a substantial volume of coarse fragments, and are derived from a variety of parent materials. This system primarily occurs on deep-soiled to stony flats, ridges, nearly flat ridgetops, and mountain slopes. All aspects are represented, but the higher elevation occurrences may be restricted to south- or west-facing slopes.

Vegetation: Vegetation types within this ecological system are usually less than 1.5 m tall and dominated by *Artemisia tridentata ssp. vaseyana, Artemisia cana ssp. viscidula*, or *Artemisia tridentata ssp. spiciformis*. A variety of other shrubs can be found in some occurrences, but these are seldom dominant. They include *Artemisia rigida, Artemisia arbuscula, Ericameria nauseosa, Chrysothamnus viscidiflorus, Symphoricarpos oreophilus, Purshia tridentata, Peraphyllum ramosissimum, Ribes cereum, Rosa woodsii, Ceanothus velutinus*, and *Amelanchier alnifolia*. The canopy cover is usually between 20-80%. The herbaceous layer is usually well represented, but bare ground may be common in particularly arid or disturbed occurrences. Graminoids that can be abundant include *Festuca idahoensis, Festuca thurberi, Festuca ovina, Elymus elymoides, Deschampsia caespitosa, Danthonia intermedia, Danthonia parryi, Stipa* spp., *Pascopyrum smithii, Bromus carinatus, Elymus trachycaulus, Koeleria macrantha, Pseudoroegneria spicata, Poa fendleriana*, or *Poa secunda*, and *Carex* spp. Forbs are often numerous and an important indicator of health. Forb species may include *Castilleja, Potentilla, Erigeron, Phlox, Astragalus, Geum, Lupinus*, and *Eriogonum, Balsamorhiza sagittata, Achillea millefolium, Antennaria rosea*, and *Eriogonum umbellatum, Fragaria virginiana, Artemisia ludoviciana, Hymenoxys hoopesii (= Helenium hoopesii)*, etc.

Dynamics: Healthy sagebrush shrublands are very productive, are often grazed by domestic livestock, and are strongly preferred during the growing season (Padgett et al. 1989). Prolonged livestock use can cause a decrease in the abundance of native bunch grasses and increase in the cover of shrubs and non-native grass species, such as *Poa pratensis*. *Artemisia cana* resprouts vigorously following spring fire, and prescribed burning may increase shrub cover. Conversely, fire in the fall may decrease shrub abundance (Hansen et al. 1995). *Artemisia tridentata* is generally killed by fires and may take over ten years to form occurrences of some 20% cover or more. The condition of most sagebrush steppe has been degraded due to fire suppression and heavy livestock grazing. It is unclear how long restoration will take to restore degraded occurrences.

SOURCES

References: Hansen et al. 1995, Hironaka et al. 1983, Johnston 2001, Mueggler and Stewart 1980, Neely et al. 2001, Padgett et al. 1989, West 1983c

Last updated: 20 Feb 2003 **Stakeholders:** WCS, MCS

Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S075 INTER-MOUNTAIN BASINS JUNIPER SAVANNA
Division 304, Steppe/Savanna, CES304.782
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Temperate [Temperate Continental], Intermediate Disturbance Interval, F-Landscape/Medium Intensity, Evergreen Sclerophyllous Tree, Graminoid

Non-Diagnostic Classifiers: Lowland [Foothill], Lowland [Lowland], Woody-Herbaceous, Ridge/Summit/Upper Slope, Sideslope, Toeslope/Valley Bottom, Calcareous

Concept Summary: This widespread ecological system occupies dry foothills and sandsheets of western Colorado, central Utah, west into the Great Basin of Nevada and southern Idaho. It is typically found at lower elevations ranging from 1500-2300 m. This system is generally found at lower elevations and more xeric sites than Great Basin Pinyon-Juniper Woodland (CES304.773) or Colorado Plateau Pinyon-Juniper Woodland (CES304.767). These occurrences are found on lower mountain slopes and plateaus. The vegetation is typically open savanna, although there may be inclusions of more dense juniper woodlands. This savanna is dominated by *Juniperus osteosperma* trees with high cover of perennial bunch grasses and forbs, with *Bouteloua gracilis* and *Pleuraphis jamesii* being most common. Species of *Artemisia* are also commonly present. Pinyon trees are typically not present because sites are outside the ecological or geographic range of *Pinus edulis* and *Pinus monophylla*.

DISTRIBUTION

Range: Western Colorado, central Utah, west into the Great Basin of Nevada and southern Idaho at lower elevations, ranging from 1500-2300 m.
Ecological Divisions: 304, 306
TNC Ecoregions: 10:, 11:C, 18:C, 19:C, 20:C, 21:C, 6:C, 9:C
Ecological Systems: Copyright © 2003 NatureServe 107
Subnations/Nations: AZ:c, CA:c, CO:c, ID:c, NV:c, OR:c, UT:c, WY:c

CONCEPT

Alliances and Associations:
• JUNIPERUS OSTEOSPERMA WOODED HERBACEOUS ALLIANCE (A.1502) Juniperus osteosperma / Hesperostipa comata Wooded Herbaceous Vegetation (CEGL001489) Juniperus osteosperma / Leymus salinus ssp. salmonis Wooded Herbaceous Vegetation (CEGL001488)
• JUNIPERUS OSTEOSPERMA WOODLAND ALLIANCE (A.536) Juniperus osteosperma / Hesperostipa neomexicana Woodland (CEGL000740) Juniperus osteosperma / Pleuraphis mutica Woodland (CEGL000736) Juniperus osteosperma / Pseudoroegneria spicata Woodland (CEGL000738) Juniperus osteosperma / Symphoricarpos oreophilus Woodland (CEGL000741)
• JUNIPERUS SCOPULORUM WOODLAND ALLIANCE (A.506) Juniperus scopulorum / Pseudoroegneria spicata Woodland (CEGL000748) Juniperus scopulorum / Schizachyrium scoparium Woodland (CEGL000750)

SOURCES

References: Knight 1994, Tuhy et al. 2002
Last updated: 20 Feb 2003 **Stakeholders:** WCS
Concept Author: NatureServe Western Ecology Team
LeadResp: WCS

S079 INTER-MOUNTAIN BASINS SEMI-DESERT SHRUB STEPPE
Division 304, Steppe/Savanna, CES304.788
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Lowland [Foothill], Lowland [Lowland], Woody-Herbaceous, Temperate [Temperate Xeric], Alkaline Soil, Aridic, Very Short Disturbance Interval, G-Landscape/High Intensity, Graminoid

Non-Diagnostic Classifiers: Mechanical Disturbance, Broad-Leaved Evergreen Shrub, Xeromorphic Shrub, Thorn Shrub, Evergreen Sclerophyllous Shrub, Succulent Shrub, Dwarf-Shrub, Forb, Short (50-100 yrs) Persistence

Concept Summary: This ecological system occurs throughout the Intermountain western U.S., typically at lower elevations on alluvial fans and flats with moderate to deep soils. This semi-arid shrub-steppe is typically dominated by graminoids (>25% cover) with an open shrub layer, but includes sparse mixed shrublands without a strong graminoid layer. Characteristic grasses include *Achnatherum hymenoides, Bouteloua gracilis, Distichlis spicata, Hesperostipa comata, Pleuraphis jamesii, Poa secunda*, and *Sporobolus airoides*. The woody layer is often a mixture of shrubs and dwarf-shrubs. Characteristic species include *Atriplex canescens, Artemisia filifolia, Chrysothamnus greenei, Chrysothamnus viscidiflorus, Ephedra* spp., *Ericameria nauseosa, Gutierrezia sarothrae*, and *Krascheninnikovia lanata*. Scattered *Artemisia tridentata* may be present but does not dominate. The general aspect of occurrences may be either open shrubland with patchy grasses or patchy open herbaceous layer. Disturbance may be important in maintaining the woody component. Microphytic crust is very important in some occurrences.

DISTRIBUTION

Range: Occurs throughout the Intermountain western U.S., typically at lower elevations.
Ecological Divisions: 304
TNC Ecoregions: 10:C, 11:C, 18:C, 19:C, 20:C, 21:C, 4:C, 6:C, 8:C, 9:C
Subnations/Nations: AZ:c, CA:c, CO:c, ID:c, MT:p, NM:c, NV:c, OR:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:

- ACHNATHERUM HYMENOIDES SHRUB HERBACEOUS ALLIANCE (A.1543) Ephedra viridis / Achnatherum hymenoides - Bouteloua gracilis Shrub Herbaceous Vegetation (CEGL001648) Ephedra viridis / Achnatherum hymenoides - Sporobolus cryptandrus Shrub Herbaceous Vegetation (CEGL001649)
- ACHNATHERUM SPECIOSUM SHRUB HERBACEOUS ALLIANCE (A.1549) Achnatherum speciosum Shrub Herbaceous Vegetation [Placeholder] (CEGL003113)
- ARTEMISIA FILIFOLIA SHRUBLAND ALLIANCE (A.816) Artemisia filifolia - Ephedra (torreyana, viridis) Shrubland (CEGL002786) Artemisia filifolia Colorado Plateau Shrubland (CEGL002697)
- BOUTELOUA ERIOPODA MICROPHYLLOUS EVERGREEN SHRUB HERBACEOUS ALLIANCE (A.1545) Gutierrezia sarothrae - Krascheninnikovia lanata - Atriplex canescens / Bouteloua eriopoda Shrub Herbaceous Vegetation (CEGL001733)
- BOUTELOUA ERIOPODA XEROMORPHIC SHRUB HERBACEOUS ALLIANCE (A.1553) Bouteloua eriopoda Coconino Plateau Shrub Herbaceous Vegetation (CEGL002787) Ephedra torreyana / Bouteloua eriopoda Shrub Herbaceous Vegetation (CEGL001731)
- BOUTELOUA GRACILIS DWARF-SHRUB HERBACEOUS ALLIANCE (A.1571) Artemisia bigelovii / Bouteloua gracilis Dwarf-shrub Herbaceous Vegetation (CEGL001742) Bouteloua gracilis Dwarf-shrub Herbaceous Vegetation [Placeholder] (CEGL005810)
- BOUTELOUA GRACILIS HERBACEOUS ALLIANCE (A.1282) Bouteloua gracilis - Hesperostipa comata Herbaceous Vegetation [Provisional] (CEGL002932)
- CHRYSOTHAMNUS VISCIDIFLORUS SHRUB HERBACEOUS ALLIANCE (A.1524) Chrysothamnus viscidiflorus - Ericameria parryi Shrub Herbaceous Vegetation [Provisional] (CEGL002781) Chrysothamnus viscidiflorus / Leymus salinus ssp. salinus Shrub Herbaceous Vegetation (CEGL001501) Chrysothamnus viscidiflorus / Poa pratensis Semi-natural Shrub Herbaceous Vegetation [Provisional] (CEGL002933)
- EPHEDRA NEVADENSIS SHRUBLAND ALLIANCE (A.857) Ephedra nevadensis / Achnatherum hymenoides Shrubland (CEGL001255) Ephedra nevadensis Basalt Shrubland [Provisional] (CEGL002936)
- EPHEDRA TORREYANA SHRUBLAND ALLIANCE (A.2572) Ephedra torreyana - Achnatherum hymenoides Hummock Shrubland (CEGL005802)
- ERICAMERIA NAUSEOSA SHRUB SHORT HERBACEOUS ALLIANCE (A.1546) Ericameria nauseosa / Bouteloua gracilis Shrub Herbaceous Vegetation (CEGL003495) Ericameria nauseosa / Muhlenbergia pungens - Achnatherum hymenoides Shrub Herbaceous Vegetation (CEGL002921)

• ERICAMERIA NAUSEOSA SHRUBLAND ALLIANCE (A.835) Ericameria nauseosa / Bromus tectorum Semi-natural Shrubland (CEGL002937)
• ERICAMERIA PARRYI SHRUBLAND ALLIANCE (A.818) Ericameria parryi / Pleuraphis jamesii - Bouteloua gracilis Shrubland (CEGL001331)
• GRAYIA SPINOSA SHRUBLAND ALLIANCE (A.1038) Grayia spinosa / Poa secunda Shrubland (CEGL001351)
• GUTIERREZIA SAROTHRAE DWARF-SHRUBLAND ALLIANCE (A.2528) Gutierrezia sarothrae - (Opuntia spp.) / Pleuraphis jamesii Dwarf-shrubland (CEGL002690)
• KRASCHENINNIKOVIA LANATA DWARF-SHRUB HERBACEOUS ALLIANCE (A.1565) Krascheninnikovia lanata / Bouteloua gracilis Dwarf-shrub Herbaceous Vegetation (CEGL001321) Krascheninnikovia lanata / Pascopyrum smithii - Bouteloua gracilis Dwarf-shrub Herbaceous Vegetation (CEGL001324)
• KRASCHENINNIKOVIA LANATA DWARF-SHRUBLAND ALLIANCE (A.1104) Krascheninnikovia lanata / Pleuraphis jamesii Dwarf-shrubland (CEGL001322) Krascheninnikovia lanata / Poa secunda Dwarf-shrubland (CEGL001326)
• PLEURAPHIS JAMESII SHRUB HERBACEOUS ALLIANCE (A.1532) Atriplex obovata / Pleuraphis jamesii - Sporobolus airoides Shrub Herbaceous Vegetation (CEGL001775) Ericameria nauseosa / Pleuraphis jamesii - (Hesperostipa comata) Shrub Herbaceous Vegetation (CEGL002996) Gutierrezia sarothrae / Sporobolus airoides - Pleuraphis jamesii Shrub Herbaceous Vegetation (CEGL001776)
• PLEURAPHIS RIGIDA / GUTIERREZIA SAROTHRAE SHRUB HERBACEOUS ALLIANCE (A.1529) Gutierrezia sarothrae / Pleuraphis rigida Shrub Herbaceous Vegetation (CEGL001543)
• SPHAEROMERIA ARGENTEA HERBACEOUS ALLIANCE (A.1654) Sphaeromeria argentea - Achnatherum swallenii Herbaceous Vegetation (CEGL001993) Sphaeromeria argentea - Artemisia frigida - Poa secunda Herbaceous Vegetation (CEGL001992)

Environment: This ecological system occurs throughout the Intermountain West from the western Great Basin to the northern Rocky Mountains and Colorado Plateau at elevations ranging from 300 m up to 2500 m. The climate where this system occurs is generally hot in summers and cold in winters with low annual precipitation, ranging from 18-40 cm and high inter-annual variation. Much of the precipitation falls as snow, and growing-season drought is characteristic. Temperatures are continental with large annual and diurnal variation. Sites are generally alluvial fans and flats with moderate to deep soils. Some sites can be flat, poorly drained and intermittently flooded with a shallow or perched water table often within 1 m depth (West 1983). Substrates are generally shallow, calcareous, fine-textured soils (clays to silt-loams), derived from alluvium; or deep, fine to medium-textured alluvial soils with some source of sub-irrigation during the summer season. Soils may be alkaline and typically moderately saline (West 1983). Some occurrences occur on deep, sandy soils, or soils that are highly calcareous (Hironaka et al. 1983).

Vegetation: The plant associations in this system are characterized by a somewhat sparse to moderately dense (10-70% cover) shrub layer of *Artemisia filifolia, Ephedra cutleri, Ephedra nevadensis, Ephedra torreyana, Ephedra viridis, Ericameria nauseosa, Chrysothamnus viscidiflorus, Gutierrezia sarothrae, Sarcobatus vermiculatus*, or *Atriplex canescens*. Other shrubs occasionally present include *Purshia tridentata* and *Tetradymia canescens*. *Artemisia tridentata* may be present but does not dominate. Trees are very rarely present in this system, but some individuals of *Pinus ponderosa, Juniperus scopulorum, Juniperus occidentalis*, or *Cercocarpus ledifolius* may occur. The herbaceous layer is dominated by bunch grasses which occupy patches in the shrub matrix. The most widespread species is *Pseudoroegneria spicata*, which occurs from the Columbia Basin to the northern Rockies. Other locally dominant or important species include *Sporobolus airoides, Leymus cinereus, Festuca idahoensis, Pascopyrum smithii, Bouteloua gracilis, Distichlis spicata, Pleuraphis jamesii, Elymus lanceolatus, Elymus elymoides, Koeleria macrantha, Muhlenbergia richardsonis, Hesperostipa comata*, and *Poa secunda*. Annual grasses, especially the exotics *Bromus japonicus* and *Bromus tectorum*, may be present to abundant. Forbs are generally of low importance and are highly variable across the range, but may be diverse in some occurrences. Species that often occur are *Symphyotrichum ascendens (= Aster adscendens), Collinsia parviflora, Penstemon caespitosus, Achillea millefolium, Erigeron compositus, Senecio* spp, and *Taraxacum officinale*. Other important genera include *Astragalus, Oenothera, Eriogonum*, and *Balsamorhiza*. Mosses and lichens may be important ground cover. Forbs are common on disturbed weedy sites. Weedy annual forbs may include the exotics *Descurainia* spp., *Helianthus annuus, Halogeton glomeratus, Lactuca serriola*, and *Lepidium perfoliatum*.

SOURCES

References: Branson et al. 1976, Hanson 1929, Hironaka et al. 1983, Tuhy et al. 2002, West 1983
Last updated: 20 Feb 2003 **Stakeholders:** WCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S090 INTER-MOUNTAIN BASINS SEMI-DESERT GRASSLAND
Division 304, Herbaceous, CES304.787
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Lowland [Foothill], Lowland [Lowland], Herbaceous, Temperate [Temperate Xeric], Alkaline Soil, Aridic, Graminoid

Non-Diagnostic Classifiers: Intermediate Disturbance Interval, F-Landscape/Medium Intensity, G-Landscape/Low Intensity, Forb, Moderate (100-500 yrs) Persistence

Concept Summary: This widespread ecological system occurs throughout the Intermountain western U.S. on dry plains and mesas, at approximately 4,750 to 7,610 feet (1,450 to 2,320 meters) in elevation. These grasslands occur in lowland and upland areas and may occupy swales, playas, mesa tops, plateau parks, alluvial flats, and plains, but sites are typically xeric. Substrates are often well-drained sandy- or loamy-textured soils derived from sedimentary parent materials, but are quite variable and may include fine-textured soils derived from igneous and metamorphic rocks. When they occur near foothills grasslands they will be at lower elevations. The dominant perennial bunch grasses and shrubs within this system are all very drought-resistant plants. These grasslands are typically dominated or codominated by *Achnatherum hymenoides, Aristida* spp., *Bouteloua gracilis, Hesperostipa comata, Muhlenbergia torreyana*, or *Pleuraphis jamesii*, and may include scattered shrubs and dwarf-shrubs of species of *Artemisia, Atriplex, Coleogyne, Ephedra, Gutierrezia*, or *Krascheninnikovia lanata*.

DISTRIBUTION

Range: Occurs throughout the Intermountain western U.S. on dry plains and mesas, at approximately 4,750 to 7,610 feet (1,450 to 2,320 meters) in elevation.
Ecological Divisions: 304, 306
TNC Ecoregions: 10:C, 11:C, 18:C, 19:C, 20:C, 21:C, 4:C, 6:C, 8:C, 9:C
Subnations/Nations: AZ:c, CA:c, CO:c, ID:c, MT:p, NM:c, NV:c, OR:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:

- ACHNATHERUM HYMENOIDES HERBACEOUS ALLIANCE (A.1262) Achnatherum hymenoides - Sporobolus contractus Herbaceous Vegetation (CEGL001652)
- ACHNATHERUM LETTERMANII HERBACEOUS ALLIANCE (A.2524) Achnatherum lettermanii - Oxytropis oreophila Herbaceous Vegetation (CEGL002734)
- ACHNATHERUM NELSONII HERBACEOUS ALLIANCE (A.1271) Achnatherum nelsonii - Koeleria macrantha Herbaceous Vegetation (CEGL001707)
- ACHNATHERUM SPECIOSUM HERBACEOUS ALLIANCE (A.1290) Achnatherum speciosum Herbaceous Vegetation [Placeholder] (CEGL003112)
- ARISTIDA PURPUREA HERBACEOUS ALLIANCE (A.2570) Aristida purpurea Herbaceous Vegetation (CEGL005800)
- BOUTELOUA ERIOPODA HERBACEOUS ALLIANCE (A.1284) Bouteloua eriopoda - Hesperostipa neomexicana Herbaceous Vegetation (CEGL001753) Bouteloua eriopoda - Pleuraphis jamesii Herbaceous Vegetation (CEGL001751) Bouteloua eriopoda Semi-desert Herbaceous Vegetation (CEGL001752)
- BOUTELOUA ERIOPODA MICROPHYLLOUS EVERGREEN SHRUB HERBACEOUS ALLIANCE (A.1545) Gutierrezia sarothrae - Krascheninnikovia lanata - Atriplex canescens / Bouteloua eriopoda Shrub Herbaceous Vegetation (CEGL001733)
- BOUTELOUA GRACILIS HERBACEOUS ALLIANCE (A.1282) Bouteloua gracilis - Bouteloua curtipendula Herbaceous Vegetation (CEGL001754) Bouteloua gracilis - Bouteloua hirsuta Herbaceous Vegetation (CEGL001755) Bouteloua gracilis - Hesperostipa comata Herbaceous Vegetation [Provisional] (CEGL002932) Bouteloua gracilis - Pleuraphis jamesii Herbaceous Vegetation (CEGL001759) Bouteloua gracilis Herbaceous Vegetation (CEGL001760)
- BOUTELOUA HIRSUTA HERBACEOUS ALLIANCE (A.1285) Bouteloua hirsuta - Bouteloua radicosa Herbaceous Vegetation (CEGL001765)
- BROMUS INERMIS SEMI-NATURAL HERBACEOUS ALLIANCE (A.3561) Bromus inermis - (Pascopyrum smithii) Semi-natural Herbaceous Vegetation (CEGL005264)
- BROMUS TECTORUM SEMI-NATURAL HERBACEOUS ALLIANCE (A.1814) Bromus tectorum Semi-natural Herbaceous Vegetation [Placeholder] (CEGL003019)
- ERICAMERIA NAUSEOSA SHRUB SHORT HERBACEOUS ALLIANCE (A.1546) Ericameria nauseosa / Bouteloua gracilis Shrub Herbaceous Vegetation (CEGL003495)

• HESPEROSTIPA COMATA BUNCH HERBACEOUS ALLIANCE (A.1270) Hesperostipa comata - (Bouteloua eriopoda, Pleuraphis jamesii) Herbaceous Vegetation (CEGL002997) Hesperostipa comata - Achnatherum hymenoides Herbaceous Vegetation (CEGL001703) Hesperostipa comata Great Basin Herbaceous Vegetation (CEGL001705)
• HESPEROSTIPA NEOMEXICANA HERBACEOUS ALLIANCE (A.1272) Hesperostipa neomexicana Herbaceous Vegetation (CEGL001708)
• MUHLENBERGIA ASPERIFOLIA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE (A.1334) Muhlenbergia asperifolia Herbaceous Vegetation (CEGL001779)
• MUHLENBERGIA MONTANA HERBACEOUS ALLIANCE (A.1260) Muhlenbergia (pungens, montana) - Heterotheca villosa Herbaceous Vegetation (CEGL002938)
• PLEURAPHIS JAMESII HERBACEOUS ALLIANCE (A.1287) Pleuraphis jamesii Herbaceous Vegetation (CEGL001777)
• PLEURAPHIS JAMESII SHRUB HERBACEOUS ALLIANCE (A.1532) Atriplex obovata / Pleuraphis jamesii - Sporobolus airoides Shrub Herbaceous Vegetation (CEGL001775)
• PLEURAPHIS RIGIDA HERBACEOUS ALLIANCE (A.1246) Pleuraphis rigida Herbaceous Vegetation [Placeholder] (CEGL003051)
• PLEURAPHIS RIGIDA SHRUB HERBACEOUS ALLIANCE (A.1539) Pleuraphis rigida Shrub Herbaceous Vegetation [Placeholder] (CEGL003052)
• POA FENDLERIANA HERBACEOUS ALLIANCE (A.1263) Poa fendleriana ssp. fendleriana Herbaceous Vegetation (CEGL001655)
• POA SECUNDA HERBACEOUS ALLIANCE (A.1291) Aristida purpurea var. longiseta - Poa secunda Herbaceous Vegetation (CEGL001781)
• POA SECUNDA SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1410) Poa secunda - Muhlenbergia richardsonis Herbaceous Vegetation (CEGL002755) Poa secunda Herbaceous Vegetation (CEGL001657)
• PSEUDOROEGNERIA SPICATA HERBACEOUS ALLIANCE (A.1265) Pseudoroegneria spicata - Achnatherum hymenoides Herbaceous Vegetation (CEGL001674) Pseudoroegneria spicata ssp. inermis Herbaceous Vegetation (CEGL001661)
• SPOROBOLUS AIROIDES HERBACEOUS ALLIANCE (A.1267) Sporobolus airoides Monotype Herbaceous Vegetation (CEGL001688)
• SPOROBOLUS AIROIDES SOD HERBACEOUS ALLIANCE (A.1241) Sporobolus airoides - Bouteloua gracilis Herbaceous Vegetation (CEGL001686) Sporobolus airoides Sod Herbaceous Vegetation [Placeholder] (CEGL001791)
• SPOROBOLUS CRYPTANDRUS HERBACEOUS ALLIANCE (A.1252) Aristida purpurea var. longiseta - Pseudoroegneria spicata - Sporobolus cryptandrus Herbaceous Vegetation (CEGL001589) Aristida purpurea var. longiseta - Sporobolus cryptandrus Herbaceous Vegetation (CEGL001515) Sporobolus cryptandrus - Poa secunda Herbaceous Vegetation (CEGL001516) Sporobolus cryptandrus Great Basin Herbaceous Vegetation (CEGL002691)
• SPOROBOLUS CRYPTANDRUS SHRUB HERBACEOUS ALLIANCE (A.1525) Sporobolus cryptandrus Shrub Herbaceous Vegetation (CEGL001514)
• THINOPYRUM INTERMEDIUM SEMI-NATURAL HERBACEOUS ALLIANCE (A.2529) Thinopyrum intermedium Semi-natural Herbaceous Vegetation (CEGL002935)

• **California community types:**
• Needle-and-thread (41.130.00)
• Great Basin Grassland (41.300.00)
• Little Galleta Grassland (41.610.00)
• Little Galleta - California Buckwheat (41.610.01)
• Little Galleta - Anderson's Wolfberry (41.610.02)
• Little Galleta - Nevada Ephedra (41.610.03)

Environment: Low-elevation grasslands in the Intermountain West region occur in semi-arid to arid climates at approximately 4,750 to 7,610 feet (1,450 to 2,320 meters) in elevation. Grasslands within this system are typically characterized by a sparse to moderately dense herbaceous layer dominated by medium-tall and short bunch grasses, often in a sod-forming growth. These grasslands occur in lowland and upland areas and may occupy swales, playas, mesa tops, plateau parks, alluvial flats, and plains. These grasslands typically occur on xeric sites. This system experiences cold temperate conditions. Hot summers and cold winters with freezing temperatures and snow are common. Annual precipitation is usually from 7.9 to 15.7 inches (20 to 40 centimeters). A significant portion of the precipitation falls in July through October during the summer monsoon storms, with the rest falling as snow during the winter and early spring months.

These grasslands occur on a variety of aspects and slopes. Sites may range from flat to moderately steep. Soils supporting this system also vary from deep to shallow, and from sandy to finer-textured. The substrate is typically sand- or shale-derived. Some sandy soil occurrences have a high cover of cryptogams on the soil. These cryptogamic species would tend to increase the stability of the highly erodible sandy soils of these grasslands during torrential summer rains and heavy wind storms (Kleiner and Harper 1977). *Muhlenbergia*-dominated grasslands which flood temporarily, combined with high evaporation rates in this dry system, can have accumulations of soluble salts in the soil. Soil salinity depends on the amount and timing of precipitation and flooding.

Dynamics: This system is maintained by frequent fires and sometimes associated with specific soils, often well-drained clay soils. A combination of precipitation, temperature, and soils limits this system to the lower elevations within the region. The dominant perennial bunch grasses and shrubs within this system are all very drought-resistant plants. Grasses that dominate semi-arid grasslands develop a dense network of roots concentrated in the upper parts of the soil where rainfall penetrates most frequently (Blydenstein 1966, Cable 1969, Sala and Lauenroth 1985, as cited by McClaran and Van Devender 1995). *Bouteloua gracilis* is also very grazing-tolerant and generally forms a short sod. *Pleuraphis jamesii* is only moderately palatable to livestock, but decreases when heavily grazed during drought and in the more arid portions of its range where it is the dominant grass (West 1972). This grass reproduces extensively from scaly rhizomes. These rhizomes make the plant resistant to trampling by livestock and have good soil-binding properties (Weaver and Albertson 1956, West 1972). *Achnatherum hymenoides* is one of the most drought-tolerant grasses in the western U.S. (USDA 1937). It is also a valuable forage grass in arid and semi-arid regions. Improperly managed livestock grazing could increase soil erosion, decrease cover of this palatable plant species and increase weedy species (USDA 1937). *Muhlenbergia asperifolia* with its flooding regime combined with high evaporation rate in these dry climates causes accumulations of soluble salts in the soil. Total vegetation cover (density and height), species composition and soil salinity depend on the amount and timing of precipitation and flooding. Growth-inhibiting salt concentrations are diluted when the soil is saturated allowing the growth of less salt-tolerant species. As the saturated soils dry, the salt concentrates until it precipitates out on the soil surface (Dodd and Coupland 1966, Ungar 1968). *Hesperostipa comata* is a deep-rooted grass that uses soil moisture below 0.5 m during the dry summers.

SOURCES

References: Cable 1967, Cable 1969, Cable 1975, Dodd and Coupland 1966, Kleiner and Harper 1977, Mast et al. 1997, Mast et al. 1998, McClaran and Van Devender 1995, Tuhy et al. 2002, Ungar 1968, Weaver and Albertson 1956, West 1983

Last updated: 20 Feb 2003 **Stakeholders:** WCS

Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S094 NORTH AMERICAN WARM DESERT LOWER MONTANE RIPARIAN WOODLAND AND SHRUBLAND
Division 302, Woody Wetland, CES302.748
Spatial Scale & Pattern: Linear **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Wetland
Diagnostic Classifiers: Forest and Woodland (Treed), Shrubland (Shrub-dominated), Riverine / Alluvial

Non-Diagnostic Classifiers: Lowland [Lowland], Tropical/Subtropical [Tropical Xeric], Temperate [Temperate Xeric], Short (50-100 yrs) Persistence

Concept Summary: This ecological system occurs in mountain canyons and valleys of southern Arizona and New Mexico, and adjacent Mexico and consists of mid- to low-elevation (1100-1800 m) riparian corridors along perennial and seasonally intermittent streams. The vegetation is a mix of riparian woodlands and shrublands. Dominant trees include *Populus angustifolia, Populus deltoides ssp. wislizeni, Populus fremontii, Platanus wrightii, Juglans major, Fraxinus velutina*, and *Sapindus saponaria*. Shrub dominants include *Salix exigua, Prunus* spp., *Alnus oblongifolia*, and *Baccharis salicifolia*. Vegetation is dependent upon annual or periodic flooding and associated sediment scour and/or annual rise in the water table for growth and reproduction.

DISTRIBUTION

Range: Southern Arizona and New Mexico, and adjacent Mexico.
Ecological Divisions: 302
TNC Ecoregions: 17:C, 22:C, 23:C, 24:C
Subnations/Nations: AZ:c, CA:c, MXBC:c, MXBS:c, MXCH:c, MXSO:c, NM:c, NV:c, TX:c

CONCEPT

Alliances and Associations:

- ALHAGI MAURORUM SEMI-NATURAL SHRUBLAND ALLIANCE (A.2567) Alhagi maurorum Semi-natural Shrubland (CEGL002784)
- BETULA OCCIDENTALIS TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.967) Populus fremontii / Betula occidentalis Wooded Shrubland (CEGL002981)
- JUGLANS MAJOR TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.957) Juglans major - Pinus edulis / Bromus carinatus Shrubland (CEGL001101) Juglans major Shrubland [Provisional] (CEGL001102)
- JUGLANS MICROCARPA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.945) Juglans microcarpa / Cladium mariscus ssp. jamaicense Shrubland (CEGL004593) Juglans microcarpa / Sorghastrum nutans Shrubland (CEGL004594) Juglans microcarpa Shrubland (CEGL001103)
- PLATANUS WRIGHTII TEMPORARILY FLOODED FOREST ALLIANCE (A.309) Platanus wrightii - Alnus oblongifolia / Baccharis salicifolia Forest (CEGL002686) Platanus wrightii - Fraxinus velutina Forest (CEGL000644) Platanus wrightii - Juglans major Forest (CEGL000645)
- PLATANUS WRIGHTII TEMPORARILY FLOODED WOODLAND ALLIANCE (A.643) Platanus wrightii Woodland (CEGL000937)
- POPULUS ANGUSTIFOLIA TEMPORARILY FLOODED FOREST ALLIANCE (A.310) Populus angustifolia / Rosa woodsii Forest (CEGL000653)
- POPULUS ANGUSTIFOLIA TEMPORARILY FLOODED WOODLAND ALLIANCE (A.641) Populus angustifolia - Juniperus deppeana / Brickellia californica Woodland (CEGL000933) Populus angustifolia / Alnus oblongifolia Woodland (CEGL000938) Populus angustifolia / Salix exigua Woodland (CEGL000654) Populus angustifolia / Salix irrorata Woodland (CEGL002647)
- POPULUS DELTOIDES SSP. WISLIZENI TEMPORARILY FLOODED FOREST ALLIANCE (A.312) Populus deltoides ssp. wislizeni / Baccharis sarothroides Forest (CEGL000663)
- POPULUS DELTOIDES TEMPORARILY FLOODED WOODLAND ALLIANCE (A.636) Populus deltoides ssp. wislizeni / Rhus trilobata Woodland (CEGL000940)
- POPULUS FREMONTII SEASONALLY FLOODED WOODLAND ALLIANCE (A.654) Populus fremontii / Muhlenbergia rigens Woodland (CEGL001455) Populus fremontii / Salix geyeriana Woodland (CEGL000943)
- POPULUS FREMONTII TEMPORARILY FLOODED FOREST ALLIANCE (A.313) Populus fremontii - Platanus wrightii Forest (CEGL000665) Populus fremontii - Salix gooddingii / Baccharis salicifolia Forest (CEGL002683) Populus fremontii - Salix gooddingii / Salix exigua Forest (CEGL002684) Populus fremontii / Acer negundo Forest (CEGL000662) Populus fremontii Forest [Placeholder] (CEGL000661)
- POPULUS FREMONTII TEMPORARILY FLOODED WOODLAND ALLIANCE (A.644) Populus fremontii - Fraxinus velutina Woodland (CEGL000942) Populus fremontii - Salix gooddingii Woodland (CEGL000944)

Populus fremontii / Baccharis emoryi Woodland [Provisional] (CEGL002946) Populus fremontii / Baccharis salicifolia Woodland (CEGL000941)
• RHUS TRILOBATA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.938) Rhus trilobata - Prunus serotina Shrubland (CEGL001119)
• ROBINIA NEOMEXICANA SHRUBLAND ALLIANCE (A.924) Robinia neomexicana / Thalictrum fendleri Shrubland (CEGL001125)
• SALIX (EXIGUA, INTERIOR) TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.947) Salix exigua / Agrostis stolonifera Shrubland (CEGL001199) Salix exigua / Elymus X pseudorepens Shrubland (CEGL001198)
• SALIX BONPLANDIANA TEMPORARILY FLOODED FOREST ALLIANCE (A.314) Salix bonplandiana Forest (CEGL000679)
• SALIX EXIGUA SEASONALLY FLOODED WOODLAND ALLIANCE (A.649) Salix exigua / Baccharis salicifolia - Baccharis neglecta / Schoenoplectus spp. Woodland (CEGL004587)
• SALIX GOODDINGII TEMPORARILY FLOODED WOODLAND ALLIANCE (A.640) Salix gooddingii - Fraxinus velutina Temporarily Flooded Woodland (CEGL003729) Salix gooddingii Woodland [Provisional] (CEGL002743)
• SALIX IRRORATA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.976) Salix irrorata Shrubland (CEGL001214)
• SALIX LAEVIGATA TEMPORARILY FLOODED WOODLAND ALLIANCE (A.646) Salix laevigata - Fraxinus velutina Woodland (CEGL000950) Salix laevigata Woodland [Provisional] (CEGL002952)
• TAMARIX SPP. SEMI-NATURAL TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.842) Tamarix spp. Temporarily Flooded Shrubland (CEGL003114)

SOURCES

References: Brown 1982, Dick-Peddie 1993, Muldavin et al. 2000a, Szaro 1989, Thomas et al. 2003a
Last updated: 20 Feb 2003 **Stakeholders:** WCS, SCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

Division 304, Mixed Upland and Wetland, CES304.780
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland, Wetland
Diagnostic Classifiers: Lowland [Lowland], Shrubland (Shrub-dominated), Toeslope/Valley Bottom, Alkaline Soil, Deep Soil, Xeromorphic Shrub

Non-Diagnostic Classifiers: Alluvial flat, Alluvial plain, Alluvial terrace, Temperate [Temperate Continental], Saline Substrate Chemistry, Sarcobatus vermiculatus, Riverine / Alluvial, Deep (>15 cm) Water

Concept Summary: This ecological system occurs throughout much of the western U.S. in Intermountain basins and extends onto the western Great Plains. It typically occurs near drainages on stream terraces and flats or may form rings around playas. Sites typically have saline soils, a shallow water table and flood intermittently, but remain dry for most growing seasons. This system usually occurs as a mosaic of multiple communities, with open to moderately dense shrublands dominated or codominated by *Sarcobatus vermiculatus*. *Atriplex canescens, Atriplex confertifolia*, or *Krascheninnikovia lanata* may be present to codominant. Occurrences are often surrounded by mixed salt desert scrub. The herbaceous layer, if present, is usually dominated by graminoids. There may be inclusions of *Sporobolus airoides*, *Distichlis spicata* (where water remains ponded the longest), or *Eleocharis palustris* herbaceous types.

DISTRIBUTION

Range: Occurs throughout much of the western U.S. in Intermountain basins and extends onto the western Great Plains.
Ecological Divisions: 303, 304
TNC Ecoregions: 10:C, 11:C, 19:C, 20:C, 26:C, 4:C, 6:C, 8:C, 9:C
Subnations/Nations: AZ:c, CA:c, CO:c, ID:c, MT:c, NV:c, OR:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:
• DISTICHLIS SPICATA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE (A.1332) Distichlis spicata - (Scirpus nevadensis) Herbaceous Vegetation (CEGL001773) Distichlis spicata - Lepidium perfoliatum Herbaceous Vegetation (CEGL001772) Distichlis spicata Herbaceous Vegetation (CEGL001770) Distichlis spicata Mixed Herb Herbaceous Vegetation (CEGL001771)

• ELEOCHARIS PALUSTRIS SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1422) Eleocharis palustris Herbaceous Vegetation (CEGL001833)
• ERICAMERIA NAUSEOSA SHRUBLAND ALLIANCE (A.835) Ericameria nauseosa / Sporobolus airoides Shrubland [Provisional] (CEGL002918)
• LEYMUS CINEREUS HERBACEOUS ALLIANCE (A.1204) Leymus cinereus Herbaceous Vegetation (CEGL001479)
• LEYMUS CINEREUS INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE (A.1329) Leymus cinereus - Distichlis spicata Herbaceous Vegetation (CEGL001481) Leymus cinereus Bottomland Herbaceous Vegetation (CEGL001480)
• PUCCINELLIA NUTTALLIANA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE (A.1335) Puccinellia nuttalliana Herbaceous Vegetation (CEGL001799)
• SALICORNIA RUBRA SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1818) Salicornia rubra Herbaceous Vegetation (CEGL001999)
• SARCOBATUS VERMICULATUS INTERMITTENTLY FLOODED SHRUB HERBACEOUS ALLIANCE (A.1554) Sarcobatus vermiculatus / Pascopyrum smithii - (Elymus lanceolatus) Shrub Herbaceous Vegetation (CEGL001508)
• SARCOBATUS VERMICULATUS INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.1046) Sarcobatus vermiculatus - Atriplex parryi / Distichlis spicata Shrubland (CEGL002764) Sarcobatus vermiculatus - Psorothamnus polydenius Shrubland (CEGL002763) Sarcobatus vermiculatus / Achnatherum hymenoides Shrubland (CEGL001373) Sarcobatus vermiculatus / Artemisia tridentata Shrubland (CEGL001359) Sarcobatus vermiculatus / Atriplex confertifolia - (Picrothamnus desertorum, Suaeda moquinii) Shrubland (CEGL001371) Sarcobatus vermiculatus / Atriplex gardneri Shrubland (CEGL001360) Sarcobatus vermiculatus / Distichlis spicata Shrubland (CEGL001363) Sarcobatus vermiculatus / Elymus elymoides - Pascopyrum smithii Shrubland (CEGL001365) Sarcobatus vermiculatus / Elymus elymoides Shrubland (CEGL001372) Sarcobatus vermiculatus / Leymus cinereus Shrubland (CEGL001366) Sarcobatus vermiculatus / Nitrophila occidentalis - Suaeda moquinii Shrubland (CEGL001369) Sarcobatus vermiculatus / Suaeda moquinii Shrubland (CEGL001370) Sarcobatus vermiculatus Shrubland (CEGL001357)
• SARCOBATUS VERMICULATUS INTERMITTENTLY FLOODED SPARSELY VEGETATED ALLIANCE (A.1877) Sarcobatus vermiculatus / Juncus balticus Sparse Vegetation (CEGL002919) Sarcobatus vermiculatus / Sporobolus airoides Sparse Vegetation (CEGL001368)
• SARCOBATUS VERMICULATUS SHRUBLAND ALLIANCE (A.1041) Sarcobatus vermiculatus / Bouteloua gracilis Shrubland (CEGL001361) Sarcobatus vermiculatus / Pseudoroegneria spicata Shrubland (CEGL001367)
• SPOROBOLUS AIROIDES HERBACEOUS ALLIANCE (A.1267) Sporobolus airoides Southern Plains Herbaceous Vegetation (CEGL001685)
• SPOROBOLUS AIROIDES INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE (A.1331) Sporobolus airoides - Distichlis spicata Herbaceous Vegetation (CEGL001687)

• **California community types:**
• Greasewood - Shadscale (36.320.01)
• Greasewood - Saltgrass (41.200.03)

SOURCES

References: Knight 1994, West 1983b
Last updated: 20 Feb 2003 **Stakeholders:** WCS, MCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S097 NORTH AMERICAN WARM DESERT RIPARIAN WOODLAND AND SHRUBLAND
Division 302, Woody Wetland, CES302.753
Spatial Scale & Pattern: Linear **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Wetland
Diagnostic Classifiers: Lowland [Lowland], Forest and Woodland (Treed), Shrubland (Shrub-dominated), Tropical/Subtropical [Tropical Xeric], Temperate [Temperate Xeric], Riverine / Alluvial

Non-Diagnostic Classifiers: Toeslope/Valley Bottom, Short (50-100 yrs) Persistence

Concept Summary: This ecological system consists of low-elevation (<1200 m) riparian corridors along medium to large perennial streams throughout canyons and the desert valleys of the southwestern United States and adjacent Mexico. The vegetation is a mix of riparian woodlands and shrublands. Dominant trees include *Acer negundo, Fraxinus velutina, Populus fremontii, Salix gooddingii, Salix lasiolepis, Celtis laevigata var. reticulata*, and *Juglans major*. Shrub dominants include *Salix geyeriana, Shepherdia argentea*, and *Salix exigua*. Vegetation is dependent upon annual or periodic flooding and associated sediment scour and/or annual rise in the water table for growth and reproduction.

DISTRIBUTION

Range: Throughout canyons and the desert valleys of the southwestern United States and adjacent Mexico.
Ecological Divisions: 302
TNC Ecoregions: 17:C, 22:C, 23:C, 24:C, 29:P
Subnations/Nations: AZ:c, CA:c, MXBC:c, MXCH:c, MXSO:c, NM:c, NV:c, TX:c

CONCEPT

Alliances and Associations:
- ARUNDO DONAX TEMPORARILY FLOODED HERBACEOUS ALLIANCE (A.1339) Arundo donax Riverbank Herbaceous Vegetation (CEGL004101)
- CELTIS LAEVIGATA VAR. RETICULATA SHRUBLAND ALLIANCE (A.1033) Celtis laevigata var. reticulata / Celtis pallida Shrubland (CEGL001163)
- JUGLANS MAJOR TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.957) Juglans major - Pinus edulis / Bromus carinatus Shrubland (CEGL001101) Juglans major Shrubland [Provisional] (CEGL001102)
- JUGLANS MICROCARPA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.945) Celtis laevigata var. reticulata - Juglans microcarpa / Leptochloa dubia Shrubland (CEGL002166) Juglans microcarpa / Cladium mariscus ssp. jamaicense Shrubland (CEGL004593) Juglans microcarpa / Sorghastrum nutans Shrubland (CEGL004594) Juglans microcarpa Shrubland (CEGL001103)
- PLATANUS RACEMOSA TEMPORARILY FLOODED WOODLAND ALLIANCE (A.634) Platanus racemosa Temporarily Flooded Woodland [Placeholder] (CEGL003079)
- PLATANUS WRIGHTII TEMPORARILY FLOODED FOREST ALLIANCE (A.309) Platanus wrightii - Alnus oblongifolia / Baccharis salicifolia Forest (CEGL002686) Platanus wrightii - Fraxinus velutina Forest (CEGL000644) Platanus wrightii - Juglans major Forest (CEGL000645)
- PLATANUS WRIGHTII TEMPORARILY FLOODED WOODLAND ALLIANCE (A.643) Platanus wrightii Woodland (CEGL000937)
- POPULUS DELTOIDES SSP. WISLIZENI TEMPORARILY FLOODED FOREST ALLIANCE (A.312) Populus deltoides / Muhlenbergia asperifolia Forest (CEGL000678) Populus deltoides ssp. wislizeni / Baccharis sarothroides Forest (CEGL000663)
- POPULUS DELTOIDES TEMPORARILY FLOODED WOODLAND ALLIANCE (A.636) Populus deltoides ssp. wislizeni / Rhus trilobata Woodland (CEGL000940)
- POPULUS FREMONTII SEASONALLY FLOODED WOODLAND ALLIANCE (A.654) Populus fremontii / Leymus triticoides Woodland (CEGL002756) Populus fremontii / Muhlenbergia rigens Woodland (CEGL001455)
- POPULUS FREMONTII TEMPORARILY FLOODED FOREST ALLIANCE (A.313) Populus fremontii - Celtis laevigata var. reticulata / Salvia pinguifolia Forest (CEGL000664) Populus fremontii - Platanus wrightii Forest (CEGL000665) Populus fremontii - Salix gooddingii / Baccharis salicifolia Forest (CEGL002683) Populus fremontii - Salix gooddingii / Salix exigua Forest (CEGL002684) Populus fremontii / Acer negundo Forest (CEGL000662) Populus fremontii Forest [Placeholder] (CEGL000661)
- POPULUS FREMONTII TEMPORARILY FLOODED WOODLAND ALLIANCE (A.644) Populus fremontii - Fraxinus velutina Woodland (CEGL000942) Populus fremontii - Salix gooddingii Woodland (CEGL000944) Populus fremontii / Baccharis salicifolia Woodland (CEGL000941)
- PARKINSONIA FLORIDA - OLNEYA TESOTA WOODLAND ALLIANCE (A.588)
- Parkinsonia florida - Olneya tesota Woodland [Placeholder] (CEGL003035)

• SALIX (EXIGUA, INTERIOR) TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.947) Salix exigua / Agrostis stolonifera Shrubland (CEGL001199) Salix exigua / Barren Shrubland (CEGL001200)
• SALIX GOODDINGII TEMPORARILY FLOODED WOODLAND ALLIANCE (A.640) Salix gooddingii - Fraxinus velutina Temporarily Flooded Woodland (CEGL003729) Salix gooddingii Woodland [Provisional] (CEGL002743)
• TAMARIX SPP. SEMI-NATURAL TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.842) Tamarix spp. Temporarily Flooded Shrubland (CEGL003114)

• **California community types:**
• Sonoran Cottonwood - Willow Riparian (61.130.05)
• Arroyo Willow Riparian Forests and Woodlands (61.201.00)
• Central Coast Arroyo Willow Riparian (61.201.01)
• Southern Arroyo Willow Riparian (61.201.02)
• Arroyo Willow / Blackberry Riparian (61.201.03)
• Arroyo Willow - Shining Willow (61.201.04)
• Black Willow Riparian Forests and Woodlands (61.202.00)
• Red Willow Riparian Forests (61.205.00)
• Red Willow (61.205.01)
• Red Willow / Arroyo Willow (61.205.02)
• Gooding Willow (61.211.01)
• Desert Olive Scrub (61.580.00)
• Desert Olive (61.580.01)
• Oregon Ash Riparian Forest (61.960.00)
• Narrowleaf Willow (63.110.00)
• Narrowleaf Willow - Desert Baccharis (63.110.01)
• Narrow-leaf Willow Riparian Scrub (63.110.02)
• Lemmon’s Willow Riparian Scrub (63.113.00)
• Lemmon’s Willow (63.113.01)
• Tamarisk Scrubs and Woodlands (63.810.00)
• Shrub Tamarisk (63.810.02)

SOURCES

References: Barbour and Major 1988, Brown 1982, Dick-Peddie 1993, Holland and Keil 1995, Muldavin et al. 2000a, Szaro 1989
Last updated: 20 Feb 2003 **Stakeholders:** WCS, SCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S098 NORTH AMERICAN WARM DESERT RIPARIAN MESQUITE BOSQUE
Division 302, Woody Wetland, CES302.752
Spatial Scale & Pattern: Linear **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Wetland
Diagnostic Classifiers: Lowland [Lowland], Toeslope/Valley Bottom, Tropical/Subtropical [Tropical Xeric], Temperate [Temperate Xeric], Prosopis spp.-dominated, Riverine / Alluvial

Non-Diagnostic Classifiers: Forest and Woodland (Treed), Shrubland (Shrub-dominated)

Concept Summary: This ecological system consists of low-elevation (<1100 m) riparian corridors along intermittent streams in valleys of southern Arizona and New Mexico, and adjacent Mexico. Dominant trees include *Prosopis glandulosa* and *Prosopis velutina*. Shrub dominants include *Baccharis salicifolia, Pluchea sericea*, and *Salix exigua*. Vegetation, especially the mesquites, tap groundwater below the streambed when surface flows stop. Vegetation is dependent upon annual rise in the water table for growth and reproduction.

DISTRIBUTION

Range: Along intermittent streams in valleys of southern Arizona and New Mexico, and adjacent Mexico.
Ecological Divisions: 302
TNC Ecoregions: 17:C, 22:C, 23:C, 24:C
Subnations/Nations: AZ:c, CA:c, MXBC:p, MXCH:c, MXSO:c, NM:c, NV:c, TX:c

CONCEPT

Alliances and Associations:
- BACCHARIS SALICIFOLIA - BACCHARIS NEGLECTA SEASONALLY FLOODED SHRUBLAND ALLIANCE (A.987) Baccharis salicifolia - Baccharis neglecta / Eustoma exaltatum Shrubland (CEGL004590)
- BACCHARIS SALICIFOLIA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.933) Baccharis salicifolia / Muhlenbergia rigens Shrubland (CEGL004572)
- BACCHARIS SAROTHROIDES INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.840) Baccharis sarothroides - Baccharis salicifolia Shrubland (CEGL001160) Baccharis sarothroides - Parkinsonia microphylla Shrubland (CEGL001159)
- BACCHARIS SERGILOIDES INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.2531) Baccharis sergiloides Shrubland [Placeholder] (CEGL002953)
- PLEURAPHIS MUTICA SHRUB HERBACEOUS ALLIANCE (A.1551) Prosopis glandulosa / Pleuraphis mutica Shrub Herbaceous Vegetation (CEGL001641)
- PLUCHEA SERICEA SEASONALLY FLOODED SHRUBLAND ALLIANCE (A.798) Pluchea sericea Seasonally Flooded Shrubland [Placeholder] (CEGL003080)

- PROSOPIS (GLANDULOSA, VELUTINA) WOODLAND ALLIANCE (A.661) Prosopis (glandulosa var. torreyana, velutina) Woodland [Placeholder] (CEGL003082)
- PROSOPIS GLANDULOSA SHRUB HERBACEOUS ALLIANCE (A.1550) Prosopis glandulosa / Bouteloua eriopoda Shrub Herbaceous Vegetation (CEGL001510)
- PROSOPIS GLANDULOSA SHRUBLAND ALLIANCE (A.1031) Prosopis glandulosa - Artemisia filifolia / Sporobolus giganteus Shrubland (CEGL002192) Prosopis glandulosa - Atriplex spp. Shrubland (CEGL002193) Prosopis glandulosa / Atriplex canescens Shrubland (CEGL001382) Prosopis glandulosa / Bouteloua curtipendula Shrubland (CEGL002194) Prosopis glandulosa / Bouteloua gracilis Shrubland (CEGL001383) Prosopis glandulosa / Mixed Grasses Shrubland (CEGL001384) Prosopis glandulosa / Muhlenbergia porteri Shrubland (CEGL001511) Prosopis glandulosa / Sporobolus airoides Shrubland (CEGL001385) Prosopis glandulosa / Sporobolus flexuosus Shrubland (CEGL001386) Prosopis glandulosa var. glandulosa / Bouteloua gracilis - Buchloe dactyloides Shrubland (CEGL003877) Prosopis glandulosa var. torreyana Shrubland (CEGL001381)
- PROSOPIS GLANDULOSA TEMPORARILY FLOODED WOODLAND ALLIANCE (A.637) Prosopis glandulosa Temporarily Flooded Woodland (CEGL004934)
- PROSOPIS GLANDULOSA WOODLAND ALLIANCE (A.611) Prosopis glandulosa / Bouteloua curtipendula - Nassella leucotricha Woodland (CEGL002133)
- PROSOPIS PUBESCENS SHRUBLAND ALLIANCE (A.1042) Prosopis pubescens Shrubland (CEGL001387)
- PROSOPIS VELUTINA SHRUBLAND ALLIANCE (A.1043) Prosopis velutina - Acacia greggii Shrubland (CEGL001388) Prosopis velutina / Celtis laevigata var. reticulata Shrubland (CEGL001390) Prosopis velutina / Muhlenbergia porteri Shrubland (CEGL001391)

- **California community types:**

- Mesquite Bosque (61.510.05)
- Mesquite Alkaline (61.510.06)
- Mesquite - Willow (61.510.07)
- Upper Desert Mesquite (61.510.08)
- Honey Mesquite Scrub (61.512.00)
- Honey Mesquite (61.512.01)
- Tornillo Scrub (61.513.00)

SOURCES

References: Barbour and Major 1988, Brown 1982, Dick-Peddie 1993, Muldavin et al. 2000a, Muldavin et al. 2000b, Szaro 1989, Thomas et al. 2003a

Last updated: 20 Feb 2003 **Stakeholders:** WCS, SCS

Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S100 NORTH AMERICAN ARID WEST EMERGENT MARSH
Division 300, Herbaceous Wetland, CES300.729
Spatial Scale & Pattern: Small Patch **Classification Confidence:** high
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Wetland
Diagnostic Classifiers: Herbaceous, Mineral: W/ A-Horizon >10 cm, Graminoid, Aquatic Herb, Depressional [Lakeshore], Depressional [Pond], Deep (>15 cm) Water, Saturated Soil

Non-Diagnostic Classifiers: Montane [Montane], Montane [Lower Montane], Lowland [Foothill], Lowland [Lowland], Backwater, Drainage bottom (undifferentiated), Floodplain, Marsh, Oxbow, Pond, Temperate [Temperate Continental], Forb, Alga, Clay Subsoil Texture

Concept Summary: This widespread ecological system occurs throughout much of the arid and semi-arid regions of western North America. Natural marshes may occur in depressions in the landscape (ponds, kettle ponds), as fringes around lakes, and along slow-flowing streams and rivers (such riparian marshes are also referred to as sloughs). Marshes are frequently or continually inundated, with water depths up to 2 m. Water levels may be stable, or may fluctuate 1 m or more over the course of the growing season. Marshes have distinctive soils that are typically mineral, but can also accumulate organic material. Soils have characteristics that result from long periods of anaerobic conditions in the soils (e.g., gleyed soils, high organic content, redoximorphic features). The vegetation is characterized by herbaceous plants that are adapted to saturated soil conditions. Common emergent and floating vegetation includes species of *Scirpus* and/or *Schoenoplectus, Typha, Juncus, Potamogeton, Polygonum, Nuphar*, and *Phalaris*. This system may also include areas of relatively deep water with floating-leaved plants (*Lemna, Potamogeton*, and *Brasenia*) and submergent and floating plants (*Myriophyllum, Ceratophyllum*, and *Elodea*).

DISTRIBUTION

Range: Occurs throughout much of the arid and semi-arid regions of western North America.
Ecological Divisions: 301, 302, 303, 304, 305, 306
TNC Ecoregions: 11:C, 17:C, 18:C, 19:C, 20:C, 21:C, 23:C, 24:C, 26:C, 27:C, 28:C, 29:C, 30:C, 6:C, 7:C, 8:C, 9:C
Subnations/Nations: AB:c, AZ:c, BC:c, CA:c, CO:c, ID:c, MT:c, MXBC:c, MXCH:c, MXSO:c, ND:c, NE:c, NM:c, NV:c, OK:c, OR:c, SD:c, TX:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:
- (POTAMOGETON DIVERSIFOLIUS, STUCKENIA FILIFORMIS) PERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1763) Potamogeton diversifolius Herbaceous Vegetation (CEGL002007) Stuckenia filiformis Herbaceous Vegetation (CEGL002008)
- CALAMAGROSTIS CANADENSIS SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1400) Calamagrostis canadensis Western Herbaceous Vegetation (CEGL001559)
- CAREX (ROSTRATA, UTRICULATA) SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1403) Carex utriculata Herbaceous Vegetation (CEGL001562)
- CAREX NEBRASCENSIS SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1417) Carex nebrascensis Herbaceous Vegetation (CEGL001813)
- CAREX VESICARIA SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.2501) Carex vesicaria Herbaceous Vegetation (CEGL002661)
- DISTICHLIS SPICATA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE (A.1332) Distichlis spicata - (Scirpus nevadensis) Herbaceous Vegetation (CEGL001773)
- ELEOCHARIS (MONTEVIDENSIS, PALUSTRIS, QUINQUEFLORA) SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1371) Eleocharis (montevidensis, palustris, quinqueflora) Seasonally Flooded Herbaceous Vegetation [Placeholder] (CEGL003050)
- GLYCERIA BOREALIS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1445) Glyceria borealis Herbaceous Vegetation (CEGL001569)
- JUNCUS BALTICUS SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1374) Juncus balticus - Carex rossii Herbaceous Vegetation (CEGL001839) Juncus balticus Herbaceous Vegetation (CEGL001838)
- LEMNA SPP. PERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1747) Lemna spp. Permanently Flooded Herbaceous Vegetation (CEGL003059)
- MYRIOPHYLLUM SIBIRICUM PERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1761) Myriophyllum sibiricum Herbaceous Vegetation (CEGL002000)
- NYMPHAEA ODORATA - NUPHAR SPP. PERMANENTLY FLOODED TEMPERATE HERBACEOUS ALLIANCE (A.1984) Nuphar lutea ssp. polysepala Herbaceous Vegetation (CEGL002001)

- PHALARIS ARUNDINACEA SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1381) Phalaris arundinacea Western Herbaceous Vegetation (CEGL001474)
- PHRAGMITES AUSTRALIS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1431) Phragmites australis Western North America Temperate Semi-natural Herbaceous Vegetation (CEGL001475)
- POTAMOGETON FOLIOSUS PERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.2518) Potamogeton foliosus Herbaceous Vegetation (CEGL002742)
- POTAMOGETON SPP. - CERATOPHYLLUM SPP. - ELODEA SPP. PERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1754) Potamogeton natans Herbaceous Vegetation (CEGL002925)
- RANUNCULUS AQUATILIS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1679) Ranunculus aquatilis - Callitriche palustris Herbaceous Vegetation (CEGL001984)
- RUPPIA (CIRRHOSA, MARITIMA) PERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1755) Ruppia (cirrhosa, maritima) Permanently Flooded Herbaceous Vegetation [Placeholder] (CEGL003119)
- SALICORNIA RUBRA SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1818) Salicornia rubra Herbaceous Vegetation (CEGL001999)
- SCHOENOPLECTUS ACUTUS - (SCHOENOPLECTUS TABERNAEMONTANI) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1443) Schoenoplectus acutus Herbaceous Vegetation (CEGL001840) Schoenoplectus tabernaemontani Temperate Herbaceous Vegetation (CEGL002623)
- SCHOENOPLECTUS AMERICANUS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1432) Schoenoplectus americanus - Carex spp. Herbaceous Vegetation (CEGL004144) Schoenoplectus americanus - Eleocharis palustris Herbaceous Vegetation (CEGL001585) Schoenoplectus americanus - Eleocharis spp. Herbaceous Vegetation (CEGL001586) Schoenoplectus americanus - Flaveria chlorifolia - (Helianthus paradoxus) Herbaceous Vegetation (CEGL004592) Schoenoplectus americanus Western Herbaceous Vegetation (CEGL001841)
- SCHOENOPLECTUS MARITIMUS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1444) Schoenoplectus maritimus Herbaceous Vegetation (CEGL001843)
- SCHOENOPLECTUS PUNGENS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1433) Schoenoplectus pungens Herbaceous Vegetation (CEGL001587)
- SPARGANIUM ANGUSTIFOLIUM PERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1760) Sparganium angustifolium Herbaceous Vegetation (CEGL001990)
- SPARGANIUM EURYCARPUM PERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.2598) Sparganium eurycarpum Herbaceous Vegetation (CEGL003323)
- SPARTINA GRACILIS SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1407) Spartina gracilis Herbaceous Vegetation (CEGL001588)
- SPARTINA PECTINATA TEMPORARILY FLOODED HERBACEOUS ALLIANCE (A.1347) Spartina pectinata Western Herbaceous Vegetation (CEGL001476)
- TRIGLOCHIN MARITIMA SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1681) Triglochin maritima Herbaceous Vegetation (CEGL001995)
- TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCHOENOPLECTUS SPP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1436) Schoenoplectus acutus - Typha latifolia - (Schoenoplectus tabernaemontani) Sandhills Herbaceous Vegetation (CEGL002030) Typha latifolia Western Herbaceous Vegetation (CEGL002010)
- TYPHA DOMINGENSIS SEASONALLY FLOODED TEMPERATE HERBACEOUS ALLIANCE (A.1392) Typha domingensis Western Herbaceous Vegetation (CEGL001845)

SOURCES

References: Brown 1982, Cooper 1986b, Dick-Peddie 1993, Faber-Langendoen et al. 1997, Hansen et al. 1995, Kittel et al. 1994, Neely et al. 2001, Padgett et al. 1989, Rondeau 2001, Szaro 1989, Ungar 1965, Ungar 1972
Last updated: 20 Feb 2003 **Stakeholders:** WCS, SCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S114 SONORA-MOJAVE-BAJA SEMI-DESERT CHAPARRAL
Division 302, Shrubland, CES302.757
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Montane [Lower Montane], Lowland [Foothill], Shrubland (Shrub-dominated), Tropical/Subtropical [Tropical Xeric], Temperate [Temperate Xeric], Intermediate Disturbance Interval, F-Patch/High Intensity, Evergreen Sclerophyllous Shrub

Non-Diagnostic Classifiers: Ridge/Summit/Upper Slope, Sideslope, Aridic, Broad-Leaved Deciduous Shrub, Broad-Leaved Evergreen Shrub, Short (50-100 yrs) Persistence

Concept Summary: This ecological system is composed of evergreen shrublands on sideslopes transitioning from low-elevation desert landscapes up into woodlands of the western Mojave and Sonoran deserts. It extends from northeast Kern County, California, into Baja Norte. Associated species include *Quercus john-tuckeri, Quercus cornelius-mulleri, Quercus berberidifolia, Arctostaphylos patula, Arctostaphylos pungens, Arctostaphylos glauca, Rhus ovata, Cercocarpus montanus var. glaber (= Cercocarpus betuloides), Ceanothus greggii, Garrya flavescens*, *Juniperus californica*, and *Nolina parryi*.

DISTRIBUTION

Range: Western Mojave and Sonoran deserts.
Ecological Divisions: 302
TNC Ecoregions: 17:C, 23:C
Subnations/Nations: AZ:c, CA:c, MXBC:c, MXSO:c, NV:c

CONCEPT

- **California community types:**
- Cupleaf Ceanothus - Fremontia - Oak Chaparral (37.212.00)
- Cupleaf Ceanothus (37.212.01)
- Greenleaf Manzanita Chaparral (37.303.00)
- Greenleaf Manzanita (37.303.01)
- Muller Oak (37.415.00)
- Muller Oak - Brittlebush-Narrowleaf Goldenbush (37.415.02)
- Muller Oak - Mountain Mahogany (37.415.03)
- Tucker Oak Scrub (37.418.00)
- Sugarbush Scrub (37.801.00)
- Shrub Live Oak Scrub (71.095.00)
- Shrub Live Oak - Singleleaf Pinyon (71.095.01)
- Shrub Live Oak - Desert Baccharis (71.095.02)
- California Juniper Woodland and Scrub (89.100.00)
- California Juniper - Desert Agave (89.100.03)
- California Juniper / Blackbush (89.100.04)
- California Juniper - Muller Oak / Blackbush (89.100.05)
- California Juniper / Blackbush - Mojave Yucca (89.100.06)
- California Juniper / Desert Needlegrass (89.100.07)
- California Juniper - Mojave Yucca / Big Galleta (89.100.08)
- California Juniper / California Buckwheat (89.100.10)
- California Juniper / Parry's Nolina (89.100.11)

SOURCES

References: Barbour and Major 1988, Brown 1982, Holland and Keil 1995, MacMahon 1988, Thomas et al. 2003a
Last updated: 20 Feb 2003 **Stakeholders:** WCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S118 GREAT BASIN FOOTHILL AND LOWER MONTANE RIPARIAN WOODLAND AND SHRUBLAND
Division 304, Woody Wetland, CES304.045
Spatial Scale & Pattern: Linear
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Wetland
Diagnostic Classifiers: Forest and Woodland (Treed), Riparian Mosaic, Riverine / Alluvial, Short (<5 yrs) Flooding Interval

Non-Diagnostic Classifiers: Montane [Lower Montane], Lowland [Foothill], Temperate [Temperate Continental]

Concept Summary: This system occurs in mountain ranges of the Great Basin and along the eastern slope of the Sierra Nevada within a broad elevation range from about 4,000 to over. 7,000 feet (1,220 to over 2,135 meters). This system often occurs as a mosaic of multiple communities that are tree-dominated with a diverse shrub component. The variety of plant associations connected to this system reflects elevation, stream gradient, floodplain width, and flooding events. Dominant trees may include *Abies concolor, Alnus incana, Betula occidentalis, Populus angustifolia, Populus balsamifera ssp. trichocarpa, Populus fremontii, Salix laevigata, Salix gooddingii*, and *Pseudotsuga menziesii*. Dominant shrubs include *Artemisia cana, Cornus sericea, Salix exigua, Salix lasiolepis, Salix lemmonii*, or *Salix lutea*. Herbaceous layers are often dominated by species of *Carex* and *Juncus*, and perennial grasses and mesic forbs such *Deschampsia caespitosa, Elymus trachycaulus, Glyceria striata, Iris missouriensis, Maianthemum stellatum*, or *Thalictrum fendleri*. Introduced forage species such as *Agrostis stolonifera, Poa pratensis, Phleum pratense*, and the weedy annual *Bromus tectorum* are often present in disturbed stands. These are disturbance-driven systems that require flooding, scour and deposition for germination and maintenance. Livestock grazing is a major influence in altering structure, composition, and function of the community.

DISTRIBUTION

Range: Occurs in mountain ranges of the Great Basin and along the eastern slope of the Sierra Nevada within a broad elevation range from about 4,000 feet (1,220 meters) to over 7,000 feet (2,135 meters).
Ecological Divisions: 304
TNC Ecoregions: 11:C, 12:C, 6:P
Subnations/Nations: CA:c, NV:c, OR:?, UT:c

CONCEPT

Alliances and Associations:
- ALNUS INCANA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.950) Alnus incana / Cornus sericea Shrubland (CEGL001145)
- ARTEMISIA CANA (SSP. BOLANDERI, SSP. VISCIDULA) SHRUBLAND ALLIANCE (A.2557) Artemisia cana (ssp. bolanderi, ssp. viscidula) / Leymus cinereus Shrubland (CEGL001460) Artemisia cana ssp. viscidula / Deschampsia caespitosa Shrubland (CEGL001074)
- ARTEMISIA NOVA SHRUBLAND ALLIANCE (A.1105) Artemisia nova - Ericameria nana Shrubland (CEGL002773)
- BETULA OCCIDENTALIS SEASONALLY FLOODED SHRUBLAND ALLIANCE (A.996) Betula occidentalis / Mesic Graminoids Shrubland (CEGL002654)
- BETULA OCCIDENTALIS TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.967) Betula occidentalis / Cornus sericea Shrubland (CEGL001161) Betula occidentalis / Maianthemum stellatum Shrubland (CEGL001162)
- CORNUS SERICEA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.968) Cornus sericea Shrubland (CEGL001165)
- POPULUS ANGUSTIFOLIA TEMPORARILY FLOODED WOODLAND ALLIANCE (A.641) Populus angustifolia / Betula occidentalis Woodland (CEGL000648) Populus angustifolia / Rhus trilobata Woodland (CEGL000652)
- POPULUS BALSAMIFERA SSP. TRICHOCARPA TEMPORARILY FLOODED FOREST ALLIANCE (A.311) Populus balsamifera ssp. trichocarpa / Alnus incana Forest (CEGL000667) Populus balsamifera ssp. trichocarpa / Mixed Herbs Forest (CEGL000675)
- POPULUS FREMONTII SEASONALLY FLOODED WOODLAND ALLIANCE (A.654) Populus fremontii / Leymus triticoides Woodland (CEGL002756) Populus fremontii / Salix geyeriana Woodland (CEGL000943)
- POPULUS FREMONTII TEMPORARILY FLOODED FOREST ALLIANCE (A.313) Populus fremontii / Salix exigua Forest (CEGL000666)
- SALIX LASIOLEPIS TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.977) Salix lasiolepis / Rosa woodsii / Mixed Herbs Shrubland (CEGL001217)

- SALIX LEMMONII SEASONALLY FLOODED SHRUBLAND ALLIANCE (A.2523) Salix lemmonii / Mesic-Tall Forbs Shrubland (CEGL002771) Salix lemmonii / Rosa woodsii Shrubland (CEGL002772)
- SALIX LUTEA SEASONALLY FLOODED SHRUBLAND ALLIANCE (A.1007) Salix lutea / Carex utriculata Shrubland (CEGL001220)
- SALIX LUTEA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.980) Salix lutea / Mesic Forbs Shrubland (CEGL002774)

SOURCES

References: Barbour and Billings 1988, Barbour and Major 1977, Manning and Padgett 1989, Sawyer and Keeler-Wolf 1995
Last updated: 16 Apr 2003 **Stakeholders:** WCS
Concept Author: J. Nachlinger and K. Schulz **LeadResp:** WCS

N21—DEVELOPED, OPEN SPACE—LOW INTENSITY
Source: NLCD draft legend, 25 July, 2003
Description: *Open Space:* Includes areas with a mixture of some construction materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed sesttings for recreation, erosion control, or aesthetic purposes. *Developed, Low intensity*: Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49 percent of total cover. These areas most commonly include single-family housing units.

N22—DEVELOPED, MEDIUM –HIGH INTENSITY
Source: NLCD draft legend, 25 July, 2003
Description: *Developed, Medium Intensity*: Includes areas with a mixture of constructed materials and vegetation. Impervious surface accoutns for 50-79 percent of the total cover. These areas most commonly include single-family housing units. *Developed, High Intensity*: Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to 100 percent of the total cover.

N80—AGRICULTURE
Source: NLCD draft legend, 25 July, 2003
Description: Agriculture—unable to make distinction between N81 and N82.

D04—INVASIVE SOUTHWEST RIPARIAN WOODLAND AND SHRUBLAND
Source: SWReGAP/NatureServe
Description: Tamarix spp. Semi-Natural Temporarily Flooded Shrubland Alliance (A842), or Elaegnus angustifolus Semi-Natural Woodland Alliance (A3566).

D06—INVASIVE PERENNIAL GRASSLAND
Source: SWReGAP/NatureServe
Description: Pennisetum spp., Bromus inermis, Poa pratensis, Eragrostis lehmannianna, Thinopyrum intermedium (A2567), Pennisetum spp., Bromus inermis, Poa pratensis, Eragrostis lehmannianna, Thinopyrum intermedium (A3561), or Poa pratensis Semi-Natural Herbaceous Alliance (A1382). Includes Agropyron cristatum.

D08—INVASIVE ANNUAL GRASSLAND
Source: SWReGAP/NatureServe
Description: Avena spp., Bromus spp., Schismus spp.

D09—INVASIVE ANNUAL AND BIENNIAL FORBLAND
Source: SWReGAP/NatureServe
Description: Salsola spp., Kochia scoparia, Halogeton glomeratum

APPENDIX B

Available GIS Datasets

Table B-1 Applicable GIS datasets for Nevada and Arizona

State	Name	Source	Source URL
NV	hydrobasins (water rights basins)	Nevada Data Browser	http://www.epa.gov/esd/land-sci/nv_geospatial/pages/nvgeo_gisdata.htm
NV	HUCs	Nevada Data Browser	http://www.epa.gov/esd/land-sci/nv_geospatial/pages/nvgeo_gisdata.htm
NV	critical habitat - desert tortoise	USFWS	
NV	Mojave CHU	USFWS	
NV	ACECs	BLM	http://www.nv.blm.gov/gis/geospatial_data.htm
NV	lakes	Nevada Data Browser	http://www.epa.gov/esd/land-sci/nv_geospatial/pages/nvgeo_gisdata.htm
NV	geology	Nevada Data Browser	http://www.epa.gov/esd/land-sci/nv_geospatial/pages/nvgeo_gisdata.htm
NV	streams	Nevada Data Browser	http://www.epa.gov/esd/land-sci/nv_geospatial/pages/nvgeo_gisdata.htm
NV	springs	Nevada Data Browser	http://www.epa.gov/esd/land-sci/nv_geospatial/pages/nvgeo_gisdata.htm
NV	counties	Nevada Data Browser	http://www.epa.gov/esd/land-sci/nv_geospatial/pages/nvgeo_gisdata.htm
NV	land ownership	Nevada Data Browser	http://www.epa.gov/esd/land-sci/nv_geospatial/pages/nvgeo_gisdata.htm
NV	sand dunes	Nevada Data Browser	http://www.epa.gov/esd/land-sci/nv_geospatial/pages/nvgeo_gisdata.htm
NV	soils	NRCS, Soil Data Mart	http://soildatamart.nrcs.usda.gov/
NV, Clark County	census data	Clark County	http://gisgate.co.clark.nv.us/gismo/Freedata.HTM
NV, Clark County	zoning, ROI, and available land use	Clark County	http://gisgate.co.clark.nv.us/gismo/Freedata.HTM
NV, Clark County	comprehensive planning	Clark County	http://gisgate.co.clark.nv.us/gismo/Freedata.HTM
NV	wilderness	BLM	http://www.nv.blm.gov/gis/geospatial_data.htm
NV	WSAs	BLM	http://www.nv.blm.gov/gis/geospatial_data.htm
NV	fire history 1910-2000	BLM	http://www.nv.blm.gov/gis/geospatial_data.htm
NV	mining claims	BLM	http://www.nv.blm.gov/gis/geospatial_data.htm
NV	grazing allotments	BLM	http://www.nv.blm.gov/gis/geospatial_data.htm
AZ	land ownership	Arizona State Land Department	http://www.land.state.az.us/alris/
AZ	county boundary	Arizona State Land Department	http://www.land.state.az.us/alris/
AZ	grazing allotments	Arizona State Land Department	http://www.land.state.az.us/alris/
AZ	wilderness	Arizona State Land Department	http://www.land.state.az.us/alris/
AZ	springs	Arizona State Land Department	http://www.land.state.az.us/alris/
AZ	streams, including ephemeral	Arizona State Land Department	http://www.land.state.az.us/alris/
AZ	HUCs	Arizona State Land Department	http://www.land.state.az.us/alris/
AZ	irrigated areas	Arizona State Land Department	http://www.land.state.az.us/alris/
AZ	hydro polygon (lakes, etc.)	Arizona State Land Department	http://www.land.state.az.us/alris/
AZ	DRGs	Arizona State Land Department	http://www.land.state.az.us/alris/
AZ	DOQQs	Arizona State Land Department	http://www.land.state.az.us/alris/
AZ	mines	Arizona State Land Department	http://www.land.state.az.us/alris/
AZ	biotic communities	Arizona State Land Department	http://www.land.state.az.us/alris/
AZ	AGFD natural vegetation	Arizona State Land Department	http://www.land.state.az.us/alris/
AZ	geological	Arizona State Land Department	http://www.land.state.az.us/alris/
AZ	county roads	Arizona State Land Department	http://www.land.state.az.us/alris/
AZ	ACECs	Arizona BLM	http://www.blm.gov/az/gis/index.htm
AZ	BLM Wilderness Areas	Arizona BLM	http://www.blm.gov/az/gis/index.htm
AZ	BLM Wilderness Study Areas	Arizona BLM	http://www.blm.gov/az/gis/index.htm
AZ	5th level watersheds	Arizona BLM	http://www.blm.gov/az/gis/index.htm

Table B-1 Applicable GIS datasets for Nevada and Arizona

State	Name	Source	Source URL
AZ	suitable dt habitat	Arizona BLM	http://www.blm.gov/az/gis/index.htm
AZ	National Conservation Areas	Arizona BLM	http://www.blm.gov/az/gis/index.htm
both states	ecological systems (vegetation)	SWReGAP	http://earth.gis.usu.edu/swgap/data.html
both states	landform	SWReGAP	http://earth.gis.usu.edu/swgap/data.html
both states	geology	SWReGAP	http://earth.gis.usu.edu/swgap/data.html
both states	National Elevation Dataset (NED)	USGS	http://ned.usgs.gov/

APPENDIX C

Final Data Screening Level Assessment Summary

Table C-1 Distribution, habitat, life history, species protection and management, and threats data gaps and short- and long-term data acquisition needs for special status species in the VRCMA Boundary identified by taxon, common and scientific name.

SPECIES			DATA GAPS[A]				
Taxon	Common Name	Scientific Name	Distribution Data Gaps	Habitat Data Gaps	Life History Data Gaps	Ongoing Species Protection and Management Data Gaps	Threats Data Gaps
Amphibian							
amphibian	Pacific tree frog	*Hyla regilla*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
Bird							
bird	American peregrine falcon	*Falco peregrinus anatum*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
bird	bald eagle	*Haliaeetus leucocephalus*	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	Impact of mercury on populations is not well understood (NDOW 2006).
bird	Bendire's thrasher	*Toxostoma bendirei*	No data gaps have been identified.	Information on habitat needs and use is needed (NDOW 2006).	Little is known about basic life history (NDOW 2006).	No data gaps have been identified.	Threats are largely unknown (NatureServe 2007).
bird	black-chinned sparrow	*Spizella atrogularis*	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	Information on impacts of habitat change is needed (USDA Forest Service 1994).	No data gaps have been identified.
bird	blue grosbeak	*Guiraca caerulea*	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	Threats south of the United States are unknown.
bird	Brewer's sparrow	*Spizella breweri*	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	Understanding of how other management practices (aside from full removal of sagebrush) affect Brewer's sparrow is relatively poor (Rotenberry et al. 1999).
bird	cactus wren	*Campylorhynchus brunneicapillus*	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
bird	crissal thrasher	*Toxostoma crissale*	General population trends are unknown.	Better understanding of habitat use in Mojave desert and washes is needed (NDOW 2006).	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.

[a]Data gaps were documented for this VRCMA document if, after reviewing available literature, data gaps were either identified specifically in the literature or, cumulatively, the literature did not provide adequate information (e.g., known threats to a particular species).

Table C-1 Distribution, habitat, life history, species protection and management, and threats data gaps and short- and long-term data acquisition needs for special status species in the VRCMA Boundary identified by taxon, common and scientific name.

SPECIES			DATA GAPS[A]				
Taxon	Common Name	Scientific Name	Distribution Data Gaps	Habitat Data Gaps	Life History Data Gaps	Ongoing Species Protection and Management Data Gaps	Threats Data Gaps
bird	ferruginous hawk	*Buteo regalis*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	Understanding of the wintering ecology, dispersal, site fidelity (breeding and winter) is needed for conservation planning. Other research needs include basic biology, color and relationship between populations of hawks and prey, especially cyclic species (NDOW 2006).	No data gaps have been identified.	Threats are not well-known for this species. The effects of land management actions on ferruginous hawks is also poorly known. More study of the use of prey populations in the agricultural/wild land interface is needed in Nevada to accurately assess the net effects of agricultural development (NDOW 2006).
bird	flammulated owl	*Otus flammeolus*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
bird	golden eagle	*Aquila chrysaetos*	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
bird	gray vireo	*Vireo vicinior*	No data gaps have been identified.	Habitat use and landscape level factors are not well understood (NDOW 2006).	Predators are not understood.	No data gaps have been identified.	Effects of habitat fragmentation, parasitism, urban development, and changing fire regimes are not well understood (NDOW 2006).
bird	Le Conte's thrasher	*Toxostoma lecontei*	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
bird	loggerhead shrike	*Lanius ludovicianus*	Reasons for rangewide decline are not understood.	Identification of crucial habitat components is needed (NDOW 2006).	No data gaps have been identified.	No monitoring is known to occur.	No data gaps have been identified.
bird	long-eared owl	*Asio otus*	Historical distribution is unknown.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
bird	Lucy's warbler	*Vermivora luciae*	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
bird	northern goshawk	*Accipiter gentilis*	Population trends need to be understood (NDOW 2006).	Seasonal and annual variations in habitat use need to be studied (NDOW 2006).	Home range size, activity budgets, diet, mate and territory fidelity, and foraging behavior are all not fully understood (NDOW 2006).	No data gaps have been identified.	Threats are not well-known for this species.
bird	northern saw-whet owl	*Aegolius acadicus*	Historical distribution and trend data on species status are unknown.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
bird	phainopepla	*Phainopepla nitens*	Population abundance and trend unknown in NV (NDOW 2007).	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.

a. Data gaps were documented for this VRCMA document if, after reviewing available literature, data gaps were either identified specifically in the literature or, cumulatively, the literature did not provide adequate information (e.g., known threats to a particular species).

Table C-1 Distribution, habitat, life history, species protection and management, and threats data gaps and short- and long-term data acquisition needs for special status species in the VRCMA Boundary identified by taxon, common and scientific name.

SPECIES			DATA GAPS[A]				
Taxon	Common Name	Scientific Name	Distribution Data Gaps	Habitat Data Gaps	Life History Data Gaps	Ongoing Species Protection and Management Data Gaps	Threats Data Gaps
bird	pinyon jay	*Gymnorhinus cyanocephalus*	No data gaps have been identified.	Little is known about landscape level habitat characteristics for this species (NDOW 2006).	Little is known about breeding ecology (NDOW 2006).	No data gaps have been identified.	No data gaps have been identified.
bird	prairie falcon	*Falco mexicanus*	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
bird	Scott's oriole	*Icterus parisorum*	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	Conservation efforts are unknown.	No data gaps have been identified.
bird	summer tanager	*Piranga rubra*	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
bird	vesper sparrow	*Pooecetes gramineus*	Status is unknown.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
bird	western bluebird	*Sialia mexicana*	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
bird	western burrowing owl	*Athene cunicularia*	A standardized survey effort is recommended to determine status, as many population estimates are simply based on "best guesses." Monitoring of demographics and occupied habitat are also needed (NDOW 2006).	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	Management strategies currently in use need to be evaluated for their effectiveness. Further investigations also needed on land use impacts; prescribed fire; disturbance; habitat enhancements (e.g., artificial burrows and perches); relocation and reintroduction; impact of predators on nest success (NDOW 2006).
bird	western screech owl	*Otus kennicotti*	No data gaps have been identified.	No data gaps have been identified.	Limited life history information.	Limited conservation information.	Threats are not well-known for this species.
bird	yellow-breasted chat	*Icteria virens*	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
Mammal							
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	Wintering areas and aggregations are unknown.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	Threats are unknown.
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.

[a]Data gaps were documented for this VRCMA document if, after reviewing available literature, data gaps were either identified specifically in the literature or, cumulatively, the literature did not provide adequate information (e.g., known threats to a particular species).

Table C-1 Distribution, habitat, life history, species protection and management, and threats data gaps and short- and long-term data acquisition needs for special status species in the VRCMA Boundary identified by taxon, common and scientific name.

SPECIES			DATA GAPS[A]				
Taxon	Common Name	Scientific Name	Distribution Data Gaps	Habitat Data Gaps	Life History Data Gaps	Ongoing Species Protection and Management Data Gaps	Threats Data Gaps
mammal	desert kangaroo rat	*Dipodomys deserti*	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	The extent to which commercial collection affects the desert kangaroo rat is unknown (RECON 2000).	No data gaps have been identified.
mammal	desert pocket mouse	*Chaetodipus penicillatus*	Status and extent are unknown within the VRCMA Boundary. Population connectivity and viability studies are needed (NDOW 2006).	No data gaps have been identified.	Habits not well known.	Conservation efforts are unknown.	Threats are unknown.
mammal	hoary bat	*Lasiurus cinereus*	Status and trends need to be determined in Nevada (NDOW 2006).	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
mammal	kit fox	*Vulpes macrotis*	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
mammal	long-eared myotis	*Myotis evotis*	Winter range and population trends are unknown.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
mammal	long-legged myotis	*Myotis volans*	No data gaps have been identified.	No data gaps have been identified.	Winter data is extremely lacking.	No data gaps have been identified.	Potentially other threats exist, but threats have been identified for this species.
mammal	Merriam's shrew	*Sorex merriami*	No data gaps have been identified.	No data gaps have been identified.	Details regarding reproduction of this species are limited (Churchfield 1990). Dispersal information is limited (NatureServe 2008).	No data gaps have been identified.	Little information is available with regards to threats. The response of this species to grazing pressure is unknown (Verts and Carraway 1998).
mammal	pallid bat	*Antrozous pallidus*	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
mammal	silver-haired bat	*Lasionycteris noctivagans*	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
mammal	spotted bat	*Euderma maculatum*	No data gaps have been identified.	No data gaps have been identified.	Reproduction is relatively unknown. This species is considered by some biologists to be an elevational migrant (AGFD 2003n). Additional information about migration is unknown.	No data gaps have been identified.	Little is known about this bat and its life history, and threats are therefore speculations (AGFD 2003n).
mammal	western pipistrelle	*Pipistrellus hesperus*	Winter range is poorly defined (NatureServe 2007).	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.

a. Data gaps were documented for this VRCMA document if, after reviewing available literature, data gaps were either identified specifically in the literature or, cumulatively, the literature did not provide adequate information (e.g., known threats to a particular species).

Table C-1 Distribution, habitat, life history, species protection and management, and threats data gaps and short- and long-term data acquisition needs for special status species in the VRCMA Boundary identified by taxon, common and scientific name.

SPECIES			DATA GAPS[A]				
Taxon	Common Name	Scientific Name	Distribution Data Gaps	Habitat Data Gaps	Life History Data Gaps	Ongoing Species Protection and Management Data Gaps	Threats Data Gaps
mammal	western red bat	*Lasiurus blossevillii*	Altitudinal distribution, and migration patterns are not well understood (TPWD 2007).	Habitat requirements (especially roost sites and foraging habitat) (TPWD 2007).	Little is known about reproductive biology (NDOW 2006).	No data gaps have been identified.	Effects of controlled burns and effects of pesticide use in orchards need to be better understood.
mammal	Allen's big-eared bat	*Idionycteris phyllotis*	Population trends need to be understood (NDOW 2006).	Delineating roosting preferences and requirements (NDOW 2007).	Current population status, and describing foraging and reproductive behavior (NDOW 2006).	Identify and map winter, maternity, bachelor, leking, and night roosts. Coordinate protection measures such as installation of bat gates or access restrictions with appropriate land management agencies. Coordinate mine inventories for significant bat colonies with mine closure programs of various agencies, including BLM, Forest Service, and NV Division of Minerals. Forest management should include efforts to maintain a variety of serial stages, including old growth and snags (NDOW 2007).	Potentially other threats exist, but threats have been identified for this species.
mammal	big free-tailed bat	*Nyctinomops macrotis*	Little is known about population dynamics (NDOW 2006).	Little is known about specific roosting requirements. Roosts are difficult to find and often inaccessible (NDOW 2007).	Many aspects of life-history are still unknown, particularly metapopulation dynamics; productivity and survivorship in response to habitat quality; and winter range, habitat use, and diet (NatureServe 2006).	No data gaps have been identified.	No data gaps have been identified.
mammal	California leaf-nosed bat	*Macrotus californicus*	No data gaps have been identified.	Research efforts should focus on surveys for new roosts, documenting roosting requirements, foraging habits, and delineating the status of this species.(NDOW 2007).	No data gaps have been identified.	No data gaps have been identified.	Potentially other threats exist, but threats have been identified for this species. The distance at which exploratory drilling and blasting affects roosting is unknown (WBWG 2005).
mammal	California myotis	*Myotis californicus*	No data gaps have been identified.	More information is needed on roosting and foraging requirements (TPWD 2007).	Little is known about mating behavior and predator/antipredator behavior (Wilson and Ruff 1999)	The use and acceptance of bat gates needs to be studied (TPWD 2007).	No data gaps have been identified.

[a]Data gaps were documented for this VRCMA document if, after reviewing available literature, data gaps were either identified specifically in the literature or, cumulatively, the literature did not provide adequate information (e.g., known threats to a particular species).

Table C-1 Distribution, habitat, life history, species protection and management, and threats data gaps and short- and long-term data acquisition needs for special status species in the VRCMA Boundary identified by taxon, common and scientific name.

SPECIES			DATA GAPS[A]				
Taxon	Common Name	Scientific Name	Distribution Data Gaps	Habitat Data Gaps	Life History Data Gaps	Ongoing Species Protection and Management Data Gaps	Threats Data Gaps
mammal	fringed myotis	*Myotis thysanodes*	Information on population trends is needed (NDOW 2006).	Delineating roosting preferences and requirements (NDOW 2007).	Descriptions of foraging and roosting behavior are needed (NDOW 2006).	No data gaps have been identified.	No data gaps have been identified.
mammal	greater western mastiff bat	*Eumops perotis californicus*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	Potentially other threats exist, but threats have been identified for this species.
mammal	little brown myotis	*Myotis lucifugus*	Although one of the most common bats in the U.S., the distribution of the little brown myotis in Nevada seems to be restricted to the northern part of the state for unknown reasons (NDOW 2007).	Although this is one of the better studied species of bat in the U.S., little is known about specific preferences of the little brown myotis in Nevada, including foraging behavior, reproductive biology, roosting requirements, and population dynamics. Information is needed on the current distribution and status of the species. Particular attention should be focused on locations and characteristics of winter hibernacula (NDOW 2007).	No data gaps have been identified.	Specific needed conservation actions: Limit human disturbance to roosting sites (particularly maternity colonies); Determine current population status, trend, and response to modification of foraging areas in riparian zones; Determine current population status, trend, and response to modification of foraging areas in riparian zones (WBWG 2005). The lack of understanding of intra-specific variation within this species compromises the effectiveness of current management policy (AGFD 2007).	Potentially other threats exist, but threats have been identified for this species.
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	Status and extent are unknown within the VRCMA Boundary.	The identification of critical roosts and limiting factors in roost requirements is incomplete especially for hibernacula. Identification and protection of significant roost sites is still needed in most areas (WBWG 2005). Although generally considered very faithful to a roost, this species probably shifts roosting sites more frequently than previously thought and these habits need further study (NDOW 2007).	Foraging behavior, reproductive biology, population dynamics, and specific roosting requirements (NDOW 2007, WBWG 2005)	Identify and map winter, maternity, bachelor, leking, and night roosts. Coordinate protection measures such as installation of bat gates or access restrictions with appropriate land management agencies. Coordinate mine inventories for significant bat colonies with mine closure programs of various agencies, including BLM, Forest Service, and NV Division of Minerals (NDOW 2007).	No data gaps have been identified.
mammal	western small-footed myotis	*Myotis ciliolabrum*	No information known on population trends (TPWD 2007).	More information is needed on roosting and foraging requirements (TPWD 2007).	Information on reproductive biology is needed (NDOW 2006).	More information is needed on the use and acceptance of bat gates (TPWD 2007).	No data gaps have been identified.

a. Data gaps were documented for this VRCMA document if, after reviewing available literature, data gaps were either identified specifically in the literature or, cumulatively, the literature did not provide adequate information (e.g., known threats to a particular species).

Table C-1 Distribution, habitat, life history, species protection and management, and threats data gaps and short- and long-term data acquisition needs for special status species in the VRCMA Boundary identified by taxon, common and scientific name.

SPECIES			DATA GAPS[A]				
Taxon	Common Name	Scientific Name	Distribution Data Gaps	Habitat Data Gaps	Life History Data Gaps	Ongoing Species Protection and Management Data Gaps	Threats Data Gaps
mammal	Yuma myotis	*Myotis yumanensis*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	Little is known about foraging behavior, reproductive biology, and population dynamics. Information is needed on the current distribution and status of the species as we currently know very little (NDOW 2007)	Specific needed conservation actions. Determine effects of pesticide use in important foraging areas on population viability and survivorship; Regulate collection and monitor population; Population Monitoring and Research (UDWR 2005).	Some of the general threats to bats could apply to *N. macrotis*. These could include impacts to foraging areas from grazing, riparian management, the use of pesticides, and in some places disturbance to the roost site (e.g., blasting of cliffs or water impoundments).(WBWG 2005). Species threats are unknown in Nevada (NDOW 2007).
Plant							
plant	alpine stinking lomatium	*Lomatium graveolens* var. *alpinum*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	Conservation efforts are unknown.	Threats are unknown.
plant	Antelope Canyon goldenbush	*Ericameria cervina*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	Very limited life history information available.	Conservation efforts are unknown.	Threats are not well-known for this species.
plant	Aven Nelson's phacelia	*Phacelia anelsonii*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	Threats are unknown.
plant	barrel cactus	*Ferocactus acanthoides* var. *lecontei*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	Limited life history information.	Conservation efforts are unknown.	Threats are unknown.
plant	Beaver Dam scurf pea	*Pediomelum castoreum*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	Very limited life history information available.	Conservation efforts are unknown.	Threats are not well-known for this species.
plant	catchfly gentian	*Eustoma exaltatum*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	Conservation efforts are unknown.	Threats are unknown.
plant	chalk liveforever	*Dudleya pulverulenta*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	Conservation efforts are unknown.	Threats are unknown.
plant	Clark Mountain agave	*Agave utahensis* var. *nevadensis*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	Unknown conservation efforts.	Threats are unknown.
plant	Clarke phacelia	*Phacelia filiae*	Status and extent are unknown within the VRCMA Boundary.	Very limited habitat information available.	Very limited life history information available.	Unknown conservation efforts.	Threats are not well-known for this species.
plant	Clokey fleabane	*Erigeron clokeyi*	Status and extent are unknown within the VRCMA Boundary.	Very limited habitat information available.	Very limited life history information available.	Unknown conservation efforts.	Threats are not well-known for this species.

[a]Data gaps were documented for this VRCMA document if, after reviewing available literature, data gaps were either identified specifically in the literature or, cumulatively, the literature did not provide adequate information (e.g., known threats to a particular species).

Table C-1 Distribution, habitat, life history, species protection and management, and threats data gaps and short- and long-term data acquisition needs for special status species in the VRCMA Boundary identified by taxon, common and scientific name.

SPECIES			DATA GAPS[A]				
Taxon	Common Name	Scientific Name	Distribution Data Gaps	Habitat Data Gaps	Life History Data Gaps	Ongoing Species Protection and Management Data Gaps	Threats Data Gaps
plant	Clokey pincushion	*Coryphantha vivipara* ssp. *rosea*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	Limited life history information.	Unknown conservation efforts.	Threats are unknown.
plant	crossidium moss	*Crossidium seriatum*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No life history information.	Conservation efforts are unknown.	Threats are not well-known for this species.
plant	dune linanthus	*Linanthus arenicola*	Status and extent are unknown within the VRCMA Boundary. Distribution is poorly known.	No data gaps have been identified.	No data gaps have been identified.	Unknown conservation efforts.	Threats are unknown.
plant	dune sunflower	*Helianthus deserticola*	Status and extent are unknown within the VRCMA Boundary. Distribution is poorly known.	No data gaps have been identified.	No data gaps have been identified.	Unknown conservation efforts.	Threats are unknown.
plant	fissidens sublimbatus	*Fissidens sublimbatus*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	Conservation efforts are unknown.	No data gaps have been identified.
plant	forked (Pahrump Valley) buckwheat	*Eriogonum bifurcatum*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	Conservation efforts are unknown.	Threats are unknown.
plant	Las Vegas bearpoppy	*Arctomecon californica*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
plant	Las Vegas buckwheat	*Eriogonum corymbosum* var. *nilesii*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	Limited life history information.	No data gaps have been identified.	Potentially other threats exist, but threats have been identified for this species.
plant	Littlefield milkvetch	*Astragalus preussii* var. *laxiflorus*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	Conservation efforts are unknown.	Threats are unknown.
plant	Mokiak milkvetch	*Astragalus mokiacensis*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	Very limited life history information available.	Conservation efforts are unknown.	Threats are not well-known for this species.
plant	Nevada didymodon	*Didymodon nevadensis*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	Very limited life history information available.	Conservation efforts are unknown.	Threats are not well-known for this species.
plant	Nevada willowherb	*Epilobium nevadense*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	Very limited life history information available.	Conservation efforts are unknown.	Threats are not well-known for this species.
plant	Nye milkvetch	*Astragalus nyensis*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	Very limited life history information available.	Conservation efforts are unknown.	Threats are not well-known for this species.

a. Data gaps were documented for this VRCMA document if, after reviewing available literature, data gaps were either identified specifically in the literature or, cumulatively, the literature did not provide adequate information (e.g., known threats to a particular species).

Table C-1 Distribution, habitat, life history, species protection and management, and threats data gaps and short- and long-term data acquisition needs for special status species in the VRCMA Boundary identified by taxon, common and scientific name.

SPECIES			DATA GAPS[A]				
Taxon	Common Name	Scientific Name	Distribution Data Gaps	Habitat Data Gaps	Life History Data Gaps	Ongoing Species Protection and Management Data Gaps	Threats Data Gaps
plant	rayless tansy aster	*Machaeranthera grindelioides* var. *depressa*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	Very limited life history information available.	Conservation efforts are unknown.	Threats are not well-known for this species.
plant	rock phacelia	*Phacelia petrosa*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	Conservation efforts are unknown.	Potentially other threats exist, but threats have been identified for this species.
plant	rosy twotone beardtongue	*Penstemon bicolor* ssp. *roseus*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No life history information.	No data gaps have been identified.	Threats are not well-known for this species.
plant	Shockley rockcress	*Arabis shockleyi*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	Conservation efforts are unknown.	Threats are unknown.
plant	silverleaf sunray	*Enceliopsis argophylla*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	Limited life history information.	Conservation efforts are unknown.	Threats are not well-known for this species.
plant	splachnobryum obtusum	*Splachnobryum obtusum*	Distribution and status are incomplete.	No habitat information available.	Very limited life history information available.	Conservation efforts are unknown.	Threats are not well understood for this species.
plant	sticky buckwheat	*Eriogonum viscidulum*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	Limited life history information.	No data gaps have been identified.	No data gaps have been identified.
plant	sticky ringstem	*Anulocaulis leisolenus*	Historical distribution is unknown.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
plant	straw milkvetch	*Astragalus lentiginosus* var. *stramineus*	Status and extent are unknown within the VRCMA Boundary.	No habitat information available.	Very limited life history information available.	Conservation efforts are unknown.	Threats are not well understood for this species.
plant	syntrichia princeps	*Syntrichia princeps*	Status and extent are unknown within the VRCMA Boundary.	No habitat information available.	Very limited life history information available.	Conservation efforts are unknown.	Threats are not well understood for this species.
plant	threecorner milkvetch	*Astragalus geyeri* var. *triquetrus*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	Only threat A is identified for this species.
plant	trichostomum moss	*Trichostomum sweetii*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	Threats are unknown.
plant	white bearpoppy	*Arctomecon merriamii*	Historical distribution is unknown.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.

[a]Data gaps were documented for this VRCMA document if, after reviewing available literature, data gaps were either identified specifically in the literature or, cumulatively, the literature did not provide adequate information (e.g., known threats to a particular species).

Table C-1 Distribution, habitat, life history, species protection and management, and threats data gaps and short- and long-term data acquisition needs for special status species in the VRCMA Boundary identified by taxon, common and scientific name.

SPECIES			DATA GAPS[A]				
Taxon	Common Name	Scientific Name	Distribution Data Gaps	Habitat Data Gaps	Life History Data Gaps	Ongoing Species Protection and Management Data Gaps	Threats Data Gaps
Reptile							
reptile	California (common) king snake	*Lampropeltis getulus californiae*	Distribution data is incomplete (NatureServe 2007).	No data gaps have been identified.	No data gaps have been identified.	Conservation efforts are unknown.	No data gaps have been identified.
reptile	glossy snake	*Arizona elegans*	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*	No data gaps have been identified.	Refine habitat relationships (NDOW 2006).	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
reptile	large-spotted leopard lizard	*Gambelia wislizenii wislizenii*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	Determine response to collection pressure (NDOW 2006).
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*	Status and extent are unknown within the VRCMA Boundary. NDOW monitoring may or may not be adequate to determine population trends (NDOW 2006).	No data gaps have been identified.	No data gaps have been identified.	Determine management needs (NDOW 2006).	No data gaps have been identified.
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*	Demographic data is needed to better assess population status and trends (NDOW 2006).	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	Determine response to collection pressure (NDOW 2006).
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
reptile	western red-tailed skink	*Eumeces gilberti rubricaudatus*	Distribution data is incomplete (NatureServe 2007).	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
reptile	banded gecko	*Coleonyx variegatus*	Population abundance is unknown in NV (NDOW 2007).	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
reptile	banded Gila monster	*Heloderma suspectum cinctum*	Population size in NV unknown (NDOW 2007).	No data gaps have been identified.	Comprehensive life history studies are needed in Nevada (NDOW 2006).	No data gaps have been identified.	No data gaps have been identified.
reptile	common zebra-tailed lizard	*Callisaurus draconoides*	Population abundance is unknown.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.

a. Data gaps were documented for this VRCMA document if, after reviewing available literature, data gaps were either identified specifically in the literature or, cumulatively, the literature did not provide adequate information (e.g., known threats to a particular species).

Table C-1 Distribution, habitat, life history, species protection and management, and threats data gaps and short- and long-term data acquisition needs for special status species in the VRCMA Boundary identified by taxon, common and scientific name.

SPECIES			DATA GAPS[A]				
Taxon	Common Name	Scientific Name	Distribution Data Gaps	Habitat Data Gaps	Life History Data Gaps	Ongoing Species Protection and Management Data Gaps	Threats Data Gaps
reptile	desert iguana	*Dipsosaurus dorsalis*	Population abundance is unknown.	Refine habitat relationships (NDOW 2006).	No data gaps have been identified.	No data gaps have been identified.	Determine response to collection pressure (NDOW 2006).
reptile	desert night lizard	*Xantusia vigilis*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	Determine management needs (NDOW 2007).	No data gaps have been identified.
reptile	Mojave desert tortoise	*Gopherus agassizii* (Mojave Population)	Future research needs to determine minimum viable population sizes in various habitat types, nutritional forage quantity and quality needs, the juvenile niche, nest microhabitat requirements, TSD as determined by field nest temperature cycles (not fixed incubation values), mating systems in nature, genetics, the taxonomy and distinctiveness of Nevada/Utah Sonoran and Sinaloan haplotypes, and the behavioral and physiological differences between these units (Natureserve 2006).	No data gaps have been identified.	No data gaps have been identified.	Restoration of the degraded desert ecosystems supporting tortoise populations is both a slow and uncertain process. Without proven protocols for effective mitigation, no assurance may be made for re-establishing climax communities. Historical climatic regimes have been altered, water tables lowered irreversibly, and new exotic vegetation may preclude the restoration of native dominants (Natureserve 2006).	No data gaps have been identified.
reptile	Mojave green rattlesnake	*Crotalus scutulatus scutulatus*	Population abundance is unknown.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
reptile	sidewinder	*Crotalus cerastes*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
reptile	speckled rattlesnake	*Crotalus mitchellii*	Status and extent are unknown within the VRCMA Boundary.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.
reptile	western chuckwalla	*Sauromalus obesus*	Determine rangewide information on population numbers, abundance, and trends.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	Overcollecting appears to be on the rise in some areas--investigate the extent of collecting and loss of habitat due to collecting (Natureserve 2006).
reptile	western leaf-nosed snake	*Phyllorhynchus decurtatus*	Population size is unknown (NatureServe 2007).	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.	No data gaps have been identified.

[a]Data gaps were documented for this VRCMA document if, after reviewing available literature, data gaps were either identified specifically in the literature or, cumulatively, the literature did not provide adequate information (e.g., known threats to a particular species).

APPENDIX D

Summary Tables for Effects Analysis

LIST OF TABLES

Table D-1 Summary of Effects of DEVELOPMENT on Special Status Species with the Potential to Occur in CLIFFS AND CANYONS Habitats

					Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	american peregrine falcon	*Falco peregrinus*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Bendire's thrasher	*Toxostoma bendirei*	X	X	LT	X			X	X	X		X		LT	X		X	X				
bird	cactus wren	*Campylorhynchus brunneicapillus*		X	LT	X			X	X	X		X		LT	X		X	X				
bird	ferruginous hawk	*Buteo regalis*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	golden eagle	*Aquila chrysaetos*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	gray vireo	*Vireo vicinior*	X	X	LT	X			X	X	X		X		LT	X		X	X				
bird	loggerhead shrike	*Lanius ludovicianus*	X		LT	X			X	X	X		X		LT	X		X	X				
bird	pinyon jay	*Gymnorhinus cyanocephalus*	X		LT	X			X	X	X		X		LT	X		X	X				
bird	prairie falcon	*Falco mexicanus*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	western bluebird	*Sialia mexicana*	X		LT	X			X	X	X		X		LT	X		X	X				
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	California leaf-nosed bat	*Macrotus californicus*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	California myotis	*Myotis californicus*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	fringed myotis	*Myotis thysanodes*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	greater western mastiff bat	*Eumops perotis californicus*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	hoary bat	*Lasiurus cinereus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	kit fox	*Vulpes macrotis*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	little brown myotis	*Myotis lucifugus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	long-eared myotis	*Myotis evotis*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				

Table D-1 Summary of Effects of DEVELOPMENT on Special Status Species with the Potential to Occur in CLIFFS AND CANYONS Habitats

					Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	long-legged myotis	*Myotis volans*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	pallid bat	*Antrozous pallidus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	silver-haired bat	*Lasionycteris noctivagans*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	spotted bat	*Euderma maculatum*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	LT	X			X	X	X		X		LT	X		X	X				
mammal	western pipistrelle	*Pipistrellus hesperus*		X	LT	X			X	X	X		X		LT	X		X	X				
mammal	western small-footed myotis	*Myotis ciliolabrum*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Yuma myotis	*Myotis yumanensis*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
plant	Antelope Canyon goldenbush	*Ericameria cervina*	X	X	LT	X			X	X	X		X		LT	X		X	X				
plant	Aven Nelson phacelia	*Phacelia anelsonii*	X		LT	X			X	X	X		X		LT	X		X	X				
plant	chalk liveforever	*Dudleya pulverulenta*	x	x	LT	x	x	x			x		x		LT	x							
plant	crossidium moss	*Crossidium seriatum*	X		LT	X			X	X	X		X		LT	X		X	X				
plant	Fissidens sublimbatus	*Fissidens sublimbatus*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
plant	Mokiak milkvetch	*Astragalus mokiacensis*	X		LT	X			X	X	X		X		LT	X		X	X				
plant	Nevada didymodon	*Didymodon nevadensis*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	California (common) king snake	*Lampropeltis getulus californiae*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	desert night lizard	*Xantusia vigilis*		X	LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				

Table D-1 Summary of Effects of DEVELOPMENT on Special Status Species with the Potential to Occur in CLIFFS AND CANYONS Habitats

					Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*	X		LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*	X	X	LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*		X	LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*	X	X	LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				
reptile	speckled rattlesnake	*Crotalus mitchelli*	X	X	LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				
reptile	Western chuckwalla	*Sauromalus obesus*	X	X	LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				

LT Long-term
ST Short-term
IIC increased illegal collection

Table D-2 Summary of Effects of DEVELOPMENT on Special Status Species with the Potential to Occur in LOW VEGETATION DESERT Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	North American Warm Desert Badland	North American Warm Desert Wash	North American Warm Desert Pavement	North American Warm Desert Playa	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	Bendire's thrasher	*Toxostoma bendirei*		X	X		LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	Brewer's sparrow	*Spizella breweri*			X		LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	cactus wren	*Campylorhyncus brunneicapillus*		X			LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	crissal thrasher	*Toxostoma crissale*		X			LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	ferruginous hawk	*Buteo regalis*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	le conte's thrasher	*Toxostoma lecontei*		X			LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	loggerhead shrike	*Lanius ludovicianus*		X			LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	Lucy's warbler	*Vermivora luciae*		X			LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	phainopepla	*Phainopepla nitens*		X			LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	prairie falcon	*Falco mexicanus*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	summer tanager	*Piranga rubra*		X			LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	Western burrowing owl	*Speotyto cunicularia hypugea*				X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	western screech owl	*Otus kennicotti*		X			LT	X	X	X	X	X	X		X		LT	X		X	X				
mammal	California leaf-nosed bat	*Macrotus californicus*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	California myotis	*Myotis californicus*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert kangaroo rat	*Dipodomys deserti*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert pocket mouse	*Chaetodipus penicillatus*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	kit fox	*Vulpes macrotis*	X	X		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				

Table D-2 Summary of Effects of DEVELOPMENT on Special Status Species with the Potential to Occur in LOW VEGETATION DESERT Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	North American Warm Desert Badland	North American Warm Desert Wash	North American Warm Desert Pavement	North American Warm Desert Playa	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	spotted bat	*Euderma maculatum*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	western pipistrelle	*Pipistrellus hesperus*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	western red bat	*Lasiurus blossevillii*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
plant	Beaver Dam scurfpea (breadroot)	*Pediomelum castoreum*			X		LT	X	X	X			X		X		LT	X							
plant	catchfly gentian	*Eustoma exaltatum*		X			LT	X	X	X			X		X		LT	X							
plant	crossidium moss	*Crossidium seriatum*	X		X		LT	X	X	X			X		X		LT	X							
plant	dune linanthus	*Linanthus arenicola*	X	X	X	X	LT	X	X	X			X		X		LT	X							
plant	dune sunflower	*Helianthus deserticola*	X		X	X	LT	X	X	X			X		X		LT	X							
plant	Las Vegas Valley buckwheat	*Eriogonum corymbosum var. aureum*		X			LT	X	X	X			X		X		LT	X							
plant	Littlefield milkvetch	*Astragalus preussii var. laxiflorus*	X	X	X		LT	X	X	X			X		X		LT	X							
plant	Mokiak milkvetch	*Astragalus mokiacensis*	X	X			LT	X	X	X			X		X		LT	X							
plant	Nevada didymodon	*Didymodon nevadensis*	X		X		LT	X	X	X			X		X		LT	X							
plant	silverleaf sunray	*Enceliopsis argophylla*	X	X			LT	X	X	X			X		X		LT	X							
plant	splachnobryum obtusum	*Splachnobryum obtusum*		X	X	X	LT	X	X	X			X		X		LT	X							
plant	straw milkvetch	*Astragalus lentiginosus var. stramineus*		X	X		LT	X	X	X			X		X		LT	X							
plant	threecorner milkvetch	*Astragalus geyeri var. triquetrus*		X			LT	X	X	X			X		X		LT	X							
plant	Trichostomum moss	*Trichostomum sweetii*	X		X		LT	X	X	X			X		X		LT	X							

Table D-2 Summary of Effects of DEVELOPMENT on Special Status Species with the Potential to Occur in LOW VEGETATION DESERT Habitats

							Direct Effects										Indirect Effects									
Taxon	Common Name	Scientific Name	North American Warm Desert Badland	North American Warm Desert Wash	North American Warm Desert Pavement	North American Warm Desert Playa	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	banded gecko	*Coleonyx variegatus*		X		X	LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				
reptile	common zebra-tailed lizard	*Callisaurus draconoides draconoides*	X	X	X		LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				
reptile	glossy snake	*Arizona elegans*		X			LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*		X			LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*			X		LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				

LT Long-term
ST Short-term
IIC increased illegal collection

Table D-3 Summary of Effects of DEVELOPMENT on Special Status Species with the Potential to Occur FOREST WOODLAND Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	Great Basin Pinyon-Juniper Woodland	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
amphibian	Pacific tree frog	*Hyla regilla*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	american peregrine falcon	*Falco peregrinus*	X	X	X		LT	X	X	X	X	X		X	X		LT	X		X	X				
bird	bald eagle	*Haliaeetus leucocephalus*				X	LT	X	X	X	X	X		X	X		LT	X		X	X				
bird	black-chinned sparrow	*Spizella atrogularis*				X	LT	X	X	X	X	X		X	X		LT	X		X	X				
bird	Brewer's sparrow	*Spizella breweri*				X	LT	X	X	X	X	X		X	X		LT	X		X	X				
bird	flammulated owl	*Otus flammeolus*	X	X	X		LT	X	X	X	X	X		X	X		LT	X		X	X				
bird	golden eagle	*Aquila chrysaetos*	X	X	X	X	LT	X	X	X	X	X		X	X		LT	X		X	X				
bird	gray vireo	*Vireo vicinior*				X	LT	X	X	X	X	X		X	X		LT	X		X	X				
bird	loggerhead shrike	*Lanius ludovicianus*				X	LT	X	X	X	X	X		X	X		LT	X		X	X				
bird	long-eared owl	*Asio otus*	X	X	X	X	LT	X	X	X	X	X		X	X		LT	X		X	X				
bird	Lucy's warbler	*Vermivora luciae*			X		LT	X	X	X	X	X			X		LT	X		X	X				
bird	northern goshawk	*Accipiter gentilis*	X	X	X		LT	X	X	X	X	X		X	X		LT	X		X	X				
bird	northern saw-whet owl	*Aegolius acadius*	X	X	X		LT	X	X	X	X	X		X	X		LT	X		X	X				
bird	phainopepla	*Phainopepla nitens*	X				LT	X	X	X	X	X		X	X		LT	X		X	X				
bird	pinyon jay	*Gymnorhinus cyanocephalus*	X		X	X	LT	X	X	X	X	X		X	X		LT	X		X	X				
bird	Scott's oriole	*Icterus parisorum*				X	LT	X	X	X	X	X		X	X		LT	X		X	X				

Table D-3 Summary of Effects of DEVELOPMENT on Special Status Species with the Potential to Occur FOREST WOODLAND Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	Great Basin Pinyon-Juniper Woodland	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	western screech owl	*Otus kennicotti*			X	X	LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	Allen's big-eared bat	*Idionycteris phyllotis*	X		X		LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	big free-tailed bat	*Nyctinomops macrotis*	X	X	X	X	LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	X	X	X	X	LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	California myotis	*Myotis californicus*	X	X	X		LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*	X	X	X	X	LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	fringed myotis	*Myotis thysanodes*	X	X	X	X	LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	hoary bat	*Lasiurus cinereus*	X	X	X	X	LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	kit fox	*Vulpes macrotis*				X	LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	long-eared myotis	*Myotis evotis*	X	X	X	X	LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	long-legged myotis	*Myotis volans*	X	X	X	X	LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	Merriam's shrew	*Sorex merriami*	X	X	X	X	LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	spotted bat	*Euderma maculatum*			X	X	LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	X	X	LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	Yuma myotis	*Myotis yumanensis*	X	X	X		LT	X	X	X	X	X		X	X		LT	X		X	X				

Table D-3 Summary of Effects of DEVELOPMENT on Special Status Species with the Potential to Occur FOREST WOODLAND Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	Great Basin Pinyon-Juniper Woodland	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
plant	alpine stinking lomatium	*Lomatium graveolens var. alpinum*	X	X	X	X	LT	X	X	X			X	X	X		LT	X							
plant	Antelope Canyon goldenbush	*Ericameria cervina*	X				LT	X	X	X			X	X	X		LT	X							
plant	Clark Mountain agave	Agave utahensis var. nevadensis				X	LT	X	X	X			X	X	X		LT	X							
plant	Clokey fleabane	*Erigeron clokeyi*			X		LT	X	X	X			X	X	X		LT	X							
plant	Clokey pincushion	*Coryphantha vivipara* ssp. *rosea*				X	LT	X	X	X			X	X	X		LT	X							
plant	Fissidens sublimbatus	*Fissidens sublimbatus*	X	X	X	X	LT	X	X	X			X	X	X		LT	X							
plant	Nevada willowherb	*Epilobium nevadense*	X		X	X	LT	X	X	X			X	X	X		LT	X							
plant	rayless tansy aster	*Machaeranthera grindelioides* var. *depressa*				X	LT	X	X	X			X	X	X		LT	X							
plant	Shockley rockcress	*Arabis shockleyi*				X	LT	X	X	X			X	X	X		LT	X							
plant	Syntrichia princeps	*Syntrichia princeps*				X	LT	X	X	X			X	X	X		LT	X							
reptile	banded gecko	*Coleonyx variegatus*				X	LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				
reptile	California (common) king snake	*Lampropeltis getulus californiae*			X	X	LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				
reptile	desert night lizard	*Xantusia vigilis*			X	X	LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*			X		LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				

Table D-3 Summary of Effects of DEVELOPMENT on Special Status Species with the Potential to Occur FOREST WOODLAND Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	Great Basin Pinyon-Juniper Woodland	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*			X	X	LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				
reptile	speckled rattlesnake	*Crotalus mitchelli*				X	LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				
reptile	western red-tailed skink	*Eumeces gilberti rubricaudatus*	X	X	X	X	LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				

LT Long-term
ST Short-term
IIC increased illegal collection

Table D-4 Summary of Effects of DEVELOPMENT on Special Status Species with the Potential to Occur in SHRUB Habitats

Taxon	Common Name	Scientific Name	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Direct Effects: Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Indirect Effects: Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Bendire's thrasher	*Toxostoma bendirei*	X				LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	black-chinned sparrow	*Spizella atrogularis*				X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	Brewer's sparrow	*Spizella breweri*		X			LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	cactus wren	*Campylorhynchus brunneicapillus*	X			X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	crissal thrasher	*Toxostoma crissale*				X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	ferruginous hawk	*Buteo regalis*			X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	golden eagle	*Aquila chrysaetos*	X		X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	long-eared owl	*Asio otus*			X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	phainopepla	*Phainopepla nitens*				X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	pinyon jay	*Gymnorhinus cyanocephalus*		X			LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	prairie falcon	*Falco mexicanus*		X		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Scott's oriole	*Icterus parisorum*				X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	vesper sparrow	*Pooecetes gramineus*		X	X		LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	western bluebird	*Sialia mexicana*		X			LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	Western burrowing owl	*Speotyto cunicularia hypugea*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	yellow-breasted chat	*Icteria virens*		X		X	LT	X	X	X	X	X	X		X		LT	X		X	X				
mammal	big free-tailed bat	*Nyctinomops macrotis*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	California myotis	*Myotis californicus*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				

Table D-4 Summary of Effects of DEVELOPMENT on Special Status Species with the Potential to Occur in SHRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*		X		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert pocket mouse	*Chaetodipus penicillatus*	X				LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	hoary bat	*Lasiurus cinereus*	X	X		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	little brown myotis	*Myotis lucifugus*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	long-eared myotis	*Myotis evotis*				X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Merriam's shrew	*Sorex merriami*		X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	pallid bat	*Antrozous pallidus*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	spotted bat	*Euderma maculatum*			X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Yuma myotis	*Myotis yumanensis*			X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
plant	alpine stinking lomatium	*Lomatium graveolens var. alpinum*		X	X	X	LT	X	X	X			X		X		LT	X							
plant	barrel cactus	*Ferocactus acanthoides* var. *lecontei*	X	X	X	X	LT	X	X	X			X		X		LT	X							
plant	chalk liveforever	*Dudleya pulverulenta*				X	LT	X	X	X			X		X		LT	X							
plant	Clarke phacelia	*Phacelia filiae*	X				LT	X	X	X			X		X		LT	X							
plant	Fissidens sublimbatus	*Fissidens sublimbatus*	X	X	X	X	LT	X	X	X			X		X		LT	X							
plant	rayless tansy aster	*Machaeranthera grindelioides* var. *depressa*	X		X		LT	X	X	X			X		X		LT	X							
plant	rock phacelia	*Phacelia petrosa*	X				LT	X	X	X			X		X		LT	X							
plant	rosy twotone beardtongue	*Penstemon bicolor* ssp. *roseus*	X	X	X	X	LT	X	X	X			X		X		LT	X							

Table D-4 Summary of Effects of DEVELOPMENT on Special Status Species with the Potential to Occur in SHRUB Habitats

Taxon	Common Name	Scientific Name	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Direct Effects										Indirect Effects								
							Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
plant	Shockley rockcress	*Arabis shockleyi*			X		LT	X	X	X			X		X		LT	X							
plant	white bearpoppy	*Arctomecon merriamii*	X				LT	X	X	X			X		X		LT	X							
reptile	banded gecko	*Coleonyx variegatus*		X		X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	banded Gila monster	*Heloderma suspectum cinctum*				X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X			X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	desert night lizard	*Xantusia vigilis*				X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	glossy snake	*Arizona elegans*	X				LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*	X				LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	large-spotted leopard lizard	*Gambelia wislizenii wislizenii*	X				LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*		X		X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*	X		X		LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*	X			X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	western red-tailed skink	*Eumeces gilberti rubricaudatus*			X	X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				

LT Long-term
ST Short-term
IC increased collection

Table D-5 Summary of Effects of DEVELOPMENT on Special Status Species with the Potential to Occur in SCRUB Habitat

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X		X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
bird	Bendire's thrasher	*Toxostoma bendirei*	X	X	X		LT	X	X	X	X	X	X		X		LT	X		X	X				X
bird	blue grosbeak	*Guiraca caerulea*	X		X		LT	X	X	X	X	X	X		X		LT	X		X	X				X
bird	Brewer's sparrow	*Spizella breweri*			X	X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	golden eagle	*Aquila chrysaetos*	X	X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
bird	gray vireo	*Vireo vicinior*		X			LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	le conte's thrasher	*Toxostoma lecontei*	X	X	X		LT	X	X	X	X	X	X		X		LT	X		X	X				X
bird	loggerhead shrike	*Lanius ludovicianus*	X	X	X	X	LT	X	X	X	X	X	X		X		LT	X		X	X				X
bird	long-eared owl	*Asio otus*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
bird	prairie falcon	*Falco mexicanus*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Scott's oriole	*Icterus parisorum*	X				LT	X	X	X	X	X	X		X		LT	X		X	X				X
bird	Western burrowing owl	*Speotyto cunicularia hypugea*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
mammal	Allen's big-eared bat	*Idionycteris phyllotis*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
mammal	big free-tailed bat	*Nyctinomops macrotis*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	California leaf-nosed bat	*Macrotus californicus*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
mammal	desert pocket mouse	*Chaetodipus penicillatus*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
mammal	fringed myotis	*Myotis thysanodes*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	hoary bat	*Lasiurus cinereus*			X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	little brown myotis	*Myotis lucifugus*	X	X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
mammal	long-legged myotis	*Myotis volans*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	pallid bat	*Antrozous pallidus*		X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				

Table D-5 Summary of Effects of DEVELOPMENT on Special Status Species with the Potential to Occur in SCRUB Habitat

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	spotted bat	*Euderma maculatum*	X			X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	western pipistrelle	*Pipistrellus hesperus*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
mammal	Yuma myotis	*Myotis yumanensis*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
plant	barrel cactus	*Ferocactus acanthoides var. lecontei*	X	X	X	X	LT	X	X	X			X		X		LT	X							X
plant	Clark Mountain agave	*Agave utahensis var. nevadensis*	X		X	X	LT	X	X	X			X		X		LT	X							X
plant	Clarke phacelia	*Phacelia filiae*	X	X	X	X	LT	X	X	X			X		X		LT	X							X
plant	Clokey pincushion	*Coryphantha vivipara ssp. rosea*	X	X	X	X	LT	X	X	X			X		X		LT	X							X
plant	crossidium moss	*Crossidium seriatum*	X		X	X	LT	X	X	X			X		X		LT	X							X
plant	dune linanthus	*Linanthus arenicola*	X		X	X	LT	X	X	X			X		X		LT	X							
plant	dune sunflower	*Helianthus deserticola*	X		X	X	LT	X	X	X			X		X		LT	X							
plant	forked (Pahrump Valley) buckwheat	*Eriogonum bifurcatum*	X	X	X	X	LT	X	X	X			X		X		LT	X							X
plant	Las Vegas bearpoppy	*Arctomecon californica*			X		LT	X	X	X			X		X		LT	X							
plant	Las Vegas Valley buckwheat	*Eriogonum corymbosum var. aureum*	X	X	X	X	LT	X	X	X			X		X		LT	X							X
plant	Nevada didymodon	*Didymodon nevadensis*			X	X	LT	X	X	X			X		X		LT	X							
plant	Nye milkvetch	*Astragalus nyensis*	X	X	X	X	LT	X	X	X			X		X		LT	X							X
plant	rock phacelia	*Phacelia petrosa*	X	X	X	X	LT	X	X	X			X		X		LT	X							X
plant	rosy twotone beardtongue	*Penstemon bicolor ssp. roseus*	X	X	X	X	LT	X	X	X			X		X		LT	X							X

Table D-5 Summary of Effects of DEVELOPMENT on Special Status Species with the Potential to Occur in SCRUB Habitat

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
plant	silverleaf sunray	*Enceliopsis argophylla*	X		X	X	LT	X	X	X			X		X		LT	X							X
plant	sticky buckwheat	*Eriogonum viscidulum*	X		X	X	LT	X	X	X			X		X		LT	X							X
plant	sticky ringstem	*Anulocaulis leisolenus*	X	X	X	X	LT	X	X	X			X		X		LT	X							X
plant	straw milkvetch	*Astragalus lentiginosus var. stramineus*	X	X	X	X	LT	X	X	X			X		X		LT	X							X
plant	threecorner milkvetch	*Astragalus geyeri var. triquetrus*	X		X	X	LT	X	X	X			X		X		LT	X							
plant	Trichostomum moss	*Trichostomum sweetii*	X		X	X	LT	X	X	X			X		X		LT	X							X
plant	white bearpoppy	*Arctomecon merriamii*	X		X	X	LT	X	X	X			X		X		LT	X							
reptile	banded gecko	*Coleonyx variegatus*	X		X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
reptile	banded Gila monster	*Heloderma suspectum cinctum*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X	X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
reptile	common zebra-tailed lizard	*Callisaurus draconoides draconoides*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
reptile	desert iguana	*Dipsosaurus dorsalis*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
reptile	desert night lizard	*Xantusia vigilis*	X				LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
reptile	desert tortoise	*Gopherus agassizii*	X		X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
reptile	glossy snake	*Arizona elegans*			X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
reptile	large-spotted leopard lizard	*Gambelia wislizenii wislizenii*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
reptile	Mojave green rattlesnake	*Crotalus scutulatus scutulatus*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
reptile	sidewinder	*Crotalus cerastes*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				X

Table D-5 Summary of Effects of DEVELOPMENT on Special Status Species with the Potential to Occur in SCRUB Habitat

Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Direct Effects										Indirect Effects									
							Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*	X				LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*			X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	speckled rattlesnake	*Crotalus mitchelli*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				X
reptile	western leaf-nosed snake	*Phyllorhynchus decurtatus*			X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				

LT Long-term
ST Short-term

Table D-6 Summary of Effects of DEVELOPMENT on Special Status Species with the Potential to Occur in AGRICULTURAL Habitats

Taxon	Common Name	Scientific Name	Agriculture	Direct Effects										Indirect Effects								
				Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	blue grosbeak	*Guiraca caerulea*	X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	blue grosbeak	*Guiraca caerulea*	X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	golden eagle	*Aquila chrysaetos*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	loggerhead shrike	*Lanius ludovicianus*	X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	long-eared owl	*Asio otus*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	northern saw-whet owl	*Aegolius acadius*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	prairie falcon	*Falco mexicanus*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	summer tanager	*Piranga rubra*	X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	western bluebird	*Sialia mexicana*	X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	Western burrowing owl	*Speotyto cunicularia hypugea*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	western screech owl	*Otus kennicotti*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	big free-tailed bat	*Nyctinomops macrotis*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	California leaf-nosed bat	*Macrotus californicus*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	fringed myotis	*Myotis thysanodes*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	little brown myotis	*Myotis lucifugus*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	pallid bat	*Antrozous pallidus*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				

LT Long-term
ST Short-term

Table D-7 Summary of Effects of DEVELOPMENT on Special Status Species with the Potential to Occur in DEVELOPED Habitats

					Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Developed, Open Space - Low Intensity	Developed, Medium - High Intensity	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	loggerhead shrike	*Lanius ludovicianus*	X		LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	northern saw-whet owl	*Aegolius acadius*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	greater western mastiff bat	*Eumops perotis californicus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	hoary bat	*Lasiurus cinereus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	little brown myotis	*Myotis lucifugus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	long-legged myotis	*Myotis volans*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	pallid bat	*Antrozous pallidus*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				

Table D-8 Summary of Effects of AGRICULTURE AND GRAZING on Special Status Species with the Potential to Occur in CLIFFS AND CANYON Habitats

					Direct Effects										Indirect Effects									
Taxon	Common Name	Scientific Name	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	american peregrine falcon	*Falco peregrinus*	X		ST/LT				X	X	X		X		LT			X	X				
bird	Bendire's thrasher	*Toxostoma bendirei*	X	X	ST/LT				X	X	X		X		LT			X	X				
bird	cactus wren	*Campylorhynchus brunneicapillus*		X	ST/LT				X	X	X		X		LT			X	X				
bird	ferruginous hawk	*Buteo regalis*	X		ST/LT				X	X	X		X		LT			X	X				
bird	golden eagle	*Aquila chrysaetos*	X		ST/LT				X	X	X		X		LT			X	X				
bird	gray vireo	*Vireo vicinior*	X	X	ST/LT				X	X	X		X		LT			X	X			X	
bird	loggerhead shrike	*Lanius ludovicianus*	X		ST/LT				X	X	X		X		LT			X	X				
bird	pinyon jay	*Gymnorhinus cyanocephalus*	X		ST/LT				X	X	X		X		LT			X	X				
bird	prairie falcon	*Falco mexicanus*		X	ST/LT				X	X	X		X		LT			X	X				
bird	western bluebird	*Sialia mexicana*	X		ST/LT				X	X	X		X		LT			X	X			X	
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*		X	ST/LT				X	X	X		X		LT			X	X				
mammal	California leaf-nosed bat	*Macrotus californicus*		X	ST/LT				X	X	X		X		LT			X	X				
mammal	California myotis	*Myotis californicus*		X	ST/LT				X	X	X		X		LT			X	X				
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*	X		ST/LT				X	X	X		X		LT			X	X				
mammal	fringed myotis	*Myotis thysanodes*	X	X	ST/LT				X	X	X		X		LT			X	X				
mammal	greater western mastiff bat	*Eumops perotis californicus*		X	ST/LT				X	X	X		X		LT			X	X				
mammal	hoary bat	*Lasiurus cinereus*	X	X	ST/LT				X	X	X		X		LT			X	X				
mammal	kit fox	*Vulpes macrotis*	X	X	ST/LT				X	X	X		X		LT			X	X				
mammal	little brown myotis	*Myotis lucifugus*	X	X	ST/LT				X	X	X		X		LT			X	X				
mammal	long-eared myotis	*Myotis evotis*	X		ST/LT				X	X	X		X		LT			X	X				
mammal	long-legged myotis	*Myotis volans*	X	X	ST/LT				X	X	X		X		LT			X	X				
mammal	pallid bat	*Antrozous pallidus*	X	X	ST/LT				X	X	X		X		LT			X	X				
mammal	silver-haired bat	*Lasionycteris noctivagans*	X		ST/LT				X	X	X		X		LT			X	X				

Table D-8 Summary of Effects of AGRICULTURE AND GRAZING on Special Status Species with the Potential to Occur in CLIFFS AND CANYON Habitats

					Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	spotted bat	*Euderma maculatum*	X	X	ST/LT				X	X	X		X		LT			X	X				
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	ST/LT				X	X	X		X		LT			X	X				
mammal	western pipistrelle	*Pipistrellus hesperus*	X	X	ST/LT				X	X	X		X		LT			X	X				
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	X	ST/LT				X	X	X		X		LT			X	X				
mammal	Yuma myotis	*Myotis yumanensis*	X	X	ST/LT				X	X	X		X		LT			X	X				
plant	Antelope Canyon goldenbush	*Ericameria cervina*	X	X	ST/LT		X	X			X				LT								
plant	Aven Nelson phacelia	*Phacelia anelsonii*	X	X	ST/LT		X	X			X				LT								
plant	chalk liveforever	*Dudleya pulverulenta*	X	X	ST/LT		X	X			X				LT								
plant	crossidium moss	*Crossidium seriatum*	X	X	ST/LT		X	X			X				LT								
plant	Fissidens sublimbatus	*Fissidens sublimbatus*	X	X	ST/LT		X	X			X				LT								
plant	Mokiak milkvetch	*Astragalus mokiacensis*	X	X	ST/LT		X	X			X				LT								
plant	Nevada didymodon	*Didymodon nevadensis*	X	X	ST/LT		X	X			X				LT								
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X	X	ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	desert night lizard	*Xantusia vigilis*		X	ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*	X	X	ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*	X	X	ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*		X	ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*	X	X	ST/LT		X	X	X	X	X		X		LT			X	X				

Table D-8 Summary of Effects of AGRICULTURE AND GRAZING on Special Status Species with the Potential to Occur in CLIFFS AND CANYON Habitats

Taxon	Common Name	Scientific Name	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Direct Effects										Indirect Effects								
					Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	speckled rattlesnake	*Crotalus mitchelli*	X	X	ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	Western chuckwalla	*Sauromalus obesus*	X	X	ST/LT		X	X	X	X	X		X		LT			X	X				

LT Long-term
ST Short-term

Table D-9 Summary of Effects of AGRICULTURE AND GRAZING on Special Status Species with the Potential to Occur in LOW VEGETATION DESERT Habitats

Taxon	Common Name	Scientific Name	North American Warm Desert Badland	North American Warm Desert Wash	North American Warm Desert Pavement	North American Warm Desert Playa	Direct Effects: Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Indirect Effects: Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	Bendire's thrasher	*Toxostoma bendirei*		X	X		ST/LT					X	X		X		LT			X	X				
bird	Brewer's sparrow	*Spizella breweri*			X		LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	cactus wren	*Campylorhynchus brunneicapillus*		X			ST/LT					X	X		X		LT			X	X				
bird	crissal thrasher	*Toxostoma crissale*		X			ST/LT					X	X		X		LT			X	X				
bird	ferruginous hawk	*Buteo regalis*		X			ST/LT						X		X		LT			X	X				
bird	le conte's thrasher	*Toxostoma lecontei*		X			ST/LT					X	X		X		LT			X	X				
bird	loggerhead shrike	*Lanius ludovicianus*		X			ST/LT					X	X		X		LT			X	X				
bird	Lucy's warbler	*Vermivora luciae*		X			ST/LT					X	X		X		LT			X	X				
bird	phainopepla	*Phainopepla nitens*		X			ST/LT					X	X		X		LT			X	X				
bird	prairie falcon	*Falco mexicanus*		X			ST/LT						X		X		LT			X	X				
bird	summer tanager	*Piranga rubra*		X			ST/LT					X	X		X		LT			X	X				
bird	Western burrowing owl	*Speotyto cunicularia hypugea*				X	ST/LT		X	X		X	X		X		LT			X	X				
bird	western screech owl	*Otus kennicotti*		X			ST/LT						X		X		LT			X	X				
mammal	California leaf-nosed bat	*Macrotus californicus*	X	X	X	X	ST/LT					X	X		X		LT			X	X				
mammal	California myotis	*Myotis californicus*		X			ST/LT					X	X		X		LT			X	X				
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*		X			ST/LT					X	X		X		LT			X	X				
mammal	desert kangaroo rat	*Dipodomys deserti*		X			ST/LT					X	X		X		LT			X	X				
mammal	desert pocket mouse	*Chaetodipus penicillatus*		X			ST/LT					X	X		X		LT			X	X				

Table D-9 Summary of Effects of AGRICULTURE AND GRAZING on Special Status Species with the Potential to Occur in LOW VEGETATION DESERT Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	North American Warm Desert Badland	North American Warm Desert Wash	North American Warm Desert Pavement	North American Warm Desert Playa	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	kit fox	*Vulpes macrotis*	X	X		X	ST/LT				X	X	X		X		LT			X	X				
mammal	spotted bat	*Euderma maculatum*		X			ST/LT					X	X		X		LT			X	X				
mammal	western pipistrelle	*Pipistrellus hesperus*	X		X		ST/LT					X	X		X		LT			X	X				
mammal	western red bat	*Lasiurus blossevillii*		X			ST/LT					X	X		X		LT			X	X				
plant	Beaver Dam scurfpea (breadroot)	*Pediomelum castoreum*			X		ST/LT		X	X			X		X		LT	X							
plant	catchfly gentian	*Eustoma exaltatum*		X			ST/LT		X	X			X		X		LT	X							
plant	crossidium moss	*Crossidium seriatum*	X		X		ST/LT		X	X			X		X		LT	X							
plant	dune linanthus	*Linanthus arenicola*	X	X	X	X	ST/LT		X	X			X		X		LT	X							
plant	dune sunflower	*Helianthus deserticola*	X		X	X	ST/LT		X	X			X		X		LT	X							
plant	Las Vegas Valley buckwheat	*Eriogonum corymbosum* var. *aureum*		X			ST/LT		X	X			X		X		LT	X							
plant	Littlefield milkvetch	*Astragalus preussii* var. *laxiflorus*	X	X	X		ST/LT		X	X			X		X		LT	X							
plant	Mokiak milkvetch	*Astragalus mokiacensis*	X	X			ST/LT		X	X			X		X		LT	X							
plant	Nevada didymodon	*Didymodon nevadensis*	X		X		ST/LT		X	X			X		X		LT	X							
plant	silverleaf sunray	*Enceliopsis argophylla*	X	X			ST/LT		X	X			X		X		LT	X							
plant	splachnobryum obtusum	*Splachnobryum obtusum*		X	X	X	ST/LT		X	X			X		X		LT	X							
plant	straw milkvetch	*Astragalus lentiginosus* var. *stramineus*		X	X		ST/LT		X	X			X		X		LT	X							
plant	threecorner milkvetch	Astragalus geyeri var. triquetrus		X			ST/LT		X	X			X		X		LT	X							

Table D-9 Summary of Effects of AGRICULTURE AND GRAZING on Special Status Species with the Potential to Occur in LOW VEGETATION DESERT Habitats

							Direct Effects										Indirect Effects									
Taxon	Common Name	Scientific Name	North American Warm Desert Badland	North American Warm Desert Wash	North American Warm Desert Pavement	North American Warm Desert Playa	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
plant	Trichostomum moss	*Trichostomum sweetii*	X		X		ST/LT		X	X			X		X		LT	X							
reptile	banded gecko	*Coleonyx variegatus*		X		X	ST/LT		X	X	X	X	X		X		LT	X		X	X				
reptile	common zebra-tailed lizard	*Callisaurus draconoides draconoides*	X	X	X		ST/LT		X	X	X	X	X		X		LT	X		X	X				
reptile	glossy snake	*Arizona elegans*		X			ST/LT		X	X	X	X	X		X		LT	X		X	X				
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*		X			ST/LT		X	X	X	X	X		X		LT	X		X	X				
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*			X		ST/LT		X	X	X	X	X		X		LT	X		X	X				

LT Long-term
ST Short-term

Table D-10 Summary of Effects of AGRICULTURE AND GRAZING on Special Status Species with the Potential to Occur in FOREST/WOODLAND Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	Great Basin Pinyon-Juniper Woodland	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
amphibian	Pacific tree frog	*Hyla regilla*	X	X	X	X	ST/LT	X			X	X	X		X		LT	X		X					
bird	american peregrine falcon	*Falco peregrinus*	X	X	X		ST/LT				X		X		X		LT			X					
bird	bald eagle	*Haliaeetus leucocephalus*				X	ST/LT				X		X		X		LT			X					
bird	black-chinned sparrow	*Spizella atrogularis*				X	ST/LT				X		X		X		LT			X					
bird	Brewer's sparrow	*Spizella breweri*				X	ST/LT				X		X		X		LT			X					
bird	flammulated owl	*Otus flammeolus*	X	X	X		ST/LT				X		X		X		LT			X					
bird	golden eagle	*Aquila chrysaetos*	X	X	X	X	ST/LT				X		X		X		LT			X					
bird	gray vireo	*Vireo vicinior*				X	ST/LT				X	X	X		X		LT			X				X	
bird	loggerhead shrike	*Lanius ludovicianus*				X	ST/LT				X	X	X		X		LT			X					
bird	long-eared owl	*Asio otus*	X	X	X	X	ST/LT				X	X	X		X		LT			X					
bird	Lucy's warbler	*Vermivora luciae*			X		ST/LT				X	X	X		X		LT			X				X	
bird	northern goshawk	*Accipiter gentilis*	X	X	X		ST/LT				X	X	X		X		LT			X					
bird	northern saw-whet owl	*Aegolius acadius*	X	X	X		ST/LT				X	X	X		X		LT			X					
bird	phainopepla	*Phainopepla nitens*	X				ST/LT				X	X	X		X		LT			X				X	
bird	pinyon jay	*Gymnorhinus cyanocephalus*	X		X	X	ST/LT				X	X	X		X		LT			X					
bird	Scott's oriole	*Icterus parisorum*				X	ST/LT				X	X	X		X		LT			X					
bird	western screech owl	*Otus kennicotti*			X	X	ST/LT				X	X	X		X		LT			X					
mammal	Allen's big-eared bat	*Idionycteris phyllotis*	X		X		ST/LT				X	X	X		X		LT			X					
mammal	big free-tailed bat	*Nyctinomops macrotis*	X	X	X	X	ST/LT				X	X	X		X		LT			X					
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	X	X	X	X	ST/LT				X	X	X		X		LT			X					
mammal	California myotis	*Myotis californicus*	X	X	X		ST/LT				X	X	X		X		LT			X					
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*	X	X	X	X	ST/LT				X	X	X		X		LT			X					

Table D-10 Summary of Effects of AGRICULTURE AND GRAZING on Special Status Species with the Potential to Occur in FOREST/WOODLAND Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	Great Basin Pinyon-Juniper Woodland	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	fringed myotis	*Myotis thysanodes*	X	X	X	X	ST/LT				X	X	X		X		LT			X					
mammal	hoary bat	*Lasiurus cinereus*	X	X	X	X	ST/LT				X	X	X		X		LT			X					
mammal	kit fox	*Vulpes macrotis*				X	ST/LT				X	X	X		X		LT			X					
mammal	long-legged myotis	*Myotis volans*	X	X	X	X	ST/LT				X	X	X		X		LT			X					
mammal	Merriam's shrew	*Sorex merriami*	X	X	X	X	ST/LT				X	X	X		X		LT			X					
mammal	spotted bat	*Euderma maculatum*			X	X	ST/LT				X	X	X		X		LT			X					
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	X	X	ST/LT				X	X	X		X		LT			X					
mammal	Yuma myotis	*Myotis yumanensis*	X	X	X		ST/LT				X	X	X		X		LT			X					
plant	alpine stinking lomatium	*Lomatium graveolens* var. *alpinum*	X	X	X	X	ST/LT		X	X			X		X		LT	X							
plant	Antelope Canyon goldenbush	*Ericameria cervina*	X				ST/LT		X	X			X		X		LT	X							
plant	Clark Mountain agave	Agave utahensis var. nevadensis				X	ST/LT		X	X			X		X		LT	X							
plant	Clokey fleabane	*Erigeron clokeyi*			X		ST/LT		X	X			X		X		LT	X							
plant	Clokey pincushion	*Coryphantha vivipara* ssp. *rosea*				X	ST/LT		X	X			X		X		LT	X							
plant	Fissidens sublimbatus	*Fissidens sublimbatus*	X	X	X	X	ST/LT		X	X			X		X		LT	X							
plant	Nevada willowherb	*Epilobium nevadense*	X		X	X	ST/LT		X	X			X		X		LT	X							
plant	rayless tansy aster	*Machaeranthera grindelioides* var. *depressa*				X	ST/LT		X	X			X		X		LT	X							
plant	Shockley rockcress	*Arabis shockleyi*				X	ST/LT		X	X			X		X		LT	X							
plant	Syntrichia princeps	*Syntrichia princeps*				X	ST/LT		X	X			X		X		LT	X							
reptile	banded gecko	*Coleonyx variegatus*				X	ST/LT		X	X			X		X		LT	X		X					
reptile	California (common) king snake	*Lampropeltis getulus californiae*			X	X	ST/LT		X	X			X		X		LT	X		X					
reptile	desert night lizard	*Xantusia vigilis*			X	X	ST/LT		X	X			X		X		LT	X		X					

Table D-10 Summary of Effects of AGRICULTURE AND GRAZING on Special Status Species with the Potential to Occur in FOREST/WOODLAND Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	Great Basin Pinyon-Juniper Woodland	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*			X		ST/LT		X	X			X		X		LT	X		X					
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*			X	X	ST/LT		X	X			X		X		LT	X		X					
reptile	speckled rattlesnake	*Crotalus mitchelli*				X	ST/LT		X	X			X		X		LT	X		X					
reptile	western red-tailed skink	*Eumeces gilberti rubricaudatus*	X	X	X	X	ST/LT		X	X			X		X		LT	X		X					

LT=Long-term
ST=Short-term

Table D-11 Summary of Effects of AGRICULTURE AND GRAZING on Special Status Species with the Potential to Occur in SHRUB Habitats

							Dierct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X		X		ST/LT				X		X		X		LT			X					
bird	Bendire's thrasher	*Toxostoma bendirei*	X				ST/LT				X	X	X		X		LT			X				X	
bird	black-chinned sparrow	*Spizella atrogularis*				X	ST/LT				X	X	X		X		LT			X					
bird	Brewer's sparrow	*Spizella breweri*		X			ST/LT				X	X	X		X		LT			X					
bird	cactus wren	*Campylorhynchus brunneicapillus*	X			X	ST/LT				X	X	X		X		LT			X					
bird	crissal thrasher	*Toxostoma crissale*				X	ST/LT				X	X	X		X		LT			X				X	
bird	ferruginous hawk	*Buteo regalis*			X		ST/LT				X		X		X		LT			X					
bird	golden eagle	*Aquila chrysaetos*	X		X	X	ST/LT				X		X		X		LT			X					
bird	long-eared owl	*Asio otus*			X	X	ST/LT				X		X		X		LT			X					
bird	phainopepla	*Phainopepla nitens*				X	ST/LT				X	X	X		X		LT			X				X	
bird	pinyon jay	*Gymnorhinus cyanocephalus*		X			ST/LT				X	X	X		X		LT			X					
bird	prairie falcon	*Falco mexicanus*		X		X	ST/LT				X		X		X		LT			X					
bird	Scott's oriole	*Icterus parisorum*				X	ST/LT				X	X	X		X		LT			X					
bird	vesper sparrow	*Pooecetes gramineus*		X	X		ST/LT				X	X	X		X		LT			X					
bird	western bluebird	*Sialia mexicana*		X			ST/LT				X	X	X		X		LT			X				X	
bird	Western burrowing owl	*Speotyto cunicularia hypugea*	X		X		ST/LT				X	X	X		X		LT			X					
bird	yellow-breasted chat	*Icteria virens*		X		X	ST/LT				X	X	X		X		LT			X				X	
mammal	big free-tailed bat	*Nyctinomops macrotis*	X	X	X	X	ST/LT				X		X		X		LT			X					
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	X	X	X	X	ST/LT				X		X		X		LT			X					
mammal	California myotis	*Myotis californicus*		X			ST/LT				X		X		X		LT			X					
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*		X		X	ST/LT				X	X	X		X		LT			X					

Table D-11 Summary of Effects of AGRICULTURE AND GRAZING on Special Status Species with the Potential to Occur in SHRUB Habitats

							Dierct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	desert pocket mouse	*Chaetodipus penicillatus*	X				ST/LT				X	X	X		X		LT			X					
mammal	hoary bat	*Lasiurus cinereus*	X	X		X	ST/LT				X	X	X		X		LT			X					
mammal	little brown myotis	*Myotis lucifugus*		X			ST/LT				X	X	X		X		LT			X					
mammal	long-eared myotis	*Myotis evotis*				X	ST/LT				X	X	X		X		LT			X					
mammal	Merriam's shrew	*Sorex merriami*		X	X	X	ST/LT				X	X	X		X		LT			X					
mammal	pallid bat	*Antrozous pallidus*	X	X	X	X	ST/LT				X	X	X		X		LT			X					
mammal	spotted bat	*Euderma maculatum*			X		ST/LT				X	X	X		X		LT			X					
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	X	X	ST/LT				X	X	X		X		LT			X					
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	X	X	X	ST/LT				X	X	X		X		LT			X					
mammal	Yuma myotis	*Myotis yumanensis*			X	X	ST/LT				X	X	X		X		LT			X					
plant	alpine stinking lomatium	*Lomatium graveolens* var. *alpinum*		X	X	X	ST/LT		X	X			X		X		LT								
plant	barrel cactus	*Ferocactus acanthoides* var. *lecontei*	X	X	X	X	ST/LT		X	X			X		X		LT								
plant	chalk liveforever	*Dudleya pulverulenta*				X	ST/LT		X	X			X		X		LT								
plant	Clarke phacelia	*Phacelia filiae*	X				ST/LT		X	X			X		X		LT								
plant	Fissidens sublimbatus	*Fissidens sublimbatus*	X	X	X	X	ST/LT		X	X			X		X		LT								
plant	rayless tansy aster	*Machaeranthera grindelioides* var. *depressa*	X		X		ST/LT		X	X			X		X		LT								
plant	rock phacelia	*Phacelia petrosa*	X				ST/LT		X	X			X		X		LT								
plant	rosy twotone beardtongue	*Penstemon bicolor* ssp. *roseus*	X	X	X	X	ST/LT		X	X			X		X		LT								
plant	Shockley rockcress	*Arabis shockleyi*			X		ST/LT		X	X			X		X		LT								

Table D-11 Summary of Effects of AGRICULTURE AND GRAZING on Special Status Species with the Potential to Occur in SHRUB Habitats

							Dierct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	banded gecko	*Coleonyx variegatus*		X		X	ST/LT		X	X			X		X		LT			X					
reptile	banded Gila monster	*Heloderma suspectum cinctum*				X	ST/LT		X	X			X		X		LT			X					
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X			X	ST/LT		X	X			X		X		LT			X					
reptile	desert night lizard	*Xantusia vigilis*				X	ST/LT		X	X			X		X		LT			X					
reptile	glossy snake	*Arizona elegans*	X				ST/LT		X	X			X		X		LT			X					
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*	X				ST/LT		X	X			X		X		LT			X					
reptile	large-spotted leopard lizard	*Gambelia wislizenii wislizenii*	X				ST/LT		X	X			X		X		LT			X					
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*		X		X	ST/LT		X	X			X		X		LT			X					
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*	X		X		ST/LT		X	X			X		X		LT			X					
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*	X			X	ST/LT		X	X			X		X		LT			X					
reptile	western red-tailed skink	*Eumeces gilberti rubricaudatus*			X	X	ST/LT		X	X			X		X		LT			X					

LT-Long-term
ST=Short-term

Table D-12 Summary of Effects of AGRICULTURE AND GRAZING on Special Status Species with the Potential to Occur in SCRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X		X	X	ST/LT				X		X		X		LT			X	X				
bird	Bendire's thrasher	*Toxostoma bendirei*	X	X	X		ST/LT				X	X	X		X		LT			X	X				
bird	blue grosbeak	*Guiraca caerulea*	X		X		ST/LT				X	X	X		X		LT			X	X			X	
bird	Brewer's sparrow	*Spizella breweri*			X	X	ST/LT				X	X	X		X		LT			X	X			X	
bird	golden eagle	*Aquila chrysaetos*	X	X			ST/LT				X		X		X		LT			X	X				
bird	gray vireo	*Vireo vicinior*		X			ST/LT				X	X	X		X		LT			X	X			X	
bird	le conte's thrasher	*Toxostoma lecontei*	X	X	X		ST/LT				X	X	X		X		LT			X	X				
bird	loggerhead shrike	*Lanius ludovicianus*	X	X	X	X	ST/LT				X	X	X		X		LT			X	X				
bird	long-eared owl	*Asio otus*	X		X		ST/LT				X		X		X		LT			X	X				
bird	prairie falcon	*Falco mexicanus*		X	X		ST/LT				X		X		X		LT			X	X				
bird	Scott's oriole	*Icterus parisorum*	X				ST/LT				X	X	X		X		LT			X	X				
bird	Western burrowing owl	*Speotyto cunicularia hypugea*	X	X	X	X	ST/LT				X	X	X		X		LT			X	X				
mammal	Allen's big-eared bat	*Idionycteris phyllotis*	X		X		ST/LT				X	X	X		X		LT			X	X				
mammal	big free-tailed bat	*Nyctinomops macrotis*		X	X		ST/LT				X	X	X		X		LT			X	X				
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*		X	X		ST/LT				X	X	X		X		LT			X	X				
mammal	California leaf-nosed bat	*Macrotus californicus*	X	X	X	X	ST/LT				X	X	X		X		LT			X	X				
mammal	desert pocket mouse	*Chaetodipus penicillatus*	X		X		ST/LT				X	X	X		X		LT			X	X				
mammal	fringed myotis	*Myotis thysanodes*		X	X		ST/LT				X	X	X		X		LT			X	X				

Table D-12 Summary of Effects of AGRICULTURE AND GRAZING on Special Status Species with the Potential to Occur in SCRUB Habitats

Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Direct Effects										Indirect Effects								
							Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	hoary bat	*Lasiurus cinereus*			X		ST/LT				X	X	X		X		LT			X	X				
mammal	little brown myotis	*Myotis lucifugus*	X	X			ST/LT				X	X	X		X		LT			X	X				
mammal	long-legged myotis	*Myotis volans*		X	X		ST/LT				X	X	X		X		LT			X	X				
mammal	pallid bat	*Antrozous pallidus*		X	X	X	ST/LT				X	X	X		X		LT			X	X				
mammal	spotted bat	*Euderma maculatum*	X			X	ST/LT				X	X	X		X		LT			X	X				
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*		X	X		ST/LT				X	X	X		X		LT			X	X				
mammal	western pipistrelle	*Pipistrellus hesperus*	X	X	X	X	ST/LT				X	X	X		X		LT			X	X				
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	X	X		ST/LT				X	X	X		X		LT			X	X				
mammal	Yuma myotis	*Myotis yumanensis*		X	X		ST/LT				X	X	X		X		LT			X	X				
plant	barrel cactus	*Ferocactus acanthoides* var. *lecontei*	X	X	X	X	ST/LT		X	X			X		X		LT								
plant	Clark Mountain agave	Agave utahensis var. nevadensis	X		X	X	ST/LT		X	X			X		X		LT								
plant	Clarke phacelia	*Phacelia filiae*	X	X	X	X	ST/LT		X	X			X		X		LT								
plant	Clokey pincushion	*Coryphantha vivipara* ssp. *rosea*	X	X	X	X	ST/LT		X	X			X		X		LT								
plant	crossidium moss	*Crossidium seriatum*	X		X	X	ST/LT		X	X			X		X		LT								
plant	dune linanthus	*Linanthus arenicola*	X		X	X	ST/LT		X	X			X		X		LT								
plant	dune sunflower	*Helianthus deserticola*	X		X	X	ST/LT		X	X			X		X		LT								

Table D-12 Summary of Effects of AGRICULTURE AND GRAZING on Special Status Species with the Potential to Occur in SCRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
plant	forked (Pahrump Valley) buckwheat	*Eriogonum bifurcatum*	X	X	X	X	ST/LT		X	X			X		X		LT								
plant	Las Vegas bearpoppy	*Arctomecon californica*			X		ST/LT		X	X			X		X		LT								
plant	Las Vegas Valley buckwheat	*Eriogonum corymbosum* var. *aureum*	X	X	X	X	ST/LT		X	X			X		X		LT								
plant	Nevada didymodon	*Didymodon nevadensis*			X	X	ST/LT		X	X			X		X		LT								
plant	Nye milkvetch	*Astragalus nyensis*	X	X	X	X	ST/LT		X	X			X		X		LT								
plant	rock phacelia	*Phacelia petrosa*	X	X	X	X	ST/LT		X	X			X		X		LT								
plant	rosy twotone beardtongu e	*Penstemon bicolor* ssp. *roseus*	X	X	X	X	ST/LT		X	X			X		X		LT								
plant	silverleaf sunray	*Enceliopsis argophylla*	X		X	X	ST/LT		X	X			X		X		LT								
plant	sticky buckwheat	*Eriogonum viscidulum*	X		X	X	ST/LT		X	X			X		X		LT								
plant	sticky ringstem	*Anulocaulis leisolenus*	X	X	X	X	ST/LT		X	X			X		X		LT								
plant	straw milkvetch	*Astragalus lentiginosus* var. *stramineus*	X	X	X	X	ST/LT		X	X			X		X		LT								
plant	threecorner milkvetch	*Astragalus geyeri* var. *triquetrus*	X		X	X	ST/LT		X	X			X		X		LT								
plant	Trichostomu m moss	*Trichostomum sweetii*	X		X	X	ST/LT		X	X			X		X		LT								
plant	white bearpoppy	*Arctomecon merriamii*	X		X	X	ST/LT		X	X			X		X		LT								

Table D-12 Summary of Effects of AGRICULTURE AND GRAZING on Special Status Species with the Potential to Occur in SCRUB Habitats

							Direct Effects										Indirect Effects									
Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	banded gecko	*Coleonyx variegatus*	X		X	X	ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	banded Gila monster	*Heloderma suspectum cinctum*	X		X		ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X	X	X		ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	common zebra-tailed lizard	*Callisaurus draconoides draconoides*	X	X	X	X	ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	desert iguana	*Dipsosaurus dorsalis*	X		X		ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	desert night lizard	*Xantusia vigilis*	X				ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	desert tortoise	*Gopherus agassizii*	X		X	X	ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	glossy snake	*Arizona elegans*			X		ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*	X	X	X	X	ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	large-spotted leopard lizard	*Gambelia wislizenii wislizenii*	X	X	X	X	ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	Mojave green rattlesnake	*Crotalus scutulatus scutulatus*	X		X		ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	sidewinder	*Crotalus cerastes*	X		X		ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*	X				ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*	X	X	X	X	ST/LT		X	X	X	X	X		X		LT			X	X				

Table D-12 Summary of Effects of AGRICULTURE AND GRAZING on Special Status Species with the Potential to Occur in SCRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*			X		ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	speckled rattlesnake	*Crotalus mitchelli*	X		X		ST/LT		X	X	X	X	X		X		LT			X	X				
reptile	western leaf-nosed snake	*Phyllorhynchus decurtatus*			X		ST/LT		X	X	X	X	X		X		LT			X	X				

LT-=Long-term
ST=Short-term

Table D-13 Summary of Effects of AGRICULTURE AND GRAZING on Special Status Species with the Potential to Occur in AGRICULTURE Habitats

Taxon	Common Name	Scientific Name	Agriculture	Direct Effects										Indirect Effects								
				Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X	ST/LT				X	X	X		X		LT			X	X				
bird	blue grosbeak	*Guiraca caerulea*	X	ST/LT				X	X	X		X		LT			X	X			X	
bird	golden eagle	*Aquila chrysaetos*	X	ST/LT				X	X	X		X		LT			X	X				
bird	loggerhead shrike	*Lanius ludovicianus*	X	ST/LT				X	X	X		X		LT			X	X				
bird	long-eared owl	*Asio otus*	X	ST/LT				X	X	X		X		LT			X	X				
bird	northern saw-whet owl	*Aegolius acadius*	X	ST/LT				X	X	X		X		LT			X	X				
bird	prairie falcon	*Falco mexicanus*	X	ST/LT				X	X	X		X		LT			X	X				
bird	summer tanager	*Piranga rubra*	X	ST/LT				X	X	X		X		LT			X	X			X	
bird	western bluebird	*Sialia mexicana*	X	ST/LT				X	X	X		X		LT			X	X			X	
bird	Western burrowing owl	*Speotyto cunicularia hypugea*	X	ST/LT				X	X	X		X		LT			X	X				
bird	western screech owl	*Otus kennicotti*	X	ST/LT				X	X	X		X		LT			X	X				
mammal	big free-tailed bat	*Nyctinomops macrotis*	X	ST/LT				X	X	X		X		LT			X	X				
mammal	California leaf-nosed bat	*Macrotus californicus*	X	ST/LT				X	X	X		X		LT			X	X				
mammal	fringed myotis	*Myotis thysanodes*	X	ST/LT				X	X	X		X		LT			X	X				
mammal	little brown myotis	*Myotis lucifugus*	X	ST/LT				X	X	X		X		LT			X	X				
mammal	pallid bat	*Antrozous pallidus*	X	ST/LT				X	X	X		X		LT			X	X				
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	ST/LT				X	X	X		X		LT			X	X				
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	ST/LT				X	X	X		X		LT			X	X				
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X	ST/LT		X	X	X	X	X		X		LT			X	X				

LT=Long-term
ST=Short-term

Table D-14 Summary of Effects of AGRICULTURE AND GRAZING on Special Status Species with the Potential to Occur in DEVELOPED Habitats

					Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Developed, Open Space - Low Intensity	Developed, Medium - High Intensity	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X		ST/LT				X	X	X		X		LT			X	X				
bird	loggerhead shrike	*Lanius ludovicianus*	X		ST/LT				X	X	X		X		LT			X	X				
bird	northern saw-whet owl	*Aegolius acadius*	X		ST/LT				X	X	X		X		LT			X	X				
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	X	X	ST/LT				X	X	X		X		LT			X	X				
mammal	greater western mastiff bat	*Eumops perotis californicus*	X	X	ST/LT				X	X	X		X		LT			X	X				
mammal	hoary bat	*Lasiurus cinereus*	X	X	ST/LT				X	X	X		X		LT			X	X				
mammal	little brown myotis	*Myotis lucifugus*	X	X	ST/LT				X	X	X		X		LT			X	X				
mammal	long-legged myotis	*Myotis volans*	X		ST/LT				X	X	X		X		LT			X	X				
mammal	pallid bat	*Antrozous pallidus*	X		ST/LT				X	X	X		X		LT			X	X				
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	ST/LT				X	X	X		X		LT			X	X				

LT=Long-term
ST=Short-term

Table D-15 Summary of Effects of HUNTING on Special Status Species with the Potential to Occur in CLIFFS AND CANYON Habitats

					Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	american peregrine falcon	*Falco peregrinus*	X		ST		X	X				X			ST			X					
bird	Bendire's thrasher	*Toxostoma bendirei*	X	X	ST								X		N/A								
bird	cactus wren	*Campylorhynchus brunneicapillus*		X	ST								X		N/A								
bird	ferruginous hawk	*Buteo regalis*	X		ST		X	X				X			ST			X					
bird	golden eagle	*Aquila chrysaetos*	X		ST		X	X				X			ST			X					
bird	gray vireo	*Vireo vicinior*	X	X	ST								X		N/A								
bird	loggerhead shrike	*Lanius ludovicianus*	X		ST								X		N/A								
bird	pinyon jay	*Gymnorhinus cyanocephalus*	X		ST								X		N/A								
bird	prairie falcon	*Falco mexicanus*		X	ST		X	X				X			ST			X					
bird	western bluebird	*Sialia mexicana*	X		ST								X		N/A								
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*		X	ST		X	X				X											
mammal	California leaf-nosed bat	*Macrotus californicus*		X	ST		X	X				X											
mammal	California myotis	*Myotis californicus*		X	ST		X	X				X											
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*	X		ST		X	X				X											
mammal	fringed myotis	*Myotis thysanodes*	X	X	ST		X	X				X											
mammal	greater western mastiff bat	*Eumops perotis californicus*		X	ST		X	X				X											
mammal	hoary bat	*Lasiurus cinereus*	X	X	ST		X	X				X											
mammal	kit fox	*Vulpes macrotis*	X	X	ST		X	X				X			ST			X					
mammal	little brown myotis	*Myotis lucifugus*	X	X	ST		X	X				X											
mammal	long-eared myotis	*Myotis evotis*	X		ST		X	X				X											

Table D-15 Summary of Effects of HUNTING on Special Status Species with the Potential to Occur in CLIFFS AND CANYON Habitats

					Direct Effects										Indirect Effects									
Taxon	Common Name	Scientific Name	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	long-legged myotis	*Myotis volans*	X	X	ST		X	X				X											
mammal	pallid bat	*Antrozous pallidus*	X	X	ST		X	X				X											
mammal	silver-haired bat	*Lasionycteris noctivagans*	X		ST		X	X				X											
mammal	spotted bat	*Euderma maculatum*	X	X	ST		X	X				X											
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	ST		X	X				X											
mammal	western pipistrelle	*Pipistrellus hesperus*	X	X	ST		X	X				X											
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	X	ST		X	X				X											
mammal	Yuma myotis	*Myotis yumanensis*	X	X	ST		X	X				X											
plant	Antelope Canyon goldenbush	*Ericameria cervina*	X	X	LT		X	X			X				LT	X							
plant	Aven Nelson phacelia	*Phacelia anelsonii*	X	X	LT		X	X			X				LT	X							
plant	chalk liveforever	*Dudleya pulverulenta*	X	X	LT		X	X			X				LT	X							
plant	crossidium moss	*Crossidium seriatum*	X	X	LT		X	X			X				LT	X							
plant	Fissidens sublimbatus	*Fissidens sublimbatus*	X	X	LT		X	X			X				LT	X							
plant	Mokiak milkvetch	*Astragalus mokiacensis*	X	X	LT		X	X			X				LT	X							
plant	Nevada didymodon	*Didymodon nevadensis*	X	X	LT		X	X			X				LT	X							

Table D-15 Summary of Effects of HUNTING on Special Status Species with the Potential to Occur in CLIFFS AND CANYON Habitats

					Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X	X	LT		X	X			X	X			LT	X							
reptile	desert night lizard	*Xantusia vigilis*		X	LT		X	X			X	X			LT	X							
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*	X	X	LT		X	X			X	X			LT	X							
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*	X	X	LT		X	X			X	X			LT	X							
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*		X	LT		X	X			X	X			LT	X							
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*	X	X	LT		X	X			X	X			LT	X							
reptile	speckled rattlesnake	*Crotalus mitchelli*	X	X	LT		X	X			X	X			LT	X							
reptile	Western chuckwalla	*Sauromalus obesus*	X	X	LT		X	X			X	X			LT	X							

LT Long-term
ST Short-term
na not applicable

Table D-16 Summary of Effects of HUNTING on Special Status Species with the Potential to Occur in LOW VEGETATION DESERT Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	North American Warm Desert Badland	North American Warm Desert Wash	North American Warm Desert Pavement	North American Warm Desert Playa	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	Bendire's thrasher	*Toxostoma bendirei*		X	X		ST								X		N/A								
bird	Brewer's sparrow	*Spizella breweri*			X		ST								X		N/A								
bird	cactus wren	*Campylorhynchus brunneicapillus*		X			ST								X		N/A								
bird	crissal thrasher	*Toxostoma crissale*		X			ST								X		N/A								
bird	ferruginous hawk	*Buteo regalis*		X			ST		X	X				X			ST			X					
bird	le conte's thrasher	*Toxostoma lecontei*		X			ST								X		N/A								
bird	loggerhead shrike	*Lanius ludovicianus*		X			ST								X		N/A								
bird	Lucy's warbler	*Vermivora luciae*		X			ST								X		N/A								
bird	phainopepla	*Phainopepla nitens*		X			ST								X		N/A								
bird	prairie falcon	*Falco mexicanus*		X			ST		X	X				X			ST			X					
bird	summer tanager	*Piranga rubra*		X			ST								X		N/A								
bird	Western burrowing owl	*Speotyto cunicularia hypugea*				X	ST								X		N/A			X					
bird	western screech owl	*Otus kennicotti*		X			ST								X		N/A			X					
mammal	California leaf-nosed bat	*Macrotus californicus*	X	X	X	X	ST		X	X				X											
mammal	California myotis	*Myotis californicus*		X			ST		X	X				X											
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*		X			ST		X	X				X											
mammal	desert kangaroo rat	*Dipodomys deserti*		X			ST		X	X				X											
mammal	desert pocket mouse	*Chaetodipus penicillatus*		X			ST		X	X				X											
mammal	spotted bat	*Euderma maculatum*		X			ST		X	X				X											
mammal	western pipistrelle	*Pipistrellus hesperus*	X		X		ST		X	X				X											

Table D-16 Summary of Effects of HUNTING on Special Status Species with the Potential to Occur in LOW VEGETATION DESERT Habitats

Taxon	Common Name	Scientific Name	North American Warm Desert Badland	North American Warm Desert Wash	North American Warm Desert Pavement	North American Warm Desert Playa	Direct Effects: Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Indirect Effects: Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	western red bat	*Lasiurus blossevillii*		X			ST		X	X				X											
mammal	kit fox	*Vulpes macrotis*	X	X		X	ST		X	X				X			ST			X					
plant	Beaver Dam scurfpea (breadroot)	*Pediomelum castoreum*			X		LT		X	X			X				LT	X							
plant	catchfly gentian	*Eustoma exaltatum*		X			LT		X	X			X				LT	X							
plant	crossidium moss	*Crossidium seriatum*	X		X		LT		X	X			X				LT	X							
plant	dune linanthus	*Linanthus arenicola*	X	X	X	X	LT		X	X			X				LT	X							
plant	dune sunflower	*Helianthus deserticola*	X		X	X	LT		X	X			X				LT	X							
plant	Las Vegas Valley buckwheat	*Eriogonum corymbosum var. aureum*		X			LT		X	X			X				LT	X							
plant	Littlefield milkvetch	*Astragalus preussii var. laxiflorus*	X	X	X		LT		X	X			X				LT	X							
plant	Mokiak milkvetch	*Astragalus mokiacensis*	X	X			LT		X	X			X				LT	X							
plant	Nevada didymodon	*Didymodon nevadensis*	X		X		LT		X	X			X				LT	X							
plant	silverleaf sunray	*Enceliopsis argophylla*	X	X			LT		X	X			X				LT	X							
plant	splachnobryum obtusum	*Splachnobryum obtusum*		X	X	X	LT		X	X			X				LT	X							
plant	straw milkvetch	*Astragalus lentiginosus var. stramineus*		X	X		LT		X	X			X				LT	X							
plant	threecorner milkvetch	*Astragalus geyeri var. triquetrus*		X			LT		X	X			X				LT	X							
plant	Trichostomum moss	*Trichostomum sweetii*	X		X		LT		X	X			X				LT	X							

Table D-16 Summary of Effects of HUNTING on Special Status Species with the Potential to Occur in LOW VEGETATION DESERT Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	North American Warm Desert Badland	North American Warm Desert Wash	North American Warm Desert Pavement	North American Warm Desert Playa	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	banded gecko	*Coleonyx variegatus*		X		X	LT		X	X			X	X			LT	X							
reptile	common zebra-tailed lizard	*Callisaurus draconoides draconoides*	X	X	X		LT		X	X			X	X			LT	X							
reptile	glossy snake	*Arizona elegans*		X			LT		X	X			X	X			LT	X							
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*		X			LT		X	X			X	X			LT	X							
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*			X		LT		X	X			X	X			LT	X							

LT Long-term
ST Short term

Table D-17 Summary of Effects of HUNTING on Special Status Species with the Potential to Occur in FOREST/WOODLAND Habitats

							Direct Effects										Indirect Effects									
Taxon	Common Name	Scientific Name	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	Great Basin Pinyon-Juniper Woodland	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
amphibian	Pacific tree frog	*Hyla regilla*	X	X	X	X	LT		X	X			X	X			LT	X							
bird	american peregrine falcon	*Falco peregrinus*	X	X	X		ST		X	X				X			ST			X					
bird	bald eagle	*Haliaeetus leucocephalus*				X	ST		X	X				X			ST			X					
bird	black-chinned sparrow	*Spizella atrogularis*				X	ST		X	X				X			ST			X					
bird	Brewer's sparrow	*Spizella breweri*				X	ST		X	X				X			ST			X					
bird	flammulated owl	*Otus flammeolus*	X	X	X		ST		X	X				X			ST			X					
bird	golden eagle	*Aquila chrysaetos*	X	X	X	X	ST		X	X				X			ST			X					
bird	gray vireo	*Vireo vicinior*				X	ST								X		N/A								
bird	loggerhead shrike	*Lanius ludovicianus*				X	ST								X		N/A								
bird	long-eared owl	*Asio otus*	X	X	X	X	ST		X	X				X			ST			X					
bird	Lucy's warbler	*Vermivora luciae*			X		ST								X		N/A								
bird	northern goshawk	*Accipiter gentilis*	X	X	X		ST		X	X				X			ST			X					
bird	northern saw-whet owl	*Aegolius acadius*	X	X	X		ST		X	X				X			ST			X					
bird	phainopepla	*Phainopepla nitens*	X				ST								X		N/A								
bird	pinyon jay	*Gymnorhinus cyanocephalus*	X		X	X	ST								X		N/A								
bird	Scott's oriole	*Icterus parisorum*				X	ST								X		N/A								
bird	western screech owl	*Otus kennicotti*			X	X	ST		X	X				X			ST			X					
mammal	Allen's big-eared bat	*Idionycteris phyllotis*	X		X		ST		X	X				X											

Table D-17 Summary of Effects of HUNTING on Special Status Species with the Potential to Occur in FOREST/WOODLAND Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	Great Basin Pinyon-Juniper Woodland	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	big free-tailed bat	*Nyctinomops macrotis*	X	X	X	X	ST		X	X				X											
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	X	X	X	X	ST		X	X				X											
mammal	California myotis	*Myotis californicus*	X	X	X		ST		X	X				X											
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*	X	X	X	X	ST		X	X				X											
mammal	fringed myotis	*Myotis thysanodes*	X	X	X	X	ST		X	X				X											
mammal	hoary bat	*Lasiurus cinereus*	X	X	X	X	ST		X	X				X											
mammal	kit fox	*Vulpes macrotis*				X	ST		X	X				X											
mammal	long-eared myotis	*Myotis evotis*	X	X	X	X	ST		X	X				X											
mammal	long-legged myotis	*Myotis volans*	X	X	X	X	ST		X	X				X											
mammal	Merriam's shrew	*Sorex merriami*	X	X	X	X	ST		X	X				X											
mammal	spotted bat	*Euderma maculatum*			X	X	ST		X	X				X											
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	X	X	ST		X	X				X											
mammal	Yuma myotis	*Myotis yumanensis*	X	X	X		ST		X	X				X											
plant	alpine stinking lomatium	*Lomatium graveolens var. alpinum*	X	X	X	X	LT		X	X			X				LT	X							
plant	Antelope Canyon goldenbush	*Ericameria cervina*	X				LT		X	X			X				LT	X							
plant	Clark Mountain agave	*Agave utahensis var. nevadensis*				X	LT		X	X			X				LT	X							
plant	Clokey fleabane	*Erigeron clokeyi*			X		LT		X	X			X				LT	X							

Table D-17 Summary of Effects of HUNTING on Special Status Species with the Potential to Occur in FOREST/WOODLAND Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	Great Basin Pinyon-Juniper Woodland	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
plant	Clokey pincushion	*Coryphantha vivipara ssp. rosea*				X	LT		X	X			X				LT	X							
plant	Fissidens sublimbatus	*Fissidens sublimbatus*	X	X	X	X	LT		X	X			X				LT	X							
plant	Nevada willowherb	*Epilobium nevadense*	X		X	X	LT		X	X			X				LT	X							
plant	rayless tansy aster	*Machaeranthera grindelioides var. depressa*				X	LT		X	X			X				LT	X							
plant	Shockley rockcress	*Arabis shockleyi*				X	LT		X	X			X				LT	X							
plant	Syntrichia princeps	*Syntrichia princeps*				X	LT		X	X			X				LT	X							
reptile	banded gecko	*Coleonyx variegatus*				X	LT		X	X			X	X			LT	X							
reptile	California (common) king snake	*Lampropeltis getulus californiae*			X	X	LT		X	X			X	X			LT	X							
reptile	desert night lizard	*Xantusia vigilis*			X	X	LT		X	X			X	X			LT	X							
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*			X		LT		X	X			X	X			LT	X							
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*			X	X	LT		X	X			X	X			LT	X							
reptile	speckled rattlesnake	*Crotalus mitchelli*				X	LT		X	X			X	X			LT	X							
reptile	western red-tailed skink	*Eumeces gilberti rubricaudatus*	X	X	X	X	LT		X	X			X	X			LT	X							

LT Long-term
ST Short-term
NA not applicable

Table D-18 Summary of Effects of HUNTING on Special Status Species with the Potential to Occur in SHRUB Habitats

							Direct Effects										Indirect Effects									
Taxon	Common Name	Scientific Name	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X		X		ST		X	X				X			ST			X					
bird	Bendire's thrasher	*Toxostoma bendirei*	X				ST								X		N/A								
bird	black-chinned sparrow	*Spizella atrogularis*				X	ST								X		N/A								
bird	Brewer's sparrow	*Spizella breweri*		X			ST								X		N/A								
bird	cactus wren	*Campylorhynchus brunneicapillus*	X			X	ST								X		N/A								
bird	crissal thrasher	*Toxostoma crissale*				X	ST								X		N/A								
bird	ferruginous hawk	*Buteo regalis*			X		ST		X	X				X			ST			X					
bird	golden eagle	*Aquila chrysaetos*	X		X	X	ST		X	X				X			ST			X					
bird	long-eared owl	*Asio otus*			X	X	ST		X	X				X			ST			X					
bird	phainopepla	*Phainopepla nitens*				X	ST								X		N/A								
bird	pinyon jay	*Gymnorhinus cyanocephalus*		X			ST								X		N/A								
bird	prairie falcon	*Falco mexicanus*		X		X	ST		X	X				X			ST			X					
bird	Scott's oriole	*Icterus parisorum*				X	ST								X		N/A								
bird	vesper sparrow	*Pooecetes gramineus*		X	X		ST								X		N/A								
bird	western bluebird	*Sialia mexicana*		X			ST								X		N/A								
bird	Western burrowing owl	*Speotyto cunicularia hypugea*	X		X		ST		X	X				X			ST			X					
bird	yellow-breasted chat	*Icteria virens*		X		X	ST								X		N/A								

Table D-18 Summary of Effects of HUNTING on Special Status Species with the Potential to Occur in SHRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	big free-tailed bat	*Nyctinomops macrotis*	X	X	X	X	ST		X	X				X											
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	X	X	X	X	ST		X	X				X											
mammal	California myotis	*Myotis californicus*		X			ST		X	X				X											
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*		X		X	ST		X	X				X											
mammal	desert pocket mouse	*Chaetodipus penicillatus*	X				ST		X	X				X											
mammal	hoary bat	*Lasiurus cinereus*	X	X		X	ST		X	X				X											
mammal	little brown myotis	*Myotis lucifugus*		X			ST		X	X				X											
mammal	long-eared myotis	*Myotis evotis*				X	ST		X	X				X											
mammal	Merriam's shrew	*Sorex merriami*		X	X	X	ST		X	X				X											
mammal	pallid bat	*Antrozous pallidus*	X	X	X	X	ST		X	X				X											
mammal	spotted bat	*Euderma maculatum*			X		ST		X	X				X											
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	X	X	ST		X	X				X											
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	X	X	X	ST		X	X				X											
mammal	Yuma myotis	*Myotis yumanensis*			X	X	ST		X	X				X											
plant	alpine stinking lomatium	*Lomatium graveolens var. alpinum*		X	X	X	LT		X	X			X				LT	X							
plant	barrel cactus	*Ferocactus acanthoides var. lecontei*	X	X	X	X	LT		X	X			X				LT	X							
plant	chalk liveforever	*Dudleya pulverulenta*				X	LT		X	X			X				LT	X							
plant	Clarke phacelia	*Phacelia filiae*	X				LT		X	X			X				LT	X							

Table D-18 Summary of Effects of HUNTING on Special Status Species with the Potential to Occur in SHRUB Habitats

Taxon	Common Name	Scientific Name	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Direct Effects: Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Indirect Effects: Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
plant	Fissidens sublimbatus	*Fissidens sublimbatus*	X	X	X	X	LT		X	X			X				LT	X							
plant	rayless tansy aster	*Machaeranthera grindelioides var. depressa*	X		X		LT		X	X			X				LT	X							
plant	rock phacelia	*Phacelia petrosa*	X				LT		X	X			X				LT	X							
plant	rosy twotone beardtongue	*Penstemon bicolor ssp. roseus*	X	X	X	X	LT		X	X			X				LT	X							
plant	Shockley rockcress	*Arabis shockleyi*			X		LT		X	X			X				LT	X							
plant	white bearpoppy	*Arctomecon merriamii*	X				LT		X	X			X				LT	X							
reptile	banded gecko	*Coleonyx variegatus*		X		X	LT		X	X			X	X			LT	X							
reptile	banded Gila monster	*Heloderma suspectum cinctum*				X	LT		X	X			X	X			LT	X							
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X			X	LT		X	X			X	X			LT	X							
reptile	desert night lizard	*Xantusia vigilis*				X	LT		X	X			X	X			LT	X							
reptile	glossy snake	*Arizona elegans*	X				LT		X	X			X	X			LT	X							
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*	X				LT		X	X			X	X			LT	X							
reptile	large-spotted leopard lizard	*Gambelia wislizenii wislizenii*	X				LT		X	X			X	X			LT	X							
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*		X		X	LT		X	X			X	X			LT	X							
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*	X		X		LT		X	X			X	X			LT	X							

Table D-18 Summary of Effects of HUNTING on Special Status Species with the Potential to Occur in SHRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*	X			X	LT		X	X			X	X			LT	X							
reptile	western red-tailed skink	*Eumeces gilberti rubricaudatus*			X	X	LT		X	X			X	X			LT	X							

LT Long-term
ST Short term

Table D-19 Summary of Effects of HUNTING on Special Status Species with the Potential to Occur in SCRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X		X	X	ST		X	X				X			ST			X					
bird	Bendire's thrasher	*Toxostoma bendirei*	X	X	X		ST								X		N/A								
bird	blue grosbeak	*Guiraca caerulea*	X		X		ST								X		N/A								
bird	golden eagle	*Aquila chrysaetos*	X	X			ST		X	X				X			ST			X					
bird	gray vireo	*Vireo vicinior*		X			ST								X		N/A								
bird	le conte's thrasher	*Toxostoma lecontei*	X	X	X		ST								X		N/A								
bird	loggerhead shrike	*Lanius ludovicianus*	X	X	X	X	ST								X		N/A								
bird	long-eared owl	*Asio otus*	X		X		ST		X	X				X			ST			X					
bird	prairie falcon	*Falco mexicanus*		X	X		ST		X	X				X			ST			X					
bird	Scott's oriole	*Icterus parisorum*	X				ST								X		N/A								
bird	Western burrowing owl	*Speotyto cunicularia hypugea*	X	X	X	X	ST		X	X				X			ST			X					
mammal	Allen's big-eared bat	*Idionycteris phyllotis*	X		X		ST		X	X				X											
mammal	big free-tailed bat	*Nyctinomops macrotis*		X	X		ST		X	X				X											
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*		X	X		ST		X	X				X											
mammal	California leaf-nosed bat	*Macrotus californicus*	X	X	X	X	ST		X	X				X											
mammal	desert pocket mouse	*Chaetodipus penicillatus*	X		X		ST		X	X				X											
mammal	fringed myotis	*Myotis thysanodes*		X	X		ST		X	X				X											
mammal	hoary bat	*Lasiurus cinereus*			X		ST		X	X				X											
mammal	little brown myotis	*Myotis lucifugus*	X	X			ST		X	X				X											
mammal	long-legged myotis	*Myotis volans*		X	X		ST		X	X				X											

Table D-19 Summary of Effects of HUNTING on Special Status Species with the Potential to Occur in SCRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	pallid bat	*Antrozous pallidus*		X	X	X	ST		X	X				X											
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*		X	X		ST		X	X				X											
mammal	western pipistrelle	*Pipistrellus hesperus*	X	X	X	X	ST		X	X				X											
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	X	X		ST		X	X				X											
mammal	Yuma myotis	*Myotis yumanensis*		X	X		ST		X	X				X											
plant	barrel cactus	*Ferocactus acanthoides var. lecontei*	X	X	X	X	LT		X	X			X				LT	X							
plant	Clark Mountain agave	*Agave utahensis var. nevadensis*	X		X	X	LT		X	X			X				LT	X							
plant	Clarke phacelia	*Phacelia filiae*	X	X	X	X	LT		X	X			X				LT	X							
plant	Clokey pincushion	*Coryphantha vivipara ssp. rosea*	X	X	X	X	LT		X	X			X				LT	X							
plant	crossidium moss	*Crossidium seriatum*	X		X	X	LT		X	X			X				LT	X							
plant	dune linanthus	*Linanthus arenicola*	X		X	X	LT		X	X			X				LT	X							
plant	dune sunflower	*Helianthus deserticola*	X		X	X	LT		X	X			X				LT	X							
plant	forked (Pahrump Valley) buckwheat	*Eriogonum bifurcatum*	X	X	X	X	LT		X	X			X				LT	X							
plant	Las Vegas bearpoppy	*Arctomecon californica*			X		LT		X	X			X				LT	X							
plant	Las Vegas Valley buckwheat	*Eriogonum corymbosum var. aureum*	X	X	X	X	LT		X	X			X				LT	X							
plant	Nevada didymodon	*Didymodon nevadensis*			X	X	LT		X	X			X				LT	X							
plant	Nye milkvetch	*Astragalus nyensis*	X	X	X	X	LT		X	X			X				LT	X							

Table D-19 Summary of Effects of HUNTING on Special Status Species with the Potential to Occur in SCRUB Habitats

Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Direct Effects: Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Indirect Effects: Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
plant	rock phacelia	*Phacelia petrosa*	X	X	X	X	LT		X	X			X				LT	X							
plant	rosy twotone beardtongue	*Penstemon bicolor ssp. roseus*	X	X	X	X	LT		X	X			X				LT	X							
plant	silverleaf sunray	*Enceliopsis argophylla*	X		X	X	LT		X	X			X				LT	X							
plant	sticky buckwheat	*Eriogonum viscidulum*	X		X	X	LT		X	X			X				LT	X							
plant	sticky ringstem	*Anulocaulis leisolenus*	X	X	X	X	LT		X	X			X				LT	X							
plant	straw milkvetch	*Astragalus lentiginosus var. stramineus*	X	X	X	X	LT		X	X			X				LT	X							
plant	threecorner milkvetch	*Astragalus geyeri var. triquetrus*	X		X	X	LT		X	X			X				LT	X							
plant	Trichostomum moss	*Trichostomum sweetii*	X		X	X	LT		X	X			X				LT	X							
plant	white bearpoppy	*Arctomecon merriamii*	X		X	X	LT		X	X			X				LT								
reptile	banded gecko	*Coleonyx variegatus*	X		X	X	LT		X	X			X	X			LT	X							
reptile	banded Gila monster	*Heloderma suspectum cinctum*	X		X		LT		X	X			X	X			LT	X							
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X	X	X		LT		X	X			X	X			LT	X							
reptile	common zebra-tailed lizard	*Callisaurus draconoides draconoides*	X	X	X	X	LT		X	X			X	X			LT	X							
reptile	desert iguana	*Dipsosaurus dorsalis*	X		X		LT		X	X			X	X			LT	X							
reptile	desert night lizard	*Xantusia vigilis*	X				LT		X	X			X	X			LT	X							
reptile	desert tortoise	*Gopherus agassizii*	X		X	X	LT		X	X			X	X			LT	X							
reptile	glossy snake	*Arizona elegans*			X		LT		X	X			X	X			LT	X							

Table D-19 Summary of Effects of HUNTING on Special Status Species with the Potential to Occur in SCRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*	X	X	X	X	LT		X	X			X	X			LT	X							
reptile	large-spotted leopard lizard	*Gambelia wislizenii wislizenii*	X	X	X	X	LT		X	X			X	X			LT	X							
reptile	Mojave green rattlesnake	*Crotalus scutulatus scutulatus*	X		X		LT		X	X			X	X			LT	X							
reptile	sidewinder	*Crotalus cerastes*	X		X		LT		X	X			X	X			LT	X							
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*	X				LT		X	X			X	X			LT	X							
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*	X	X	X	X	LT		X	X			X	X			LT	X							
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*			X		LT		X	X			X	X			LT	X							
reptile	speckled rattlesnake	*Crotalus mitchelli*	X		X		LT		X	X			X	X			LT	X							
reptile	western leaf-nosed snake	*Phyllorhynchus decurtatus*			X		LT		X	X			X	X			LT	X							

LT Long-term
ST Short-term
NA not applicable

Table D-20 Summary of Effects of HUNTING on Special Status Species with the Potential to Occur in AGRICULTURE Habitats

				Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Agriculture	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X	Hunting would be unlikely to occur in this habitat type.																		
bird	blue grosbeak	*Guiraca caerulea*	X	Hunting would be unlikely to occur in this habitat type.																		
bird	golden eagle	*Aquila chrysaetos*	X	Hunting would be unlikely to occur in this habitat type.																		
bird	loggerhead shrike	*Lanius ludovicianus*	X	Hunting would be unlikely to occur in this habitat type.																		
bird	long-eared owl	*Asio otus*	X	Hunting would be unlikely to occur in this habitat type.																		
bird	northern saw-whet owl	*Aegolius acadius*	X	Hunting would be unlikely to occur in this habitat type.																		
bird	prairie falcon	*Falco mexicanus*	X	Hunting would be unlikely to occur in this habitat type.																		
bird	summer tanager	*Piranga rubra*	X	Hunting would be unlikely to occur in this habitat type.																		
bird	western bluebird	*Sialia mexicana*	X	Hunting would be unlikely to occur in this habitat type.																		
bird	Western burrowing owl	*Speotyto cunicularia hypugea*	X	Hunting would be unlikely to occur in this habitat type.																		
bird	western screech owl	*Otus kennicotti*	X	Hunting would be unlikely to occur in this habitat type.																		
mammal	big free-tailed bat	*Nyctinomops macrotis*	X	Hunting would be unlikely to occur in this habitat type.																		
mammal	California leaf-nosed bat	*Macrotus californicus*	X	Hunting would be unlikely to occur in this habitat type.																		
mammal	fringed myotis	*Myotis thysanodes*	X	Hunting would be unlikely to occur in this habitat type.																		
mammal	little brown myotis	*Myotis lucifugus*	X	Hunting would be unlikely to occur in this habitat type.																		
mammal	pallid bat	*Antrozous pallidus*	X	Hunting would be unlikely to occur in this habitat type.																		
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	Hunting would be unlikely to occur in this habitat type.																		
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	Hunting would be unlikely to occur in this habitat type.																		
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X	Hunting would be unlikely to occur in this habitat type.																		

Table D-21 Summary of Effects of HUNTNG on Special Status Species with the Potential to Occur in DEVELOPED Habitats

					Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Developed, Open Space - Low Intensity	Developed, Medium - High Intensity	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X		Hunting would be unlikely to occur in this habitat type.																		
bird	loggerhead shrike	*Lanius ludovicianus*	X		Hunting would be unlikely to occur in this habitat type.																		
bird	northern saw-whet owl	*Aegolius acadius*	X		Hunting would be unlikely to occur in this habitat type.																		
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	X	X	Hunting would be unlikely to occur in this habitat type.																		
mammal	greater western mastiff bat	*Eumops perotis californicus*	X	X	Hunting would be unlikely to occur in this habitat type.																		
mammal	hoary bat	*Lasiurus cinereus*	X	X	Hunting would be unlikely to occur in this habitat type.																		
mammal	little brown myotis	*Myotis lucifugus*	X	X	Hunting would be unlikely to occur in this habitat type.																		
mammal	long-legged myotis	*Myotis volans*	X		Hunting would be unlikely to occur in this habitat type.																		
mammal	pallid bat	*Antrozous pallidus*	X		Hunting would be unlikely to occur in this habitat type.																		
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	Hunting would be unlikely to occur in this habitat type.																		

Table D-22 Summary of Effects of MINING on Special Status Species with the Potential to Occur in CLIFFS AND CANYON Habitats

					Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	american peregrine falcon	*Falco peregrinus*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Bendire's thrasher	*Toxostoma bendirei*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	cactus wren	*Campylorhynchus brunneicapillus*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	ferruginous hawk	*Buteo regalis*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	golden eagle	*Aquila chrysaetos*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	gray vireo	*Vireo vicinior*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	loggerhead shrike	*Lanius ludovicianus*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	pinyon jay	*Gymnorhinus cyanocephalus*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	prairie falcon	*Falco mexicanus*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	western bluebird	*Sialia mexicana*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	California leaf-nosed bat	*Macrotus californicus*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	California myotis	*Myotis californicus*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	fringed myotis	*Myotis thysanodes*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	greater western mastiff bat	*Eumops perotis californicus*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	hoary bat	*Lasiurus cinereus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	kit fox	*Vulpes macrotis*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	little brown myotis	*Myotis lucifugus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	long-eared myotis	*Myotis evotis*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	long-legged myotis	*Myotis volans*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				

Table D-22 Summary of Effects of MINING on Special Status Species with the Potential to Occur in CLIFFS AND CANYON Habitats

					Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	pallid bat	*Antrozous pallidus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	silver-haired bat	*Lasionycteris noctivagans*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	spotted bat	*Euderma maculatum*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	western pipistrelle	*Pipistrellus hesperus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Yuma myotis	*Myotis yumanensis*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
plant	Antelope Canyon goldenbush	Ericameria cervina	X	X	LT	X	X	X			X	X	X		LT	X							
plant	Antelope Canyon goldenbush	*Ericameria cervina*	X	X	LT	X	X	X	X	X	X	X	X		LT	X							
plant	Aven Nelson phacelia	*Phacelia anelsonii*	X	X	LT	X	X	X			X	X	X		LT	X							
plant	chalk liveforever	Dudleya pulverulenta	X	X	LT	X	X	X			X	X	X		LT	X							
plant	crossidium moss	*Crossidium seriatum*	X	X	LT	X	X	X			X	X	X		LT	X							
plant	Fissidens sublimbatus	*Fissidens sublimbatus*	X	X	LT	X	X	X			X	X	X		LT	X							
plant	Mokiak milkvetch	*Astragalus mokiacensis*	X	X	LT	X	X	X			X	X	X		LT	X							
plant	Nevada didymodon	*Didymodon nevadensis*	X	X	LT	X	X	X			X	X	X		LT	X							

Table D-22 Summary of Effects of MINING on Special Status Species with the Potential to Occur in CLIFFS AND CANYON Habitats

					Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	desert night lizard	*Xantusia vigilis*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	speckled rattlesnake	*Crotalus mitchelli*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	Western chuckwalla	*Sauromalus obesus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				

LT Long-term

Table D-23 Summary of Effects of MINING on Special Status Species with the Potential to Occur in LOW VEGETATION DESERT Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	North American Warm Desert Badland	North American Warm Desert Wash	North American Warm Desert Pavement	North American Warm Desert Playa	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	Bendire's thrasher	*Toxostoma bendirei*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Brewer's sparrow	*Spizella breweri*			X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	cactus wren	*Campylorhynchus brunneicapillus*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	crissal thrasher	*Toxostoma crissale*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	ferruginous hawk	*Buteo regalis*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	le conte's thrasher	*Toxostoma lecontei*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	loggerhead shrike	*Lanius ludovicianus*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Lucy's warbler	*Vermivora luciae*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	phainopepla	*Phainopepla nitens*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	prairie falcon	*Falco mexicanus*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	summer tanager	*Piranga rubra*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Western burrowing owl	*Speotyto cunicularia hypugea*				X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	western screech owl	*Otus kennicotti*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	California leaf-nosed bat	*Macrotus californicus*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	California myotis	*Myotis californicus*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert kangaroo rat	*Dipodomys deserti*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert pocket mouse	*Chaetodipus penicillatus*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	spotted bat	*Euderma maculatum*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	western pipistrelle	*Pipistrellus hesperus*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				

Table D-23 Summary of Effects of MINING on Special Status Species with the Potential to Occur in LOW VEGETATION DESERT Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	North American Warm Desert Badland	North American Warm Desert Wash	North American Warm Desert Pavement	North American Warm Desert Playa	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	western red bat	*Lasiurus blossevillii*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	kit fox	*Vulpes macrotis*	X	X		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
plant	Beaver Dam scurfpea (breadroot)	*Pediomelum castoreum*			X		LT	X	X	X			X	X	X		LT	X							
plant	catchfly gentian	*Eustoma exaltatum*		X			LT	X	X	X			X	X	X		LT	X							
plant	crossidium moss	*Crossidium seriatum*	X		X		LT	X	X	X			X	X	X		LT	X							
plant	dune linanthus	*Linanthus arenicola*	X	X	X	X	LT	X	X	X			X	X	X		LT	X							
plant	dune sunflower	*Helianthus deserticola*	X		X	X	LT	X	X	X			X	X	X		LT	X							
plant	Las Vegas Valley buckwheat	*Eriogonum corymbosum var. aureum*		X			LT	X	X	X			X	X	X		LT	X							
plant	Littlefield milkvetch	*Astragalus preussii var. laxiflorus*	X	X	X		LT	X	X	X			X	X	X		LT	X							
plant	Mokiak milkvetch	*Astragalus mokiacensis*	X	X			LT	X	X	X			X	X	X		LT	X							
plant	Nevada didymodon	*Didymodon nevadensis*	X		X		LT	X	X	X			X	X	X		LT	X							
plant	silverleaf sunray	*Enceliopsis argophylla*	X	X			LT	X	X	X			X	X	X		LT	X							
plant	splachnobryum obtusum	*Splachnobryum obtusum*		X	X	X	LT	X	X	X			X	X	X		LT	X							
plant	straw milkvetch	*Astragalus lentiginosus var. stramineus*		X	X		LT	X	X	X			X	X	X		LT	X							
plant	threecorner milkvetch	*Astragalus geyeri var. triquetrus*		X			LT	X	X	X			X	X	X		LT	X							
plant	Trichostomum moss	*Trichostomum sweetii*	X		X		LT	X	X	X			X	X	X		LT	X							

Table D-23 Summary of Effects of MINING on Special Status Species with the Potential to Occur in LOW VEGETATION DESERT Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	North American Warm Desert Badland	North American Warm Desert Wash	North American Warm Desert Pavement	North American Warm Desert Playa	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	banded gecko	*Coleonyx variegatus*		X		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	common zebra-tailed lizard	*Callisaurus draconoides draconoides*	X	X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	glossy snake	*Arizona elegans*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*			X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				

LT Long-term

Table D-24 Summary of Effects of MINING on Special Status Species with the Potential to Occur in FOREST/WOODLAND Habitats

Taxon	Common Name	Scientific Name	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	Great Basin Pinyon-Juniper Woodland	Direct Effects										Indirect Effects								
							Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
amphibian	Pacific tree frog	*Hyla regilla*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	american peregrine falcon	*Falco peregrinus*	X	X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	bald eagle	*Haliaeetus leucocephalus*				X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	black-chinned sparrow	*Spizella atrogularis*				X	LT	X	X	X	X	X		X	X		LT	X		X	X				
bird	Brewer's sparrow	*Spizella breweri*				X	LT	X	X	X	X	X		X	X		LT	X		X	X				
bird	flammulated owl	*Otus flammeolus*	X	X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	golden eagle	*Aquila chrysaetos*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	gray vireo	*Vireo vicinior*				X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	loggerhead shrike	*Lanius ludovicianus*				X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	long-eared owl	*Asio otus*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Lucy's warbler	*Vermivora luciae*			X		LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	northern goshawk	*Accipiter gentilis*	X	X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	northern saw-whet owl	*Aegolius acadius*	X	X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	phainopepla	*Phainopepla nitens*	X				LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	pinyon jay	*Gymnorhinus cyanocephalus*	X		X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Scott's oriole	*Icterus parisorum*				X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	western screech owl	*Otus kennicotti*			X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				

Table D-24 Summary of Effects of MINING on Special Status Species with the Potential to Occur in FOREST/WOODLAND Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	Great Basin Pinyon-Juniper Woodland	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	Allen's big-eared bat	*Idionycteris phyllotis*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	big free-tailed bat	*Nyctinomops macrotis*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	California myotis	*Myotis californicus*	X	X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*	X	X	X	X	LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	fringed myotis	*Myotis thysanodes*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	hoary bat	*Lasiurus cinereus*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	kit fox	*Vulpes macrotis*				X	LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	long-eared myotis	*Myotis evotis*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	long-legged myotis	*Myotis volans*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Merriam's shrew	*Sorex merriami*	X	X	X	X	LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	spotted bat	*Euderma maculatum*			X	X	LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Yuma myotis	*Myotis yumanensis*	X	X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
plant	alpine stinking lomatium	*Lomatium graveolens var. alpinum*	X	X	X	X	LT	X	X	X			X	X	X		LT	X							
plant	Antelope Canyon goldenbush	*Ericameria cervina*	X				LT	X	X	X			X	X	X		LT	X							
plant	Clark Mountain agave	Agave utahensis var. nevadensis				X	LT	X	X	X			X	X	X		LT	X							

Table D-24 Summary of Effects of MINING on Special Status Species with the Potential to Occur in FOREST/WOODLAND Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	Great Basin Pinyon-Juniper Woodland	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
plant	Clokey fleabane	*Erigeron clokeyi*			X		LT	X	X	X			X	X	X		LT	X							
plant	Clokey pincushion	*Coryphantha vivipara* ssp. *rosea*				X	LT	X	X	X			X	X	X		LT	X							
plant	Fissidens sublimbatus	*Fissidens sublimbatus*	X	X	X	X	LT	X	X	X			X	X	X		LT	X							
plant	Nevada willowherb	*Epilobium nevadense*	X		X	X	LT	X	X	X			X	X	X		LT	X							
plant	rayless tansy aster	*Machaeranthera grindelioides* var. *depressa*				X	LT	X	X	X			X	X	X		LT	X							
plant	Shockley rockcress	*Arabis shockleyi*				X	LT	X	X	X			X	X	X		LT	X							
plant	Syntrichia princeps	*Syntrichia princeps*				X	LT	X	X	X			X	X	X		LT	X							
reptile	banded gecko	*Coleonyx variegatus*				X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	California (common) king snake	*Lampropeltis getulus californiae*			X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	desert night lizard	*Xantusia vigilis*			X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*			X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*			X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	speckled rattlesnake	*Crotalus mitchelli*				X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	western red-tailed skink	*Eumeces gilberti rubricaudatus*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				

LT Long-term

Table D-25 Summary of Effects of MINING on Special Status Species with the Potential to Occur in SHRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Bendire's thrasher	*Toxostoma bendirei*	X				LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	black-chinned sparrow	*Spizella atrogularis*				X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	Brewer's sparrow	*Spizella breweri*		X			LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	cactus wren	*Campylorhynchus brunneicapillus*	X			X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	crissal thrasher	*Toxostoma crissale*				X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	ferruginous hawk	*Buteo regalis*			X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	golden eagle	*Aquila chrysaetos*	X		X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	long-eared owl	*Asio otus*			X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	phainopepla	*Phainopepla nitens*				X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	pinyon jay	*Gymnorhinus cyanocephalus*		X			LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	prairie falcon	*Falco mexicanus*		X		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Scott's oriole	*Icterus parisorum*				X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	vesper sparrow	*Pooecetes gramineus*		X	X		LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	western bluebird	*Sialia mexicana*		X			LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	Western burrowing owl	*Speotyto cunicularia hypugea*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	yellow-breasted chat	*Icteria virens*		X		X	LT	X	X	X	X	X	X		X		LT	X		X	X				
mammal	big free-tailed bat	*Nyctinomops macrotis*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	California myotis	*Myotis californicus*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*		X		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert pocket mouse	*Chaetodipus penicillatus*	X				LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	hoary bat	*Lasiurus cinereus*	X	X		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	little brown myotis	*Myotis lucifugus*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				

Table D-25 Summary of Effects of MINING on Special Status Species with the Potential to Occur in SHRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	long-eared myotis	*Myotis evotis*				X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Merriam's shrew	*Sorex merriami*		X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	pallid bat	*Antrozous pallidus*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	spotted bat	*Euderma maculatum*			X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Yuma myotis	*Myotis yumanensis*			X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
plant	alpine stinking lomatium	*Lomatium graveolens var. alpinum*		X	X	X	LT	X	X	X			X		X		LT	X							
plant	barrel cactus	*Ferocactus acanthoides var. lecontei*	X	X	X	X	LT	X	X	X			X		X		LT	X							
plant	chalk liveforever	*Dudleya pulverulenta*				X	LT	X	X	X			X		X		LT	X							
plant	Clarke phacelia	*Phacelia filiae*	X				LT	X	X	X			X		X		LT	X							
plant	Fissidens sublimbatus	*Fissidens sublimbatus*	X	X	X	X	LT	X	X	X			X		X		LT	X							
plant	rayless tansy aster	*Machaeranthera grindelioides var. depressa*	X		X		LT	X	X	X			X		X		LT	X							
plant	rock phacelia	*Phacelia petrosa*	X				LT	X	X	X			X		X		LT	X							
plant	rosy twotone beardtongue	*Penstemon bicolor ssp. roseus*	X	X	X	X	LT	X	X	X			X		X		LT	X							
plant	Shockley rockcress	*Arabis shockleyi*			X		LT	X	X	X			X		X		LT	X							
plant	white bearpoppy	*Arctomecon merriamii*	X				LT	X	X	X			X		X		LT	X							
reptile	banded gecko	*Coleonyx variegatus*		X		X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	banded Gila monster	*Heloderma suspectum cinctum*				X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X			X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				

Table D-25 Summary of Effects of MINING on Special Status Species with the Potential to Occur in SHRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	desert night lizard	*Xantusia vigilis*				X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	glossy snake	*Arizona elegans*	X				LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*	X				LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	large-spotted leopard lizard	*Gambelia wislizenii wislizenii*	X				LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*		X		X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*	X		X		LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*	X			X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	western red-tailed skink	*Eumeces gilberti rubricaudatus*			X	X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				

LT Long-term
IC increated collection

Table D-26 Summary of Effects of MINING on Special Status Species with the Potential to Occur in SCRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X		X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Bendire's thrasher	*Toxostoma bendirei*	X	X	X		LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	blue grosbeak	*Guiraca caerulea*	X		X		LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	Brewer's sparrow	*Spizella breweri*			X	X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	golden eagle	*Aquila chrysaetos*	X	X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	gray vireo	*Vireo vicinior*		X			LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	le conte's thrasher	*Toxostoma lecontei*	X	X	X		LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	loggerhead shrike	*Lanius ludovicianus*	X	X	X	X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	long-eared owl	*Asio otus*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	prairie falcon	*Falco mexicanus*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Scott's oriole	*Icterus parisorum*	X				LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	Western burrowing owl	*Speotyto cunicularia hypugea*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Allen's big-eared bat	*Idionycteris phyllotis*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	big free-tailed bat	*Nyctinomops macrotis*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	California leaf-nosed bat	*Macrotus californicus*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert pocket mouse	*Chaetodipus penicillatus*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	fringed myotis	*Myotis thysanodes*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	hoary bat	*Lasiurus cinereus*			X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	little brown myotis	*Myotis lucifugus*	X	X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				

Table D-26 Summary of Effects of MINING on Special Status Species with the Potential to Occur in SCRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	long-legged myotis	*Myotis volans*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	pallid bat	*Antrozous pallidus*		X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	spotted bat	*Euderma maculatum*	X			X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	western pipistrelle	*Pipistrellus hesperus*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Yuma myotis	*Myotis yumanensis*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
plant	barrel cactus	*Ferocactus acanthoides* var. *lecontei*	X	X	X	X	LT	X	X	X			X		X		LT	X							
plant	Clark Mountain agave	Agave utahensis var. nevadensis	X		X	X	LT	X	X	X			X		X		LT	X							
plant	Clarke phacelia	*Phacelia filiae*	X	X	X	X	LT	X	X	X			X		X		LT	X							
plant	Clokey pincushion	*Coryphantha vivipara* ssp. *rosea*	X	X	X	X	LT	X	X	X			X		X		LT	X							
plant	crossidium moss	*Crossidium seriatum*	X		X	X	LT	X	X	X			X		X		LT	X							
plant	dune linanthus	*Linanthus arenicola*	X		X	X	LT	X	X	X			X		X		LT	X							
plant	dune sunflower	*Helianthus deserticola*	X		X	X	LT	X	X	X			X		X		LT	X							
plant	forked (Pahrump Valley) buckwheat	*Eriogonum bifurcatum*	X	X	X	X	LT	X	X	X			X		X		LT	X							

Table D-26 Summary of Effects of MINING on Special Status Species with the Potential to Occur in SCRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
plant	Las Vegas bearpoppy	*Arctomecon californica*			X		LT	X	X	X			X		X		LT	X							
plant	Las Vegas Valley buckwheat	*Eriogonum corymbosum* var. *aureum*	X	X	X	X	LT	X	X	X			X		X		LT	X							
plant	Nevada didymodon	*Didymodon nevadensis*			X	X	LT	X	X	X			X		X		LT	X							
plant	Nye milkvetch	*Astragalus nyensis*	X	X	X	X	LT	X	X	X			X		X		LT	X							
plant	rock phacelia	*Phacelia petrosa*	X	X	X	X	LT	X	X	X			X		X		LT	X							
plant	rosy twotone beardtongue	*Penstemon bicolor* ssp. *roseus*	X	X	X	X	LT	X	X	X			X		X		LT	X							
plant	silverleaf sunray	*Enceliopsis argophylla*	X		X	X	LT	X	X	X			X		X		LT	X							
plant	sticky buckwheat	*Eriogonum viscidulum*	X		X	X	LT	X	X	X			X		X		LT	X							
plant	sticky ringstem	*Anulocaulis leisolenus*	X	X	X	X	LT	X	X	X			X		X		LT	X							
plant	straw milkvetch	*Astragalus lentiginosus* var. *stramineus*	X	X	X	X	LT	X	X	X			X		X		LT	X							
plant	threecorner milkvetch	*Astragalus geyeri var. triquetrus*	X		X	X	LT	X	X	X			X		X		LT	X							
plant	Trichostomum moss	*Trichostomum sweetii*	X		X	X	LT	X	X	X			X		X		LT	X							
plant	white bearpoppy	*Arctomecon merriamii*	X		X	X	LT	X	X	X			X		X		LT	X							
reptile	banded gecko	*Coleonyx variegatus*	X		X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	banded Gila monster	*Heloderma suspectum cinctum*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X	X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				

Table D-26 Summary of Effects of MINING on Special Status Species with the Potential to Occur in SCRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	common zebra-tailed lizard	*Callisaurus draconoides draconoides*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	desert iguana	*Dipsosaurus dorsalis*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	desert night lizard	*Xantusia vigilis*	X				LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	desert tortoise	*Gopherus agassizii*	X		X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	glossy snake	*Arizona elegans*			X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	large-spotted leopard lizard	*Gambelia wislizenii wislizenii*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	Mojave green rattlesnake	*Crotalus scutulatus scutulatus*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	sidewinder	*Crotalus cerastes*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*	X				LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*			X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	speckled rattlesnake	*Crotalus mitchelli*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	western leaf-nosed snake	*Phyllorhynchus decurtatus*			X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				

LT Long-term

Table D-27 Summary of Effects of MINING on Special Status Species with the Potential to Occur in AGRICULTURE Habitats

<table>
<tr><th rowspan="2">Taxon</th><th rowspan="2">Common Name</th><th rowspan="2">Scientific Name</th><th rowspan="2">Agriculture</th><th colspan="10">Direct Effects</th><th colspan="9">Indirect Effects</th></tr>
<tr><th>Short- term (ST)/Long-term (LT)</th><th>Habitat Loss</th><th>Direct Mortality</th><th>Injury</th><th>Loss of foraging habitat</th><th>Loss of nesting/denning habitat</th><th>Habitat Alteration or Degradation</th><th>Potential for injury</th><th>Human disturbance</th><th>Other</th><th>Short- term (ST)/Long-term (LT)</th><th>Habitat fragmentation</th><th>Predation/competition</th><th>Loss of prey</th><th>Loss of food source</th><th>Disease/parasites</th><th>Hybridization</th><th>Brood parasitism</th><th>Other</th></tr>
<tr><td>bird</td><td>bald eagle</td><td>Haliaeetus leucocephalus</td><td>X</td><td colspan="19">Mining would be unlikely to occur in agriculture habitats.</td></tr>
<tr><td>bird</td><td>blue grosbeak</td><td>Guiraca caerulea</td><td>X</td><td colspan="19">Mining would be unlikely to occur in agriculture habitats.</td></tr>
<tr><td>bird</td><td>golden eagle</td><td>Aquila chrysaetos</td><td>X</td><td colspan="19">Mining would be unlikely to occur in agriculture habitats.</td></tr>
<tr><td>bird</td><td>loggerhead shrike</td><td>Lanius ludovicianus</td><td>X</td><td colspan="19">Mining would be unlikely to occur in agriculture habitats.</td></tr>
<tr><td>bird</td><td>long-eared owl</td><td>Asio otus</td><td>X</td><td colspan="19">Mining would be unlikely to occur in agriculture habitats.</td></tr>
<tr><td>bird</td><td>northern saw-whet owl</td><td>Aegolius acadius</td><td>X</td><td colspan="19">Mining would be unlikely to occur in agriculture habitats.</td></tr>
<tr><td>bird</td><td>prairie falcon</td><td>Falco mexicanus</td><td>X</td><td colspan="19">Mining would be unlikely to occur in agriculture habitats.</td></tr>
<tr><td>bird</td><td>summer tanager</td><td>Piranga rubra</td><td>X</td><td colspan="19">Mining would be unlikely to occur in agriculture habitats.</td></tr>
<tr><td>bird</td><td>western bluebird</td><td>Sialia mexicana</td><td>X</td><td colspan="19">Mining would be unlikely to occur in agriculture habitats.</td></tr>
<tr><td>bird</td><td>Western burrowing owl</td><td>Speotyto cunicularia hypugea</td><td>X</td><td colspan="19">Mining would be unlikely to occur in agriculture habitats.</td></tr>
<tr><td>bird</td><td>western screech owl</td><td>Otus kennicotti</td><td>X</td><td colspan="19">Mining would be unlikely to occur in agriculture habitats.</td></tr>
<tr><td>mammal</td><td>big free-tailed bat</td><td>Nyctinomops macrotis</td><td>X</td><td colspan="19">Mining would be unlikely to occur in agriculture habitats.</td></tr>
<tr><td>mammal</td><td>California leaf-nosed bat</td><td>Macrotus californicus</td><td>X</td><td colspan="19">Mining would be unlikely to occur in agriculture habitats.</td></tr>
<tr><td>mammal</td><td>fringed myotis</td><td>Myotis thysanodes</td><td>X</td><td colspan="19">Mining would be unlikely to occur in agriculture habitats.</td></tr>
<tr><td>mammal</td><td>little brown myotis</td><td>Myotis lucifugus</td><td>X</td><td colspan="19">Mining would be unlikely to occur in agriculture habitats.</td></tr>
<tr><td>mammal</td><td>pallid bat</td><td>Antrozous pallidus</td><td>X</td><td colspan="19">Mining would be unlikely to occur in agriculture habitats.</td></tr>
<tr><td>mammal</td><td>Townsend's big-eared bat</td><td>Corynorhinus townsendii</td><td>X</td><td colspan="19">Mining would be unlikely to occur in agriculture habitats.</td></tr>
<tr><td>mammal</td><td>western small-footed myotis</td><td>Myotis ciliolabrum</td><td>X</td><td colspan="19">Mining would be unlikely to occur in agriculture habitats.</td></tr>
<tr><td>reptile</td><td>California (common) king snake</td><td>Lampropeltis getulus californiae</td><td>X</td><td colspan="19">Mining would be unlikely to occur in agriculture habitats.</td></tr>
</table>

Table D-28 Summary of Effects of MINING on Special Status Species with the Potential to Occur in CLIFFS AND CANYON Habitats

					Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Developed, Open Space - Low Intensity	Developed, Medium - High Intensity	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	loggerhead shrike	*Lanius ludovicianus*	X		LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	northern saw-whet owl	*Aegolius acadius*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	greater western mastiff bat	*Eumops perotis californicus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	hoary bat	*Lasiurus cinereus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	little brown myotis	*Myotis lucifugus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	long-legged myotis	*Myotis volans*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	pallid bat	*Antrozous pallidus*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				

LT Long-term

Table D-29 Summary of Effects of RECREATION on Special Status Species with the Potential to Occur in CLIFFS AND CANYON Habitats

					Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	american peregrine falcon	*Falco peregrinus*	X		ST/LT		X	X			X	X	X										
bird	Bendire's thrasher	*Toxostoma bendirei*	X	X	ST/LT						X		X										
bird	cactus wren	*Campylorhynchus brunneicapillus*		X	ST/LT						X		X										
bird	ferruginous hawk	*Buteo regalis*	X		ST/LT		X	X			X	X	X										
bird	golden eagle	*Aquila chrysaetos*	X		ST/LT		X	X			X	X	X										
bird	gray vireo	*Vireo vicinior*	X	X	ST/LT						X		X										
bird	loggerhead shrike	*Lanius ludovicianus*	X		ST/LT						X		X										
bird	pinyon jay	*Gymnorhinus cyanocephalus*	X		ST/LT						X		X										
bird	prairie falcon	*Falco mexicanus*		X	ST/LT		X	X			X	X	X										
bird	western bluebird	*Sialia mexicana*	X		ST/LT						X		X										
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*		X	ST/LT						X	X	X										
mammal	California leaf-nosed bat	*Macrotus californicus*		X	ST/LT						X	X	X										
mammal	California myotis	*Myotis californicus*		X	ST/LT						X	X	X										
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*	X		ST/LT						X	X	X										
mammal	fringed myotis	*Myotis thysanodes*	X	X	ST/LT						X	X	X										
mammal	greater western mastiff bat	*Eumops perotis californicus*		X	ST/LT						X	X	X										
mammal	hoary bat	*Lasiurus cinereus*	X	X	ST/LT						X	X	X										
mammal	kit fox	*Vulpes macrotis*	X	X	ST/LT						X	X	X										
mammal	little brown myotis	*Myotis lucifugus*	X	X	ST/LT						X	X	X										
mammal	long-eared myotis	*Myotis evotis*	X		ST/LT						X	X	X										
mammal	long-legged myotis	*Myotis volans*	X	X	ST/LT						X	X	X										
mammal	pallid bat	*Antrozous pallidus*	X	X	ST/LT						X	X	X										

Table D-29 Summary of Effects of RECREATION on Special Status Species with the Potential to Occur in CLIFFS AND CANYON Habitats

Taxon	Common Name	Scientific Name	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Direct Effects: Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Indirect Effects: Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	silver-haired bat	*Lasionycteris noctivagans*	X		ST/LT						X	X	X										
mammal	spotted bat	*Euderma maculatum*	X	X	ST/LT						X	X	X										
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	ST/LT						X	X	X										
mammal	western pipistrelle	*Pipistrellus hesperus*	X	X	ST/LT						X	X	X										
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	X	ST/LT						X	X	X										
mammal	Yuma myotis	*Myotis yumanensis*	X	X	ST/LT						X	X	X										
plant	Antelope Canyon goldenbush	*Ericameria cervina*	X	X	ST/LT		X	X			X		X		LT	X							
plant	Aven Nelson phacelia	*Phacelia anelsonii*	X	X	ST/LT		X	X			X		X		LT	X							
plant	chalk liveforever	*Dudleya pulverulenta*	X	X	ST/LT		X	X			X		X		LT	X							
plant	crossidium moss	*Crossidium seriatum*	X	X	ST/LT		X	X			X		X		LT	X							
plant	Fissidens sublimbatus	*Fissidens sublimbatus*	X	X	ST/LT		X	X			X		X		LT	X							
plant	Mokiak milkvetch	*Astragalus mokiacensis*	X	X	ST/LT		X	X			X		X		LT	X							
plant	Nevada didymodon	*Didymodon nevadensis*	X	X	ST/LT		X	X			X		X		LT	X							
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X	X	ST/LT		X	X			X	X	X		LT	X							
reptile	desert night lizard	*Xantusia vigilis*		X	ST/LT		X	X			X	X	X		LT	X							
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*	X	X	ST/LT		X	X			X	X	X		LT	X							
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*	X	X	ST/LT		X	X			X	X	X		LT	X							
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*		X	ST/LT		X	X			X	X	X		LT	X							

Table D-29 Summary of Effects of RECREATION on Special Status Species with the Potential to Occur in CLIFFS AND CANYON Habitats

					Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*	X	X	ST/LT		X	X			X	X	X		LT	X							
reptile	speckled rattlesnake	*Crotalus mitchelli*	X	X	ST/LT		X	X			X	X	X		LT	X							
reptile	Western chuckwalla	*Sauromalus obesus*	X	X	ST/LT		X	X			X	X	X		LT	X							

LT Long-term
ST Short-term

Table D-30 Summary of Effects of RECREATION on Special Status Species with the Potential to Occur in LOW VEGETATION DESERT Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	North American Warm Desert Badland	North American Warm Desert Wash	North American Warm Desert Pavement	North American Warm Desert Playa	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	Bendire's thrasher	*Toxostoma bendirei*		X	X		ST/LT	X					X		X										
bird	Brewer's sparrow	*Spizella breweri*			X		ST/LT	X					X		X										
bird	cactus wren	*Campylorhynchus brunneicapillus*		X			ST/LT	X					X		X										
bird	crissal thrasher	*Toxostoma crissale*		X			ST/LT	X					X		X										
bird	ferruginous hawk	*Buteo regalis*		X			ST/LT	X					X	X	X										
bird	le conte's thrasher	*Toxostoma lecontei*		X			ST/LT	X					X		X										
bird	loggerhead shrike	*Lanius ludovicianus*		X			ST/LT	X					X		X										
bird	Lucy's warbler	*Vermivora luciae*		X			ST/LT	X					X		X										
bird	phainopepla	*Phainopepla nitens*		X			ST/LT	X					X		X										
bird	prairie falcon	*Falco mexicanus*		X			ST/LT	X					X	X	X										
bird	summer tanager	*Piranga rubra*		X			ST/LT	X					X		X										
bird	Western burrowing owl	*Speotyto cunicularia hypugea*				X	ST/LT	X					X		X										
bird	western screech owl	*Otus kennicotti*		X			ST/LT	X					X		X										
mammal	California leaf-nosed bat	*Macrotus californicus*	X	X	X	X	ST/LT	X					X	X	X										
mammal	California myotis	*Myotis californicus*		X			ST/LT	X					X	X	X										
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*		X			ST/LT	X					X	X	X										
mammal	desert kangaroo rat	*Dipodomys deserti*		X			ST/LT	X					X	X	X										
mammal	desert pocket mouse	*Chaetodipus penicillatus*		X			ST/LT	X					X	X	X										
mammal	western pipistrelle	*Pipistrellus hesperus*	X		X		ST/LT	X					X	X	X										
mammal	western red bat	*Lasiurus blossevillii*		X			ST/LT	X					X	X	X										
mammal	kit fox	*Vulpes macrotis*	X	X		X	ST/LT	X					X	X	X		ST			X					
plant	Beaver Dam scurfpea (breadroot)	*Pediomelum castoreum*			X		ST/LT	X	X	X			X		X		LT	X							

Table D-30 Summary of Effects of RECREATION on Special Status Species with the Potential to Occur in LOW VEGETATION DESERT Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	North American Warm Desert Badland	North American Warm Desert Wash	North American Warm Desert Pavement	North American Warm Desert Playa	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
plant	catchfly gentian	*Eustoma exaltatum*		X			ST/LT	X	X	X			X		X		LT	X							
plant	crossidium moss	*Crossidium seriatum*	X		X		ST/LT	X	X	X			X		X		LT	X							
plant	dune linanthus	*Linanthus arenicola*	x	x	x	x	ST/LT	x	x	x			x		x		LT	x							
plant	dune sunflower	*Helianthus deserticola*	x		x	x	ST/LT	x	x	x			x		x		LT	x							
plant	Las Vegas Valley buckwheat	*Eriogonum corymbosum* var. *aureum*		X			ST/LT	X	X	X			X		X		LT	X							
plant	Littlefield milkvetch	*Astragalus preussii* var. *laxiflorus*	X	X	X		ST/LT	X	X	X			X		X		LT	X							
plant	Mokiak milkvetch	*Astragalus mokiacensis*	X	X			ST/LT	X	X	X			X		X		LT	X							
plant	Nevada didymodon	*Didymodon nevadensis*	X		X		ST/LT	X	X	X			X		X		LT	X							
plant	silverleaf sunray	*Enceliopsis argophylla*	X	X			ST/LT	X	X	X			X		X		LT	X							
plant	splachnobryum obtusum	*Splachnobryum obtusum*		X	X	X	ST/LT	X	X	X			X		X		LT	X							
plant	straw milkvetch	*Astragalus lentiginosus var. stramineus*		X	X		ST/LT	X	X	X			X		X		LT	X							
plant	threecorner milkvetch	*Astragalus geyeri var. triquetrus*		X			ST/LT	X	X	X			X		X		LT	X							
plant	Trichostomum moss	*Trichostomum sweetii*	X		X		ST/LT	X	X	X			X		X		LT	X							
reptile	banded gecko	*Coleonyx variegatus*		X		X	ST/LT	X	X	X			X	X	X		LT	X							
reptile	common zebra-tailed lizard	*Callisaurus draconoides draconoides*	X	X	X		ST/LT	X	X	X			X	X	X		LT	X							
reptile	glossy snake	*Arizona elegans*		X			ST/LT	X	X	X			X	X	X		LT	X							
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*		X			ST/LT	X	X	X			X	X	X		LT	X							
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*			X		ST/LT	X	X	X			X	X	X		LT	X							

LT Long-term
ST Short-term

Table D-31 Summary of Effects of RECREATION on Special Status Species with the Potential to Occur in FOREST/WOODLAND Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	Great Basin Pinyon-Juniper Woodland	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
amphibian	Pacific tree frog	*Hyla regilla*	X	X	X	X	ST/LT		X	X	X	X	X	X	X										
bird	american peregrine falcon	*Falco peregrinus*	X	X	X		ST/LT		X	X	X	X	X	X	X										
bird	bald eagle	*Haliaeetus leucocephalus*				X	ST/LT		X	X	X	X	X	X	X										
bird	black-chinned sparrow	*Spizella atrogularis*				X	ST/LT		X	X	X	X	X	X	X										
bird	Brewer's sparrow	*Spizella breweri*				X	ST/LT		X	X	X	X	X	X	X										
bird	flammulated owl	*Otus flammeolus*	X	X	X		ST/LT		X	X	X	X	X	X	X										
bird	golden eagle	*Aquila chrysaetos*	X	X	X	X	ST/LT		X	X	X	X	X	X	X										
bird	gray vireo	*Vireo vicinior*				X	ST/LT				X	X	X		X										
bird	loggerhead shrike	*Lanius ludovicianus*				X	ST/LT				X	X	X		X										
bird	long-eared owl	*Asio otus*	X	X	X	X	ST/LT		X	X	X	X	X	X	X										
bird	Lucy's warbler	*Vermivora luciae*			X		ST/LT				X	X	X		X										
bird	northern goshawk	*Accipiter gentilis*	X	X	X		ST/LT		X	X	X	X	X	X	X										
bird	northern saw-whet owl	*Aegolius acadius*	X	X	X		ST/LT		X	X	X	X	X	X	X										
bird	phainopepla	*Phainopepla nitens*	X				ST/LT				X	X	X		X										
bird	pinyon jay	*Gymnorhinus cyanocephalus*	X		X	X	ST/LT				X	X	X		X										
bird	Scott's oriole	*Icterus parisorum*				X	ST/LT				X	X	X		X										
bird	western screech owl	*Otus kennicotti*			X	X	ST/LT		X	X	X	X	X	X	X										

Table D-31 Summary of Effects of RECREATION on Special Status Species with the Potential to Occur in FOREST/WOODLAND Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	Great Basin Pinyon-Juniper Woodland	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	Allen's big-eared bat	*Idionycteris phyllotis*	X		X		ST/LT		X	X	X	X	X	X	X										
mammal	big free-tailed bat	*Nyctinomops macrotis*	X	X	X	X	ST/LT		X	X	X	X	X	X	X										
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	X	X	X	X	ST/LT		X	X	X	X	X	X	X										
mammal	California myotis	*Myotis californicus*	X	X	X		ST/LT		X	X	X	X	X	X	X										
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*	X	X	X	X	ST/LT		X	X	X	X	X	X	X										
mammal	hoary bat	*Lasiurus cinereus*	X	X	X	X	ST/LT		X	X	X	X	X	X	X										
mammal	kit fox	*Vulpes macrotis*				X	ST/LT		X	X	X	X	X	X	X										
mammal	long-legged myotis	*Myotis volans*	X	X	X	X	ST/LT		X	X	X	X	X	X	X										
mammal	Merriam's shrew	*Sorex merriami*	X	X	X	X	ST/LT		X	X	X	X	X	X	X										
mammal	spotted bat	*Euderma maculatum*			X	X	ST/LT		X	X	X	X	X	X	X										
plant	alpine stinking lomatium	*Lomatium graveolens var. alpinum*	X	X	X	X	ST/LT		X	X			X		X		LT	X							
plant	Antelope Canyon goldenbush	*Ericameria cervina*	X				ST/LT		X	X			X		X		LT	X							
plant	Clark Mountain agave	Agave utahensis var. nevadensis				X	ST/LT		X	X			X		X		LT	X							
plant	Clokey fleabane	*Erigeron clokeyi*			X		ST/LT		X	X			X		X		LT	X							
plant	Clokey pincushion	*Coryphantha vivipara* ssp. *rosea*				X	ST/LT		X	X			X		X		LT	X							

Table D-31 Summary of Effects of RECREATION on Special Status Species with the Potential to Occur in FOREST/WOODLAND Habitats

Taxon	Common Name	Scientific Name	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	Great Basin Pinyon-Juniper Woodland	Direct Effects: Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Indirect Effects: Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
plant	Fissidens sublimbatus	*Fissidens sublimbatus*	X	X	X	X	ST/LT		X	X			X		X		LT	X							
plant	Nevada willowherb	*Epilobium nevadense*	X		X	X	ST/LT		X	X			X		X		LT	X							
plant	rayless tansy aster	*Machaeranthera grindelioides* var. *depressa*				X	ST/LT		X	X			X		X		LT	X							
plant	Shockley rockcress	*Arabis shockleyi*				X	ST/LT		X	X			X		X		LT	X							
plant	Syntrichia princeps	*Syntrichia princeps*				X	ST/LT		X	X			X		X		LT	X							
reptile	banded gecko	*Coleonyx variegatus*				X	ST/LT		X	X	X	X	X	X	X		LT	X							
reptile	California (common) king snake	*Lampropeltis getulus californiae*			X	X	ST/LT		X	X	X	X	X	X	X		LT	X							
reptile	desert night lizard	*Xantusia vigilis*			X	X	ST/LT		X	X	X	X	X	X	X		LT	X							
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*			X		ST/LT		X	X	X	X	X	X	X		LT	X							
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*			X	X	ST/LT		X	X	X	X	X	X	X		LT	X							
reptile	speckled rattlesnake	*Crotalus mitchelli*				X	ST/LT		X	X	X	X	X	X	X		LT	X							
reptile	western red-tailed skink	*Eumeces gilberti rubricaudatus*	X	X	X	X	ST/LT		X	X	X	X	X	X	X		LT	X							

LT Long-term
ST Short-term

Table D-32 Summary of Effects of RECREATION on Special Status Species with the Potential to Occur in SHRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X		X		ST						X	X	X										
bird	Bendire's thrasher	*Toxostoma bendirei*	X				ST						X		X										
bird	black-chinned sparrow	*Spizella atrogularis*				X	ST						X		X										
bird	Brewer's sparrow	*Spizella breweri*		X			ST						X		X										
bird	cactus wren	*Campylorhynchus brunneicapillus*	X			X	ST						X		X										
bird	crissal thrasher	*Toxostoma crissale*				X	ST						X		X										
bird	ferruginous hawk	*Buteo regalis*			X		ST						X	X	X										
bird	golden eagle	*Aquila chrysaetos*	X		X	X	ST						X	X	X										
bird	long-eared owl	*Asio otus*			X	X	ST						X	X	X										
bird	phainopepla	*Phainopepla nitens*				X	ST						X		X										
bird	pinyon jay	*Gymnorhinus cyanocephalus*		X			ST						X		X										
bird	prairie falcon	*Falco mexicanus*		X		X	ST						X	X	X										
bird	Scott's oriole	*Icterus parisorum*				X	ST						X		X										
bird	vesper sparrow	*Pooecetes gramineus*		X	X		ST						X		X										
bird	western bluebird	*Sialia mexicana*		X			ST						X		X										
bird	Western burrowing owl	*Speotyto cunicularia hypugea*	X		X		ST						X	X	X										
bird	yellow-breasted chat	*Icteria virens*		X		X	ST						X		X										
mammal	big free-tailed bat	*Nyctinomops macrotis*	X	X	X	X	ST						X	X	X										
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	X	X	X	X	ST						X	X	X										
mammal	California myotis	*Myotis californicus*		X			ST						X	X	X										

Table D-32 Summary of Effects of RECREATION on Special Status Species with the Potential to Occur in SHRUB Habitats

Taxon	Common Name	Scientific Name	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Direct Effects										Indirect Effects									
							Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*		X		X	ST						X	X	X										
mammal	desert pocket mouse	*Chaetodipus penicillatus*	X				ST						X	X	X										
mammal	hoary bat	*Lasiurus cinereus*	X	X		X	ST						X	X	X										
mammal	little brown myotis	*Myotis lucifugus*		X			ST						X	X	X										
mammal	long-eared myotis	*Myotis evotis*				X	ST						X	X	X										
mammal	Merriam's shrew	*Sorex merriami*		X	X	X	ST						X	X	X										
mammal	pallid bat	*Antrozous pallidus*	X	X	X	X	ST						X	X	X										
mammal	spotted bat	*Euderma maculatum*			X		ST						X	X	X										
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	X	X	ST						X	X	X										
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	X	X	X	ST						X	X	X										
mammal	Yuma myotis	*Myotis yumanensis*			X	X	ST						X	X	X										
plant	alpine stinking lomatium	*Lomatium graveolens var. alpinum*	X	X	X	X	LT		X	X			X		X		LT	X							
plant	barrel cactus	*Ferocactus acanthoides* var. *lecontei*	X	X	X	X	LT		X	X			X		X		LT	X							
plant	Clarke phacelia	*Phacelia filiae*	X				LT		X	X			X		X		LT	X							
plant	Fissidens sublimbatus	*Fissidens sublimbatus*	X	X	X	X	LT		X	X			X		X		LT	X							
plant	rayless tansy aster	*Machaeranthera grindelioides* var. *depressa*	X		X		LT		X	X			X		X		LT	X							
plant	rock phacelia	*Phacelia petrosa*	X				LT		X	X			X		X		LT	X							
plant	rosy twotone beardtongue	*Penstemon bicolor* ssp. *roseus*	X	X	X	X	LT		X	X			X		X		LT	X							
plant	Shockley rockcress	*Arabis shockleyi*			X		LT		X	X			X		X		LT	X							

Table D-32 Summary of Effects of RECREATION on Special Status Species with the Potential to Occur in SHRUB Habitats

							Direct Effects										Indirect Effects									
Taxon	Common Name	Scientific Name	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	banded gecko	*Coleonyx variegatus*		X		X	LT		X	X			X	X	X		LT	X							
reptile	banded Gila monster	*Heloderma suspectum cinctum*				X	LT		X	X			X	X	X		LT	X							
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X			X	LT		X	X			X	X	X		LT	X							
reptile	desert night lizard	*Xantusia vigilis*				X	LT		X	X			X	X	X		LT	X							
reptile	glossy snake	*Arizona elegans*	X				LT		X	X			X	X	X		LT	X							
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*	X				LT		X	X			X	X	X		LT	X							
reptile	large-spotted leopard lizard	*Gambelia wislizenii wislizenii*	X				LT		X	X			X	X	X		LT	X							
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*		X		X	LT		X	X			X	X	X		LT	X							
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*	X		X		LT		X	X			X	X	X		LT	X							
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*	X			X	LT		X	X			X	X	X		LT	X							
reptile	western red-tailed skink	*Eumeces gilberti rubricaudatus*			X	X	LT		X	X			X	X	X		LT	X							

LT Long-term
ST Short-term

Table D-33 Summary of Effects of RECREATION on Special Status Species with the Potential to Occur in SCRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X		X	X	ST		X	X			X	X	X										
bird	Bendire's thrasher	*Toxostoma bendirei*	X	X	X		ST						X		X										
bird	blue grosbeak	*Guiraca caerulea*	X		X		ST						X		X										
bird	Brewer's sparrow	*Spizella breweri*			X	X	ST						X		X										
bird	golden eagle	*Aquila chrysaetos*	X	X			ST		X	X			X	X	X										
bird	gray vireo	*Vireo vicinior*		X			ST						X		X										
bird	le conte's thrasher	*Toxostoma lecontei*	X	X	X		ST						X		X										
bird	loggerhead shrike	*Lanius ludovicianus*	X	X	X	X	ST						X		X										
bird	long-eared owl	*Asio otus*	X		X		ST		X	X			X	X	X										
bird	prairie falcon	*Falco mexicanus*		X	X		ST		X	X			X	X	X										
bird	Scott's oriole	*Icterus parisorum*	X				ST						X		X										
bird	Western burrowing owl	*Speotyto cunicularia hypugea*	X	X	X	X	ST		X	X			X	X	X										
mammal	Allen's big-eared bat	*Idionycteris phyllotis*	X		X		ST		X	X			X	X	X										
mammal	big free-tailed bat	*Nyctinomops macrotis*		X	X		ST		X	X			X	X	X										
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*		X	X		ST		X	X			X	X	X										
mammal	California leaf-nosed bat	*Macrotus californicus*	X	X	X	X	ST		X	X			X	X	X										
mammal	desert pocket mouse	*Chaetodipus penicillatus*	X		X		ST		X	X			X	X	X										
mammal	fringed myotis	*Myotis thysanodes*		X	X		ST		X	X			X	X	X										
mammal	hoary bat	*Lasiurus cinereus*			X		ST		X	X			X	X	X										

Table D-33 Summary of Effects of RECREATION on Special Status Species with the Potential to Occur in SCRUB Habitats

Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Direct Effects: Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Indirect Effects: Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	little brown myotis	*Myotis lucifugus*	X	X			ST		X	X			X	X	X										
mammal	long-legged myotis	*Myotis volans*		X	X		ST		X	X			X	X	X										
mammal	pallid bat	*Antrozous pallidus*		X	X	X	ST		X	X			X	X	X										
mammal	spotted bat	*Euderma maculatum*	X			X	ST		X	X			X	X	X										
mammal	western pipistrelle	*Pipistrellus hesperus*	X	X	X	X	ST		X	X			X	X	X										
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	X	X		ST		X	X			X	X	X										
mammal	Yuma myotis	*Myotis yumanensis*		X	X		ST		X	X			X	X	X										
plant	barrel cactus	*Ferocactus acanthoides* var. *lecontei*	X	X	X	X	LT		X	X			X		X		LT	X							
plant	Clark Mountain agave	Agave utahensis var. nevadensis	X		X	X	LT		X	X			X		X		LT	X							
plant	Clarke phacelia	*Phacelia filiae*	X	X	X	X	LT		X	X			X		X		LT	X							
plant	Clokey pincushion	*Coryphantha vivipara* ssp. *rosea*	X	X	X	X	LT		X	X			X		X		LT	X							
plant	crossidium moss	*Crossidium seriatum*	X		X	X	LT		X	X			X		X		LT	X							
plant	forked (Pahrump Valley) buckwheat	*Eriogonum bifurcatum*	X	X	X	X	LT		X	X			X		X		LT	X							
plant	Las Vegas bearpoppy	*Arctomecon californica*			X		LT		X	X			X		X		LT	X							
plant	Las Vegas Valley buckwheat	*Eriogonum corymbosum* var. *aureum*	X	X	X	X	LT		X	X			X		X		LT	X							
plant	Nevada didymodon	*Didymodon nevadensis*			X	X	LT		X	X			X		X		LT	X							
plant	Nye milkvetch	*Astragalus nyensis*	X	X	X	X	LT		X	X			X		X		LT	X							

Table D-33 Summary of Effects of RECREATION on Special Status Species with the Potential to Occur in SCRUB Habitats

							Direct Effects										Indirect Effects									
Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
plant	rock phacelia	*Phacelia petrosa*	X	X	X	X	LT		X	X			X		X		LT	X							
plant	rosy twotone beardtongue	*Penstemon bicolor* ssp. *roseus*	X	X	X	X	LT		X	X			X		X		LT	X							
plant	silverleaf sunray	*Enceliopsis argophylla*	X		X	X	LT		X	X			X		X		LT	X							
plant	sticky buckwheat	*Eriogonum viscidulum*	X		X	X	LT		X	X			X		X		LT	X							
plant	sticky ringstem	*Anulocaulis leisolenus*	X	X	X	X	LT		X	X			X		X		LT	X							
plant	straw milkvetch	*Astragalus lentiginosus* var. *stramineus*	X	X	X	X	LT		X	X			X		X		LT	X							
plant	Trichostomum moss	*Trichostomum sweetii*	X		X	X	LT		X	X			X		X		LT	X							
reptile	banded gecko	*Coleonyx variegatus*	X		X	X	LT		X	X			X	X	X		LT	X							
reptile	banded Gila monster	*Heloderma suspectum cinctum*	X		X		LT		X	X			X	X	X		LT	X							
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X	X	X		LT		X	X			X	X	X		LT	X							
reptile	common zebra-tailed lizard	*Callisaurus draconoides draconoides*	X	X	X	X	LT		X	X			X	X	X		LT	X							
reptile	desert iguana	*Dipsosaurus dorsalis*	X		X		LT		X	X			X	X	X		LT	X							
reptile	desert night lizard	*Xantusia vigilis*	X				LT		X	X			X	X	X		LT	X							
reptile	desert tortoise	*Gopherus agassizii*	X		X	X	LT		X	X			X	X	X		LT	X							
reptile	glossy snake	*Arizona elegans*			X		LT		X	X			X	X	X		LT	X							
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*	X	X	X	X	LT		X	X			X	X	X		LT	X							

Table D-33 Summary of Effects of RECREATION on Special Status Species with the Potential to Occur in SCRUB Habitats

Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Direct Effects: Short- term (ST)/Long-term (LT)	Direct Effects: Habitat Loss	Direct Effects: Direct Mortality	Direct Effects: Injury	Direct Effects: Loss of foraging habitat	Direct Effects: Loss of nesting/denning habitat	Direct Effects: Habitat Alteration or Degradation	Direct Effects: Potential for injury	Direct Effects: Human disturbance	Direct Effects: Other	Indirect Effects: Short- term (ST)/Long-term (LT)	Indirect Effects: Habitat fragmentation	Indirect Effects: Predation/competition	Indirect Effects: Loss of prey	Indirect Effects: Loss of food source	Indirect Effects: Disease/parasites	Indirect Effects: Hybridization	Indirect Effects: Brood parasitism	Indirect Effects: Other
reptile	large-spotted leopard lizard	*Gambelia wislizenii wislizenii*	X	X	X	X	LT		X	X			X	X	X		LT	X							
reptile	Mojave green rattlesnake	*Crotalus scutulatus scutulatus*	X		X		LT		X	X			X	X	X		LT	X							
reptile	sidewinder	*Crotalus cerastes*	X		X		LT		X	X			X	X	X		LT	X							
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*	X				LT		X	X			X	X	X		LT	X							
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*	X	X	X	X	LT		X	X			X	X	X		LT	X							
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*			X		LT		X	X			X	X	X		LT	X							
reptile	speckled rattlesnake	*Crotalus mitchelli*	X		X		LT		X	X			X	X	X		LT	X							
reptile	western leaf-nosed snake	*Phyllorhynchus decurtatus*			X		LT		X	X			X	X	X		LT	X							

LT Long-term
ST Short-term

Table D-34 Summary of Effects of RECREATION on Special Status Species with the Potential to Occur in AGRICULTURE Habitats

				Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Agriculture	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X	Mining would be unlikely to occur in agriculture habitats.																		
bird	blue grosbeak	*Guiraca caerulea*	X	Mining would be unlikely to occur in agriculture habitats.																		
bird	golden eagle	*Aquila chrysaetos*	X	Mining would be unlikely to occur in agriculture habitats.																		
bird	loggerhead shrike	*Lanius ludovicianus*	X	Mining would be unlikely to occur in agriculture habitats.																		
bird	long-eared owl	*Asio otus*	X	Mining would be unlikely to occur in agriculture habitats.																		
bird	northern saw-whet owl	*Aegolius acadius*	X	Mining would be unlikely to occur in agriculture habitats.																		
bird	prairie falcon	*Falco mexicanus*	X	Mining would be unlikely to occur in agriculture habitats.																		
bird	summer tanager	*Piranga rubra*	X	Mining would be unlikely to occur in agriculture habitats.																		
bird	western bluebird	*Sialia mexicana*	X	Mining would be unlikely to occur in agriculture habitats.																		
bird	Western burrowing owl	*Speotyto cunicularia hypugea*	X	Mining would be unlikely to occur in agriculture habitats.																		
bird	western screech owl	*Otus kennicotti*	X	Mining would be unlikely to occur in agriculture habitats.																		
mammal	big free-tailed bat	*Nyctinomops macrotis*	X	Mining would be unlikely to occur in agriculture habitats.																		
mammal	California leaf-nosed bat	*Macrotus californicus*	X	Mining would be unlikely to occur in agriculture habitats.																		
mammal	fringed myotis	*Myotis thysanodes*	X	Mining would be unlikely to occur in agriculture habitats.																		
mammal	little brown myotis	*Myotis lucifugus*	X	Mining would be unlikely to occur in agriculture habitats.																		
mammal	pallid bat	*Antrozous pallidus*	X	Mining would be unlikely to occur in agriculture habitats.																		
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	Mining would be unlikely to occur in agriculture habitats.																		
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	Mining would be unlikely to occur in agriculture habitats.																		
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X	Mining would be unlikely to occur in agriculture habitats.																		

Table D-35 Summary of Effects of RECREATION on Special Status Species with the Potential to Occur in DEVELOPED Habitats

					Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Developed, Open Space - Low Intensity	Developed, Medium - High Intensity	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X		ST								X										
bird	loggerhead shrike	*Lanius ludovicianus*	X		ST								X										
bird	northern saw-whet owl	*Aegolius acadius*	X		ST								X										
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	X	X	ST								X										
mammal	greater western mastiff bat	*Eumops perotis californicus*	X	X	ST								X										
mammal	hoary bat	*Lasiurus cinereus*	X	X	ST								X										
mammal	little brown myotis	*Myotis lucifugus*	X	X	ST								X										
mammal	long-legged myotis	*Myotis volans*	X		ST								X										
mammal	pallid bat	*Antrozous pallidus*	X		ST								X										
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	ST								X										

ST Short-term

Table D-36 Summary of Effects of ROADS on Special Status Species with the Potential to Occur in CLIFFS AND CANYON Habitats

					Direct Effects										Indirect Effects								
Taxon	Commono Name	Scientific Name	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	american peregrine falcon	*Falco peregrinus*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Bendire's thrasher	*Toxostoma bendirei*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	cactus wren	*Campylorhynchus brunneicapillus*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	ferruginous hawk	*Buteo regalis*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	golden eagle	*Aquila chrysaetos*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	gray vireo	*Vireo vicinior*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	loggerhead shrike	*Lanius ludovicianus*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	pinyon jay	*Gymnorhinus cyanocephalus*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	prairie falcon	*Falco mexicanus*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	western bluebird	*Sialia mexicana*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	California leaf-nosed bat	*Macrotus californicus*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	California myotis	*Myotis californicus*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	fringed myotis	*Myotis thysanodes*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	greater western mastiff bat	*Eumops perotis californicus*		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	hoary bat	*Lasiurus cinereus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	kit fox	*Vulpes macrotis*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	little brown myotis	*Myotis lucifugus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	long-eared myotis	*Myotis evotis*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	long-legged myotis	*Myotis volans*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	pallid bat	*Antrozous pallidus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				

Table D-36 Summary of Effects of ROADS on Special Status Species with the Potential to Occur in CLIFFS AND CANYON Habitats

					Direct Effects										Indirect Effects								
Taxon	Commono Name	Scientific Name	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	silver-haired bat	*Lasionycteris noctivagans*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	spotted bat	*Euderma maculatum*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	western pipistrelle	*Pipistrellus hesperus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Yuma myotis	*Myotis yumanensis*	X	X	LT	X	X	X			X	X	X		LT	X		X	X				
plant	Antelope Canyon goldenbush	*Ericameria cervina*	X	X	LT	X	X	X			X	X	X		LT	X							
plant	Aven Nelson phacelia	*Phacelia anelsonii*	X	X	LT	X	X	X			X	X	X		LT	X							
plant	chalk liveforever	*Dudleya pulverulenta*	X	X	LT	X	X	X			X	X	X		LT	X							
plant	crossidium moss	*Crossidium seriatum*	X	X	LT	X	X	X			X	X	X		LT	X							
plant	Fissidens sublimbatus	*Fissidens sublimbatus*	X	X	LT	X	X	X			X	X	X		LT	X							
plant	Mokiak milkvetch	*Astragalus mokiacensis*	X	X	LT	X	X	X			X	X	X		LT	X							
plant	Nevada didymodon	*Didymodon nevadensis*	X	X	LT	X	X	X			X	X	X		LT	X							
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	desert night lizard	*Xantusia vigilis*		X	LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*	X	X	LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*	X	X	LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*		X	LT	X	X	X	X	X	X	X	X	IIC	LT	X		X	X				
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*	X	X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				

Table D-36 Summary of Effects of ROADS on Special Status Species with the Potential to Occur in CLIFFS AND CANYON Habitats

					Direct Effects										Indirect Effects								
Taxon	Commono Name	Scientific Name	Colorado Plateau Mixed Bedrock Canyon and Tableland	North American Warm Desert Bedrock Cliff and Outcrop	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	speckled rattlesnake	*Crotalus mitchelli*	X	X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	Western chuckwalla	*Sauromalus obesus*	X	X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				

LT Long-term
ST Short-term
IC increased collection

Table D-37 Summary of Effects of ROADS on Special Status Species with the Potential to Occur in LOW VEGETATION DESERT Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	North American Warm Desert Badland	North American Warm Desert Wash	North American Warm Desert Pavement	North American Warm Desert Playa	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	Bendire's thrasher	*Toxostoma bendirei*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Brewer's sparrow	*Spizella breweri*			X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	cactus wren	*Campylorhynchus brunneicapillus*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	crissal thrasher	*Toxostoma crissale*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	ferruginous hawk	*Buteo regalis*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	le conte's thrasher	*Toxostoma lecontei*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	loggerhead shrike	*Lanius ludovicianus*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Lucy's warbler	*Vermivora luciae*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	phainopepla	*Phainopepla nitens*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	prairie falcon	*Falco mexicanus*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	summer tanager	*Piranga rubra*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Western burrowing owl	*Speotyto cunicularia hypugea*				X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	western screech owl	*Otus kennicotti*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	California leaf-nosed bat	*Macrotus californicus*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	California myotis	*Myotis californicus*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert kangaroo rat	*Dipodomys deserti*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert pocket mouse	*Chaetodipus penicillatus*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	western pipistrelle	*Pipistrellus hesperus*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	western red bat	*Lasiurus blossevillii*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	kit fox	*Vulpes macrotis*	X	X		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
plant	Beaver Dam scurfpea (breadroot)	*Pediomelum castoreum*			X		LT	X	X	X			X	X	X		LT	X							
plant	catchfly gentian	*Eustoma exaltatum*		X			LT	X	X	X			X	X	X		LT	X							
plant	crossidium moss	*Crossidium seriatum*	X		X		LT	X	X	X			X	X	X		LT	X							

Table D-37 Summary of Effects of ROADS on Special Status Species with the Potential to Occur in LOW VEGETATION DESERT Habitats

							Direct Effects										Indirect Effects									
Taxon	Common Name	Scientific Name	North American Warm Desert Badland	North American Warm Desert Wash	North American Warm Desert Pavement	North American Warm Desert Playa	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
plant	dune linanthus	*Linanthus arenicola*	X	X	X	X	LT	X	X	X			X	X	X		LT	X							
plant	dune sunflower	*Helianthus deserticola*	X		X	X	LT	X	X	X			X	X	X		LT	X							
plant	Las Vegas Valley buckwheat	*Eriogonum corymbosum* var. *aureum*		X			LT	X	X	X			X	X	X		LT	X							
plant	Littlefield milkvetch	*Astragalus preussii* var. *laxiflorus*	X	X	X		LT	X	X	X			X	X	X		LT	X							
plant	Mokiak milkvetch	*Astragalus mokiacensis*	X	X			LT	X	X	X			X	X	X		LT	X							
plant	Nevada didymodon	*Didymodon nevadensis*	X		X		LT	X	X	X			X	X	X		LT	X							
plant	silverleaf sunray	*Enceliopsis argophylla*	X	X			LT	X	X	X			X	X	X		LT	X							
plant	splachnobryum obtusum	*Splachnobryum obtusum*		X	X	X	LT	X	X	X			X	X	X		LT	X							
plant	straw milkvetch	*Astragalus lentiginosus* var. *stramineus*		X	X		LT	X	X	X			X	X	X		LT	X							
plant	threecorner milkvetch	*Astragalus geyeri* var. *triquetrus*		X			LT	X	X	X			X	X	X		LT	X							
plant	Trichostomum moss	*Trichostomum sweetii*	X		X		LT	X	X	X			X	X	X		LT	X							
reptile	banded gecko	*Coleonyx variegatus*		X		X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	common zebra-tailed lizard	*Callisaurus draconoides draconoides*	X	X	X		LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	glossy snake	*Arizona elegans*		X			LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*		X			LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*			X		LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				

LT Long-term
ST Short-term
IC increased collection

Table D-38 Summary of Effects of ROADS on Special Status Species with the Potential to Occur in FOREST/WOODLAND Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	Great Basin Pinyon-Juniper Woodland	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	**Other**	**Short- term (ST)/Long-term (LT)**	**Habitat fragmentation**	**Predation/competition**	**Loss of prey**	**Loss of food source**	**Disease/parasites**	**Hybridization**	**Brood parasitism**	**Other**
amphibian	Pacific tree frog	*Hyla regilla*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	american peregrine falcon	*Falco peregrinus*	X	X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	bald eagle	*Haliaeetus leucocephalus*				X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	black-chinned sparrow	*Spizella atrogularis*				X	LT	X	X	X	X	X		X	X		LT	X		X	X				
bird	Brewer's sparrow	*Spizella breweri*				X	LT	X	X	X	X	X		X	X		LT	X		X	X				
bird	flammulated owl	*Otus flammeolus*	X	X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	golden eagle	*Aquila chrysaetos*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	gray vireo	*Vireo vicinior*				X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	loggerhead shrike	*Lanius ludovicianus*				X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	long-eared owl	*Asio otus*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Lucy's warbler	*Vermivora luciae*			X		LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	northern goshawk	*Accipiter gentilis*	X	X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	northern saw-whet owl	*Aegolius acadius*	X	X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	phainopepla	*Phainopepla nitens*	X				LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	pinyon jay	*Gymnorhinus cyanocephalus*	X		X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Scott's oriole	*Icterus parisorum*				X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	western screech owl	*Otus kennicotti*			X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Allen's big-eared bat	*Idionycteris phyllotis*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	big free-tailed bat	*Nyctinomops macrotis*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				

Table D-38 Summary of Effects of ROADS on Special Status Species with the Potential to Occur in FOREST/WOODLAND Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	Great Basin Pinyon-Juniper Woodland	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	**Other**	**Short- term (ST)/Long-term (LT)**	**Habitat fragmentation**	**Predation/competition**	**Loss of prey**	**Loss of food source**	**Disease/parasites**	**Hybridization**	**Brood parasitism**	**Other**
mammal	California myotis	*Myotis californicus*	X	X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*	X	X	X	X	LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	fringed myotis	*Myotis thysanodes*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	hoary bat	*Lasiurus cinereus*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	kit fox	*Vulpes macrotis*				X	LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	long-eared myotis	*Myotis evotis*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	long-legged myotis	*Myotis volans*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Merriam's shrew	*Sorex merriami*	X	X	X	X	LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	spotted bat	*Euderma maculatum*			X	X	LT	X	X	X	X	X		X	X		LT	X		X	X				
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Yuma myotis	*Myotis yumanensis*	X	X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
plant	alpine stinking lomatium	*Lomatium graveolens* var. *alpinum*	X	X	X	X	LT	X	X	X			X	X	X		LT	X							
plant	Antelope Canyon goldenbush	*Ericameria cervina*	X				LT	X	X	X			X	X	X		LT	X							
plant	Clark Mountain agave	Agave utahensis var. nevadensis				X	LT	X	X	X			X	X	X		LT	X							
plant	Clokey fleabane	*Erigeron clokeyi*			X		LT	X	X	X			X	X	X		LT	X							
plant	Clokey pincushion	*Coryphantha vivipara* ssp. *rosea*				X	LT	X	X	X			X	X	X		LT	X							
plant	Fissidens sublimbatus	*Fissidens sublimbatus*	X	X	X	X	LT	X	X	X			X	X	X		LT	X							
plant	Nevada willowherb	*Epilobium nevadense*	X		X	X	LT	X	X	X			X	X	X		LT	X							

Table D-38 Summary of Effects of ROADS on Special Status Species with the Potential to Occur in FOREST/WOODLAND Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Rocky Mountain Ponderosa Pine Woodland	Great Basin Pinyon-Juniper Woodland	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	**Other**	**Short- term (ST)/Long-term (LT)**	**Habitat fragmentation**	**Predation/competition**	**Loss of prey**	**Loss of food source**	**Disease/parasites**	**Hybridization**	**Brood parasitism**	**Other**
plant	rayless tansy aster	*Machaeranthera grindelioides* var. *depressa*				X	LT	X	X	X			X	X	X		LT	X							
plant	Shockley rockcress	*Arabis shockleyi*				X	LT	X	X	X			X	X	X		LT	X							
plant	Syntrichia princeps	*Syntrichia princeps*				X	LT	X	X	X			X	X	X		LT	X							
reptile	banded gecko	*Coleonyx variegatus*				X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	California (common) king snake	*Lampropeltis getulus californiae*			X	X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	desert night lizard	*Xantusia vigilis*			X	X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*			X		LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*			X	X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	speckled rattlesnake	*Crotalus mitchelli*				X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	western red-tailed skink	*Eumeces gilberti rubricaudatus*	X	X	X	X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				

LT Long-term
ST Short-term
IC increased collection

Table D-39 Summary of Effects of ROADS on Special Status Species with the Potential to Occur in SHRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Bendire's thrasher	*Toxostoma bendirei*	X				LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	black-chinned sparrow	*Spizella atrogularis*				X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	Brewer's sparrow	*Spizella breweri*		X			LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	cactus wren	*Campylorhynchus brunneicapillus*	X			X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	crissal thrasher	*Toxostoma crissale*				X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	ferruginous hawk	*Buteo regalis*			X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	golden eagle	*Aquila chrysaetos*	X		X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	long-eared owl	*Asio otus*			X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	phainopepla	*Phainopepla nitens*				X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	pinyon jay	*Gymnorhinus cyanocephalus*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	prairie falcon	*Falco mexicanus*		X		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Scott's oriole	*Icterus parisorum*				X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	vesper sparrow	*Pooecetes gramineus*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	western bluebird	*Sialia mexicana*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Western burrowing owl	*Speotyto cunicularia hypugea*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	yellow-breasted chat	*Icteria virens*		X		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	big free-tailed bat	*Nyctinomops macrotis*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	California myotis	*Myotis californicus*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert bighorn sheep	*Ovis canadensis nelsoni*		X		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert pocket mouse	*Chaetodipus penicillatus*	X				LT	X	X	X	X	X	X	X	X		LT	X		X	X				

Table D-39 Summary of Effects of ROADS on Special Status Species with the Potential to Occur in SHRUB Habitats

Taxon	Common Name	Scientific Name	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Direct Effects: Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Indirect Effects: Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
mammal	hoary bat	*Lasiurus cinereus*	X	X		X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	little brown myotis	*Myotis lucifugus*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	long-eared myotis	*Myotis evotis*				X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Merriam's shrew	*Sorex merriami*		X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	pallid bat	*Antrozous pallidus*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	spotted bat	*Euderma maculatum*			X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Yuma myotis	*Myotis yumanensis*			X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
plant	alpine stinking lomatium	*Lomatium graveolens* var. *alpinum*		X	X	X	LT	X	X	X			X		X		LT	X							
plant	barrel cactus	*Ferocactus acanthoides* var. *lecontei*	X	X	X	X	LT	X	X	X			X		X		LT	X							
plant	chalk liveforever	*Dudleya pulverulenta*				X	LT	X	X	X			X		X		LT	X							
plant	Clarke phacelia	*Phacelia filiae*	X				LT	X	X	X			X		X		LT	X							
plant	Fissidens sublimbatus	*Fissidens sublimbatus*	X	X	X	X	LT	X	X	X			X		X		LT	X							
plant	rayless tansy aster	*Machaeranthera grindelioides* var. *depressa*	X		X		LT	X	X	X			X		X		LT	X							
plant	rock phacelia	*Phacelia petrosa*	X				LT	X	X	X			X		X		LT	X							
plant	rosy twotone beardtongue	*Penstemon bicolor* ssp. *roseus*	X	X	X	X	LT	X	X	X			X		X		LT	X							
plant	Shockley rockcress	*Arabis shockleyi*			X		LT	X	X	X			X		X		LT	X							
plant	white bearpoppy	*Arctomecon merriamii*	X				LT	X	X	X			X		X		LT	X							
reptile	banded gecko	*Coleonyx variegatus*		X		X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	banded Gila monster	*Heloderma suspectum cinctum*				X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				

Table D-39 Summary of Effects of ROADS on Special Status Species with the Potential to Occur in SHRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Mogollon Chaparral	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X			X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	desert night lizard	*Xantusia vigilis*				X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	glossy snake	*Arizona elegans*	X				LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*	X				LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	large-spotted leopard lizard	*Gambelia wislizenii wislizenii*	X				LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*		X		X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*	X		X		LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*	X			X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	western red-tailed skink	*Eumeces gilberti rubricaudatus*			X	X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				

LT Long-term
ST Short-term
IC increased collection

Table D-40 Summary of Effects of ROADS on Special Status Species with the Potential to Occur in SCRUB Habitats

							Direct Effects										Indirect Effects									
Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Short- Term (St)/Long-Term (Lt)	Habitat Loss	Direct Mortality	Injury	Loss Of Foraging Habitat	Loss Of Nesting/Denning Habitat	Habitat Alteration Or Degradation	Potential For Injury	Human Disturbance	Other	Short- Term (St)/Long-Term (Lt)	Habitat Fragmentation	Predation/Competition	Loss Of Prey	Loss Of Food Source	Disease/Parasites	Hybridization	Brood Parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X		X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Bendire's thrasher	*Toxostoma bendirei*	X	X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	blue grosbeak	*Guiraca caerulea*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Brewer's sparrow	*Spizella breweri*			X	X	LT	X	X	X	X	X	X		X		LT	X		X	X				
bird	golden eagle	*Aquila chrysaetos*	X	X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	gray vireo	*Vireo vicinior*		X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	le conte's thrasher	*Toxostoma lecontei*	X	X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	loggerhead shrike	*Lanius ludovicianus*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	long-eared owl	*Asio otus*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	prairie falcon	*Falco mexicanus*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Scott's oriole	*Icterus parisorum*	X				LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Western burrowing owl	*Speotyto cunicularia hypugea*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Allen's big-eared bat	*Idionycteris phyllotis*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	big free-tailed bat	*Nyctinomops macrotis*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	California leaf-nosed bat	*Macrotus californicus*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	desert pocket mouse	*Chaetodipus penicillatus*	X		X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	fringed myotis	*Myotis thysanodes*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	hoary bat	*Lasiurus cinereus*			X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	little brown myotis	*Myotis lucifugus*	X	X			LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	long-legged myotis	*Myotis volans*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	pallid bat	*Antrozous pallidus*		X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	spotted bat	*Euderma maculatum*	X			X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				

Table D-40 Summary of Effects of ROADS on Special Status Species with the Potential to Occur in SCRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Short- Term (St)/Long-Term (Lt)	Habitat Loss	Direct Mortality	Injury	Loss Of Foraging Habitat	Loss Of Nesting/Denning Habitat	Habitat Alteration Or Degradation	Potential For Injury	Human Disturbance	Other	Short- Term (St)/Long-Term (Lt)	Habitat Fragmentation	Predation/Competition	Loss Of Prey	Loss Of Food Source	Disease/Parasites	Hybridization	Brood Parasitism	Other
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	western pipistrelle	*Pipistrellus hesperus*	X	X	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Yuma myotis	*Myotis yumanensis*		X	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
plant	barrel cactus	*Ferocactus acanthoides* var. *lecontei*	X	X	X	X	LT	X	X	X			X	X	X		LT	X							
plant	Clark Mountain agave	Agave utahensis var. nevadensis	X		X	X	LT	X	X	X			X	X	X		LT	X							
plant	Clarke phacelia	*Phacelia filiae*	X	X	X	X	LT	X	X	X			X	X	X		LT	X							
plant	Clokey pincushion	*Coryphantha vivipara* ssp. *rosea*	X	X	X	X	LT	X	X	X			X	X	X		LT	X							
plant	crossidium moss	*Crossidium seriatum*	X		X	X	LT	X	X	X			X	X	X		LT	X							
plant	dune linanthus	*Linanthus arenicola*	X		X	X	LT	X	X	X			X	X	X		LT	X							
plant	dune sunflower	*Helianthus deserticola*	X		X	X	LT	X	X	X			X	X	X		LT	X							
plant	forked (Pahrump Valley) buckwheat	*Eriogonum bifurcatum*	X	X	X	X	LT	X	X	X			X	X	X		LT	X							
plant	Las Vegas bearpoppy	*Arctomecon californica*			X		LT	X	X	X			X	X	X		LT	X							
plant	Las Vegas Valley buckwheat	*Eriogonum corymbosum* var. *aureum*	X	X	X	X	LT	X	X	X			X	X	X		LT	X							
plant	Nevada didymodon	*Didymodon nevadensis*			X	X	LT	X	X	X			X	X	X		LT	X							
plant	Nye milkvetch	*Astragalus nyensis*	X	X	X	X	LT	X	X	X			X	X	X		LT	X							
plant	rock phacelia	*Phacelia petrosa*	X	X	X	X	LT	X	X	X			X	X	X		LT	X							
plant	rosy twotone beardtongue	*Penstemon bicolor* ssp. *roseus*	X	X	X	X	LT	X	X	X			X	X	X		LT	X							
plant	silverleaf sunray	*Enceliopsis argophylla*	X		X	X	LT	X	X	X			X	X	X		LT	X							
plant	sticky buckwheat	*Eriogonum viscidulum*	X		X	X	LT	X	X	X			X	X	X		LT	X							

Table D-40 Summary of Effects of ROADS on Special Status Species with the Potential to Occur in SCRUB Habitats

							Direct Effects										Indirect Effects									
Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Short- Term (St)/Long-Term (Lt)	Habitat Loss	Direct Mortality	Injury	Loss Of Foraging Habitat	Loss Of Nesting/Denning Habitat	Habitat Alteration Or Degradation	Potential For Injury	Human Disturbance	Other	Short- Term (St)/Long-Term (Lt)	Habitat Fragmentation	Predation/Competition	Loss Of Prey	Loss Of Food Source	Disease/Parasites	Hybridization	Brood Parasitism	Other
plant	sticky ringstem	*Anulocaulis leisolenus*	X	X	X	X	LT	X	X	X			X	X	X		LT	X							
plant	straw milkvetch	*Astragalus lentiginosus* var. *stramineus*	X	X	X	X	LT	X	X	X			X	X	X		LT	X							
plant	threecorner milkvetch	*Astragalus geyeri* var. *triquetrus*	X		X	X	LT	X	X	X			X	X	X		LT	X							
plant	Trichostomum moss	*Trichostomum sweetii*	X		X	X	LT	X	X	X			X	X	X		LT	X							
plant	white bearpoppy	*Arctomecon merriamii*	X		X	X	LT	X	X	X			X	X	X		LT	X							
reptile	banded gecko	*Coleonyx variegatus*	X		X	X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	banded Gila monster	*Heloderma suspectum cinctum*	X		X		LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X	X	X		LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	common zebra-tailed lizard	*Callisaurus draconoides draconoides*	X	X	X	X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	desert iguana	*Dipsosaurus dorsalis*	X		X		LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	desert night lizard	*Xantusia vigilis*	X				LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	desert tortoise	*Gopherus agassizii*	X		X	X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X	X			
reptile	glossy snake	*Arizona elegans*			X		LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	Great Basin collared lizard	*Crotaphytus insularis bicinctores*	X	X	X	X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	large-spotted leopard lizard	*Gambelia wislizenii wislizenii*	X	X	X	X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	Mojave green rattlesnake	*Crotalus scutulatus scutulatus*	X		X		LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	sidewinder	*Crotalus cerastes*	X		X		LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	Sonoran lyre snake	*Trimorphodon biscutatus lambda*	X				LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*	X	X	X	X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				

Table D-40 Summary of Effects of ROADS on Special Status Species with the Potential to Occur in SCRUB Habitats

							Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Mojave Mid-Elevation Mixed Desert Scrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonora-Mojave Mixed Salt Desert Scrub	Short- Term (St)/Long-Term (Lt)	Habitat Loss	Direct Mortality	Injury	Loss Of Foraging Habitat	Loss Of Nesting/Denning Habitat	Habitat Alteration Or Degradation	Potential For Injury	Human Disturbance	Other	Short- Term (St)/Long-Term (Lt)	Habitat Fragmentation	Predation/Competition	Loss Of Prey	Loss Of Food Source	Disease/Parasites	Hybridization	Brood Parasitism	Other
reptile	southern plateau lizard	*Sceloporus undulatus tristichus*			X		LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	speckled rattlesnake	*Crotalus mitchelli*	X		X		LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				
reptile	western leaf-nosed snake	*Phyllorhynchus decurtatus*			X		LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				

LT Long-term
ST Short-term
IC increased collection

Table D-41 Summary of Effects of ROADS on Special Status Species with the Potential to Occur in AGRICULTURE Habitats

				Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Agriculture	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	blue grosbeak	*Guiraca caerulea*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	golden eagle	*Aquila chrysaetos*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	loggerhead shrike	*Lanius ludovicianus*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	long-eared owl	*Asio otus*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	northern saw-whet owl	*Aegolius acadius*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	prairie falcon	*Falco mexicanus*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	summer tanager	*Piranga rubra*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	western bluebird	*Sialia mexicana*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	Western burrowing owl	*Speotyto cunicularia hypugea*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	western screech owl	*Otus kennicotti*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	big free-tailed bat	*Nyctinomops macrotis*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	California leaf-nosed bat	*Macrotus californicus*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	fringed myotis	*Myotis thysanodes*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	little brown myotis	*Myotis lucifugus*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	pallid bat	*Antrozous pallidus*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	western small-footed myotis	*Myotis ciliolabrum*	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
reptile	California (common) king snake	*Lampropeltis getulus californiae*	X	LT	X	X	X	X	X	X	X	X	IC	LT	X		X	X				

LT Long-term
ST Short-term
IC increased collection

Table D-42 Summary of Effects of ROADS on Special Status Species with the Potential to Occur in DEVELOPED Habitats

					Direct Effects										Indirect Effects								
Taxon	Common Name	Scientific Name	Developed, Open Space - Low Intensity	Developed, Medium - High Intensity	Short- term (ST)/Long-term (LT)	Habitat Loss	Direct Mortality	Injury	Loss of foraging habitat	Loss of nesting/denning habitat	Habitat Alteration or Degradation	Potential for injury	Human disturbance	Other	Short- term (ST)/Long-term (LT)	Habitat fragmentation	Predation/competition	Loss of prey	Loss of food source	Disease/parasites	Hybridization	Brood parasitism	Other
bird	bald eagle	*Haliaeetus leucocephalus*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	loggerhead shrike	*Lanius ludovicianus*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
bird	northern saw-whet owl	*Aegolius acadius*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Brazilian free-tailed bat	*Tadarida brasiliensis*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	greater western mastiff bat	*Eumops perotis californicus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	hoary bat	*Lasiurus cinereus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	little brown myotis	*Myotis lucifugus*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	long-legged myotis	*Myotis volans*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	pallid bat	*Antrozous pallidus*	X		LT	X	X	X	X	X	X	X	X		LT	X		X	X				
mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	X	X	LT	X	X	X	X	X	X	X	X		LT	X		X	X				

LT Long-term

APPENDIX D

Aquatic and Riparian Species Descriptions

DRAFT

Aquatic and Riparian Species Descriptions

September 18, 2008

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Section 1: Aquatic Species Descriptions

1.1 DESERT SUCKER

Scientific Name: *Catostomus clarki*

1.1.1 Protection Warranted

1.1.1.1 Endangered Species Act

- Not listed as threatened or endangered under the ESA.
- Former Category 2 Candidate Species (NNHP 2004)

1.1.1.2 Other Protections

- Listed as a BLM Sensitive Species (S) in Arizona.
- Listed as a wildlife species of concern by the State of Utah (UDWR 2006)
- Ranked as imperiled (S2) across its range in Nevada and Utah.
- Ranked as vulnerable-apparently secure (G3G4/S3S4) across its range in Arizona.

1.1.1.3 General Description

The desert sucker is a member of the Catostomidae family. Members of this family have a mouth that is located on the underside of the head, with thick, fleshy lips which enable the fish to attach to rocks in quicker flowing waters.

Catostomus clarki is a medium-sized catostomid fish, attaining adult size of 8 to 31 inches (203.0 to 787.0 mm) in standard length and can weigh up to 4 pounds (1.8 kg). Its body is sharply bi-colored: silvery tan to dark greenish from above and silvery to yellowish from below. Scales on the upper half have dark spots which form faint, dashed lines. The sucker’s lower lip is about three times as thick as the upper lip, with small papillae evenly dispersed over the lower lip (Minckley 1973). They typically have jaws with cartilaginous scraping edges (Sublette et al. 1990). Desert suckers are found in the Virgin River and Bill Williams River drainages typically have 80 to 100 scales in their lateral line. These suckers have 8 to 12 dorsal and pelvic rays, and a small flap of skin present at the base of each pelvic ray.

Similar in appearance to other Catostomids inhabiting the same waters, the desert sucker has cartilaginous edges on the inside of the lips that allow field identification.

1.1.1.4 Distribution

Historic Distribution

The historic range of the desert sucker includes Arizona, Nevada, New Mexico, Utah and Mexico, with suitable habitat in the lower Colorado River downstream of the Grand Canyon and the Lower Virgin River watershed Virgin River Basin in Utah, Arizona, and Nevada.

The desert sucker once occurred throughout Arizona, including the Santa Cruz River watershed. This species was eliminated from the area near Tucson by 1937. The desert sucker is currently extirpated from all of Pima County, but may still exist along the Santa Cruz River upstream of the county line (Pima County 2002).

Current Distribution

Catostomus clarki occurs in the lower Colorado River downstream from the Grand Canyon, generally including the Bill Williams, Salt, Gila, and San Francisco River drainages at elevations of 480 to 8,840 feet (146 to 2,696 m). Their range includes the tributary streams of the Gila River drainage upstream of the Gila, Arizona, and the Virgin River basin of Utah, Arizona, and Nevada including the pluvial White River and Meadow Valley Wash.

1.1.1.5 Habitat

The desert sucker can be found in rapids and flowing pools of streams and rivers primarily over bottoms of gravel-rubble with sandy silt in the interstices. Adults live in pools, moving at night to swift riffles and runs to feed. Young inhabit riffles throughout the day, feeding on midge larvae. This species is intolerant of lake conditions created by dams.

Their preferred temperature is believed to be 63.5 ºF (17.5º C) within modal bounds ranging from 50-70ºF (10.0-21.0ºC). Although they prefer temperatures around 65 ºF, desert suckers have been found to survive temperatures exceeding 90 ºF (32.0º C). Experimental studies on oxygen deprivation suggest that the desert sucker has a lower tolerance to reduced oxygen than other native stream fishes.

1.1.1.6 Life History

Reproductive Biology

Spawning is generally in late winter and early spring where adults congregate in large numbers on riffles, in a manner similar to other species of the Catostomus family. Actual act of spawning generally consists of one large female and several smaller males. Adhesive eggs are deposited in a shallow depression made in the gravel. Eggs hatch in a few days. Young tend to congregate along the banks in quiet water in tremendous numbers, where they then progressively move into the mainstream as they increase in size. Juveniles are mature by their second year of life, where they reach a length of about 4-5 inches (10.2-12.7 cm).

Diet

Young desert suckers feed primarily on the larvae of aquatic insects (chironomid), while the adults feed mostly on aquatic plants and parts of plants present along the stream bottom. Feeding is performed predominantly by scraping plant materials off of rocks and small stones. As an adult, this species is primarily herbivorous, removing aufwuchs (diatoms and algae) from stones and occasionally ingesting plant detritus.

Migration

Significant migration habits of the desert sucker are not well documented. However, some studies have indicated that desert suckers exhibit little seasonal movement and are resistant to downstream displacement despite floods.

1.1.1.7 Threats Warranting Protection

Alteration of historic flow regimes and construction of reservoirs have diminished available habitat. In addition, the stocking of non-native fishes has increased competition and introduced hybridization.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Lack of stable instream flows and low water levels as a result of diversions cause changes in water temperature, affect aquatic vegetation, and alter water chemistry including dissolved oxygen levels. Dams and diversions also act as barriers to fish movement within the system and fragment desert sucker habitat and populations. In areas of extensive habitat fragmentation, migration becomes virtually non-existent. This alteration of historic flow regimes have diminished available habitat for Catostomus clarki (AGFD 2002).

The predominant causes of aquatic habitat losses to the desert sucker include groundwater depletion, springhead use, mining, water diversions/water catchments, altered river flow regimes, habitat fragmentation/barriers, soil erosion, streambank alteration/channelization, grazing by ungulates, livestock management, nuisance animals, and contaminants from waste water and runoff (AGFD 2006). The desert sucker is also intolerant of lake conditions associated with dams, reservoirs and impoundments (Pima County 2002). Introduction of exotic species can also impact the desert sucker by increasing predation and competition in otherwise suitable habitat needed for propagation. Agricultural practices have also modified several areas of desert sucker habitat through alteration of the riparian zone. Riparian alterations often cause stream bank erosion, siltation, and devegetation (AGFD 2006).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

This is not a known threat for the desert sucker.

Disease or Predation

Aquatic species introduced into the Virgin River system have been identified as contributing to reductions of native fish populations, and may affect desert sucker habitat by competing for limited resources such as food and space. Disease and parasites do not appear to have had significant impact on the population trends of the desert sucker.

The Inadequacy of Existing Regulatory Mechanisms

The desert sucker is listed not federally listed under the ESA. In 1994, the desert sucker was listed in the Federal Register as a Category 2 species for consideration to be listed as threatened or endangered. In 1996, the USFWS changed the listing of “Federal Candidate” species, wherein the “Category” designation was eliminated and species listed under Categories 2 and 3 were no longer considered candidates for listing under the Endangered Species Act. Currently, this species is now classified by the USFWS as a "Species of Concern."

Only Nevada and Utah classify the desert sucker as imperiled (S2) throughout its statewide range. The Nevada Administrative Code (NAC 503.090) states that there is no open season on protected species, which includes the desert sucker, and no closed season on unprotected species. In Arizona, Catostomus clarki is considers as vulnerable-apparently secure (G3G4/S3S4), but afforded no special protective measures (NatureServe 2006).

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Natural limiting factors include drought, flood and in some instances, natural barriers and native species interactions. The extent that natural factors affect desert suckers is unclear. It has been documented that the desert sucker has a lower tolerance to reduced levels of dissolved oxygen (Pima County 2002) and drought (AGFD 2006) than other native stream fishes in the Virgin River Basin.

Pollution from return flows, municipal drains and agriculture is a potential problem for all native species within the basin. Return flows from municipal drains and agriculture can make up a significant portion of a stream's total flow. Water from these return flows can be polluted with pesticides as well as other wastes. Low flows, caused naturally or by diversions, increase the impacts of pollution, erosion, siltation and mineral springs have on the chemical composition of the water.

1.1.1.8 Conservation

The desert sucker is included in the Nevada State Wildlife Habitat Incentives Program (WHIP), 2006. The objectives and priorities identified in this plan help facilitate the creation, restoration, and enhancement efforts of key wildlife habitats and targeted species in the state. The plan places a major emphasis on wildlife habitats of national and state significance, threatened and endangered species, species of special concern and habitats of local concern. The locally led process along with the collaboration between local, state and federal wildlife partners, allowed for the development of this plan and the identification of wildlife habitat concerns throughout Nevada.

Conservation measures needed for the continued existence of the desert sucker could be achieved by establishing existing baseline conditions, re-establishing population maintenance flows, enhancing and maintaining desert sucker habitat, selectively controlling non-indigenous fish, maintaining genetic viability of the desert sucker species, monitoring populations and habitat, and developing a mitigation plan and protocol for future activities.

Recovery Units

No recovery units are proposed for the desert sucker since it is not a federally listed ESA species.

Critical Habitat

No critical habitat has been designated for the desert sucker since it is not a federally listed ESA species.

1.1.1.9 Species Status

Rangewide

The desert sucker once occurred throughout Arizona, including the Virgin River watershed. This species was extirpated from all of Pima County by 1937. According to Arizona officials, the desert sucker has decreased rapidly in the southern part of its range (AGFD 1995).

Lower Virgin River Watershed

There are 78 recorded occurrences of the flannelmouth sucker in the Lower Virgin River watershed from the NNHP, UDWR, and AGFD datasets (NNHP, UDWR, and AGFD 2007).

1.2 FLANNELMOUTH SUCKER

Scientific Name: *Catostomus latipinnis*

1.2.1 Protection Warranted

1.2.1.1 Endangered Species Act

- Former Category 2 Candidate species

Other Protections

- Listed as a BLM Sensitive Species (S)
- Ranked as critically imperiled on a state/region scale, and vulnerable-apparently secure on a global scale (G3G4/S1)
- Listed on the Utah Sensitive Species List (UDWR 2006)

1.2.1.2 General Description

The flannelmouth sucker belongs to the Catostomidae family, the members of which are characterized by soft rays and a fleshy, subterminal protractile mouth. This family is comprised of 12 genera and 60 species in the United States and Canada (Robins et al. 1991).

The flannelmouth sucker has a medium sized head with a prominent snout that joins a streamlined, tapering body into a narrow caudal peduncle. The species has a ventral mouth with large, well-developed lips. There is usually one row of papillae on the lower lip which is deeply incised to the jaw. The upper lip usually has 5-8 rows of papillae. The flannelmouth's eyes are small and high on their head. Their fins are large, with 14-18 rays on the pectoral fins and 10-14 rays on the dorsal fin. The caudal fin is deeply forked. The adult flannelmouth sucker will have a greenish brown to bluish gray coloration from above, and a deep yellow to orange-red coloration from below with a pale white ventral area. Their heads may be pinkish in color on occasion (Bezzerides and Bestgen, 2002).

Flannelmouth suckers are a large Catostomidae species with maximum total lengths upwards of 25.6 inches (650 mm). Average size of mature adult flannelmouth suckers is approximately 19.7 inches (500 mm). Flannelmouth suckers are a long-lived species with a maximum life span of about 30 years (Weiss 1993).

1.2.1.3 Distribution

Historic Distribution

Historically, the flannelmouth sucker was commonly found in most, if not all, medium to large, lower elevation rivers of the Upper Colorado River drainage. It was found in similar habitats of the Lower Colorado River drainage, but in lesser numbers (Joseph et al. 1977). Although this species is typically associated with large rivers, it also occurs in smaller tributaries and occasionally in lakes and reservoirs (Bezzerides and Bestgen 2002).

Current Distribution

While the flannelmouth sucker is still found in most of its historical range in the Upper Colorado River Basin, it is less abundant and absent from its historical range in Nevada, Utah, and Arizona. Its distribution in the Virgin River Basin is restricted to localized areas of suitable habitat (Sublette et al. 1990). It is believed that populations have become more restricted in the lower basin due to the severe impacts of dams and diversions on flow regimes, habitat availability, and habitat quality. In California, this species is considered extirpated due to these impacts.

1.2.1.4 Habitat

Flannelmouth suckers are typically found in slower, warmer rivers in plateau regions. They usually inhabit the mainstem of moderate to large rivers but are occasionally found in small streams. This species frequents pools and deep runs but can also be found in the mouths of tributaries, riffles, and backwaters. Flannelmouth suckers are occasionally found in lakes and reservoirs, but they generally react poorly to impounded habitats, or habitats influenced by impoundments (Minckley 1973).

Habitat association can be attributed to feeding strategies during specific life stages. Larval and young-of-the-year flannelmouth suckers are often associated with backwaters and shoreline areas of slow runs or pools (Joseph et al. 1977). Larvae drift 5.3 miles (8.6 km) on average after hatching; during this time, they actively seek near-shore habitat (Robinson et al. 1998). Larvae then congregate in shallow pools and backwater areas.

Juvenile and adult flannelmouth suckers most often utilize run, pool, and eddy habitats (Joseph et al. 1977). This species appears to prefer temperatures around 77 °F (25 °C) (Sublette et al. 1990). Flannelmouth sucker are rare in cooler headwater streams. There has been no reported shift in habitat preference due to seasonal changes or changes in discharge cycles.

Studies have shown that flannelmouth suckers avoid cooler temperatures in headwater reaches and in the tailwaters of some dams. The effects of other physical parameters (e.g., dissolved oxygen, sediment, channel form) on the distribution and density of flannelmouth sucker have not been studied in detail and are not well understood (Rees, 2005)

1.2.1.5 Life History

Reproductive Biology

Although flannelmouth sucker typically spawn between April and June, recently evidence has indicated the occurrence of fall spawning in Havasu Creek, Arizona (Douglas and Douglas, 2000), and evidence of year-round spawning in the Little Colorado River, Colorado (Robinson et al.1998).

Juvenile flannelmouth sucker may reach sexual maturity by age 4, but in most commonly maturity is reached by age 5 or 6, with all reaching full maturity by their 8th year. Mature fish average 16.6 to 25.4 inches (421 to 646 mm) in total length (McKinney et al. 1999), with mature females tending to be slightly larger than mature males.

Spawning occurs at water temperatures ranging from 53.6°F to 59°F (12 to 15°C), and the timing of spawning is correlated with the receding limb of the hydrograph (Weiss 1993).

Flannelmouth spawning aggregations have been observed in tributaries of the Lower Colorado River in glides or slow riffles, over medium-coarse gravel substrate (Weiss 1993). Ripe females have been collected in areas with cobble substrate and an average velocity of 3.3 ft per second (1 m per second). Although actual spawning was not observed, it is likely that spawning occurred nearby (Rees 2005).

Flannelmouth suckers are non-guarding, lithophilic breeders that leave their eggs on the surface of the substrate. During spawning, several fish congregate, closely spaced and in parallel. Eggs and sperm are released simultaneously in the water column, allowing fertilization of eggs while suspended. Once fertilized, the adhesive, demersal eggs sink and either adhere to gravel or fall into crevices Eggs typically incubate for six to seven days. Fecundity depends on fish size and location, but females typically lay from 4,000 to 40,000 eggs each spring. Sex ratios (male:female) are typically 2:1 or 3:1 (Weiss 1993, McKinney et al. 1999).

Diet

Flannelmouth suckers are omnivorous, benthic foragers that use their fleshy, protrusible lips to take in macroinvertebrates, algae, and debris. Flannelmouth suckers demonstrate an ontogenetic shift in diet that parallels their life stage specific habitat use. Larvae feed primarily on aquatic invertebrates, crustaceans, and organic/inorganic debris (Joseph et al. 1977). Young-of-the year (YOY) flannelmouth suckers in backwater habitats typically feed on diptera larvae, crustaceans, algae, and organic/inorganic debris (Muth and Snyder 1995). As flannelmouth suckers become juvenile and adult fish, their diet shifts and becomes primarily composed of benthic matter including organic debris, algae, and aquatic invertebrates The research to date reports no shift in food preference due to season, hydrological cycles, or migration, or between juvenile and adult stages (Joseph et al. 1977).

Competition for food resources may exist between flannelmouth and other Catostomidae such as the bluehead sucker. The introduced white sucker may also compete with flannelmouth sucker in the many areas that they have been invaded.

Migration

The movements of flannelmouth sucker and are typically associated with life stage (Bezzerides and Bestgen 2002). Flannelmouth sucker eggs are demersal and adhesive, where after fertilization they adhere to the substrate surface and hatch within several days of fertilization. After hatching, flannelmouth sucker larvae undergo a period where they drift with the current. It has been suggested that the larvae have the ability to actively enter and escape the drift. This drift mechanism likely accomplishes two separate objectives: population dispersal and location of suitable larval habitat.

Long distance movement has been detected in several flannelmouth sucker populations. However, portions of those populations were also classified as sedentary, remaining within the same general reach. Researchers have documented both diel and seasonal movement. Active movement and movement between major habitat types (e.g., riffle, pool, run) are most common at night (Rees 2005). The occasional long-distance migration may be essential for maintenance of relatively isolated populations that occur in smaller tributaries at higher elevations. Furthermore, upstream movement of juveniles and adults would be required to offset a downstream drift of larvae (Bezzerides and Bestgen 2002).

1.2.1.6 Threats Warranting Protection

Flannelmouth sucker populations have declined in abundance and distribution throughout their historic range primarily as a result of human-induced activities that divert water and change the flow regime in both tributary and mainstem streams (Bezzerides and Bestgen 2002). Flow manipulation, water development projects, habitat loss, negative interaction with invasive species (via predation/competition), and chemical pollution can be pinned as the main reasons for the decline of flannelmouth sucker in the Virgin River in Arizona, Nevada, and Utah (Cross 1985). Dam construction and the associated alterations of the thermal and hydrological regimes have negatively impacted flannelmouth sucker populations. Other threats include modification of streambeds through channelization, landscape changes resulting from land use, and local degradation of riparian zones that reduces the natural function of the stream ecosystem. Detailed information concerning the distribution, life history, population trends, and community ecology for this species is relatively limited. Specific local and regional information must be obtained prior to the development of management actions. Currently, management implications can be based only on the limited information regarding this species.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Flannelmouth sucker populations have suffered reductions in abundance and distribution from the same mechanisms that have caused the near extinction of other endemic fish species in this drainage. Hydrological and thermal characteristics altered as a result of dams, blockage of migration, genetic isolation of populations from dams, hybridization with other Catostomus species (AGFD 2001), and altered historic flow regimes have diminished available habitat for the flannelmouth sucker (AGFD 2002). Other mechanisms that are affecting the habitat availibilty for the flannelmouth sucker are: groundwater depletion, springhead use, mining, water diversions/water catchments, altered river flow regimes, habitat fragmentation/barriers, soil erosion, streambank alteration/channelization, grazing by ungulates, dams/reservoirs/impoundments, livestock management, nuisance animals, contaminants from waste water and runoff, management for game animals and sportfish, bait bucket dumping, illegal stocking, hybridization (AGFD 2006) alteration of hydrologic, physical and thermal characteristics of river habitats, blockage of migration routes due to dam construction, hybridization with other Catostomus species (NDOW 2006).

Both habitat degradation through loss, modification, and/or fragmentation, and interactions with non-native species imperil the long-term persistence of flannelmouth sucker. Each may work independently or in conjunction with the other to create an environment where populations may be reduced or eliminated. The relative importance of each threat and the specific cause-effect relationship usually depend on location.

Habitat loss occurs when streams are dewatered or when dams block upstream migration for seasonal use or when currently occupied areas are inundated by reservoirs. Habitat modification occurs when the natural stream flow regime is changed or when stream channels are modified by channelization, scouring, or sedimentation from land use practices. Land use practices that can impact stream channels include construction of roads through highly erodible soils, improper timber harvest practices, and overgrazing in riparian areas that all lead to increased sediment load in the system and the subsequent change in stream channel morphology.

Water development, road construction, timber harvest, and grazing of riparian areas are likely to continue to impact flannelmouth sucker habitat in the future. Modification of land use management techniques to decrease the impact to flannelmouth sucker habitat may lessen the anthropogenic threats to this species. However, it is unlikely that all impacts or threats could be minimized or halted. Modifications of land use management techniques include the specification of fish passage at new or existing low head diversion to eliminate or reduce fragmentation of habitat and loss of habitat, and the specification of minimum flow regimes to promote connectivity of habitats and also maintenance of baseflow habitat during summer seasons or irrigation seasons. Other practices include specifications for buffer zones for road construction and timber harvest as well as grazing of riparian areas to promote healthy riparian growth and reduce sedimentation from upland areas (Rees 2005).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

This threat was not included as a basis for warranting protection under the ESA.

Disease or Predation

The flannelmouth sucker is likely a desirable prey item for predatory non-native species. Large, non-native predators, including northern pike, channel catfish, and smallmouth bass, occur in many of the drainages containing flannelmouth sucker. In addition, red shiners have been reported to feed on native larval fish, including flannelmouth sucker larvae.

The Inadequacy of Existing Regulatory Mechanisms

At this time, there are no existing management strategies that are specific to the flannelmouth sucker. The general lack of information for this species suggests that management should begin with a detailed survey of each drainage that could potentially hold populations of flannelmouth sucker. Flannelmouth sucker, like other endemic species in the Virgin River Basin, have not been well-studied until recent years. Most of the information for native nongame species, like the flannelmouth sucker, is only incidental to primary studies focusing on local federally listed species populations. Given the known threats to this species, conservation measures should concentrate on maintaining aquatic habitat diversity and natural temperature and flow regimes in stream reaches with existing and adjacent flannelmouth sucker populations.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Natural limiting factors include drought, flood and in some instances, natural barriers and native species interactions. Pollution from return flows, municipal drains and agriculture is a potential problem for all native species within the basin. Return flows from municipal drains and agriculture can make up a significant portion of a stream's total flow. Water from these return flows can be polluted with pesticides as well as other wastes. Low flows, caused naturally or by diversions, increase the impacts that pollution, erosion, siltation, and mineral springs have on the chemical composition of the water.

1.2.1.7 Conservation

The Range-wide Conservation Agreement for Roundtail Chub, Bluehead Sucker and Flannelmouth Sucker (UDWR 2004) outlines conservation program needs for this species. There are a number of multi-party conservation teams and plans in place to implement conservation for this species, including a range-wide agreement working group and the Lower Virgin River Recovery Implementation Team (RIT) which directs and implements conservation actions on the Virgin River in Nevada. Key conservation elements include maintenance of flows, habitat protection and restoration, and the control of nonnative competitors and predators.

Recovery Units

No recovery units are proposed for the flannelmouth sucker since it is not a federally listed ESA species.

Critical Habitat

No critical habitat has been designated for the flannelmouth sucker since it is not a federally listed ESA species.

1.2.1.8 Species Status

Rangewide

The flannelmouth sucker is not listed by federal statute as threatened or endangered, but it has been given special status with other agencies. The flannelmouth sucker currently has a Natural Heritage Program rank of G3G4/S1 (globally vulnerable but apparently secure/ regionally imperiled). In the remainder of its range, the BLM considers this species to be Sensitive. Utah considers flannelmouth sucker a species of concern due to declining populations. New Mexico gives this species no special status.

Lower Virgin River Watershed

There are 27 recorded occurrences of the flannelmouth sucker in the Lower Virgin River watershed from the NNHP, UDWR, and AGFD datasets (NNHP, UDWR, and AGFD 2007).

1.3 SPECKLED DACE

Scientific Name: *Rhinichthys osculus*

1.3.1 <u>Protection Warranted</u>

1.3.1.1 Endangered Species Act

- Not listed as threatened or endangered under the ESA.

Other Protections

- Listed as a Sensitive Species by BLM.
- Ranked as demonstrably widespread, abundant and secure across its global range (G5)
- Ranked as vulnerable- apparently secure in the state of Arizona (S3S4)
- Ranked as demonstrably widespread, abundant and secure across its regional range in Nevada and Utah (S5)

1.3.1.2 General Description

The speckled dace is a member of the Cyprinidae family. Members of this family include carp and small minnows. The family has a worldwide distribution with many genera and species. It is the largest family of fresh-water fish, with about 2,420 species of cyprinids in about 220 genera.

The speckled dace is a small (usually <70 mm total length), slender minnow, with a stout tail, a small mouth slightly under a pointed nose, and small scales. It is variable in color, ranging from brownish to yellowish green, with darker blotches on the side. The blotches often form an untidy lateral band. During spawning, the fins have reddish tints. The pharyngeal teeth are 1 or 2, 4-4, 2 or 1, are hooked, and have a grinding surface.

The absence of barbels and high scale counts around the caudal peduncle differentiate Canadian species from populations in the United States. Many subspecies and distinct populations are recognized in the United States, and many of these isolated populations are considered to be at risk.

1.3.1.3 Distribution

Historic Distribution

The historic range of the speckled dace includes a number of morphologically variable populations in isolated drainages between the Colorado River drainage of Arizona to Columbia River drainages of the Pacific Northwest. Speckled dace are native to all major western drainages from the Columbia and Colorado rivers south to Sonora, Mexico. In the United States, populations occur as far south as California, Arizona and New Mexico. In Canada, they reach the northern limit of their distribution and are confined to the Kettle River system (Kettle, West Kettle, and Granby rivers) of south central British Columbia.

Current Distribution

Speckled dace are currently found in all major western drainages from the Columbia and Colorado rivers south to Sonora, Mexico, and inhabit most of their historic range from the Kettle River system of south central British Columbia into Mexico.

1.3.1.4 Habitat

The speckled dace has adapted to many different types of habitat, ranging from cold swift-flowing mountain headwaters to warm intermittent desert streams and springs. Typically, speckled dace are bottom dwellers that can be found in riffles, runs, and pools of headwaters, creeks, small to medium rivers, and rarely in lakes. They tend to reside in water less than 1.6 ft

(0.5 m) deep with current averaging about 1.3ft/sec (0.4m/sec). These fish often congregate below riffles and eddies. Speckled dace adults prefer swift water for breeding.

Native species of speckled dace can be found in rocky riffles of all major western drainages from the Columbia and Colorado rivers south to Sonora, Mexico. They tend to live among the larger bottom substrates of riffle habitats where they can hide from predators and feed on aquatic insects. Speckled dace have been captured at depths of over 3 feet (1 m), with small young-of-the-year fish remaining in the shallow stream edge habitat. Peak abundance of speckled dace are typically found around an elevation of 6 562- 9843 feet (2,000 to 3,000 m), and rarely below 4921 feet (1,500 m).

1.3.1.5 Life History

Reproductive Biology

Rhinichthys osculus mature in their second summer and have two breeding periods- one in spring and the other in late summer. Existing data indicate that speckled dace breed in July at sizes larger than 40 mm standard length, probably spawning for the first time at the age of 2 or 3, and are not likely to live much beyond the age of 4. They spawn over coarse substrate that has been cleaned by territorial males using a broadcast spawning method. The females congregate in large groups and release many eggs as a group, with each mature females carrying between 400 and 2,000 eggs. Newly hatched fry can then be seen in August and September. Speckled dace do not form shoals except during the breeding season.

Diet

Speckled dace are omnivorous benthic (bottom) feeders eating primarily insect larvae and other invertebrates, although algae and fish eggs are also consumed. Larger dace feed near the bottom, taking mostly aquatic insects, although they also consume a considerable amount of filamentous green algae, the latter perhaps inadvertently as they grab insect larvae. Their intestine is not long and coiled as is typical of herbivores.

Migration

Major species movements or migrations of the speckled dace are not documented. Although, some populations have been noted to re-invade isolated refuges within Arizona rivers after devastating floods (Minckley 1973). Young of the year are often observed amongst stones in spring and summer as they scurry along the river’s edges. However, they are inconspicuous in cooler weather when their metabolic activity is reduced. Waterfalls and dams can impede upstream migration of dace.

1.3.1.6 Threats Warranting Protection

Limited range within a single river system and lack of abundance are major risk factors for speckled dace. Abundance appears to be limited by the availability of good quality habitat for adults, which is presumed to be decreasing partly as a consequence of low summer flows.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Threats in this category include groundwater depletions and springhead use, mining, water diversion/water catchments, altered river flow regimes, streambank alteration/channelization, grazing by ungulates, dams/reservoirs/impoundments, livestock management, contaminants from waste water and runoff (AGFD 2006), habitat alteration, dewatering of springs, headwaters, and middle portions of major streams, water impoundment, channelization, diversion, regulation of discharges, and cattle in riparian areas (NDOW 2006).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Although the speckled dace is a popular bait and sportfish, over-utilization is not a known threat to the propagation of this species.

Disease or Predation

Predators of the speckled dace include piscivorous birds such as kingfishers and herons, soft-shelled turtles and other vertebrate species that fish along stream banks. Although terrestrial and aquatic predators occur in the area, larger speckled dace habitually hide or retreat under rocks where they are protected. Severe spring flooding may be a major factor of mortality for juveniles before they find suitable shelter. Younger stages of dace actively move along inshore stream edges, and are visible to terrestrial predators and easily caught.

The Inadequacy of Existing Regulatory Mechanisms

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Drought has been identified as having a negative effect on the continued existence of the speckled dace (AGFD 2006).

1.3.1.7 Conservation

A speckled dace species management plan is under development (NDOW 2006). This plan aims to work with private landowners to develop conservation strategies, to secure water rights where necessary to protect spring flows and spring outflows, and exclude sensitive springs from direct impacts of grazing, recreation, other disturbance sources. The plan will work to eliminate groundwater pumping that threatens surface flows at critical springs, and eliminate or minimize introduced species that competed with the speckled dace. In some systems, NDOW is developing a Programmatic Candidate Conservation Agreement with Assurances to assist in the development of landowner agreements for private land conservation (NDOW 2006).

Recovery Units

No recovery units proposed for the speckled dace since it is not a federally listed ESA species.

Critical Habitat

No critical habitat has been designated for the speckled dace since it is not a federally listed ESA species.

1.3.1.8 Species Status

Rangewide

The speckled dace continues to inhabit most of it's historic range from the Colorado River drainage of Arizona to Columbia River drainages of the Pacific Northwest. In the United States, populations continue to occur as far south as California, Arizona and New Mexico. In Canada, they reach the northern limit of their distribution in the Kettle River system of south central British Columbia.

Lower Virgin River Watershed

The speckled dace populations in the Virgin River are considered stable at this time (AGFD 2002). There are 84 recorded occurrences of speckled dace in the Lower Virgin River watershed from the NNHP, UDWR, and AGFD datasets (NNHP, UDWR, and AGFD 2007).

1.3.2 Virgin River Chub

Scientific Name: *Gila seminuda*

1.3.2.1 Protection Warranted

Endangered Species Act

- August 24, 1989: Virgin River population listed as Endangered, without critical habitat (54 FR 35305-35311). Muddy River population was not listed, but taxonomically is the same species.
- April 19, 1995: Final Recovery Plan approved for the Virgin River population (FWS 1994c).
- May 16, 1996: Recovery Plan for the Muddy River population approved (FWS 1996).
- January 26, 2000: Critical habitat designated (54 FR 4140-4156).

Nevada Administrative Code

- Classified as Endangered under NAC 503.065 (Protected, Endangered and Threatened Fish). The Muddy River population is classified as sensitive under NAC 503.067 (Sensitive Fish).

Other Protections

- BLM sensitive species.
- Forest Service sensitive species (AGFD 2001).
- Listed as endangered by the State of Arizona; it is also considered a wildlife species of special concern in Arizona (AGFD 2001).
- Listed as a sensitive species by the State of Utah (UDWR 2006).

1.3.2.2 General Description

The Virgin River chub is a subspecies of Gila robusta of the Cyprinidae family, and is considered the rarest native fish in the Virgin River. It is a silvery, medium-sized minnow that averages about 20 centimeters in total length, but can grow to a length of 45 centimeters (FWS 1994).

1.3.2.3 Distribution

Historic Distribution

The Virgin River chub is endemic to 134 miles of the Virgin River in southwest Utah, northwest Arizona, and southeast Nevada. It is believed the Virgin River chub occurred historically throughout most of the Virgin River from its original confluence with the mainstem Colorado upstream to La Verkin Creek, near the town of Hurricane, Utah.

The Virgin River chub was collected historically within the Muddy (Moapa) River in Nevada and within the mainstem Virgin River from Pah Tempe Springs (also called La Verkin Springs), Utah, downstream to the confluence with the Colorado River in Nevada (Cope and Yarrow 1875; Cross 1975, as cited in FWS 1994). It is likely that the Virgin River chub once occurred well above Pah Tempe Springs.

Current Distribution

At present, the Virgin River chub occurs within the Muddy River and within the mainstem Virgin River from Pah Tempe Springs downstream to the Mesquite Diversion (FWS 2001b). The Virgin River chub has not been collected below this point, except for a few individuals, since the late 1970’s (Virgin River Fishes Data Base, as cited in FWS 1994). The Virgin River chub also occurs within the Muddy River in Nevada. A captive population of Virgin River chub is currently maintained at the Dexter National Fish Hatchery and Technology Center as a refugium population and for propagation studies.

1.3.2.4 Habitat

The Virgin River chub is most often associated with deep runs or pool habitats of slow to moderate velocities with large boulders or instream cover, such as root snags. Both adults and juveniles are often associated within these habitats. Hardy et al. (1989) indicated that Virgin River chub smaller than 80 millimeters in total length (TL) utilize depths greater than about 0.18 inch at velocities between 0.08 to 0.15 inches/second over sand substrates in association with large boulders or instream cover. Virgin River chub between 80 millimeters and 140 millimeters in TL utilize depths greater than 0.30 inch at velocities ranging between 0.00 to 0.76 inches/second over sand substrates with boulders or instream cover. Virgin River chub greater than 140 millimeters TL utilize depths greater than 0.61 to 0.91 inch at velocities from 0.00 to 0.55 inches/second with similar substrates as the other size classes noted above. Schumann (1978) and Deacon et al. (1987) found that the final adult thermal preference was approximately 24º Centigrade.

1.3.2.5 Life History

Reproductive Biology

Hickman (1987) reported ripe females and males in April, May, and June, over gravel or rock substrate but the time of spawning has not been determined. The Virgin River chub is known to spawn successfully in the mainstem of the Virgin River (Utah Division of Wildlife Resources, unpub. data). No parental care is provided for the eggs, which hatch in one week or less. The Virgin River chub is usually associated with deep, protected areas of swift water.

Diet

The Virgin River chub is omnivorous and has demonstrated considerable dietary shifts with age and season. It feeds mainly on debris and chironomids in February; Cladophora and debris in June; debris and Spyrogyra and Cladophora in September; and unidentified drift animals, dragonfly larvae, debris, and Cladophora in December. Young fish feed almost entirely on macroinvertebrates while adults feed almost exclusively on algae and debris (Greger and Deacon 1988). Cross (1975) reported that up to 90 percent of the diet consisted of filamentous algae.

1.3.2.6 Threats Warranting Protection

Threats to the Virgin River chub include natural and exotic predators, habitat alteration, toxic spills, and floods. A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat alteration, through water impoundments and diversions, and floods are some of the main threats to the Virgin River chub (FWS 2001b).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

This threat was not included as a basis for warranting protection under the ESA.

Disease or Predation

Predators on the Virgin River chub include piscivorous birds such as kingfishers and herons, soft-shelled turtles, and other vertebrate species. This is especially true during periods of low flow and clear water. Fish that feed on all life-stages of the Virgin River chub include the introduced channel catfish (Ictalurus punctatus), tilapia, and black bullhead (Ameiurus melas). Largemouth bass (Micropterus salmoides), green sunfish (Lepomis cyanellus), and mosquitofish (Gambusia affinis), and the native Virgin spinedace probably prey on larvae. Disease, such as fish specific asian tapeworm, is also a threat to the Virgin River chub (FWS 2001b).

The Inadequacy of Existing Regulatory Mechanisms

This threat was not included as a basis for warranting protection under the ESA.

Other Natural or Manmade Factors Affecting the Species Continued Existence

Toxic spills threaten the persistence of the Virgin River chub (FWS 2001b).

1.3.2.7 Conservation

A recovery plan was developed for the woundfin and the Virgin River chub in 1994. The objective of this plan was to prevent the extinction of the two species. If the Virgin River chub is not listed in the Muddy River, then the downlisting criteria of the plan for the Virgin River chub would be identical to those identified for the woundfin: 1) Virgin River flows essential to survival of all stages of species are ensured, 2) degraded Virgin River habitats from Pah Tempe Springs to Lake Mead are improved and maintained to allow continued existence of all life stages at viable population levels, and 3) barriers to upstream movements of introduced fishes are established and red shiners and other nonnative species that present a major threat to the continued existence of the native fish community are eliminated upstream of those barriers. If the

Virgin River chub were to be listed in the Muddy River, then recovery criteria that addressed fish in both rivers would need to be developed. At the time of the recovery plan's finalization, delisting criteria for the Virgin River chub were unable to be determined (FWS 1994c). A 5-year status review was initiated in April 2006 to review the listing status of the species (FWS 2006b).

The Muddy River population of Virgin River chub was included as a species of special concern in the Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem (FWS 1995). No recovery actions were developed specifically for the Virgin River chub, rather, the actions proposed for the Moapa dace would also benefit the seven endemic aquatic species analyzed in the plan (Virgin River chub being one of the species).

Recovery Units

There are no recovery units identified for the Virgin River chub.

Critical Habitat

Critical habitat was designated for the Virgin River chub in 2000 along 87.5 miles of the mainstem Virgin River and its floodplain from the confluence of La Verkin Creek, Utah to Halfway Wash, Nevada (above Lake Mead), which represents approximately 65.8 percent of its historical range in the Virgin River basin (FWS 2000). No critical habitat has been designated in the Muddy River. In the Lower Virgin River watershed, critical habitat starts from the northeastern end in Arizona and continues southwest into Nevada, 18.6 miles from the Arizona border (FWS 2000).

1.3.2.8 Species Status

Rangewide

The Virgin River chub historically occurred in the mainstem Virgin River from Pah Tempe Springs, Utah, downstream to the confluence with the Colorado River in Nevada. This species has experienced a general decline in Utah, Arizona, and Nevada, particularly since the mid-1980s (FWS 2001b). In the vicinity of the Lower Virgin River watershed, the Virgin River chub occurs within a 26-mile stretch of the Muddy River in The County (between the Warm Springs area and the Wells Siding Diversion to Bowman Reservoir), and the mainstream Virgin River that flows through eastern Lincoln and Clark counties (65 FR 4140-4156).

In the Muddy River, the Virgin River chub experienced a decline of up to 83 percent between 1938 and 1963. Distribution shifted upstream during the following years (1964 to 1968) and by 1975, chub had been eliminated from the lower Muddy River (RECON 2000). As of 1995, there were still up to 30,000 individuals inhabiting the river and its spring systems; however, surveys in 1998 documented a significant decline in chub numbers in the river and the extirpation of chub from the spring systems (RECON 2000).

Sampling at the Beaver Dam Wash Reach, located in Arizona (RM 72-68.5), between 2000 and 2002 continued to support a large, diverse native fish community (i.e., flannelmouth sucker, desert sucker, speckled dace, and Virgin River chub) when compared to the lower reaches. The Virgin River chub seemed to have an especially good reproductive year in 2002 as was evident throughout most of the Virgin River. The Virgin River chub is much more abundant in this reach than anywhere below the Mesquite Diversion. The catch rate from the June 2002 collection was significantly higher than most of the collections since 1996 (BIO-WEST 2004).

Virgin River Area

In 1993, BIO-WEST began studies on the distribution and abundance of native fishes (including Virgin River chub) in the lower Virgin River (Golden and Holden 2004). By 1996, BIO-WEST had sampled most of the Virgin River between Beaver Dam Wash, Arizona, and the confluence with Lake Mead. Starting in 1996, BIO-WEST created three long-term monitoring reaches in the lower Virgin River [Beaver Dam Wash (River Mile [RM] 72–68.5), Mesquite, Nevada (RM 58–54.5), and Riverside, Nevada (RM 49–45.5)], which are monitored several times a year to establish trends in native fish populations (Golden and Holden 2004).

Lower Virgin River Watershed

Critical habitat for the Virgin River chub is designated along the Virgin River and its floodplain throughout most of the Lower Virgin River watershed (FWS 2000). While suitable habitat for the Virgin River chub is present upstream from the Lower Virgin River watershed, the portion of the Virgin River within the Lower Virgin River watershed is not suitable.

Two of the long-term monitoring reaches surveyed by BIO-WEST (the Mesquite and Riverside reaches) are located within the Lower Virgin River watershed. Results from these studies support the notion that the Virgin River chub is very uncommon in the Virgin River throughout Nevada.

In the Riverside Reach, only one Virgin River chub was collected during the entire sampling period from 1996 to 2002; collection in this reach occurred in October 1997 (Golden and Holden 2004). In the Mesquite Bridge Reach, the Virgin River chub was only found three times, and in very low numbers, during the entire sampling period from 1996 to 2002 (Golden and Holden 2004). Table 3-2 provides the results of Virgin River chub surveys conducted at the Riverside and Mesquite reaches from 1993 to 2002.

In addition to the BIO-WEST studies, NDOW, with the assistance of Arizona Game and Fish Department personnel, conducted native fish surveys using standardized protocols in fall 2001 (October 4), spring 2002 (May 2), fall 2002 (September 24), and spring 2003 (April 30) in the lower reaches of the Virgin River in both Nevada and Arizona (NDOW 2002, 2003). During these four surveys, only one Virgin River chub was captured in Nevada; this occurred at the Bunkerville Diversion site during the fall 2001 survey (NDOW 2002, 2003). Table 3-2 provides the results of Virgin River chub surveys conducted near the Bunkerville Diversion from 1997 to 2003.

In summary, based on these studies, it appears that the Virgin River chub is very rare in the Nevada portion of the Virgin River. There have been no consistent populations detected during surveys; all detections were of only one or very few individuals (Golden and Holden 2004, NDOW 2002, NDOW 2003).

Table 3-2 Virgin River chub survey data for portions of the Lower Virgin River watershed from 1993 to 2003

Year	Mesquite Reach[1]	Riverside Reach[1]	Near the Bunkerville Diversion[1]
1993	NS	1[a]	NS
1994	NS	1[a]	NS
1995	NS	1[a]	NS
1996	0[a]	0[a]	NS
1997	2[b]	1[b]	NS
1998	1[b]	0[b]	NS
1999	2[b]	0[b]	6 (May)[b] 46 (Oct)[b]
2000	0[b]	0[b]	8 (June)[b] 22 (Oct)[b]
2001	0[b]	0[b]	16[b,c]
2002	0[b]	0[b]	0[b,c]
2003	NS	NS	0[c]

Source:
[a]Holden and Abate 199
[b]Golden and Holden 2004
[c]NDOW 2003

Notes:
[1]NS = Site not surveyed, as identified through reports currently available to ENTRIX

1.3.3 Virgin River Spinedace (Lepidomeda mollispinis mollispinis)

1.3.3.1 Protection Warranted

Endangered Species Act

- Not listed under the Endangered Species Act of 1973, as amended
- April 5, 1995, the U.S. Fish and Wildlife Service (USFWS) proposed critical habitat for three species, which included woundfin, Virgin River chub, and Virgin spinedace (USFWS 1995)
- February 6, 1996, USFWS withdrew its proposal to list the Virgin spinedace as threatened and the subsequent proposal to designate critical habitat (USFWS 1996)
- proposal was withdrawn mainly because the State of Utah, along with eight signatory parties, developed and implemented the Virgin Spinedace Conservation Agreement and Strategy (Utah Department of Natural Resources [UDNR] et al. 1995)

Other Protections

- BLM Nevada Sensitive Species
- Subspecies is classified as a sensitive species in Nevada and is protected from collection under NAC 503.067 and NRS 501 (NNHP 2004)
- Wildlife species of concern (WSC), AGFD 2001
- On Utah Sensitive Species List (UDWR 2006)

1.3.3.2 Species Description

The Virgin spinedace is a small minnow endemic to the Virgin River Basin in Utah, Nevada, and Arizona. Its body is silvery with a brassy sheen and occasionally has light sooty blotches on the dorso-lateral half (UDNR et al. 1995). When breeding, males develop a reddish-orange color on the basal band of the anal fin and bases of paired fins (Minckley 1973, as cited in Arizona Game and Fish Department [AGFD] 2001). The Virgin spinedace has a terminal mouth, rounded head and belly, and a body size typically ranging from 60 to 120 mm (2.4 to 4.7 in) standard length (Addley and Hardy 1993; Rinne 1971, as cited in UDNR et al. 1995). The dorsal fin has eight rays and the anal fin has nine (range 8 to 10 rays). There are 77 to 91 scales on the lateral line (AGFD 2001, UDNR et al. 1995). The Virgin spinedace has two rows of pharyngeal teeth, which number 2, 5-4, 2 (Minckley 1973, as cited in AGFD 2001).

1.3.3.3 Distribution and Abundance

The Virgin spinedace is endemic to the Virgin River drainage, covering the states of Utah, Arizona, and Nevada (USFWS 1996, Heinrich and Hutchings 2005). The historical distribution of the Virgin spinedace has not been well documented (Valdez et al. 1991, as cited in USFWS 1996). It is thought that Virgin spinedace were common to abundant in tributaries of the Virgin River and some mainstem reaches above Pah Tempe (La Verkin) Springs, near Hurricane, Utah (Holden et al. 1974, as cited in USFWS 1996). Below Pah Tempe Springs in the mainstem Virgin River, Virgin spinedace were probably less abundant, with the exception of the mouths of Quail Creek and Beaver Dam Wash, where the Virgin spinedace was common (USFWS 1996). Within the State of Nevada, spinedace were extirpated from Beaver Dam Creek sometime during the late 1960’s, most likely due to the construction of Schroeder Reservoir, which reduced their available habitat dramatically, and competition with non-native species, due to the abundance of rainbow trout in the system (Heinrich and Hutchings 2005).

The current distribution of the Virgin spinedace is mostly in Utah, where occupied habitat includes the mainstem Virgin River above Quail Creek diversion, three reaches in Beaver Dam Wash, the Santa Clara River between Veyo springs and Gunlock Reservoir, isolated reaches in Moody Wash and Mogatsu Creek, and a 6.3 km reach in the lower Santa Clara River (USFWS 1994). Virgin spinedace also have been found in the lower reaches of La

Verkin, Ash, North, and Shunes creeks, and in the lower reaches of both the North and East Forks of the Virgin River (USFWS 1994). Virgin spinedace are occasionally collected in the mainstem Virgin River between Pah Tempe Springs and Littlefield, Arizona (USFWS 1994). Cross (1975) reviewed past collections, and reported that Virgin spinedace have not been found below Littlefield, Arizona, since 1942 (USFWS 1994).

The largest populations of Virgin spinedace are in the upper mainstem above Quail Creek diversion and in drainages of the Santa Clara River and Beaver Dam Wash (Addley and Hardy 1993, as cited in UDNR et al. 1995). Small populations are in Ash Creek, La Verkin Creek, and the lower mainstem below Pah Tempe Springs, while intermediate-sized populations exist in the remaining areas of its current distribution (UDNR et al. 1995).

1.3.3.4 Life History and Ecology

Habitat

Virgin spinedace are typically found in clear, cool, swift streams that are interspersed with pools, runs, and riffles (Valdez et al. 1991, Deacon et al. 1979, as cited in UDNR et al. 1995). Virgin spinedace occupy pools with cover, such as boulders or undercut banks. This species appears to prefer pool depths of 10 to 90 cm (3.9 to 35.4 in) and current velocities of 10 to 100 cm/sec over sand and gravel substrates (AGFD 2001). Other substrate types include rubble/cobble and silt (USFWS 1995a). Virgin spinedace will often utilize shear zones between low and high current velocities (AGFD 2001). Variations in habitat preferences have been noted (Rinne 1971, as cited in UDNR et al. 1995). Nursery preferences are unclear (UDNR et al. 1995). Upper thermal preferences have been reported as 23.1°C (Deacon et al. 1987, as cited in UDNR et al. 1995).

Reproduction Biology

Virgin spinedace mature in about 1 year and have a life span of about 3 years (USFWS 1994). Populations of Virgin spinedace usually consist mostly of young-of-the-year and one-year-old fish (UDNR et al. 1995). Sexual dimorphism is not apparent during most of the year, but sexes are distinguishable during peak breeding season (UDNR et al. 1995). Females typically are more "robust and plump, while males remain streamlined" (UDNR et al. 1995). Both sexes exhibit a reddish-orange coloration at the bases of the paired fins (UDNR et al. 1995).

Rinne (1971) observed that Virgin spinedace spawned over gravel and sand substrates at the shallow downstream end of deep pools (USFWS 1994). A solitary female was observed depositing eggs in the shallow downstream end of the pool and the eggs were fertilized by several males (USFWS 1994). Two and three-year-old females appear to be more fecund than one-year-old females (Rinne 1971, as cited in UDNR et al. 1995). Age-one fish generally comprise the majority of the spawning population (90 percent) (Addley and Hardy 1993, as cited in UDNR et al. 1995).

Diet

Virgin spinedace are primarily insectivorous, feeding seasonally on aquatic and terrestrial insects, insect larvae, and floating plant material (NatureServe 2006). Virgin spinedace feed on drifting prey at the surface and in midwater (UDNR et al. 1995). Usually, Virgin spinedace will maintain equilibrium in the midwater column and dart to the surface to capture prey in a manner similar to drift-feeding salmonids (Addley and Hardy 1993, Rinne 1971, as cited in UDNR et al. 1995).

Activity/Movements/Dispersal/Migration

Virgin spinedace spawn from April to June at mean daily water temperatures of 13° to 17°C (55° to 63°F) and day lengths of about 13 hours (UDNR et al. 1995, USFWS 1994). As in most fish species, the important factors controlling timing of spawning appear to be photoperiod and temperature.

1.3.3.5 Threats Warranting Protection

Threats to the Virgin spinedace include modification and loss of habitat and the introduction and establishment of nonnative fish, particularly red shiner (USFWS 1995a). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Building of dams and associated reservoirs, water diversion structures, canals, laterals, aqueducts, and the dewatering of streams caused loss or degradation of available habitat (USFWS 1995a). The Virgin River Basin has been significantly altered by dams and diversions built for agriculture and municipal purposes. These structures, and the dewatering which often followed, resulted in the elimination or degradation of Virgin spinedace habitat and impacted populations. River reaches that historically contained Virgin spinedace habitat, but are now dewatered, include the DI ranch (East Fork of Beaver Dam Wash), the Santa Clara River below Gunlock Reservoir, Mogatsu Creek, Ash Creek near Toquerville, Leeds Creek, and the mainstem Virgin River between Quail Creek Diversion and Pah Tempe Springs (Hardy and Addley 1993, as cited in USFWS 1994). All of these areas are in Utah.

Agricultural practices also modified several areas of habitat for the Virgin spinedace through alteration of the riparian zone (UDNR et al. 1995). Areas that have some evidence of impacts from crop production include lower La Verkin Creek, lower Ash Creek, and middle Virgin River reaches (UDNR et al. 1995). Reaches impacted by livestock include the Santa Clara River below Gunlock Reservoir, lower Santa Clara River, lower North Creek, lower La Verkin Creek, lower Ash Creek, and portions of the Virgin River mainstem (UDNR et al. 1995).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

This threat was not included as a basis for warranting protection under the ESA.

Disease or Predation

Several non-native fish species have been identified as contributing to the decline of native fish populations (Addley and Hardy 1993, USFWS 1993, as cited in UDNR et al. 1995). For example, since 1984, woundfin and Virgin River chub populations have declined, and the red shiner has nearly replaced most native fish in the Virgin River up to the Johnson Diversion (USFWS 1995a). By 1986, the red shiner had become the most abundant species from the Washington Fields Diversion to Lake Mead (USFWS 1995a). Predation by species such as crayfish and competition may also be impacting Virgin spinedace. Although disease and parasites do not appear to be a major contributing factor to the decline of Virgin spinedace, they may have adverse effects when coupled with other threat and stress factors (Addley and Hardy 1993, as cited in UDNR et al. 1995).

The Inadequacy of Existing Regulatory Mechanisms

Protection levels for the Virgin spinedace vary between states. The Virgin spinedace is listed as a protected species by the State of Utah. However, impacts are difficult to monitor and protection for the Virgin spinedace is difficult to enforce (USFWS 1994). The State of Nevada has enacted similar regulations prohibiting the illegal take of Virgin spinedace. No protection is provided for the Virgin spinedace in Arizona (USFWS 1994).

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Natural limiting factors include drought, flood, and in some instances, natural barriers and native species interactions (UDNR et al. 1995). It is unclear to what extent these natural limiting factors affect the Virgin spinedace (UDNR et al. 1995). Pollution from return flows, municipal drains and agriculture may also be a potential problem for all native Virgin River species (UDNR et al. 1995). Mining along Beaver Dam Wash and Moody Wash may contribute to habitat degradation (UDNR et al. 1995, USFWS 1994). Recreational use (e.g., off-road vehicles) may also be significantly impacting several reaches including the Santa Clara below Gunlock Reservoir, the lower Santa Clara, and the lower mainstem Virgin River (UDNR et al. 1995).

1.3.3.6 Lower Virgin River Watershed

Most occupied Virgin spinedace habitat occurs in Utah. As such, most conservation actions have focused on habitat in Utah. Small populations of Virgin spinedace may be found below Pah Tempe in the Virgin River (UDNR et al. 1995). As part of the Virgin Spinedace Conservation Agreement and Strategy (UDNR et al. 1995), the Nevada Department of Wildlife (NDOW) has been reintroducing these fish into historic habitat beginning in 1997, initially within a tributary stream, and later into the mainstem Beaver Dam Creek in 2004 (Heinrich and Hutchings 2005). Surveys in Beaver Dam Wash represent the nearest survey for Virgin spinedace to the Project Area. Surveys in 2005 have shown recruitment for the first time since the repatriation effort began (Heinrich and Hutchings 2005). This recruitment follows a year of massive winter flooding. A January storm potentially equivalent to a 100-year flood event within the Beaver Dam Creek system, ultimately required the breeching of the Schroeder Reservoir Dam to protect downstream residents. Stream reaches have been stripped of overstory, pool depths have been dramatically reduced, and much of the large boulder substrates have been removed. This has produced limited habitat for adult rainbow trout resulting in somewhat depressed numbers, and an advantage to the smaller spinedace adults, which have responded positively (Heinrich and Hutchings 2005).

1.3.4 Woundfin

Scientific Name: *Plagopterus argentissimus*

1.3.4.1 Protection Warranted

Endangered Species Act

- October 13, 1970: Listed endangered, without critical habitat (35 FR 16047 16048), except in Gila River drainage in Arizona and New Mexico.
- July 24, 1985: Experimental, nonessential population designated in the Gila River drainage in Arizona and New Mexico; this population is excluded from endangered status (50 FR 30188 30295).
- April 19, 1995: Final Recovery Plan approved (Virgin River Fishes [2 spp.], FWS 1994c).
- January 26, 2000: Critical habitat designated (65 FR 4140 4156).

Other Protections

- Classified as endangered under NAC 503.065 (Protected, Endangered and Threatened Fish).
- BLM Sensitive Species
- Listed as endangered by the State of Arizona; it is also considered a wildlife species of special concern in Arizona (AGFD 2000).
- Listed as a sensitive species by the State of Utah (UDWR 2006).

1.3.4.2 General Description

A small, silvery minnow, the woundfin does not exceed 100 millimeters (SL), has a streamlined torpedo-shaped body with a slightly flattened head and belly. The two leading dorsal fin-rays form a sharp spine that gives the species its name (FWS 1994). The woundfin can be distinguished from similar spikedace and spinedace by the presence of a small barbel at each corner of the mouth and the lack of scales (AGFD 2000).

1.3.4.3 Distribution

Historic Distribution

The original range of the woundfin extended from near the junction of the Salt and Verde Rivers at Tempe, Arizona, to the mouth of the Gila River at Yuma, Arizona (Gilbert and Scofield 1898, as cited in FWS 1994). The species was also likely found in the mainstream Colorado River from Yuma upstream to the Virgin River in Nevada, Arizona, and Utah, and into LaVerkin Creek, a tributary to the Virgin River in Utah (Gilbert and Scofield 1898, Snyder 1915, Miller and Hubbs 1960, Cross 1975, as cited in FWS 1994). However, from biological considerations alone, there is also reason to believe that woundfin occurred yet further upstream on the Verde, Salt, and Gila rivers in Arizona (Miller and Hubbs 1960, as cited in FWS 1994).

Current Distribution

The woundfin has been extirpated in almost all of its historic range, except for the mainstem Virgin River. Present day distribution ranges from Pah Tempe Springs on the mainstem Virgin River and the lower portion of LaVerkin Creek in Utah, downstream to Lake Mead (FWS 1994). A single specimen was collected from the Muddy River in The County, Nevada, in the late 1960s, but none has been collected since. The woundfin is considered extirpated from the Muddy River (FWS 1994). The woundfin has also been transplanted into four localities in Arizona: the Hassayampa River, Salt River, Sycamore Creek, and the Paria River (Arizona Game and Fish Stocking Records, unpublished data, as cited in FWS 1994). A captive population was also established in 1988 at the Dexter National Fish Hatchery and Technology Center, New Mexico, to assist in research to develop rearing protocols and propagation standards (FWS 1994).

1.3.4.4 Habitat

Adult and juvenile woundfin associate with sand and fine gravel substrates in runs and quiet waters adjacent to riffles. Adults are usually found in water depths of 0.5–1.4 feet (0.15–0.43 meter) with slow to moderate velocity while juveniles select areas with deeper and slower moving water. Woundfin larvae associate with growths of filamentous algae in backwater areas and along stream margins (FR 2000). Deacon et al. (1987) reported the preferred water temperature for adults was approximately 18º Centigrade while other studies indicate that temperatures exceeding 30 Centigrade spur woundfin to move to deeper, cooler pools (FWS 1994).

1.3.4.5 Life History

Reproductive Biology

The woundfin reproductive cycle appears to be initiated by a combination of increasing water temperatures, lengthening daylight, and the decline of spring runoff (FWS 1994). Spawning in the Virgin River by woundfin populations begins in April–May and continues throughout August. Woundfin fry generally appear by June, but continue to be produced throughout summer. Maturation appears to occur in the second summer, and few if any individuals live more than four years (AGFD 2000).

Diet

The woundfin is omnivorous and readily shifts its preference depending on food availability. Food items found in woundfin stomachs include filamentous algae, detrital material, seeds, and insects (AGFD 2000). Greger and Deacon (1988) suggested seasonal shifts in food selectivity correspond to shifts in habitat foraging area. They also documented dietary differences between woundfin populations in disturbed and undisturbed segments of the lower Virgin River (Greger and Deacon 1988, as cited in FWS 1994).

Activity/Movements/Dispersal/Migration

Very little information exists on movement of the woundfin. Downstream movement within the river by adults and other life stages has been noted in some cases (FWS 1994) but the extent of upstream movement, if any, is not known.

1.3.4.6 Threats Warranting Protection

Threats to the woundfin include restricted distribution, loss of significant portions of habitat range, deterioration of habitats, and introduction of non-native species. A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Alteration of flow regimes from construction of dams and diversions, and decreased water quality, are the principal threats to this species. These have resulted in habitat deterioration and the loss of significant portions of the woundfin's historic range.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

This threat was not included as a basis for warranting protection under the ESA.

Disease or Predation

Predation from birds and other fishes and competition from exotic species such as channel catfish, black bullhead and largemouth bass all play a part in impacting woundfin populations within the Virgin River. Changes to flow patterns also facilitated movement of red shiners upstream in the Virgin River. This non-native fish, which has greatly impacted the woundfin through competition for food and space and possibly through predation of larvae, has largely replaced the woundfin and has introduced the Asian tapeworm, a parasite found on many of the remaining woundfin (Heckmann et al. 1986). It has also been determined that red shiners have a significant dietary overlap with woundfin (Greger and Deacon 1988, as cited in FWS 1994).

The Inadequacy of Existing Regulatory Mechanisms

This threat was not included as a basis for warranting protection under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

This threat was not included as a basis for warranting protection under the ESA.

1.3.4.7 Conservation

A recovery plan was developed for the woundfin and Virgin River chub in 1994. The objective of this plan is to prevent the extinction of the two species. The long-term goal for the woundfin is to downlist the species to threatened status. Downlisting criteria include 1) Virgin River flows essential to survival of all stages of species are ensured, 2) degraded Virgin River habitats from Pah Tempe Springs to Lake Mead are improved and maintained to allow continued existence of all life stages at viable population levels, and 3) barriers to upstream movements of introduced fishes are established and red shiners and other nonnative species that present a major threat to the continued existence of the native fish community are eliminated upstream of those barriers. Interim delisting criteria include 1) the establishment of two additional self-sustaining populations in the wild within its historic range and 2) essential habitats, important migration routes, required stream flows, and water quality of both the Virgin River habitat and the habitat of transplanted populations are legally protected and the threats of other significant physical, chemical, or biological modification, such that habitat would become unsuitable for the woundfin, are removed (FWS 1995). A 5-year status review was initiated in April 2006 to review the listing status of the species (FWS 2006b).

Recovery Units

There are no recovery units for the woundfin.

Critical Habitat

Critical habitat was designated for the woundfin in 2000 along 87.5 miles of the mainstem Virgin River and its 100-year floodplain, extending from the confluence of LaVerkin Creek, Utah to Halfway Wash, Nevada (above Lake Mead) (FWS 2000). This represents 12.5 percent of historical habitat. The length of critical habitat along the Virgin River in Nevada is 18.6 miles (29.9 kilometers). No critical habitat was designated in the Muddy River. In the Lower Virgin River watershed, critical habitat starts from the northeastern end in Arizona and continues southwest into Nevada, 18.6 miles from the Arizona border (FWS 2000).

1.3.4.8 Species Status

Rangewide

The woundfin has been extirpated from most of its historical range and is currently found only in the mainstem Virgin River, from Pah Tempe Springs in Utah to Lake Mead in northwestern

Arizona (Mohave County) (FWS 2001c). This species occurs in 25.9 miles of the Virgin River in The County, Nevada (RECON 2000). The woundfin has experienced a general decline in Utah, Arizona, and Nevada, particularly since the mid-1980s due to the cumulative effects of dewatering from numerous diversion projects; proliferation of nonnative fishes; and alterations to natural flow, temperature, and sediment regimes (FWS 2000).

Virgin River Area

BIO-WEST has been evaluating the distribution and abundance of native fishes (including woundfin) in the lower Virgin River since 1993. By 1996, BIO-WEST had sampled most of the Virgin River between Beaver Dam Wash, Arizona, and the confluence with Lake Mead. Beginning in 1996, BIO-WEST created three long-term monitoring reaches in the lower Virgin River (Beaver Dam Wash [RM 72–68.5], Mesquite, Nevada [RM 58–54.5], and Riverside, Nevada [RM 49–45.5]), which are monitored several times a year to establish trends in native fish populations (BIO-WEST 2004).

Lower Virgin River Watershed

Critical habitat for the woundfin is designated along the Virgin River and its floodplain through most of the Lower Virgin River watershed (FWS 2000). Suitable habitat for the woundfin is present in the Virgin River through its entire length within the Lower Virgin River watershed.

Two of the long-term monitoring reaches surveyed by BIO-WEST (the Mesquite and Riverside reaches) are located within the Lower Virgin River watershed. It should be noted that a component of the sampling procedures was designed to assist NDOW in assessing efforts associated with stocking woundfin in the Virgin River.

In the Riverside Reach, approximately 20 percent of the woundfin captured from 1996 to 1998 were tagged fish released by NDOW (Golden and Holden 2004). Relatively high (for Nevada) numbers of woundfin were observed after fish were stocked; however, numbers later declined. Woundfin disappeared from their catch in 2001. In the Mesquite Bridge Reach, more than 50 percent of the woundfin collected in this reach from 1996 to 1998 were tagged fish (Golden and Holden 2004). Woundfin were captured in this reach after having been stocked less than 2 miles upstream. However, no woundfin have been collected in this section of the river since June 2001 (Golden and Holden 2004). Table 3 1 provides the results of woundfin surveys conducted at the Riverside and Mesquite reaches from 1993 to 2002.

Woundfin numbers between the Bunkerville and Mesquite diversions were influenced by the stocking of 11,200 woundfin in 1999 and 4,500 woundfin in 2000, within the Nevada portion of the reach (Holden and Golden 2000, Nevada Division of Wildlife 2001). Table 3-1 provides the results of woundfin surveys conducted near the Bunkerville Diversion from 1999 to 2003.

Table 3-1 Woundfin survey and stocking data for portions of the Lower Virgin River watershed from 1993 to 2003.

Year	Mesquite Reach[1]	Riverside Reach[1]	Near the Bunkerville Diversion[1]
1993	NS	~45a	NS
1994	NS	160a	NS
1995	NS	~65a	NS
500 woundfin stocked at the Riverside Bridge – February 1996[b] 1,250 woundfin stocked at an undisclosed location – December 1996[b] 1,100 woundfin stocked at an undisclosed location – April 1997[b] 5,800 woundfin stocked at an undisclosed location – December 1997[b] 4,500 woundfin stocked at an undisclosed location – January 1998[b] 3,440 woundfin stocked at an undisclosed location – April 1998[b]			
1996–1998	179[b]	224[b]	NS
1,700 woundfin stocked near the Arizona/Nevada border – May 1999b			
1999	NS	NS	5 (Oct)[b]
9,500 woundfin stocked near the Arizona/Nevada border – October 1999			
2000	0 (May)[b] 0 (Jun)[b] 10 (Oct)[b]	4 (May)[b] 50 (Jun)[b] 1 (Aug)[b]	400 adults (Jun)[b] 242 young (Jun)[b] 625 (Aug)[b] 5 (Oct)[b]
4,500 woundfin stocked near the Arizona/Nevada border – October 2000[b]			
2001	5 (Jun)[b]	146 (Mar)[b] 3 (Jun)[b]	87 (May)[b]
2001–2002	0[b]	0–15 (Jul '01–May'02)[b]	0[c]
2002	0[b]	0[b]	0[c]
2003	NS	NS	0[c]

Source:
[a]Holden and Abate 1999
[b]Golden and Holden 2004
[c]NDOW 2003

Notes:
[1]NS = Site not surveyed, as identified through reports currently available to ENTRIX

In addition to these studies, NDOW, with the assistance of Arizona Game and Fish Department personnel, conducted woundfin surveys using standardized protocols in fall 2001, spring and fall 2002, and spring 2003 in the lower reaches of the Virgin River in both Nevada and Arizona (NDOW 2002, 2003). No woundfin were captured at the Nevada monitoring sites during either survey period (NDOW 2002, 2003).

Holden et al. (2001) conclude that a myriad of factors have contributed to the decline of woundfin in the Virgin River; however, they identified non-native red shiner abundance and low flows as the two main factors influencing woundfin abundance. These factors may have contributed to fewer numbers of woundfin in the lower Virgin River in 2001.

In summary, based on these studies, the Riverside Reach had a small but consistent woundfin population until summer 2000, when it began to decline. The Mesquite Bridge and Riverside reaches were almost completely devoid of native fishes, including woundfin, by fall 2001. Currently, there are no healthy woundfin populations remaining in the Virgin River that are unaffected by human-caused disturbances.

Section 2: Riparian Species Descriptions

2.1 ARIZONA TOAD

Scientific Name: *Bufo microscaphus*

2.1.1 Protection Warranted

2.1.1.1 Endangered Species Act

The Arizona toad is not a federally listed species.

Other Protections

- The Arroyo Southwestern toad (Bufo microscaphus californicus), a subspecies of Arizona Toad found in California and Mexico, is listed as federally endangered (FR 1994).
- Utah Wildlife Species of Concern (UDWR 2006).

2.1.1.2 General Description

Arizona toad is uniformly warty with the eyelids and the front of the oval parotoid glands usually pale; usually there is a light area on each sacral hump and in the middle of the back. Cranial crests are weak or absent, dorsal color varies with substrate color. Both males and females have a pale throat. Young have red-tipped tubercles on dorsum and the underside of the feet is yellow (NatureServe 2007).

2.1.1.3 Distribution

Historic Distribution

Sullivan and Lamb (1988) presented evidence that Woodhouse's Toad (Bufo woodhousii) is displacing B. microscaphus in some areas in central Arizona. In Arizona, B. microscaphus is now absent from historical localities where the riparian corridor has been altered dramatically through the construction of impoundments (Sullivan 1993).

Current Distribution

The distribution of Arizona toad is highly fragmented; it includes south central Utah at Arizona border, southwestern Utah and southern Nevada southward into Mexican highlands of Durango and Chihuahua (Stebbins 2003). Arizona and western New Mexico are also part of the current distribution (AGFD 2002).

2.1.1.4 Habitat

Habitats for the Arizona toad include rocky streams and canyons in the pine-oak belt; upland desert and evergreen woodland. Habitat is benthic, with the species burrowing in or using soil, fallen log/debris. Elevation ranges from 146 to 2,560 meters. It inhabits streams, washes, irrigated crop lands, reservoirs, and uplands adjacent to water (NatureServe 2006).

2.1.1.5 Life History

Reproductive Biology

The tadpole is the larval form of this species; eggs hatch in water are aquatic until tadpoles develop into froglets. Adults live on land, but return to water to mate and lay eggs. The species breeds February to July, but may be above ground until September; breeding not dependent on rainfall. Arizona toad lays eggs on the bottom of shallow, slow-moving streams. Distribution is scattered (AGFD 2002).

Diet

Adults consume arthropods (crickets, beetles, ants) and some snails. Tadpoles consume plant matter, algae, and organic debris (AGFD 2002).

Migration

Migrates between nonbreeding terrestrial habitats and breeding pools (several hundred meters) (AGFD 2002).

2.1.1.6 Threats Warranting Protection

Habitat loss and degradation and competition with the Woodhouse toad are threats to the Arizona toad (AGFD 2002).

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Habitat conversion from livestock management (AGFD 2006) and construction of impoundments, water diversions and manipulations may all negatively impact Arizona toad populations (AGFD 2002, UDWR 2005, NDOW 2007, AGFD 2006).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species (NatureServe 2006).

Disease or Predation

Predators of larvae include killdeer, garter snakes; predators of adults include small mammals and raccoons (AGFD 2002).

The Inadequacy of Existing Regulatory Mechanisms

Although this is a species of concern in Utah, Arizona toad is not a listed species and otherwise receives no federal or state protection.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

In Nevada, the range of the Woodhouse toad has expanded to overlap Arizona toad habitat, and evidence exists that historic Arizona toad populations in the Las Vegas Valley have been entirely replaced by the Woodhouse toad. Habitat changes and modifications are occurring that may favor the Woodhouse toad in areas where the two toad species co-occur. As with other amphibians in NV, inherent population threat due to limited distribution and isolated populations. (NDOW 2007). Hybridization with Woodhouse toad has been thought to be a threat in dammed aquatic systems (AGFD 2002, NatureServe 2006).

2.1.1.7 Conservation

There are few known conservation measures are proposed that are meant to directly protect Arizona toads. They may benefit from land acquisitions that protect habitat from development or other restoration projects (RECON 2000, SWPARC 2007).

2.1.1.8 Recovery Units

No recovery plan has been proposed for this species.

2.1.1.9 Critical Habitat

No critical habitat has been designated for this species.

2.1.1.10 Species Status

Rangewide

Population trends are not well understood (AGFD 2002). The species is apparently declining in some areas.

Lower Virgin River Watershed

Within the Lower Virgin River watershed, this species occurs in scattered locations in southwestern Utah, southern Nevada, and Arizona. Distribution in Nevada is limited to isolated populations in Lincoln and Clark Counties (NDOW 2007). This species' range is continuous along the Virgin River and its tributaries in southwestern Utah (Naturserve 2006). It occurs Mohave County, Arizona (AGFD 2002), and southern portion of Utah, where it is concentrated within the Virgin River basin in Washington County, Utah (UDWR 2005). Eleven known occurrences exist within the Lower Virgin River watershed (NNHP, UDWR, and AGFD 2007 occurrence data).

2.2 LOWLAND LEOPARD FROG

Scientific Name: *Rana yavapaiensis*

2.2.1 <u>Protection Warranted</u>

2.2.1.1 Endangered Species Act

The lowland leopard frog is not a federally listed species.

Other Protections

- Listed as a wildlife species of concern in Arizona (AGFD 2006).

2.2.1.2 General Description

The lowland leopard frog, or the Yavapai leopard frog, is tan, gray-brown, or light gray-greeen to green above, yellow below. It has dorsolateral folds, tuberculate skin, and unusually vague upper lip stripe. The chin is mottled in older individuals. The dark network on the rear of thighs is distinct. Yellow groin color often extends onto rear of belly and underside of legs. Males have a swollen and darkened thumb base (Stebbins 1985).

Calls are brief, containing 10-16 pulses lasting a little over half a second (Stebbins 1985).

2.2.1.3 Distribution

Historic Distribution

The lowland leopard frog has apparently been extirpated in Imperial Valley, California, and along the lower Colorado River, Arizona-California, although it may be extant in some areas close to the Colorado River in Arizona. It has been replaced by the introduced Rio Grande Leopard Frog (Rana berlandieri) along the Colorado and Gila rivers, Arizona. It is believed to be extirpated from New Mexico (IUCN et al 2006).

Current Distribution

This species ranges from western and central Arizona and southwestern New Mexico, in the United States, south to northern Sonora and northwestern Chihuahua, and south-central and southeastern California and adjacent Arizona, from San Felipe Creek to the Colorado River. In Arizona, it is found in every county except Apache and Navajo with 57% of all localities occurring in Gila, Maricopa, and Yavapai counties (IUCN et al 2006).

AGFD reports lowland leopard frog as occurring in low elevation sites in the Colorado River drainage and its tributaries in NV, CA, AZ, NM, northern Sonora, and extreme NE Baja California, Mexico (AGFD 2001).

2.2.1.4 Habitat

Lowland leopard frogs occupy wetlands in lower and upper Sonoran Desert, grasslands, oak and oak-pine woodland (AGFD 2001). This species preferably inhabits rocky streams in canyon habitats surrounded by conifer forests or ponds and stream pools, usually in areas of scrub desert. Eggs and larvae develop in quiet water (IUCN et al. 2006).

2.2.1.5 Life History

Reproductive Biology

Reproduction is aquatic. In Arizona, frogs breed primarily from January to May, with additional breeding occurring in some populations in summer and early fall after the onset of the summer rains. (Sredl unpublished data; Rorabaugh 2006). Male lowland leopard frogs attract a potential mate by emitting an airborne call consisting of a series of low pulses lasting 3 to 8 seconds (Platz and Frost 1984). Proximate cues that stimulate mating in R. yavapaiensis are not well studied, although rainfall and water temperature have been mentioned as cues for other leopard frog species in the Southwest. Egg masses have been observed from January through late April and October (Ruibal 1959; Collins and Lewis 1979; Frost and Platz 1983). Females deposit spherical masses attached to submerged vegetation, bedrock, or gravel. Eggs usually are deposited near the surface of the water (Sartorius and Rosen, 2000; Sredl, as cited in Lannoo 2005). Clutch size has not been studied in R. yavapaiensis. Egg masses have been observed to hatch in the wild in 15-18 days (Sartorius and Rosen, 2000; Sredl, as cited in Lannoo 2005). Egg masses are found in

January to late April and October (AGFD 2001). Larvae metamorphose in as little as 3 to 4 months or as long as 9 months and can overwinter (Collins and Lewis 1979; Sredl unpublished data); size at metamorphosis ranges from 25-29 mm SUL (Platz 1988 Sredl, as cited in Lannoo 2005).

Diet

Adults eat arthropods, other invertebrates, and fish; tadpoles are herbivorous (e.g., algae, organic debris, plant tissue, minute organisms) (AGFD 2001).

Migration

Breeding migrations have not been noted in R. yavapaiensis as have been described for some amphibians.

2.2.1.6 Threats Warranting Protection

Habitat alteration, fragmentation and introduced species are threats to populations of lowland leopard frog.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

The greatest threats to this species are habitat alteration and fragmentation (NatureServe 2006). Habitat alteration is the result of agricultural practices, livestock grazing, development, and reservoir construction. Damming, draining, and the diversion of water have fragmented formerly contiguous aquatic habitats (NatureServe 2006, AGFD 2006c). Habitat fragmentation and water manipulation can lead to local extirpation by disrupting the metapopulation dynamics of lowland leopard frogs in arid landscapes (AGFD 2006c). Trail development; urban and rural development; and livestock grazing and agricultural expansion have further degraded, fragmented, or destroyed habitat (AGFD 2006).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species (NatureServe 2006).

Disease or Predation

A chytrid fungus has infected populations of R. yavapaiensis as well as six other ranid frogs and two other amphibians causing mass die-offs and local extirpations (AGFD 2006c, NatureServe 2006). Introduced crayfish, predatory fish and bullfrogs have impacted populations as well.

The Inadequacy of Existing Regulatory Mechanisms

Other than being a species of concern in Arizona, this species receives little state or federal protection. In Arizona, Rana yavapaiensis is a closed season species. Collections of this species are illegal statewide without a scientific collecting or similar permit (AGFD 2006b).

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Populations are vulnerable to large-scale mortality on a frequent basis due to drought and sulphur toxicity (NatureServe 2006, AGFD 2006b).

2.2.1.7 Conservation

There are few known conservation measures are proposed that are meant to directly protect lowland leopard frogs. They may benefit from land acquisitions that protect habitat from development or other restoration projects. This species occurs in and is being managed for on several state and federally managed lands in Arizona (IUCN et al 2006).

Recovery Units

There are no recovery units proposed for the lowland leopard frog, it is not a federally listed species.

Critical Habitat

No critical habitat has been designated for the lowland leopard frog, it is not a federally listed species.

2.2.1.8 Species Status

Rangewide

Populations of lowland leopard frog are declining throughout its range with the exception of central Arizona (NatureServe 2007).

Lower Virgin River Watershed

It is unknown if surveys have been conducted, and its distribution is unknown within the Lower Virgin River watershed. Seven occurrences within the Lower Virgin River watershed are recorded in the NNHP, UDWR, and AGFD databases (NNHP, UDWR, and AGFD 2007 occurrence datasets).

Drought, non-native fishes, crayfishes, and frogs occur in the Lower Virgin River watershed, and chytrid fungus may potentially occur here as well.

2.3 RELICT LEOPARD FROG

Scientific Name: *Rana onca*

2.3.1 Protection Warranted

2.3.1.1 Endangered Species Act

June 13, 2002: Listing as Federal Candidate Species (67 FR 40657-40679). This listing has been continued to present time (69 FR 24875-24904, 70 FR 24869-24934, 71 FR 53755-53835).

Nevada Administrative Code

- Classified as Protected under NAC 503.075 (Amphibians: Classification).

Other Protections

- This species is considered Sensitive by the USDA Forest Service and The Nevada Natural Heritage Program (NNHP) ranks the relict leopard frog as critically imperiled.

2.3.1.2 General Description

The adult relict leopard frog is a small spotted frog with a body length of 1.75 to 3.5 inches (Stebbins 2003). The dorsal coloration is brown, gray or greenish with distinct greenish-brown spots. These spots occur on the back and thighs and become reduced or obscure anteriorly with no spots usually present on the nose (Stebbins 2003). The dorsolateral folds, characteristic of members of the genus Rana, become indistinct well before the groin. The relict leopard frog is whitish ventrally with dark mottling on the throat and yellow or yellow-orange under the legs and groin. Males tend to be more uniform in color and less spotted than females, have a darkened, enlarged thumb base and tend to be slightly smaller than females (Jennings 1988).

Relict leopard frog larvae are moderately sized (3.3 inches in total length), have a dull citrine or greenish olive dorsum, are heavily mottled, and have an elongate, pale green-yellow tail with a rounded tip. Larvae are ventrally semitransparent (Wright and Wright 1949; Jennings 1988).

The relict leopard frog is a member of the Ranid or true frog genus and based on a number of gross morphological characteristics, R. onca is considered part of the Rana pipiens complex (leopard frogs). This is a grouping of more than 25 species in North and Central America (Hillis 1988; Relict Leopard Frog Working Group [RLFWG] 2001). While there is some debate as to whether the relict leopard frog is the same species as the extinct Las Vegas Valley Leopard Frog (Rana fisheri), Jennings et al. (1995) concluded that the relict leopard frog is not synonymous with R. fisheri, and should be considered a separate and distinct species.

2.3.1.3 Ecology

The known historical distribution of relict leopard frog was springs, streams and wetlands within the Virgin River drainage in Utah, Arizona, and Nevada, downstream from Hurricane, Utah, and along the Muddy River drainage, Nevada (Platz 1984). It also occurred along the Colorado River from its confluence with the Virgin River downstream to Black Canyon below Lake Mead in Nevada and Arizona (RLFWG 2001).

Relict leopard frog was thought to be extinct since the 1950’s; however, it was re-discovered in 1991 (Bradford and Jennings 1997). The relict leopard frog was confirmed to occupy eight sites within its historic range following its rediscovery. Populations at two of these sites have subsequently been extirpated (Center for Biological Diversity [CBD] and Southern Utah Wilderness Alliance [SUWA] 2002). Currently, the relict leopard frog is extant at six sites in two general areas, both occur within the Lake Mead National Recreation Area; one near the Overton Arm area of Lake Mead and the other in Black Canyon (CBD and SUWA 2002). These areas represent less than 10 km of linear habitat, less than 1 percent of their original distribution (CBD and SUWA 2002).

Habitat

Relict leopard frog habitat includes permanent small streams, springs, and spring-fed wetlands below 760 m (Jennings 1988). Historically, relict leopard frogs were limited to habitats characterized by deep and shallow aquatic habitats with clean, clear water. The relict leopard frog prefers areas with submerged, emergent and perimeter vegetation to forage and for refuge (RLFWG 2001). Such vegetation includes bulrush, cattail, spikerush and small tules and is likely required as cover and as a substrate for oviposition (Jennings and Hayes 1994). Current observations suggest that adults prefer moderately vegetated shorelines. Remnant populations of relict leopard frog are confined to perennial desert springs along the Virgin and Colorado rivers (CBD and SUWA 2002). Water sources for all six sites with extant populations of frogs are geothermally influenced and subsequently water temperatures remain between 16 C and 55 C (Pohlmann et al. 1998). The remaining habitats seem to reflect a preference for minimally disturbed sites implying that spring-influenced habitats may be critical for key life history traits of relict leopard frog (Jennings pers. comm. 2002 as cited in CBD and SUWA 2002).

The three areas recently inhabited by the relict leopard frog differ greatly. Littlefield is a small, marshy wetland fed by a spring near the shore of the Virgin River (CBD and SUWA 2002). These frogs are now extirpated. The Overton Arm sites of Lake Mead are fast moving springs formed by geothermal upwelling (CBD and SUWA 2002). Black Canyon habitats are geothermal springs that flow over rocky substrate with mesquite and tamarisk vegetation cover (CBD and SUWA 2002).

2.3.1.4 Life History

Reproductive Biology

Male relict leopard frogs appear to reach sexual maturity within the first year (42 mm SVL) (D. Bradford unpublished data as cited in RLFWG 2001). The age at which females become sexually mature is unknown, but mark recapture studies suggest high turnover within a population and survivorship averaging 27 percent per year (D. Bradford unpublished data as cited in RLFWG 2001).

The relict leopard frog breeds in late January through April, with peak oviposition occurring in February and March. Water temperature does not appear to influence the breeding season as it differs among sites with extant frogs. Favored breeding habitat seems to be quiet, shallow pools outside the channel or in slow moving microhabitats within a stream (Bradford et al. 2001). Eggs discovered are deposited in clusters 4 to 6 cm in diameter and contain upwards of 250 eggs. Egg clusters are attached to vegetation within a few centimeters of the water surface. Sites with moderate cover are preferred.

While the exact duration between oviposition and hatch are unknown, anecdotal field observations suggest approximately one week is needed. Additional anecdotal evidence suggests that several months are needed to attain metamorphosis (Bradford et al. 2001). In a laboratory setting, relict leopard frog larvae exposed to natural photoperiods and abundant food metamorphose 6.5 months after hatch. Hatchling larvae are usually found in motionless congregations in shallow, open pool margins for up to one week after hatching. Larvae are active diurnally and evidence of flocking has not been found.

Behavior

Relict leopard frogs are observed most often sitting motionless in shallow water along channel edges. Individuals are generally spaced one to two meters apart with frogs occurring at higher densities at favorite sites (RLFWG 2001).

Relict leopard frogs are active year-round, although they likely hibernated at the higher elevations (above 600 m) within their historic range. Within the current range, the relict leopard frog display no evidence of torpor or hibernation during cold weather, although adult frogs are more difficult to find during cold periods, even in geothermal springs (Bradford et al. 2001).

Activity levels appear to differ seasonally. Frogs tend to be more nocturnal in the summer months transitioning to a diurnal activity pattern in the winter (RLFWG 2001). There is no evidence of aestivation during summer or dry periods as the relict leopard frog is found only around permanent wet areas.

Diet

While no dietary studies of the relict leopard frog have been conducted, presumably their diet is similar to that of other ranid frog species. Ranid species eat small invertebrates such as spiders, crustaceans, many varieties of insects, and small vertebrates as well (AGFD 1997). Ranid larvae consume plant materials such as algae, detritus, plant tissue and potentially small invertebrates (AGFD 1997).

Migration

Relict leopard frog appears to be a relatively stationary frog that moves only short distances. A 3-year mark-recapture study recorded the mean distance moved by adult frogs to be only 18 meters. The longest distance recorded was 120 meters (Bradford unpublished data, as cited in RLFWG 2001). Another study conducted by Jennings et al. (1995) recorded the longest movement at 200 meters. Furthermore, studies have shown no evidence of seasonal migration or hibernation (Bradford et al. 2001). Due to the fragmentation of extant sites and the lack of protective vegetation or wet periods to serve as migration corridors, remaining populations are effectively allopatrically isolated (Jennings pers. comm. 2002 as cited in CBD and SUWA 2002).

Predator Avoidance

Adult relict leopard frogs flee by jumping into deep water or into a cluster of thick vegetation when disturbed. In diurnal conditions, frogs are flighty, usually jumping prior to being spotted, however at night, frogs will remain motionless unless threatened. Frogs will generally reemerge in 10 to 15 minutes (RLFWG 2001).

Larvae appear to randomly flee when disturbed. Displaced individuals tend to seek cover among vegetation and in loose mud, often burying themselves, or under rocks or ledges depending on substrate availability.

2.3.1.5 Threats

Threats to the relict leopard frog include alterations to habitat, disease, predation, illegal collection, grazing, habitat fragmentation, and low genetic diversity. A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Water development within the historic range of relict leopard frog, including the impoundment of water, loss of the natural flow regime, the damming of the Colorado River and subsequent inundation of suitable habitat, are all likely factors that caused and continue to endanger remaining populations (CBD and SUWA 2002).

Relict leopard frog is extremely susceptible to the lowering of the water table via diversions and ground water pumping (AGFD 1996, 1998). Due to this species reliance on spring water, such a lowering of the water table could result in the drying of the spring-influenced wetlands they inhabit. The extinction trajectory throughout the frogs' historic range occurred concurrently with the alteration of aquatic habitat due to marsh draining and water development for agriculture and urban development (Jennings 1988, Jennings and Hayes 1994). Clark County currently has an 8 percent annual growth rate (Clark County 2000), not atypical of other counties in the region. Continued use of diminishing water resources and additional demand due to expanding urban centers could foreseeably cause such a scenario (CBD and SUWA 2002).

Cattle and feral burro impacts may be a significant cause of decline throughout the relict leopard frog's historic range. Physical destruction of habitat such as erosion from trampling may cause severe enough water quality impacts to cause decline in herpetofauna (Jones 1979, Jennings and Hayes 1994), and the exclusion of cattle has seen the reestablishment of other periled ranid frogs in California (Dunne 1995). Grazing animals may also serve as a vector for disease and fungal infection and cause direct mortality and loss of recruitment by trampling adult frogs and egg masses (USFWS 2000b).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

The relict leopard frog populations are so small that any collection or utilization for commercial, recreational, scientific or educational purposes may prove significant (CBD and SUWA 2002). However, if scientific collections of eggs and small larvae for research and laboratory experiments are coordinated, it is not likely to pose a significant threat as this age class has high mortality under natural conditions (99% mortality) (Romin, pers. comm. as cited in CBD and SUWA 2002).

Disease or Predation

Disease and fungal infections may serve as a significant cause of mortality. A bacterial infection caused by Aeromanas hydrophila killed a large portion of a lowland leopard frog (R. yavapaensis) population in Arizona in 1992. This particular infection may be triggered by stress (Sredl 1997).

Chytrid fungus (Batrachochytrium dendrobatidis) was identified in numerous Arizona amphibians in 1998 including several species of leopard frogs (Sredl et al. 2000, Bradley et al. 2002). Chytrid is highly virulent attacking the keratin in the skin and mouthparts of frogs, eventually killing them. Infections have been recorded and correlated with major die-offs and population declines in the lowland leopard frog and Chiricahua leopard frog (R. chiricahuensis). It does not appear that Chytrid has yet infected extant relict leopard frog populations (Romin, pers. comm. as cited in CBD and SUWA 2002).

Introduced exotic species exist that predate upon and/or compete with native ranid frogs and which have become established and widely distributed along the Virgin, Muddy and Colorado rivers (CBD and SUWA 2002). These species include bullfrogs (R. catesbeiana) and predatory fishes such as bass (Micropterus spp.), sunfish (Lepomis spp.) and catfish. Red Swamp Crayfish (Procambarus clarkii) and western spiny soft-shell turtles (Trionyx spiniferus emeryi) are also present (Jennings and Hayes 1994, RLFWG 2001). These introduced species are suspected to have contributed to population declines of the relict leopard frog along with other amphibian species (Corn 1994, Jennings and Hayes 1994). These species may all exert a strong negative influence on frog populations through predation at all life history stages (CBD and SUWA 2002).

While the relict leopard frog currently has no federal protection against take under the ESA, all remaining extant populations occur within the Lake Mead National Recreation Area managed by the NPS. This affords certain blanket protections against possessing, destroying, injuring, defacing, removing, or disturbing wildlife. Additionally, NPS has regulations against introducing non-native predators into a National Park.

Inadequate Regulatory Mechanisms

Arizona, Nevada, and Utah all limit the collection, study, or use of relict leopard frogs to those with a scientific collecting permit, and each state has regulations limiting or prohibiting the anthropogenic dispersal of threats, such as non-native organisms, to the frog (Relict Leopard Frog Conservation Team 2005). However, these regulations have not completely prevented illegal non-native species introductions at some locations, such as various species of fishes at Rogers and Blue Point springs (Relict Leopard Frog Conservation Team 2005). Relict leopard frogs and their habitat are protected by federal regulations (Relict Leopard Frog Conservation Team 2005).

Other Natural or Manmade Factors Affecting the Species Continued Existence

Due to the low population numbers and the severe fragmentation of the relict leopard frog habitat, low genetic variation may threaten remaining frog populations (CBD and SUWA 2002). Invasive plant species such as tamarisk, with high evapo-transpiration rates, may further lower groundwater and may cause higher salinity levels within relict leopard frog habitat.

2.3.1.6 Conservation

The Relict Leopard Frog Conservation Team (2005) prepared a Conservation Agreement and Rangewide Conservation Assessment and Strategy for the relict leopard frog. Signatories to this agreement include federal and state agencies, local interests, academia and non governmental organizations. The primary purpose of the Conservation Agreement is to expedite implementation of conservation measures for relict leopard frog in Clark County, Nevada and Mohave County, Arizona. Immediate conservation actions are needed to reduce threats to relict leopard frog, increase both the size and number of populations, and maintain associated riparian and wetland habitats (Relict Leopard Frog Conservation Team 2005). Some examples of conservation actions needed to address threats include: protect and enhance occupied and nearby habitats; prevent illegal collection or use of relict leopard frogs; selectively control detrimental non-native aquatic species; identify and control the spread of disease; prevent detrimental modifications and degradation of relict leopard frog habitat; and develop distribution and life history information; establish populations in new areas to alleviate small population size, limited habitat, and fragmentation of populations (Relict Leopard Frog Conservation Team 2005).

2.3.1.7 Recovery Units

The relict leopard frog is not yet listed under the ESA, nor has a recovery plan been developed. Therefore, there are no designated recovery units for the relict leopard frog.

2.3.1.8 Critical Habitat

The relict leopard frog is not yet listed under the ESA. Therefore, there is no designated critical habitat for the relict leopard frog.

2.3.1.9 Species Status

Rangewide

The relict leopard frog was historically found in the Muddy and Virgin River drainages. The current distribution is reduced to six populations in two areas of the Lake Mead National Recreation Area: Overton Arm area of Lake Mead and Black Canyon below Lake Mead. Both areas represent historical localities, with specimen records dating from 1936 at the Overton Arm area and from 1955 at Black Canyon (USFWS 2004b). These two areas comprise only a fraction of the historical distribution of the species, encompassing maximum linear extents of only 3.6 and 5.1 km (2.2 and 3.2 mi), respectively (USFWS 2004b). USFWS (2004b) believes that within the Overton Arm area, dispersal of relict leopard frogs may be possible between Blue Point and Rogers springs, which are separated by a minimum of 1.6 km (1 mi). Two relict leopard frogs have been observed by NPS staff at a small spring located between Rogers and Blue Point Springs (R. Haley, pers. comm. 2004 as cited in USFWS 2004b).

Populations at two additional localities have recently been extirpated (Littlefield, Arizona, and Corral Spring, Nevada). In addition, three individual leopard frogs have been observed on different occasions in 2000, 2001, and 2002 at the Willow Beach National Fish Hatchery at Willow Beach, Arizona, located 10 km downstream from Bighorn Sheep Spring in Black Canyon (C. Fiegel pers. comm., as cited in Relict Leopard Frog Conservation Team 2005). One of these was collected and confirmed as the relict leopard frog based on mtDNA sequence similarity (J. Jaeger unpublished data, as cited in Relict Leopard Frog Conservation Team 2005), and another possessed a mark used in recent sampling of upstream populations. A population of leopard frogs of undetermined identity has been found in Surprise Canyon, a tributary to the Colorado River in the lower Grand Canyon. In 1987, Barry Adams, an associate of Lawrence Stevens (ecological consultant, Flagstaff), took a photograph of a leopard frog in Surprise Canyon. The frog was not collected. In 1997, Michael Douglas (Colorado State University, Fort Collins) found a dead, badly degraded leopard frog (Relict Leopard Frog Conservation Team 2005). In 2004, surveys within Surprise Canyon documented a large population of these frogs. Analysis of mtDNA samples indicate that these frogs are most closely related to lowland leopard frogs (J. Jaeger pers. comm., as cited in Relict Leopard Frog Conservation Team 2005).

An extant population of leopard frogs at Wahweap Creek near Big Water, Utah, and Page, Arizona is morphologically similar to the relict leopard frog and the lowland leopard frog. The taxonomy of these frogs also needs resolution, although these frogs were not similar to any known southwestern leopard frog based on mtDNA analysis (Rorabaugh et al. 2002, as cited in Relict Leopard Frog Conservation Team 2005).

POPULATION ESTIMATES

The Relict Leopard Frog Conservation Team (2005) summarized the following population estimates. Visual encounter surveys (VES) have been conducted multiple times at all sites, and mark-recapture studies have been conducted at two sites (Bradford et al. 2004, S. Romin pers. comm., as cited in Relict Leopard Frog Conservation Team 2005). At the upper 555 m segment of Blue Point Spring, 96 adult frogs ($\geq$ 42 mm SUL) were captured and marked during 13 visits over the 2-year period, 1995-1996. The estimated number of frogs averaged 36 (95% confidence limits, 27 to 45), and estimated annual survivorship averaged 0.27. Visual encounter surveys between 1991 and 2001 at this site showed considerable variation in numbers encountered (4 to 32 frogs over a 385 m reach; n = 23 visits). There was no consistent pattern of increase or decrease in numbers detected over this time period, although the data suggested an increase rather than a decrease. At Bighorn Sheep Spring in Black Canyon, which extends approximately 450 m in length, a single mark-recapture effort (60 initially marked adults) in March to April 2001 yielded an estimate of 637 adults (95% confodemce limits, 381 to 1210). VESs on 3 to 4 visits during 1997 to 2001 at the sites in Black Canyon yielded average counts of 110, 5, and 13 at Bighorn Sheep Spring, Salt Cedar, and Boy Scout springs, respectively.

To obtain a rough estimate of the total number of relict leopard frog adults, mark-recapture estimates of population size, VES counts, and estimates for extent of available habitat are combined (Bradford et al. 2004). At the Northshore sites, the estimated total linear extent of aquatic habitat is 5.1 km, based on ground measurements, aerial photographs, and USGS digital orthophotoquads. Assuming a frog density similar to that observed in the upper segment of Blue Point Spring in 1995 to 1996 (i.e. mean of 35.9 adults/555 m), the estimated total number of frogs in the Northshore Arm Area is 330 adults. This is likely an overestimate, because the density of frogs encountered in most of the aquatic habitat in this area is conspicuously lower than the density seen at the upper Blue Point Spring Area. In Black Canyon, the population estimate at Bighorn Sheep Spring was 637 adults for a time when 104 frogs were counted in the VES, a factor of 6.1. Applying this factor to the average VES counts at the other 2 sites in Black Canyon (mean counts of 5 and 13), an estimate of 750 frogs is obtained for the total adult population size in Black Canyon, 85 percent of which are at Bighorn Sheep Spring. This yields approximately 1,100 adult frogs as the rough estimate for the total population of adult relict leopard frogs, more than half of which occur at one site. These estimates should be interpreted with caution as numbers of relict leopard frogs in a population are expected to vary considerably within and among years (Sredl et al. 1997, Skelly et al. 1999, Sartorius and Rosen 2000).

RECENT POPULATION EXTIRPATIONS

The Relict Leopard Frog Conservation Team (2005) also summarized information for recent population extirpations. At Corral Spring, frogs were counted and marked during 16 visits between November 1991 and December 1994 (Bradford et al. 2004). The maximum number of frogs observed of all sizes was 40, but the population became extirpated by early 1995. Between 1991 and 1995, the change in habitat was conspicuous at Corral Springs. The pools that were initially largely open with scattered emergent vegetation became choked with emergent vegetation, primarily Scirpus spp. By early summer of 1994, most of these pools had virtually no open water. This extirpation may have been a natural process, because individuals may periodically colonize this site from Rogers Spring during wet periods after the site is scoured by flood waters, and populations may subsequently be extirpated due to shrinkage of aquatic habitat and vegetation encroachment as drier conditions prevail.

The surveys were initiated in late 1991, a year with high-precipitation storms associated with an El Niño/Southern Oscillation event that scoured vegetation at Corral Spring (R. Jennings pers. comm., as cited in Relict Leopard Frog Conservation Team 2005). Moreover, aquatic habitats were more extensive along the creek below Rogers Spring than in subsequent years. During such wet times, frogs possibly could colonize Corral Spring from Rogers Spring by traveling 3.0 km along a drainage channel that currently contains desert wash habitat, or by traveling 1.6 km straight-line distance. Similar dispersal distances have been reported for other ranid species in the Southwest, albeit in more mesic environments (Marsh and Trenham 2001). For example, Frost and Bagnara (1977) noted movement of plains leopard frogs (R. blairi) for 8 km or more along a creek in the Chiricahua Mountains. Rosen and Schwalbe (1998) found up to 25 young adult and subadult Chiricahua leopard frogs (R. chiricahuensis) at a roadside puddle in the San Bernardino Valley, Arizona. They believed that the only possible origin of these frogs was a stock tank located 5.5 km away.

Whether the relict leopard frog persisted at Corral Spring between 1957 (when several specimens were collected) and 1991 is not known. The demise of the relict leopard frog at Corral Spring may have been influenced by the construction of a fence in 1991 to exclude feral burros (Equus asinus) from most of the site. Prior to the fence, burros may have kept emergent vegetation from completely covering pools.

At the Littlefield site, frogs were observed during the daytime in 1992 and 1996, and six were counted at night in both April and July 1998. None of the frogs captured in July were those marked in April. No frogs were found during three nighttime surveys between March and May 2001 (Bradford et al. 2004). Bullfrogs were observed in an artificial pond at the site in 1992 and 2001, whereas relict leopard frogs were observed only within open marshy habitat near one spring source. As at Corral Spring, the demise of the relict leopard frog population occurred concomitantly with loss of pool habitat due to rapid encroachment of emergent vegetation. Between 1992 and 2001, vegetation cover (primarily Scirpus spp.) had increased dramatically such that no pools of open water remained exposed except for the artificial pond. Until some years ago, vegetation within the marsh was kept open by livestock grazing. Subsequently, with the absence of grazing, emergent vegetation grew over virtually all the former open water at the site (Bradford et al. 2004). Introduced bullfrogs have also become established in wetlands along this portion of the Virgin River (BIO-WEST, Inc. 2001).

Lower Virgin River Watershed

The Lower Virgin River watershed includes the Littlefield extinction site and a portion of the Lake Mead NRA near the Overton Arm, which are described in the Rangewide Status section above. Seven occurrences have been recorded in the NNHP, UDWR, and AGFD species databases (NNHP, UDWR, and AGFD 2007 occurrence datasets).

2.4 WESTERN TOAD

Scientific Name: *Bufo boreas*

2.4.1 Protection Warranted

2.4.1.1 Endangered Species Act

- The western toad is not a federally listed species.

Other Protections

- Listed as a wildlife species of concern by the State of Utah (UDWR 2006).

2.4.1.2 General Description

White or cream-colored dorsal stripe and lack of cranial crests will identify western toads. The well-separated parotid glands are oval and slightly larger than the upper eyelids. Well developed tarsal fold. Dusky, gray, or greenish above, with wars set in dark blotches and often tinged with rust (Stebbins 1985).

Terrestrial individuals are primarily nocturnal. When weather becomes extremely hot, dry or cold western toads become inactive (Zeiner 1988).

Territorial males make short twittering calls when other males are seen approaching (Zeiner 1988).

2.4.1.3 Distribution

Historic Distribution

Western toads have not been extirpated from significant areas of their current range (NatureServe 2007).

Current Distribution

This species occurs along the Pacific Coast of North America from southern Alaska to Baja California, and ranges eastward to the Rocky Mountains in west-central Alberta, Montana, Wyoming, Utah, Colorado, and (formerly) northern New Mexico. It is absent from most of the desert south-west. Its elevational range extends from sea level to at least 3,640 meters (NatureServe 2006).

2.4.1.4 Habitat

This species is found in a wide variety of habitats including desert springs and streams, meadows and woodlands and mountain wetlands. It is also known from around ponds, lakes, reservoirs, and slow-moving rivers and streams. It digs its own burrow in loose soil or uses those of small mammals, or shelters under logs or rocks. The eggs and larvae develop in shallow areas of ponds, lakes, or reservoirs, or in pools of slow-moving streams (NatureServe 2006). Adults are highly terrestrial and may live considerable distances from water (Zeiner 1988),

2.4.1.5 Life History

Reproductive Biology

The breeding period of western toad is variable on location and climatic conditions (NatureServe 2007). In California, the breeding season extends from January to July. Females lay stringy egg masses in two strands that are tangled with submerged vegetation and other debris at the bottom of breeding areas. Breeding and egg-laying normally occur in quiet waters less than 12 in deep. Almost any source of standing water, both of natural and manmade origins, can be used used for reproduction. Tadpoles metamorphose in summer and fall (Zeiner 1988). Adult females may skip one or more year between successive breeding events (NatureServe 2007).

Diet

Adults will feed on arthropods, earthworms, snails and slugs. Tadpoles filter plant materials and planktonic organisms suspended in the water column or feed on bottom detritus (Zeiner 1988)

Migration

In some areas, pronounced movements to areas with hibernacula occur, especially where there are severe winters. They have been known to travel up to 900 m to hibernacula. In milder climates, seasonal movements are not extensive except to and from breeding sites. (Zeiner 1988). However, movements across upland habitats up to 5 km have been recorded (NatureServe 2007).

2.4.1.6 Threats Warranting Protection

Increasing levels of ultraviolet radiation, acidification of water, disease, chytrid fungus and other fungi, trematode infections, habitat loss and degradation, and competing with and being preyed upon nonnative species (NatureServe 2007). These are outlined in detail below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Declines in western toad populations may be related to habitat destruction and degredation and water retention projects, but these factors have not been adequately addressed (NatureServe 2007).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species (NatureServe 2006).

Disease or Predation

Tadpoles are fed upon by birds, garter snakes and predatory aquatic invertebrates (Zeiner 1988). Persistent predation on adult toads by common ravens (Corvis corax) seems to have significantly impacted populations in Oregonm and possibly significant predation by birds has been observed in Colorado and Idaho (NatureServe 2007).

The Inadequacy of Existing Regulatory Mechanisms

Although found in many national and state parks, wildlife refuges, wilderness areas and other protected lands, western toads are vulnerable to acidification of water, ozone depletion, disease and other threats (NatureServe 2007). Since the western toad has no federal protection, smaller isolated populations are prone to being extirpated.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Ozone depletion and the associated increased levels of ultraviolet light have been thought to negatively affect western toad eggs, as they are sensitive to ultraviolet radiation. Livestock have been observed trampling large numbers of toadlets (NatureServe 2007), and altering habitats by grazing or other agricultural practices may negatively impact the species.

It has been hypothesized that immunosuppression, caused by one or more environmental factors that stress toads, coupled with cold body temperatures lower the toad's body ability to fight disease. This may lead to infection by Aeromonas hydrophila bacteria (also known as "red-leg") or other infectious agents that may lead to the death of individuals and possibly the extirpation of whole populations. Western toad die-offs have been caused by chytrid fungus (Batrachochytrium dendrobatidis) infections in the Southern Rockies. The pathogenic fungus Saprolegnia ferax, introduced by fish-stocking, causes mortality in toad eggs. Limb mutations, which may increase mortality in larval and metamorphosing individuals have been linked with trematode infections by Ribeiroia ondatrae (NatureServe 2007).

2.4.1.7 Conservation

There are no known conservation measures are proposed that are meant to directly protect western toads. They may benefit from land acquisitions that protect habitat from development or other restoration projects.

Recovery Units

No recovery plan has been designated for the western toad; it is not a federally listed species.

Critical Habitat

No critical habitat has been designated for the western toad; it is not a federally listed species.

2.4.1.8 Species Status

Rangewide

Western toad is common throughout much of its range. However, rapid declines in many populations of western toad across its range for unknown reasons, even in quality habitat, are a cause of concern. These declining populations include those in the Yosemite area of the Sierra Nevada in California and Rocky Mountain populations in Colorado, Wyoming (NatureServe 2007).

Lower Virgin River Watershed

The status of western toad within the watershed is unknown. No occurrences have been recorded in the NNHP, UDWR, or AGFD databases (NNHP, UDWR, and AGFD 2007). Chytrid fungus potentially could occur in the Lower Virgin River watershed. Bullfrogs are known to occur in area.

2.5 COMMON BLACK-HAWK

Scientific Name: *Buteogallus anthracinus*

2.5.1 Protection Warranted

2.5.1.1 Endangered Species Act

- This species is not currently listed or proposed as threatened or endangered under the ESA.

Other Protections

- Listed as a wildlife species of special concern by the State of Arizona (AGFD 2006).

2.5.1.2 General Description

The common black-hawk is a member of the Accipitridae family. Members of this family include the majority of all diurnal birds of prey, and live in a variety of habitats throughout North America.

The common black-hawk is about 17 to 22 inches (43 to 56 cm) long and weigh from 28 to 42 ounces (790 to 1200 grams). They are black with a “grayish bloom,” and a broad white median band in the tail (Schnell 1994). Females are larger than males, but the difference is not easily noticeable. Juveniles are brown and buff, have strong face patterns, and alternating dark and light tail pattern (Schnell 1994)

2.5.1.3 Distribution

Historic Distribution

Information is not available to determine the historic range of this species. Loss of riparian habitat and impacts from DDT have caused local declines in breeding population size (Schnell 1994).

Current Distribution

The range of the common black-hawk includes from south-western Nevada and south-eastern Utah, through parts of Arizona, New Mexico, Texas, and Central America, to northern South America.

2.5.1.4 Habitat

Within the U.S., the common black-hawk is an obligate riparian nester, and prefers mature trees in groves associated with perennial water (Schnell 1994). It is associated with lowland forests, swamps, and mangroves and forages in tidal flats or open woodland (NatureServe 2007).

2.5.1.5 Life History

Reproductive Biology

Migratory common black-hawks arrive at their breeding grounds from early March through April, and depart from the breeding grounds in mid-October (Schnell 1994).

Pair formation includes aerial displays and courtship feeding. In Aravaipa Canyon, AZ, aerial breeding displays begin immediately after arrival at the breeding grounds (early March), and nest building begins in late March.

Nests are often built on top of old nests, and are usually in a mature tree in a grove of trees, associated with perennial water. Both male and female participate in nest-building. Nests are constructed of leaved twigs, and can be constructed in a variety of tree species including cottonwood, sycamore, willow, pine, and walnut.

In Arizona, most eggs are laid between mid-April to past mid-June. Eggs are incubated by both sexes; clutch sizes are from 1-2 eggs, and are laid at 2 day intervals. Incubation is performed by both sexes, and hatching interval is the same as the laying interval (NatureServe 2007; Schnell 1994). Eggs hatch after an average of 38 days (Schnell, J. H. 1994), and young are tended by both parents (NatureServe 2007); the female broods the young and distributes food delivered by the male (Schnell 1994).

Young fledge after approximately 46 days, and are self-sufficient about 2 months after fledging.

Diet

The common black-hawk hunts from a perch, dropping onto prey, or occasionally wades in pools to move prey into shallows. This species has a broad diet, and eats fish, frogs, crustaceans, non-venomous snakes, and lizards. The male often removes flight feathers and fins before delivering prey to the nest. This species will cache uneaten prey for later retrieval (Schnell 1994).

Migration

The northern extent of the range of this species is primarily breeding range, and individuals in this area migrate south after the breeding season; southern North America through Southern America is year-round range (Schnell 1994).

2.5.1.6 Threats Warranting Protection

Threats to common-black hawk are primarily habitat loss including loss or alteration of riparian forest and activities that impact water such as damming, diversions, and pumping (Schnell 1994).

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Urban development is increasing in the Lower Virgin River watershed. Drought is also a concern. Overgrazing has the potential to occur in riparian habitats.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Not included in background literature as a threat.

Disease or Predation

Common black-hawks have been preyed upon by golden eagles, although this is rare (Schnell 1994).

The Inadequacy of Existing Regulatory Mechanisms

Not included in background literature as a threat.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Pesticide use may contaminate food base for this species. Contamination of prey species could occur from pesticide use or toxic spills within the Lower Virgin River watershed. Currently, water quality levels for the Lower Virgin River are on the 303(d) list for turbidity, temperature, and boron.

2.5.1.7 Conservation

Conservation and restoration of riparian habitat is critical to maintaining populations of this species. In addition, identification of wintering range is required to aid in the conservation of this species.

Recovery Units

There are no recovery units proposed for the common black-hawk; it is not a federally listed species.

Critical Habitat

No critical habitat has been designated for the common black-hawk; it is not a federally listed species.

2.5.1.8 Species Status

Rangewide

The common black-hawk is considered vulnerable throughout its North American range due to threats to riparian habitat. Breeding habitat is considered critically imperiled or imperiled in Texas, Utah, and New Mexico.

Lower Virgin River Watershed

This species is known from the Virgin River Valley (USFWS 2000, Wauer 1969); two occurrences within the Lower Virgin River watershed are recorded in the NNHP, UDWR, and AGFD species databases (NNHP, UDWR, and AGFD 2007).

2.6 WESTERN YELLOW-BILLED CUCKOO

Scientific Name: *Coccyzus americanus occidentalis*

2.6.1 Protection Warranted

2.6.1.1 Endangered Species Act

- December 30, 1982: Included on the list of category 2 candidates proposed for listing as threatened or endangered under the ESA.

Other Protections

- Listed as endangered by the State of California (DFG 2006).
- Listed as a candidate for state-listing by the State of Washington (Washington Department of Fish and Wildlife 2006).
- Listed as a wildlife species of special concern by the State of Arizona (AGFD 2006).
- Listed as a sensitive species by the State of Utah (UDWR 2006).
- Classified as protected and sensitive under Nevada Administrative Code 503.050 (Protected, Endangered and Sensitive Birds).

2.6.1.2 General Description

The yellow-billed cuckoo is a member of the Cuculidae family. Members of this family have a zygodactyl foot with two toes pointed forwards and two backwards, moderate to heavy bill, and a ring of bare skin around the eye.

The yellow-billed cuckoo is about twelve inches (30 centimeters) long and weigh approximately two ounces (60 grams). They are long slender birds with short dark legs. The plumage is a brownish-gray above and white below, with rufous primaries on the wings. The lower mandible is yellow. The underside of the tail feathers has a bold black and white pattern. Males and females look similar, although males may have a slightly larger bill and more distinct oval markings on the undertail. Juveniles have a fainter tail pattern and may have a dark bill.

The call of the yellow-billed cuckoo is a fast hollow “kuk kuk kuk” that slows and ends with “kukakowlp- kowlp;”

2.6.1.3 Distribution

Historic Distribution

The historic range of the yellow-billed cuckoo includes riparian woodlands California, New Mexico, Arizona, Nevada, Washington, Oregon, British Columbia, Utah, Colorado, Wyoming, Idaho, and Texas. It was believed to be common and widespread in California and Arizona and common in riparian areas of New Mexico. The yellow-billed cuckoo wintered in South America.

Current Distribution

The yellow-billed cuckoo is now considered extirpated from Washington, Oregon, Idaho and British Columbia. However, the cuckoo is reported as a rare vagrant from Washington (SAS 2005) and British Columbia (National Birding Hotline Cooperative 2002), and there are recent reports from certain locations in Idaho (Taylor 2000). The yellow-billed cuckoo breeds California, southern Nevada, Utah, southern Wyoming, and Northern Mexico. The yellow-billed cuckoo is reported sporadically in Nevada and is generally assumed to be a vagrant there. There were consistent sightings reported only on a section of the Carson River between 1986 and 1997 (Nevada Partners in Flight 1999). The yellow-billed cuckoo was reported nesting in Nevada at Beaver Dam Wash in Lincoln County in 1979. In California, surveys conducted throughout the state found a total of 30–33 pairs and 31 unmated males at nine sites (Laymon and Halterman 1989). A study conducted from 1988 to 1990 along the Sacramento River in California found populations fluctuating between 23–35 pairs (Halterman 1991). An Arizona study reported a statewide population estimate of 425 cuckoos (Johnson et al. 1987).

2.6.1.4 Habitat

Breeding habitat includes riparian woodlands dominated by cottonwoods (Populus fremontii) and willows (Salix spp). Patches must be at least 16.8 hectares with a minimum of 3.0 hectares of closed canopy broad leaf forest to provide adequate habitat for the yellow-billed cuckoo (Laymon and Halterman 1987). Optimal patch size is greater than 80 hectares and wider than 580 meters (Laymon and Halterman 1987). Because nests are generally constructed in willows while foraging occurs in the cottonwood canopy, multistory structure is required (Laymon and Halterman 1987). The yellow-billed cuckoo is generally absent from salt cedar- (Tamarisk spp.) dominated areas (Hunter et al. 1987).

Nesting generally occurs in riparian woodlands of deciduous trees with a dense (ungrazed) understory near water (Wiggins 2005). Laymon and Halterman (1989) found that preferred nesting sites in California, excluding Colorado River sites, had at least 15 hectares of deciduous riparian forest, at least three hectares of closed canopy, a canopy height of 5 to 30 meters, and a mean vegetative understory height of one to six meters. There is a positive correlation between riparian patch size and number of cuckoos (Laymon 1998).

2.6.1.5 Life History

Reproductive Biology

The breeding season for the yellow-billed cuckoo is June through August (Nevada Partners in Flight 1999), nesting begins in June and offspring fledge from July through August.

Nests are almost always constructed in willows (Nevada Partners in Flight 1999). Both sexes build the nest, generally about 3–40 feet above the ground and two-thirds of the distance from the trunk on horizontal branches in willow or mesquite thickets. Nests are stick platforms about 6–7 inches in diameter lined with leaves, grass, and catkins (Laymon 1998).

The yellow-billed cuckoo lays between two and five eggs and begins incubating after the first egg is laid, leading to asynchronous hatching. Both sexes incubate the eggs for a period of 9–12 days (Laymon 1998). Nestlings are typically brooded and fed by both parents, although one parent may provide the majority of food (Wiggins 2005). Adults may have a “helper”, usually an unrelated younger male cuckoo that assists with feeding nestlings (Laymon 1998). Young usually fledge at 5–8 days of age, and parents continue to feed fledglings for an unknown period lasting at least two weeks (Laymon 1998, Wiggins 2005). The yellow-billed cuckoo generally only raises one brood each year. However, during years with above-average food supply, up to three broods may be successfully raised (Laymon and Halterman 1989).

Most females appear to breed in their first year, and a few year-old males at the South Fork Kern River have acquired mates and successfully bred. However, most first year males are helpers at other nests and do not breed until their second year. The life expectancy of the yellow-billed cuckoo is unknown (Laymon 1998).

The yellow-billed cuckoo may be both an interspecific and intraspecific brood parasite, although this behavior is more common in Old World cuckoos (Nevada Partners in Flight 1999).

Diet

The primary foraging strategy of the yellow-billed cuckoo is gleaning, although it has been known to sally or drop to the ground while foraging. The yellow-billed cuckoo is an insectivore. The preferred prey items are caterpillars (Lepidoptera larvae), katydids, and grasshoppers (Orthoptera). Green caterpillars (Sphingidae family, spinx moth larvae) are a particularly important food source. Other prey includes cicadas (Homoptera), dragonflies (Odonata), butterflies and moths (Lepidoptera), beetles (Coleoptera), spiders (Araneae), and treefrogs (Anura) (Laymon 1998). Cottonwoods are an important foraging substrate (Laymon and Halterman 1989).

Migration

The yellow-billed cuckoo is a neotropical migrant, wintering in tropical deciduous and evergreen forests of South America, from Colombia and Venezuela south to Argentina (Nevada Partners in Flight 1999). Virtually nothing is known on the status of the cuckoo on their wintering grounds. Birds return to breeding sites in June and depart in late August (Nevada Partners in Flight 1999).

2.6.1.6 Threats Warranting Protection

Declines in yellow-billed cuckoo populations are attributed to habitat loss and fragmentation, and pesticide use (Fleury 1994, Wiggins 2005). A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Predominant causes of riparian habitat losses include conversion to agricultural and other uses, dams and river flow management, stream channelization and stabilization, and livestock grazing. Riparian habitat losses are estimated at 90–95 percent for Arizona, 90 percent for New Mexico, 90–99 percent for California, and more than 70 percent nationwide (Noss et al. 1995; Ohmart 1994, as cited in FWS 2001). Habitat loss has occurred through water management, land use practices, and exotic species invasion. Water management reduces suitable riparian habitat with dams or reservoirs, diversions, or groundwater pumping. These management practices reduce or modify riparian habitat by altering flood duration and frequency, sediment and nutrition deposition, floodplain hydration, inundation period, and seed dispersal of riparian vegetation (Wiggins 2005). Land use practices that reduce suitable habitat for the yellow-billed cuckoo includes channelization and bank stabilization, conversion to agricultural use, pesticide use, and grazing. Channelization and bank stabilization have similar effects as general water management, but may also increase stream velocity and raise streambeds above groundwater levels, preventing adequate water supply to the roots of riparian vegetation (Finch et al 2000). Agricultural clearing of riparian areas results in a direct loss of habitat (FWS 2001). Grazing reduces understory vegetation and slows or completely prevents the recruitment of riparian woody species (Wiggins 2005). The elimination of livestock grazing appears to allow a robust vegetative understory, increasing numbers of the yellow-billed cuckoo at the San Pedro River in Arizona (Kreuper et al 2001). Grazing may also affect habitat if selective grazing of native vegetation promotes the establishment of exotic species (Wiggins 2005). Exotic species can degrade the habitat needed for the yellow-billed cuckoo. Salt cedar (Tamarix spp.) and giant reed (Arundo donax) are exotic species that dominate many riparian woodlands without providing suitable nesting or foraging opportunities for the yellow-billed cuckoo (Laymon 1998).

Fragmentation effects include the loss of patches large enough to sustain local populations, leading to local extinctions, and the potential loss of migratory corridors, affecting the ability to recolonize habitat patches (Hunter 1996, as cited in FWS 2001).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

This threat was not included as a basis for warranting protection under the ESA.

Disease or Predation

Falcons (Falco spp.), hawks, jays, grackles (Quiscalus spp.), and various snake and mammal species are natural predators of the yellow-billed cuckoo. In a nest success study in Arkansas, 91 percent of nest failures (n = 252) were predated, with small mammals, birds and reptiles the largest source of predators (Wilson 1999, as cited in FWS 2001a).

The Inadequacy of Existing Regulatory Mechanisms

As stated in the 12-month finding document (FWS 2001), the Migratory Bird Treaty Act (MBTA) (16 U.S.C. Sec.703–712) is the only current federal protection provided the yellow-billed cuckoo (FWS 2001). However, there are no provisions in the MBTA for preventing habitat disturbance, unless direct mortality or destruction of active nests would occur. The majority of the occupied areas west of the Continental Divide for the yellow-billed cuckoo lie within California, Arizona, and New Mexico (Hughes 1999, as cited in FWS 2001). Only California and Arizona classify the yellow-billed cuckoo as endangered (California Department of Fish and Game [CDFG] 2001 as cited in FWS 2001, AGFD 2002). Utah considers the yellow-billed cuckoo as threatened. In Nevada, the yellow-billed cuckoo is identified as critically imperiled due to extreme rarity, imminent threats, or biological factors, and is proposed for protection as threatened. The California Endangered Species Act (CESA) prohibits unpermitted possession, purchase, sale, or take of listed species. However, the CESA definition of take does not include harm, which under the Act can include destruction of habitat that actually kills or injures wildlife by significantly impairing essential behavioral patterns (50 CFR 17.3). CESA does require consultation between the CDFG and other State agencies to ensure that activities of State agencies will not jeopardize the continued existence of State-listed species (CERES, in litt., 2001, as cited in FWS 2001). The yellow-billed cuckoo has no State status in Oregon because it has not been considered an active breeding species since the 1940s (B. Alterman, pers. comm., 2001, as cited in FWS 2001). In Washington, the yellow-billed cuckoo is considered critically imperiled (five or fewer occurrences). However, no active nesting has been documented since the 1930s.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Pesticide use may affect yellow-billed cuckoo populations (Groschupf 1987; Hughes 1999, as cited in FWS 2001a). Although the evidence is too limited to evaluate this effect, it warrants further study. Where riparian areas border agricultural lands, pesticide use may affect the yellow-billed cuckoo through reducing prey numbers or poisoning nestlings if pesticides are sprayed where birds are nesting (Laymon and Halterman 1987, as cited in FWS 2001). For example, eggshell fragments collected in 1985 from yellow-billed cuckoo nests along the South Fork of the Kern River in California averaged 19 percent thinner than eggshells collected prior to DDT use (Laymon and Halterman 1987, as cited in FWS 2001).

2.6.1.7 Conservation

A number of conservation measures for the yellow-billed cuckoo are being enacted (FWS 2005). In southeastern Arizona, a federal, state and private cooperative effort was able to purchase and protect in perpetuity 2,628 acres of land for numerous threatened species as well as the yellow-billed cuckoo. The land will be managed by the Arizona Game and Fish Department (Arizona Game and Fish Department 2005). In New Mexico, over $787,000 in grants were given to Tribal entities for the monitoring and restoration of riparian habitats and species including both the southwestern willow flycatcher and the yellow-billed cuckoo; and in Nevada $145,500 was given to the Tribes for restoration of approximately 20 miles of the Truckee River as part of the Tribal Landowner Incentives Program and Tribal Wildlife Grant Program (Service 2005c). In California, over $151,000 in Federal grants were given to the State for neotropical bird habitat and overwintering site studies. In Colorado, over $120,000 in federal grants were given to the State for developing conservation plans for neotropical bird species (Service 2005b). Several states have also implemented or are planning exotic plant removal projects and riparian area restoration (e.g. McLaughlin Reserve - California; Virgin River - Utah, Arizona, Nevada; 10-year plan submitted to Governor in 2004 – Colorado).

A recovery plan for wetland and aquatic species in Inyo and Mono counties in California addressed the conservation of the yellow-billed cuckoo (FWS 1998).

Recovery Units

There are no recovery units proposed for the yellow-billed cuckoo, it is not a federally listed species.

Critical Habitat

No critical habitat has been designated for the yellow-billed cuckoo, it is not a federally listed species.

2.6.1.8 Species Status

Rangewide

The yellow-billed cuckoo appears to be on the decline throughout its range. Available data indicate that the yellow-billed cuckoo's range and population size have notably declined across much of the western United States in the past 50 years (FWS 2001). Coarse extrapolations of yellow-billed cuckoo density data, suggest that western populations were once substantially larger than they are today (FWS 1985, as cited in FWS 2001). According to historic descriptive accounts, the yellow-billed cuckoo was widespread and locally common in California and Arizona, locally common in certain river reaches in New Mexico, common in certain locations in Oregon and Washington, local and uncommon along scattered drainages in arid and semiarid lands in western Colorado and Wyoming, Idaho, Nevada, and Utah, as well as probably uncommon and localized in British Columbia. Insufficient survey data do not allow for evaluation of population trends west of the Continental Divide, but data is available for two Service regions that span both sides of the Divide. Breeding Bird Survey (BBS) data indicate declines of 2.7 percent in Region 2 (Arizona, Oklahoma, Texas, and New Mexico; 1980–1996), and 4.7 percent in Region 6 (Kansas, Nebraska, the Dakotas, Montana, Colorado, Utah, and Wyoming; 1980–1996, FWS 2001).

East of the Rocky Mountains in the United States, the yellow-billed cuckoo is uncommon to common as a breeding bird. The species' habitat in this region, riparian and other broad-leaved woodlands (Ehrlich et al. 1988), occupy a significant area of the region (FWS 1981). This is in sharp contrast to the west, where suitable habitat is limited to narrow and often widely separated riparian zones that occupy less than one percent of the western landscape (FWS 1981; Knopf and Samson 1994). Trend data based on detections by the BBS program (BBS 1999) indicate significant population declines between 1966 and 1996 in 12 of 29 eastern and central states; the average annual decline during this period was 1.9 percent. Most of these declines have occurred since 1980. The average number of detections of the yellow-billed cuckoo increased in these 29 States for the interval from 1966 to 1979; however, the average number of detections decreased in all 29 states between 1980 and 1996. In 15 of these states, the decline between 1980 and 1996 is statistically significant. The average annual decline during this period was 2.8 percent. Trends vary widely between states, ranging from a decline of 15.8 percent (Connecticut, 1966–1996) to an increase of 17 percent (Nebraska, 1966–1979). The species breeds locally in Mexico, and is a widespread transient during migration (Howell and Webb 1995). The species has been recorded as a summer resident (presumably breeding) locally within several regions of Mexico, including the state of Baja California Sur, northwest Mexico from Sonora and Chihuahua south to Zacatecas, northeast Mexico on the Atlantic slope from Coahuila to Tamaulipas, and in the northern Yucatan Peninsula (Howell and Webb 1995). The species has been recorded as locally common in the state of Sonora (Russell and Monson 1998), but recent or quantitative information for that area is lacking (L. Hays, Service, pers. comm., 1999), as is data on the status of yellow-billed cuckoo populations in Mexico.

Virgin River Area

Under contract by the Southern Nevada Water Authority, the San Bernardino County Museum has conducted surveys for special status birds, including the yellow-billed cuckoo, in suitable habitat along the Virgin and Muddy rivers since 2000 (Miller et al. 2006). Reports for surveys conducted in 2000 (McKernan and Braden 2001), 2001 (McKernan and Carter 2002), 2002 (Rathbun and Braden 2003), 2003 (Braden et al. 2005a), 2004 (Braden et al. 2005b) and 2005 (Miller et al. 2006) have been completed. Surveys were not conducted for some sites along the Virgin River during 2005 because no suitable habitat was available at those sites due to flood damage and/or flood control measures (Miller et al. 2006). Eleven sites along the Virgin River and five sites along the Muddy River have been included in these surveys. Aside from the Fisherman's Cove and Virgin River Landing sites which were not sampled until 2003, populations along the Virgin River have declined from higher detection numbers in 2000 and/or 2001. No detections have occurred at the Muddy River sites since 2003. However, the yellow-billed cuckoo has an irruptive breeding pattern (inconsistent years and locations for breeding); therefore, interpreting perceived decreases in cuckoo populations is difficult (Miller et al. 2006).

The Nevada Division of Wildlife (NDOW) (2001) conducted surveys in 2000 in southern Nevada and documented 19 yellow-billed cuckoos, comprising 4 pairs and 11 unpaired birds; no nests were found. An estimate by NDOW put the summer population of the yellow-billed cuckoo between 20 and 30 birds state-wide. Suitable habitat for the yellow-billed cuckoo is very limited in Nevada, with most areas of cottonwood riparian forests being fragmented (NDW, in litt., 2001). The decline of the yellow-billed cuckoo in The County, Nevada has been attributed to the reduction or degradation of riparian habitat, river channelization, livestock grazing, use of pesticides, non-native plant encroachment (tamarisk), and brownheaded cowbird parasitism (Clark County 2000).

Lower Virgin River Watershed

Suitable habitat for the yellow-billed cuckoo is present in the riparian area along the length of the Virgin River through the Lower Virgin River watershed and beyond (Figure 3-5). Two of the areas surveyed for the yellow-billed cuckoo by the San Bernardino County Museum (Mesquite Bridge and Mormon Mesa) are located along the Virgin River within the Lower Virgin River watershed (Miller et al. 2006).

MESQUITE, NEVADA

Surveys at the Mesquite Bridge, which crosses the Virgin River near the City, were completed in this area in 2000 (McKernan and Braden 2001), 2001 (McKernan and Carter 2002), 2002 (Rathbun and Braden 2003), 2003 (Braden et al. 2005a), and 2004 (Braden et al. 2005b). In 2005, surveys were not conducted at the Mesquite Bridge due to the lack of suitable habitat, which resulted from flooding in early 2005 and/or flood control measures that removed vegetation from the area (Miller et al. 2006). Habitat at the Mesquite Bridge consists of dense stands of Goodding willow and tamarisk that had developed enough structurally by 1999 or 2000 to be suitable for the yellow-billed cuckoo (McKernan and Braden 2001, McKernan and Carter 2002). Detections have been low at the bridge, with only one individual detected in July 2000 (McKernan and Braden 2001) and one in July 2003 (Braden et al. 2005a). Table 3-5 provides the results of yellow-billed cuckoo surveys at the Mesquite Bridge from 2000 to 2004.

MORMON MESA, NEVADA

In the Mormon Mesa area along the Virgin River there are several areas of suitable habitat, and surveys for the yellow-billed cuckoo were conducted there in 2000 (McKernan and Braden 2001), 2001 (McKernan and Carter 2002), 2002 (Rathbun and Braden 2003), 2003 (Braden et al. 2005a), 2004 (Braden et al. 2005b), and 2005 (Miller et al. 2006). This area consists of a mixture of native (black willow, sandbar willow) and non-native (tamarisk) habitats that are suitable for the yellow-billed cuckoo; however, all detections have been in the non-native habitat (i.e., dense tamarisk) (McKernan and Braden 2001, McKernan and Carter 2002). Table 3-5 provides the results of yellow-billed cuckoo surveys in the Mormon Mesa area from 2000 to 2005.

Table 3-5 Yellow-billed cuckoo survey data for the Mesquite Bridge and Mormon Mesa within the Lower Virgin River watershed from 2000 to 2005

	Mesquite Bridge			Mormon Mesa		
Year	No. of Resident Adults Detected[1]	No. of Successful Nests Detected[1]	No. of Young Detected[1]	No. of Resident Adults Detected	No. of Successful Nests Detected	No. of Young Detected
2000	1[a]	0[a]	0[a]	3–4[a]	0[a]	0[a]
2001	0[b]	0[b]	0[b]	8–12[b]	1[b]	1[b]
2002	0[c]	0[c]	0[c]	0[c]	0[c]	0[c]
2003	1[d]	0[d]	0[d]	0[d]	0[d]	0[d]
2004	0[e]	0[e]	0[e]	0[e]	0[e]	0[e]
2005	NS[f]	NS[f]	NS[f]	0[f]	0[f]	0[f]

Source:
[a]McKernan and Braden 2001
[b]McKernan and Carter 2002
[c]Rathbun and Braden 2003
[d]Braden et al. 2005a
[e]Braden et al. 2005b
[f]Miller et al. 2006

Notes
[1]NS = Site not surveyed because of the lack of suitable habitat

LITTLEFIELD, ARIZONA

At the Littlefield North site, which is located along the Virgin River outside of the Lower Virgin River watershed approximately 20 miles upstream from the City, the San Bernardino County Museum surveyed for the yellow-billed cuckoo in 2000 (McKernan and Braden 2001), 2001 (McKernan and Carter 2002), 2002 (Rathbun and Braden 2003), 2003 (Braden et al. 2005a), 2004 (Braden et al. 2005b), and 2005 (Miller et al. 2006). Habitat at this site is a multi-layered riparian gallery forest consisting of a large Fremont cottonwood grove, with canopy heights over 25 meters, adjacent to even-aged stands of Goodding willow, with canopy heights of 3–7 meters (McKernan and Braden 2001, Rathbun and Braden 2003, Braden et al. 2005b). Two yellow-billed cuckoos were detected from June through August 2000 (McKernan and Braden 2001), and no detections have occurred since (McKernan and Carter 2002, Rathbun and Braden 2003, Braden et al. 2005a, Braden et al. 2005b, Miller et al. 2006).

2.7 YUMA CLAPPER RAIL

Scientific Name: *Rallus longirostris yumanensis*

2.7.1 Protection Warranted

2.7.1.1 Endangered Species Act

- March 11, 1967: Listed as Endangered, without critical habitat under the Endangered Species Preservation Act of 1966 (32 FR 4001); listing carried over to the ESA of 1973
- January 4, 1983: Final Recovery Plan approved (FWS 1983).

Other Protections

- Listed as threatened by the State of Arizona; it is also considered a wildlife species of special concern in Arizona (AGFD 2002).
- Listed as endangered by the State of California in 1971; downlisted to threatened by the State of California in 1978 (DFG 2006).
- Classified as Protected and Endangered under NAC 503.050 (Protected, Endangered and Sensitive Birds).

2.7.1.2 General Description

The Yuma clapper rail is a chicken-shaped bird with a long, down-curved beak. Both sexes are slate brown above, with light cinnamon underparts and barred flanks. This subspecies is slightly lighter in color and slightly thinner than other clapper rails (Banks and Tomlinson 1974). Fully grown, the bird measures 14 to 16 inches in length. The clapper rail’s call is sharp with a series of “kek” or “clack” notes. The clapper rail call is such that sometimes calls of a single bird may sound like multiple birds are present (Grinnell et al. 1918, as cited in Patten 2001).

2.7.1.3 Distribution

Historic Distribution

The historic distribution is unknown; however, it is believed that the Yuma clapper rail occurred mostly in the Colorado River delta in Mexico prior to the construction of dams on the lower Colorado River. After the construction of these dams, more Yuma clapper rail habitat became available in the United States and it is likely that more birds began to nest in the United States (Eddleman and Conway 1998).

Current Distribution

The Yuma clapper rail occurs in marshland habitats within the basins of the lower Colorado River (Mexico, Arizona, California, Nevada, and Utah) and Salton Sea (California). The largest populations are found within the extensive marshes associated with the mainstem lower Colorado River, and adjacent to the Salton Sea (FWS 1983). Rails also are found along major tributary systems of the Colorado River including the Gila, Salt, and Verde rivers in Yuma, Maricopa, Pinal, Yavapai (possibly), and Gila counties, Arizona; the Bill Williams River in La Paz County, Arizona; the Muddy River in Clark, County, Nevada; and the Virgin River in The County, Nevada, Washington County, Utah, and Mohave County, Arizona.

2.7.1.4 Habitat

The Yuma clapper rail occurs in freshwater or brackish marshland habitats, most often with tall, dense emergent vegetation composed primarily of cattail (Typha spp.) and bulrush (Scirpus ssp.). The interface between marsh and dense riparian vegetation has been considered important, and some birds have been located in flooded saltcedar (Tamarix spp.) and willow (Salix spp.) stands adjacent to the marshes (Todd 1986, Eddleman 1989). The main factors determining habitat use according to Eddleman (1989) are the annual range of water depth and the existence of residual mats of marsh vegetation. Stable or slowly changing water levels are preferred over conditions with large and rapid water level fluctuations; openings within the wetland, especially open channels with flowing water are also important (Todd 1971, Tomlinson and Todd 1973). The Yuma clapper rail will use quiet backwater ponds, flowing stream or riverside areas, irrigation canals and drainage ditches, reservoirs, and small lakes where cattail habitat is available. Natural and artificially constructed marshes can provide suitable habitat. The most productive clapper rail areas consist of a mosaic of uneven-aged marsh vegetation interspersed with open water of variable depths (Conway et al. 1993) and adjacent to dense riparian vegetation.

The Yuma clapper rail occurs most often in large, extensive patches of emergent marsh vegetation (hundreds of acres in size). Gould (1975), in Imperial County, California, recorded 57 percent of all rail occurrences within patches of marsh greater than 20 acres in size. However, Gould (1975) also found clapper rails in marshes as small as 0.5 acre. Todd (1986) found clapper rails in marsh patches as small as 0.3 acre. Mean density of the Yuma clapper rail on the lower Colorado River during the breeding season was 0.1 per acre, but ranged as high as 0.32 per acre (Anderson and Ohmart 1985). These data suggest that a 10-acre patch of marsh habitat may support one or two pairs of clapper rails.

Home ranges of individuals or pairs may encompass up to 43 hectares (106 acres) and may extensively overlap with home ranges of other birds. Year-round home ranges averaged 7.5 hectares (18.5 acres) (Rosenberg et al. 1991).

2.7.1.5 Life History

Reproductive Biology

Breeding occurs from February though early July (Todd 1986, FWS 1983). Nests are constructed in dense marsh vegetation, among low growing riparian plants at the edge of the water, or on the top of dead cattails remaining from the previous year’s growth. Mature cattail/bulrush stands provide materials for nest building and cover for their nests. Sometimes nests are placed in the forks of small shrubs that lie just above moist soil or above water that is up to 2 feet deep. There is no evidence of more than one brood per season, despite the long breeding period (Eddleman 1989). Both adults care for the eggs and young. Clutch size is usually six to eight eggs. Young are precocial and follow the adults through the marsh within 48 hours of hatching. Adults lead the young to productive feeding areas where they quickly learn to feed on their own (FWS 1983, Todd 1986). Young are mostly capable of flight at approximately 9–10 weeks of age. Young birds experience high mortality within their first month of life due to predation.

Diet

The preferred prey of the Yuma clapper rail is crayfish, predominantly Procambarus clarki (Todd 1986), which is not native to Arizona. Crayfish comprise up to 95 percent of the rail's diet by volume (Ohmart and Tomlinson 1977). The rails will also take isopods, aquatic and terrestrial beetles, damselfly and dragonfly nymphs, earwigs, grasshoppers, spiders, freshwater shrimp, freshwater clams, leeches, plant seeds, and small fish.

Migration

The Yuma clapper rail was once believed to be highly migratory (it was thought that most birds spent the winter in Mexico). However, data obtained by telemetry revealed that most rails (over 70 percent) do not migrate (Eddleman 1989). Very little is known about the dispersal of adult or juvenile birds, but evidence indicates that the Yuma clapper rail can effectively disperse to new habitats provided that habitat corridors exist between the old and new sites (Rosenberg et al. 1991). Rosenberg et al. (1991) speculated that the Yuma clapper rail is a recent invader (since 1900) to the northern portions of the lower Colorado River basin after extensive damming of the river in the early 1900s. The dams created relatively stable water benefiting marshland habitats suitable for the rail.

2.7.1.6 Threats Warranting Protection

Threats to the Yuma clapper rail include alterations to habitat and environmental contaminants. A brief summary of threats in the context of the five listing factors used to assess species for listing as threatened or endangered under ESA are described below.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Water management projects within the lower Colorado River basin have both destroyed and created Yuma clapper rail habitat. Damming of the Colorado River by Reclamation altered natural flow regimes, inundated habitats, and created backwaters that developed extensive marshlands. Channel dredging, bank stabilization, water diversions, other channel maintenance activities, and development in the flood plain can potentially destroy large areas of marsh habitat and disturb birds, especially during nesting. Cattails and clapper rails are rather tolerant of water level fluctuations, so long as cattail habitats are not dried out completely, and that water levels do not rise rapidly during the nesting season. The birds can adjust nest height if waters rise slowly and not to a height above the tops of emergent vegetation (Eddleman 1989).

Management of the Colorado River has contributed to the expansion of marshes as well as their increased longevity. However, controlling the natural flow regime of the river has eliminated the variable physical conditions that provide for marsh regeneration. Cattail habitat that becomes too dense through the accumulation of dead, previous-years vegetation is less suitable for clapper rails because birds have difficulty accessing the interior of the stand. Under a natural hydrograph, the high and low water cycles of the river created and destroyed marshes with regularity. Controlling the Colorado River with dams, the natural river processes are constrained and marshes are stabilized. Such stability facilitates overgrowth of marshes. Also, many of the backwaters have trapped high sediment loads facilitating successional changes, such that these backwaters no longer provide habitat for the rail.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

This threat was not included as a basis for warranting protection under the ESA.

Disease or Predation

This threat was not included as a basis for warranting protection under the ESA.

The Inadequacy of Existing Regulatory Mechanisms

This threat was not included as a basis for warranting protection under the ESA.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Recent environmental contaminant studies on the Colorado River (Roberts 1996, King et al. 2000) have indicated there are high levels of selenium (a trace metalloid) in Yuma clapper rail tissues and eggs, and in crayfish, the rail's primary prey. Similar concentration of selenium found in other species have resulted in metabolic problems and reduced reproductive success. No adverse impacts from selenium have been observed in the Yuma clapper rail; however, due to the rail's secretive nature, nests are difficult to find, young birds are hard to observe, and reproductive success is difficult to monitor.

2.7.1.7 Conservation

A recovery plan was approved in 1983 (FWS 1983). A major objective of the recovery plan was to obtain a minimum breeding population of 700 to 1,000 individuals in the United States. In compliance with ESA regulations, FWS conducted a five-year status review of the Yuma clapper rail (FWS 2006c).

Reasonable and prudent measures for the Yuma clapper rail contained in the 1997 Biological Opinion (FWS 1997) have been implemented by Reclamation in the Lower Colorado River area (FWS 2005b). These measures have resulted in no net loss of rail habitat due to river maintenance activities, and the continuation of programs to maintain the suitability of existing marshes as habitat for the rail. The implementation of these reasonable and prudent measures, combined with active management for rail habitats, now being undertaken in combination with research into the use of fire as a management tool, have contributed to an improvement in the status of the clapper rail since 1997 (FWS 2005b).

Recovery Units

There are no recovery units proposed for the Yuma clapper rail.

Critical Habitat

No critical habitat has been designated for the Yuma clapper rail.

2.7.1.8 Species Status

Rangewide

The Yuma clapper rail is secretive and not often seen in the dense marsh vegetation it inhabits. Its distinctive calls aid in the identification of birds in the field, and population estimates are based on call-counts taken between late April and mid-June, the period of peak responses to taped calls (Todd 1986). The percentage of breeding birds responding to taped vocalizations has been estimated at 70–80 percent for paired birds and 90–95 percent for unpaired rails (Bennett and Ohmart 1978), though the frequency of calling and responsiveness to taped calls varies seasonally. In 1987, the Yuma clapper rail population along the lower Colorado River was estimated to be between 400 and 750 individuals in the United States, with 450–970 in Mexico (Eddleman 1989). In 1994, the population on the Colorado River in the United States was estimated to be 1,145 individuals. The Yuma clapper rail population in Mexico was estimated to include 6,300 birds in 2000 (Hinojosa-Huerta et al. 2000). Surveys in 2003 documented 809 birds in the United States, though a population estimate had not been determined. It is believed that approximately one-quarter to one-half of all Yuma clapper rails occur in the Colorado River delta in Mexico (the unlisted population), however the amount of movement between rail populations within Mexico and the United States is unknown. These population estimates suggest that Yuma clapper rail populations have been relatively stable within the lower Colorado River basin.

Virgin River Area

The Muddy and Virgin rivers contain extensive riparian areas, which are suitable for the Yuma clapper rail to use for breeding (Rathbun and Braden 2002). Yuma clapper rail surveys were conducted in southern Nevada (including the lower Virgin and Muddy rivers) by NDOW in 1999 (Tomlinson and Micone 2000) and 2000 (Gallagher et al. 2001). Under contract by the Southern Nevada Water Authority, the San Bernardino County Museum conducted surveys for special status birds, including the Yuma clapper rail, in suitable habitat along the Virgin and Muddy rivers. Reports for surveys conducted in 2000 (McKernan and Braden 2001), 2001 (McKernan and Carter 2002), 2002 (Rathbun and Braden 2003), 2003 (Braden et al. 2005a), 2004 (Braden et al. 2005b) and 2005 (Miller et al. 2006) have been completed. Initial surveys reported the presence of the Yuma clapper rail in both river valleys, with breeding pairs and fledglings confirmed during the 2000 surveys along the Virgin River and the lower Muddy River (McKernan and Braden 2001). However, the 2004 survey did not detect any individuals along the Muddy River; habitat loss due to tamarisk removal, low river flows, and entrenchment of the Muddy River is thought to have been responsible for their absence (Braden et al. 2005). In 2005, the Yuma clapper rail was not detected along the Virgin or Muddy river (Miller et al. 2006).

Southern Nevada is known as the Yuma clapper rail's northern distribution limit; populations at the limits of a species' distribution are usually more sensitive to environmental and or ecological change. Lower-than-average precipitation throughout the area over the last nine years (Braden et al. 2005) and habitat loss are likely factors in the reduced abundance of the Yuma clapper rail throughout the region. In addition, extensive flooding to the Muddy and Virgin rivers during January 2005 led to further habitat destruction and fragmentation throughout much of the MSHCP area, resulting in an even greater reduction in suitable clapper rail habitat (BIO-WEST 2005). In fact, surveys were not conducted for some sites along the Virgin River, including Mesquite Bridge, during 2005 because no suitable habitat was available at those sites, due to flood damage and/or flood control measures (Miller et al. 2006).

Lower Virgin River Watershed

Suitable habitat for the Yuma clapper rail is present in marshes along the margin of the Virgin River (Figure 3-3).

MESQUITE, NEVADA

Yuma clapper rail surveys were conducted in suitable habitat near the Mesquite Bridge by the San Bernardino County Museum from 2000 to 2004 (Miller et al. 2006). This location was surveyed and reported as three separate sites: Mesquite Bridge north, Mesquite Bridge, and Mesquite Bridge south. Habitat east of the bridge consisted of dense tamarisk and willow stands with small cattail patches (totaling about 3 acres) within the active river channel. At the bridge, there was an area between 5 and 15 acres of linear marsh habitat adjacent to the river channel where cattail and herbaceous plants were more prevalent, grading into dense tamarisk and willow. In addition, there was an unspecified area of linear cattail marsh within an earthen agricultural ditch (McKernan and Carter 2002; and Rathbun and Braden 2003). Table 3-3 provides results of Yuma clapper rail surveys conducted at the Mesquite Bridge from 2000 to 2004.

MORMON MESA, NEVADA

In the Mormon Mesa area, which consists of three marshes with suitable habitat for the Yuma clapper rail (East Marsh, Long Marsh, and Big Marsh), surveys were conducted from 2000 to 2005 (Miller et al. 2006). Habitat at these three marshes consists of cattail, tamarisk, and willow, with some open water habitat (McKernan and Braden 2001, McKernan and Carter 2002). At times, lower-than-average flows reduce the amount of time the East marsh is inundated and sometimes it is completely dry (Braden et al. 2005b). Table 3-3 provides results of Yuma clapper rail surveys conducted in the Mormon Mesa area from 2000 to 2005.

Table 3-3 Yuma clapper rail survey data for the Mesquite Bridge and Mormon Mesa within the Lower Virgin River watershed from 2000 to 2005.

Year	Mesquite Bridge Surveys			Mormon Mesa Surveys		
	No. of Resident Adults Detected[1]	No. of Successful Nests Detected[1]	No. of Young Detected[1]	No. of Resident Adults Detected	No. of Successful Nests Detected	No. of Young Detected
2000	2[a]	0[a]	0[a]	16[a]	1[a]	2[a]
2001	0[b]	0[b]	0[b]	11–15[b]	1[b]	1[b]
2002	2[c]	0[c]	0[c]	3[c]	0[c]	0[c]
2003	1[d]	0[d]	0[d]	0[d]	0[d]	0[d]
2004	1[e]	0[e]	0[e]	1[e]	0[e]	0[e]
2005	NS[f]	NS[f]	NS[f]	0[f]	0[f]	0[f]

Source:
[a]McKernan and Braden 2001
[b]McKernan and Carter 2002
[c]Rathbun and Braden 2003
[d]Braden et al. 2005a
[e]Braden et al. 2005b
[f]Miller et al. 2006

Note:
[1]NS = Site not surveyed because of the lack of suitable habitat

LITTLEFIELD, ARIZONA

Near the Lower Virgin River watershed along the Virgin River, 20 miles upstream from the City at Littlefield, Arizona, suitable habitat for the Yuma clapper rail is present and surveys were conducted from 2000 to 2004 (Miller et al. 2006). There are three sites in Littlefield where surveys have been conducted: Littlefield North, Littlefield Bridge, and Littlefield South (McKernan and Braden 2001). At the Littlefield North site, habitat consists of approximately 0.9 acre of even-aged cattail marsh with some willow stands at the edge of open water

(McKernan and Braden 2001. Habitat at the Littlefield Bridge site consists of less than 5 acres of even-aged cattail marsh with some willow at the edge of open water (McKernan and Braden 2001). At the Littlefield South site, there are more than 20 acres of marsh habitat comprised mostly of cattails and mixed cattails and tamarisk; very little open water is present (McKernan and Braden 2001). Four Yuma clapper rails (two pairs) were detected in 2000 (McKernan and Braden 2001) and two Yuma clapper rails (unpaired) were detected in 2004 at the Littlefield sites (Braden et al. 2005b). Flooding in early 2005 left the habitat unsuitable for the Yuma clapper rail (Miller et al. 2006). However, follow-up surveys in early 2006 indicated that the area might have become suitable for the Yuma clapper rail by the 2006 survey season (Miller et al. 2006).

Lower-than-average precipitation throughout the area over the last nine years (Braden et al. 2005) and habitat loss are likely factors in the reduced abundance of Yuma clapper rail throughout the region. Rathbun and Braden (2003) speculated that declines in numbers of clapper rails from 2000 through 2002 in the Virgin River basin, especially at Mormon Mesa downstream from Mesquite, may be due to extended drought conditions that may have reduced habitat quality and/or brought about increased predation on the birds. Miller et al. (2006) also discussed possible causes of decline in Yuma clapper rail numbers at all sites surveyed since 2000, but stressed that not enough information was available to draw conclusions. This is, in part, because other suitable habitat exists near the sampled locations, and the population status at these sites is currently unknown (Miller et al. 2006).

Section 3: Riparian and Upland Species Descriptions

3.1 AMERICAN PEREGRINE FALCON

Scientific Name: *Falco peregrinus anatum*

3.1.1 Protection Warranted

3.1.1.1 Endangered Species Act

- Delisted from ESA threatened status in 1999 (AGFD 2002)

Other Protections

- Wildlife Species of Concern in Arizona (AGFD 2002)
- Forest Service Sensitive delisted (USDA, FS Region 3,1999)

3.1.1.2 General Description

Distribution

The American peregrine falcon occurs throughout much of North America from the subarctic boreal forests of Alaska and Canada south to Mexico (USFWS 1999).

Habitat

Range-wide, this species inhabits many terrestrial biomes. Most commonly occupied habitats contain cliffs for nesting, with open gulfs of air, and generally open landscapes for foraging (Clayton et al. 2002). In Clark County, this species can be found in mixed conifer, pinyon-juniper, sagebrush, lowland riparian, grassland habitats, as well as agricultural and urban areas (Clark County 2006). Commonly occupied habitats contain cliffs, for nesting, with open gulfs of air and generally open landscapes for foraging. In addition to natural habitats, many artificial habitats are now used (urban, human-built environments such as towers, buildings, etc.).

3.1.1.3 Life History

Reproductive Biology

Reproduction usually begins mid-March but may occur as early as February. Eggs begin to appear in late March, but peak laying activity is in April (White et al. 2002).

Diet

Mostly birds, estimated at about 77–99% (frequency not biomass), passerines to small geese; occasionally mammals and rarely amphibians, fish, and insects (White et al. 2002).

Migration

3.1.1.4 Threats Warranting Protection

Specific threats on the NRA have not been identified due to the limited occurrence of the species on the NRA. However, threats to the peregrine falcon within Clark County include habitat modification and degradation, as well as disturbance due to rock climbing; mortality through collisions and electrocution with power lines; and, illegal take (Clark County 2006).

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

This threat was not included as a basis for warranting protection under the ESA.

Disease or Predation

Peregrine falcons are usually killed only by large avian predators such as eagles, gyrfalcons, or, at night, great horned owls. Nestlings and immatures are subjected to greater array of predators, including other peregrines; ground nests depredated by mammals (White et al. 2002)

The Inadequacy of Existing Regulatory Mechanisms

Other Natural or Manmade Factors Affecting the Species' Continued Existence

3.1.1.5 Conservation

Recovery Units

There are no recovery units proposed for the yellow-billed cuckoo, it is not a federally listed species.

Critical Habitat

No critical habitat has been designated for the yellow-billed cuckoo, it is not a federally listed species.

3.1.1.6 Species Status

Rangewide

Lower Virgin River Watershed

3.2 LEWIS'S WOODPECKER

Scientific Name: *Melanerpes lewis*

3.2.1 Protection Warranted

3.2.1.1 Endangered Species Act

- This species is not currently listed or proposed as threatened or endangered under the ESA.

Other Protections

- Listed as a wildlife species of concern by the State of Utah (UDWR 2006).
- Listed as a candidate for state-listing by the State of Washington (Lewis et al. 2002).

General Description

The Lewis's woodpecker is a member of the Picidae family. Members of this family have zygodactyl feet for walking up trees and grasping limbs, strong bills for drilling and drumming on trees, and long, sticky tongues for extracting food. They nest in cavities, excavating their own nests.

The Lewis's woodpecker is about 10-11 inches long (26-28 cm) with a wingspan of 19-20 inches (49-52 cm). The average weight of this species is 3.11-4.87 ounces (88-138 g). They are medium-sized woodpeckers with a greenish-black head, back, wings, and tail; a gray collar and chest; a pinkish or salmon red belly; and, a dark red face. The wings and tail are dark with no white spots or patches. Males and females look alike, but juveniles lack a red face and a gray collar and chest (Tobalske 1997).

The call of the Lewis's woodpecker is a series of "churs."

3.2.1.2 Distribution

Historic Distribution

This species has shown a recent decline in the Western states, possibly due to competition for snags and nest cavities and loss of their historic riparian and ponderosa pine habitat. In Washington, the Lewis's woodpecker is only locally abundant as a breeding bird, and its range has contracted within the last half of this century to include only habitats east of the Cascade crest. Historically, this woodpecker was known to breed throughout the Puget Trough, southwest Washington, and the Olympic Peninsula. Currently in Washington, Lewis's woodpeckers only breed east of the Cascades from the Columbia Gorge north, and east into the Okanogan highlands and northeast Washington (Lewis et al. 2002).

Current Distribution

The Lewis's woodpecker has a large range in the western U.S. and adjacent southern Canada, but distribution can be spotty. It is apparently declining in abundance, and may have declined 60 per cent or more since the 1960s (NatureServe 2006).

Lewis's woodpecker breeds from southern British Columbia to southwestern South Dakota, and from northwestern Nebraska to south-central California, as well as in central Utah, southern New Mexico, and eastern Colorado. The breeding range in western North America approximately matches the distribution of ponderosa pine (Pinus ponderosa) (Tobalske 1997).

It winters south to northwestern Mexico, including northern Oregon, southern Idaho, central Colorado, and south-central Nebraska, irregularly occurring in northern Baja California, northern Mexico, southern New Mexico, and west Texas. The northern part of the population moves to southern parts of its range in the non-breeding season (UDWR 2006).

Populations in the northern half of the breeding range move southward for winter; present year-round in rest of breeding range although some birds migrate out. Movements likely vary in magnitude from year to year, probably in relation to food availability. Nomadic flocks have been observed in fall and winter (NatureServe 2006).

3.2.1.3 Habitat

Three preferred habitat types are open ponderosa pine forest, open riparian woodland dominated by cottonwood, and logged or burned pine (Pinus spp.) forest; however, breeding birds are also found in oak (Quercus spp.) woodland, nut and fruit orchards, piñon pine–juniper (Pinus cembroides–Juniperus spp.) woodland, a variety of pine and fir (Abies spp.) forests, and agricultural areas including farm and ranchland. It is classified as a specialist in burned pine forest habitat, although suitability of burned area as habitat may vary with post-fire age, size and intensity of burn, and geographic region (Tobalske 1997).

Territory includes only the area around nest cavity in summer, or storage tree in winter, and immediate vicinity; home ranges for foraging overlap broadly. Reports of territory size of 1.0–6.1 ha in Blue Mountains of Washington and Oregon (Tobalske 1997).
Open stands near water are the preferred habitat in the Blue Mountains of the Pacific Northwest. This species is migratory within the northern portion of its breeding range; most individuals leave these areas during winter. It is present throughout year in many portions of the remainder of its breeding range.

The major breeding habitat consists of open park-like ponderosa pine forests. The Lewis's woodpecker is attracted to burned-over Douglas-fir, mixed conifer, pinyon-juniper, riparian, and oak woodlands, but is also found in the fringes of pine and juniper stands, and deciduous forests, especially riparian cottonwoods. Areas with a good understory of grasses and shrubs to support insect prey populations are preferred. Dead trees and stumps are required for nesting. Wintering grounds are over a wide range of habitats, but oak woodlands are preferred (UDWR 2006).

The Lewis's woodpecker is a cavity nester, excavating a hole in tall trees, often dead or blackened by fire. It will also nest in utility poles, or stumps, but prefers ponderosa pine, cottonwood, or sycamore. The male selects the site but both male and female excavate the cavity (UDOW 2006).

Lewis' woodpeckers have high nest site fidelity and often use the same cavity in consecutive years. This woodpecker will excavate its own nest cavity, but it also uses natural cavities or holes excavated by other woodpeckers. Being a weak excavator, the Lewis's woodpecker prefers soft snags to live trees (Lewis et al. 2002).

3.2.1.4 Life History

Reproductive Biology

Earlier mean breeding dates in southern portions of range and at low elevations, and later mean dates in the north and at high elevations. In California, migrants arrive in early May; courtship among paired birds and unmated males generally starts immediately. Onset of incubation ranges from mid-April to late June; peak activity occurs in May and June and duration of incubation averages 14–16 days in Utah. Departure from nest occurs at 28–34 days of age in California. Juveniles remain near nest site for at least 10 days while being fed by adults (Tobalske 1997).

Lewis's woodpecker forms life-long pair bonds. The male and female incubate approximately 6-7 white eggs for 13-14 days; the male incubates at night, and both alternate during the day. The young are altricial and fledge in 28-34 days after being attended by both parents. One or possibly two broods are produced yearly (NatureServe 2006; UDWR 2006).

Unlike other woodpeckers, it is not morphologically well-adapted to excavate cavities in hard wood. It tends to nest in a natural cavity, abandoned northern flicker (Colaptes auratus) hole, or previously used cavity, 1-52 meters above ground. Sometimes, this woodpecker will excavate a new cavity in a soft snag, dead branch of a living tree, or rotting utility pole. Mated pairs may return to the same nest site in successive years. On partially-logged burns with high nesting densities in Idaho, nest sites were characterized by the presence of large, soft snags and an average of 62 snags per hectare that had more than 23 centimeter dbh (NatureServe 2006).

Diet

The diet of this woodpecker consists of insects during the breeding season and nuts and berries during the winter. Insects are caught in the air by flying out from a perch site, sometimes with very acrobatic flights. It is the only woodpecker than perches on wires. Insects are also picked off leaves or from the ground (UDWR 2006).

In the fall, the diet is mainly fruits and berries. Acorns or other nuts are stored (and used in winter) by removing the shell, breaking the nut into bits that will wedge into natural crevices of dead trees, power poles and oaks. This caching of food is not done communally, and the Lewis's woodpecker will defend a winter store of food from other woodpeckers (primarily acorn woodpeckers). Seeds and fruit at feeders can be used. There is no apparent foraging difference between the sexes. The Lewis's woodpecker flight is unusual, by steady crow-like wing beats, rather than alternating bursts of wing beats and undulating flight like other woodpeckers (UDWR 2006).

Migration

Lewis's woodpecker is migratory within the northern portion of its breeding range; most individuals leave these areas during winter. It is present throughout year in many portions of the remainder of its breeding range (Tobalske 1997).

3.2.1.5 Threats Warranting Protection

Lewis's woodpecker is vulnerable to processes that result in a permanent loss of large snags (nesting sites) or degradation of foraging habitat. Such habitat alteration evidently is the reason for the declines that have occurred in coastal areas of British Columbia and Washington.

Drought and overgrazing pose continued threats to riparian habitats in arid regions. Fire suppression encourages the replacement of ponderosa pine forests by Douglas-fir, and leads to denser, closed-canopy forest stands. It will decline with fire suppression in ponderosa pine/Douglas fir stands compared to regular fire intervals of 10-30 years. The species may be most sensitive to destruction of specialized winter habitat. It has also been suggested that European starlings (Sturnus vulgaris) may usurp nesting habitat (NatureServe 2006).

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Urban development is increasing in the Lower Virgin River watershed. Drought is also a concern. Overgrazing has the potential to occur in riparian habitats.

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

Livestock grazing should be limited where the Lewis's woodpecker occurs, so that native understory vegetation is not destroyed. However, more research is necessary to determine the specific threshold limits on grazing pressure to protect habitat for species. A brushy understory is necessary to provide an adequate insect prey base (Lewis et al. 2002).

Disease or Predation

All reported predators are birds. Predation by red-tailed hawk and American kestrel is common, and they are reported to prey heavily on juveniles soon after young leave the nest. In Utah, half of a brood was taken as fledglings climbed up the nest tree for the first time. In Colorado in winter, an attack by Cooper's hawk and 3 attacks by sharp-shinned hawks were unsuccessful (Tobalske 1997).

The Inadequacy of Existing Regulatory Mechanisms

Unknown.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

When replanting after a timber harvest, attempts should be made to duplicate natural tree species composition, rather than replanting with a single species. Sections of logged or burned forest should be left to regenerate naturally to brush. The brushy forest stage is important for maintaining healthy insect populations and should not be suppressed (Lewis et al. 2002).

3.2.1.6 Conservation

A Conservation Assessment was completed in 2002 by the U.S. Forest Service (Abele et al. 2004). This species is included in the Utah Partners in Flight Avian Conservation Strategy (UDWR 2006).

Recovery Units

There are no recovery units proposed for the Lewis's woodpecker; it is not a federally listed species.

Critical Habitat

No critical habitat has been designated for the Lewis's woodpecker; it is not a federally listed species.

3.2.1.7 Species Status

Rangewide

On the basis of Breeding Bird Survey (BBS) and Christmas Bird Count (CBC) data, the overall population may have declined by approximately 60 per cent. Populations tend to be scattered and irregular and are considered rare, uncommon, or irregularly common throughout the range; local abundance may be cyclical or irregular. In the past century, populations have apparently declined in British Columbia by more than 50 percent and also decreased in Oregon, California, and Utah. BBS data indicate a significant decline in the United States for the period of 1966-1999 (-3.6 per cent average annual or 67 per cent overall decline; $P = 0.00$; $N = 64$ survey routes) and a non-significant declining trend between 1980 and 1996 (-1.7 per cent; $P = 0.22$; $N = 53$). Similar significant, negative trends are present survey-wide, both for the Western BBS Region and for the U.S. Fish and Wildlife Service Region 1. Washington State posted a significant decline averaging -8.4 per cent annually for the same period ($P = 0.01$, $N = 10$). Overall, however, BBS sample sizes are relatively low for robust trend analysis. Significant declines have occurred in coastal areas of Washington and the species is extirpated from coastal British Columbia. CBC data show non-significant declining trends survey-wide and in California, Colorado, and Oregon, and a non-significant increase in Arizona, for the period from 1959 to 1988. It has also been suggested that populations appear to have stabilized recently, but those in riparian habitats in arid regions continue to be vulnerable to drought, overgrazing, and other habitat degradations (NatureServe 2006).

Lower Virgin River Watershed

This species has an unknown status and extent within the Lower Virgin River watershed. There are 2 reported occurrences in the Utah portion of the watershed (from UDWR occurrence data).

The Nevada Division of Wildlife (NDOW) (2001) conducted surveys in 2000 in southern Nevada and documented 19 yellow-billed cuckoos, comprising 4 pairs and 11 unpaired birds; no nests were found. An estimate by NDOW put the summer population of the yellow-billed cuckoo between 20 and 30 birds state-wide. Suitable habitat for the yellow-billed cuckoo is very limited in Nevada, with most areas of cottonwood riparian forests being fragmented (NDW, in litt., 2001). The decline of the yellow-billed cuckoo in The County, Nevada has been attributed to the reduction or degradation of riparian habitat, river channelization, livestock grazing, use of pesticides, non-native plant encroachment (tamarisk), and brownheaded cowbird parasitism (Clark County 2000).

3.3 LITTLE BROWN MYOTIS

Scientific Name: *Myotis lucifugus*

3.3.1 <u>Protection Warranted</u>

3.3.1.1 Endangered Species Act

- Little brown myotis is not a listed species.

Other Protections

- Little brown myotis is a apecies of special concern in California (Zeiner 1990).

3.3.1.2 General Description

Cinnamon-buff to dark brown above, buffy to pale gray below, hairs on back have long glossy tips. The ear, when laid forward, reaches approximately the nostril. The tragus is about half as high as the ear. The calcar lacks a keel. The length of little brown myotis' head and body is 41-54 mm, the ear 11-15.5 mm, forearm 33-41 mm. The braincase rises gradually from the rostrum; the greatest length of skull is 14-16 mm, the length of the upper toothrow is 5-6.6 mm (NatureServe 2007).

Summer colonies usually range from 50 to 2,500 animals, winter groups may contain tens of thousands. From April-May to September-October bats are active and breeding, they are hibernating the rest of the year (NatureServe 2007). Day roosts, night roosts, hibernation roosts and nursery roosts are separately used (Zeiner 1990).

3.3.1.3 Distribution

Historic Distribution

Questionable historic presence in Clark County, present in Lincoln County, Nevada (NNHP 2004). NDOW states that this species is only present in Northern, NV: Esmeralda, Washoe, Storey, Churchill, Lander, Elko and White Pine counties. (NDOW 2007).

Current Distribution

Little brown myotis occur throughout Canada south through the United States, being less common or absent from the Great Plains and from Arizona east to Louisiana. Although one of the most common bats in the U.S., the distribution of the little brown myotis in Nevada seems to be restricted to the northern part of the state for unknown reasons (NDOW 2007).

3.3.1.4 Habitat

Little brown myotis utilize a variety of woodland habitats, and can also be found in grasslands, fields, orchards, chaparral, suburban areas and urban areas. Natural structures such as caves, hollow trees and snags and caves are used for resting and maternity sites, as well as man-made structures such as tunnels, abandoned mines and buildings. A narrow microclimate is necessary for raising young and suitable maternity sites may limit distribution and abundance.

3.3.1.5 Life History

Reproductive Biology

Little brown myotis mate from September to October, where ovulation and fertilization will be delayed until spring. Gestation lasts 50-60 days, followed by birth of one young in late spring or early summer. Females are able to produce young in their first or second year. Little brown myotis have been documented delaying or foregoing reproduction in wet years in British Columbia. Females may breed up to 12 years of age (NatureServe 2007).

Diet

Flying insects such as mosquitoes, midges, caddisflies, moths, hoppers, small beetles and spiders are most frequently consumed. Little brown myotis often forage over water and along the margins of lakes and streams and detect prey by echolocation at a range of one meter.

Migration

Eastern populations are known to migrate hundreds of miles between summer and winter habitats. Western populations are thought to hibernate near their summer range (NatureServe 2007).

3.3.1.6 Threats Warranting Protection

Habitat loss, pesticides, disturbance, and control efforts are threats to little brown myotis.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Alterations in snag density and recruitment by timber harvest, agricultural or residential habitat conversion or riparian forest alteration for flood control. Highly aggregated hibernation in abandoned mines in eastern and central North America suggests closure of cold mines without adequate survey could have major population impact. Populations in montane forest islands, especially near the southern range limit, are at greater risk because population sizes and available habitat are small and development pressures (e.g., forest recreation) can be high (WBWG 2005). The conversion of piñon-juniper habitat, building demolition, mine reclamation, and renewed mining decreases habitat. Disturbance to hibernating colonies (NDOW 2007).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known utilization of this species (NatureServe 2007).

Disease or Predation

Predators include birds, snakes, house cats, mice and other small mammals (Fenton and Barclay, Zeiner 1990). Little brown myotis are also known to be susceptible to rabies (Zeiner 1990). Accidents probably contribute to more mortality than either predators or parasites (i.e. impalement on barbed wire and burrdocks, and animals killed in hibernacula by flood waters) (Fenton and Barclay).

The Inadequacy of Existing Regulatory Mechanisms

In Arizona, all bats are protected through Commission Order 14, and cannot be taken alive or dead, under auspices of a hunting license. Bats cannot be imported, exported, or otherwise possessed, without a special permit issued pursuant to Article 4 (Live Wildlife Rules) (AGFD 2006). Otherwise, this species receives no federal or state protection.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

Fat-soluble pesticides are dangerous when combined with migratory stress and the depletion of fat reserves related to migration and hibernation. Disturbance in hibernating bats in winter is destructive because of the energy expense that is expended when myotis are aroused (Zeiner 1990).

3.3.1.7 Conservation

Recovery Units

No recovery plan has been proposed for little brown myotis, it is not a federally listed species.

Critical Habitat

No critical habitat has been designated for little brown myotis, it is not a federally listed species.

3.3.1.8 Species Status

Rangewide

Widespread and common throughout its range, apparently with no significant population declines (NatureServe 2007)

Lower Virgin River Watershed

Conversion of pinyon juniper habitat and disturbances to abandoned and active mines are possible within the Lower Virgin River Watershed.

Potential for pest control operations around developed areas to affected this species in the Lower Virgin River watershed.

3.4 WESTERN YELLOW BAT

Scientific name: *Lassirius xanthinus, Lassirius pyromelana*

3.4.1 <u>Protection Warranted</u>

3.4.1.1 Endangered Species Act

Western yellow bat is not a federally listed species.

Other Protections

Yellow bats are not protected under any Nevada state law, but are ranked as critically imperiled (S1) by the Nevada Natural Heritage Program due to the fact that they are known from only one location (NDOW 2007).

3.4.1.2 General Description

A medium-sized bat with light yellow fur. The anterior half of the dorsal surface of the inter-femoral membrane is furred. The ears are short (Jameson and Peeters 2004). Western yellow bats are solitary roosters (AGFD 2003; Bradley et al).

3.4.1.3 Distribution

Historic Distribution

Locally, its historic range limited to Clark County, NV (NNHP 2004). Muddy River drainage, Clark County, NV (NDOW 2007). Known primarily from Tucson and Phoenix. Also taken in Yuma (including the Yuma Proving Ground), Sasabe, along the Bill Williams River and in the Chiricahua Mountains. (AGFD 2003). Its current distribution does not seem significantly different from that of its historic distribution.

Current Distribution

Extends from extreme southern Nevada, California, Arizona, and New Mexico through Baja California to southern Mexico (most of Mexico but not the eastern coast) (NatureServe) have been netted in the Henry Mountains (Garfield County), Utah in 1993; may be expanding range northward due to the planting of ornamental plants (SWReGAP)

3.4.1.4 Habitat

Yellow bats are highly localized and restricted to areas with adequate palm roosts, but microclimates of these palms are unknown and needs investigation. (NDOW 2007). They will also use palm oasis's for foraging and utilize other riparian areas as well (Zeiner 1990).

3.4.1.5 Life History

Reproductive Biology

Western yellow bats have a litter of one or two (AGFD 2003). Pregnancy occurs from April to June; lactating has been documented from June - July (Bradley et al).

Diet

This species feeds on small to medium sized night-flying insects (AGFD 2003).

Migration

A portion of the population is believed to migrate south, but routes and destinations are unknown (NDOW 2007). may be migratory in part of range; may be migratory in southern Nevada as population drastically decline during the winter months in the upper Moapa Valley; individuals captured in winter months are almost always male (AGFD 2003) However, more recent data indicates that the species is present year-round in Clark County, Nevada (Bradley et al) known gap in knowledge (Williams) domestic cats are a known predators (Williams)

3.4.1.6 Threats Warranting Protection

The loss of habitat, particularly palm trees, and predation by domestic cats are threats to this species.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Probably one of the primary threats in the U.S. to this species is the loss of roosting habitat. L. xanthinus roost in the dead leaf skirts of palm trees (AGFD 2003, NDOW 2007). Trimming of palm trees for aesthetic or fire management purposes in most cases completely removes viable roosting habitat (WBWG 2005f, AGFD 2003). Also, possibly destruction of riparian forest and woodland habitats. (AGFD 2003, NDOW 2007).

Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes

The spread of urban areas may lead to an increase of pet or feral cats which may prey upon western yellow bat (WBWG 2005). No additional significant threats for this species are known.

Disease or Predation

Domestic cats, whether pets or feral, may be a substantial source of predation (WBWG 2005).

The Inadequacy of Existing Regulatory Mechanisms

In Arizona, all bats are protected through Commission Order 14, and cannot be taken alive or dead, under auspices of a hunting license. Bats cannot be imported, exported, or otherwise possessed, without a special permit issued pursuant to Article 4 (Live Wildlife Rules) (AGFD 2006b). This species does not receive any federal or state protection.

Other Natural or Manmade Factors Affecting the Species' Continued Existence

This species is vulnerable to pest control operations (WBWG 2005, NDOW 2007, AGFD 2006).

3.4.1.7 Conservation

See the Nevada Bat Plan and Lower Colorado River MSCP.

Recovery Units

No recovery plan has been proposed for this species.

Critical Habitat

No critical habitat has been designated for this species.

3.4.1.8 Species Status

Rangewide

Range-wide, western yellow bats seem to be expanding their range, probably due to the wide-spread use of ornamental palm trees in landscaping plans (NDOW 2007).

Lower Virgin River Watershed

Unknown status and extent within the Lower Virgin River watershed. Information is needed about the distribution and status of this species in Nevada (NDOW 2007).

The potential for destruction of riparian forests exists within the Lower Virgin River watershed, as does pest control measures.