

Covered Species Habitat Loss by Ecosystem Tracking System

Report from Clark County, Nevada, Department of Air Quality and Environmental Management, Desert Conservation Program to Science Advisor, Desert Research Institute

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Executive Summary

The Clark County Multiple Species Habitat Conservation Plan's (MSHCP: RECON 2000) Section 10(a) Incidental Take Permit (USFWS 2001b) is for incidental take of desert tortoise and seventy-seven (77) other species within Clark County in connection with development on non-Federal lands and Nevada Department of Transportation activities in Clark County and within desert tortoise habitat in adjacent Nevada counties below the 38th parallel and below 5,000 feet in elevation. A total of 145,000 non-Federal acres may be disturbed under the term of the MSHCP's Section 10(a) Incidental Take Permit (USFWS 2001b). The MSHCP's Adaptive Management Program (AMP) tracks covered species habitat loss by ecosystem to determine the impacts of the Section 10(a) Incidental Take Permit (USFWS 2001b) on the seventy-eight (78) covered species. The results of a spatial analysis of land use trends (Clark County 2008) were compared to ecosystems and land management categories as described in the MSHCP. This analysis shows that none of the habitat losses within the eleven (11) ecosystems exceeded the anticipated potential losses as described in the USFWS analysis of the potential impacts of the MSHCP's Section 10(a) Incidental Take Permit (USFWS 2001a).

Results of this habitat loss analysis indicate that the majority of habitat loss (48,240 of a total of 56,512 acres of habitat loss) has occurred in the Mojave Desert Scrub ecosystem, and those 48,240 acres represent 1.39% of that ecosystem's distribution within Clark County. Species' habitats that are described in the MSHCP as occurring within these two ecosystems are: sticky ringstem, Las Vegas bearpoppy, white bearpoppy, threecorner milkvetch, Spring Mountain milkvetch, alkali mariposa lily, sticky buckwheat, blue diamond cholla, glossy snake, banded gecko, sidewinder, speckled rattlesnake, Mojave green rattlesnake, Great Basin collared lizard, desert iguana, large-spotted leopard lizard, desert tortoise, California (common) king snake, western leaf-nosed snake, western long-nosed snake, and Sonoran lyre snake (RECON 2000). The ecosystem which incurred the largest percentage lost (3.21%) was Salt Desert Scrub with 6,699 of 208,564 acres of that ecosystem lost. Species' habitats described in the MSHCP as occurring in the Salt Desert Scrub ecosystem are: silver-haired bat, long-eared myotis, sticky ringstem, Las Vegas bearpoppy, white bearpoppy, forked (Pahrump Valley) buckwheat, Parish's phacelia, glossy snake, sidewinder, speckled rattlesnake, Great Basin collared lizard, desert iguana, large-spotted leopard lizard, desert tortoise, California (common) king snake, western leaf-nosed snake, and western long-nosed snake (RECON 2000). The losses of habitat within the Mojave Desert Scrub and Salt Desert Scrub ecosystems are each less than the anticipated potential losses of 4% and 10% respectively, as described in the USFWS analysis of the potential impact of the MSHCP's Section 10(a) Incidental Take Permit (USFWS 2001a).

A comparison of the losses in each ecosystem within the four MSHCP Management Area categories showed that losses appear to be taking place within the areas anticipated by the USFWS analysis of the potential impact of the MSHCP's Section 10(a) Incidental Take Permit (USFWS 2001a). Recommendations for possible enhancement and additional uses of the

present covered species habitat loss by ecosystem tracking system, and balancing this habitat loss by ecosystem with mitigation or conservation measures are presented.

Introduction

The MSHCP's Section 10(a) Incidental Take Permit (USFWS 2001b) is for incidental take of desert tortoises and seventy-seven (77) other Covered Species within Clark County in connection with development on non-Federal lands and Nevada Department of Transportation activities in Clark County and within desert tortoise habitat in adjacent Nevada Counties below the 38th parallel and 5,000 feet in elevation (RECON 2000 p. 2.4). Incidental take is permitted on a per acre habitat loss basis rather than by the number of individuals of each listed covered species. For each non-Federal acre to be disturbed under the Section 10(a) Incidental Take Permit, a fee of \$550.00 is paid into a mitigation fund. Up to a total of 15,000 acres may be exempted from the fee if the lands to be disturbed are to serve a municipal purpose. A total of 145,000 non-Federal acres may be disturbed under the term of the MSHCP's Section 10(a) Incidental Take Permit (USFWS 2001b).

The MSHCP's Adaptive Management Program (AMP) tracks covered species habitat loss by ecosystem to determine the impacts of the Section 10(a) Incidental Take Permit (USFWS 2001b) on the seventy-eight (78) covered species. For the purposes of the analyses in this report, habitat loss is considered equivalent to acres of incidental take. Data are available to document the number of acres permitted for incidental take (habitat loss) to date under the Section 10(a) Incidental Take Permit, the spatial extent of actual habitat loss to date during the term of the Section 10(a) Incidental Take Permit, the ecosystems described in the MSHCP and the covered species that are expected to rely upon each ecosystem for habitat.

The MSHCP and USFWS's analysis of the potential impacts of issuing the Section 10(a) Incidental Take Permit (the Biological Opinion) defined eleven (11) ecosystem categories (figure 1) based upon vegetation communities and described which of the covered species' habitats occurred within each of the ecosystems (RECON 2000 and USFWS 2001a.) These relationships are shown in table 1. Few updates to the narrative conceptual models of species' habitat requirements found in the MSHCP and the Biological Opinion have been received to date, and those received are of a preliminary nature; thus no revisions have been made to these relationships between species' habitat and ecosystems. Verification of these and additional preliminary updates to species habitat conceptual models are anticipated in two years as the result of several interlocal agreements between the County and Federal Agencies and contracts with not-for-profit organizations. Recommendations are made regarding future use of these data.

This report and analyses are focused solely on habitat loss to date under the MSHCP Section 10(a) Incidental Take Permit (USFWS 2001b) and do not attempt to address larger questions regarding changes to ecosystem quality, function or health from the impacts of this habitat loss or other anthropogenic or natural sources, nor do this report and analyses extend to assessments of species status or changes in species status. This report highlights those ecosystems and species' habitats that have been directly impacted by habitat loss to date, and makes recommendation for additional analyses of ecosystem health and species status.

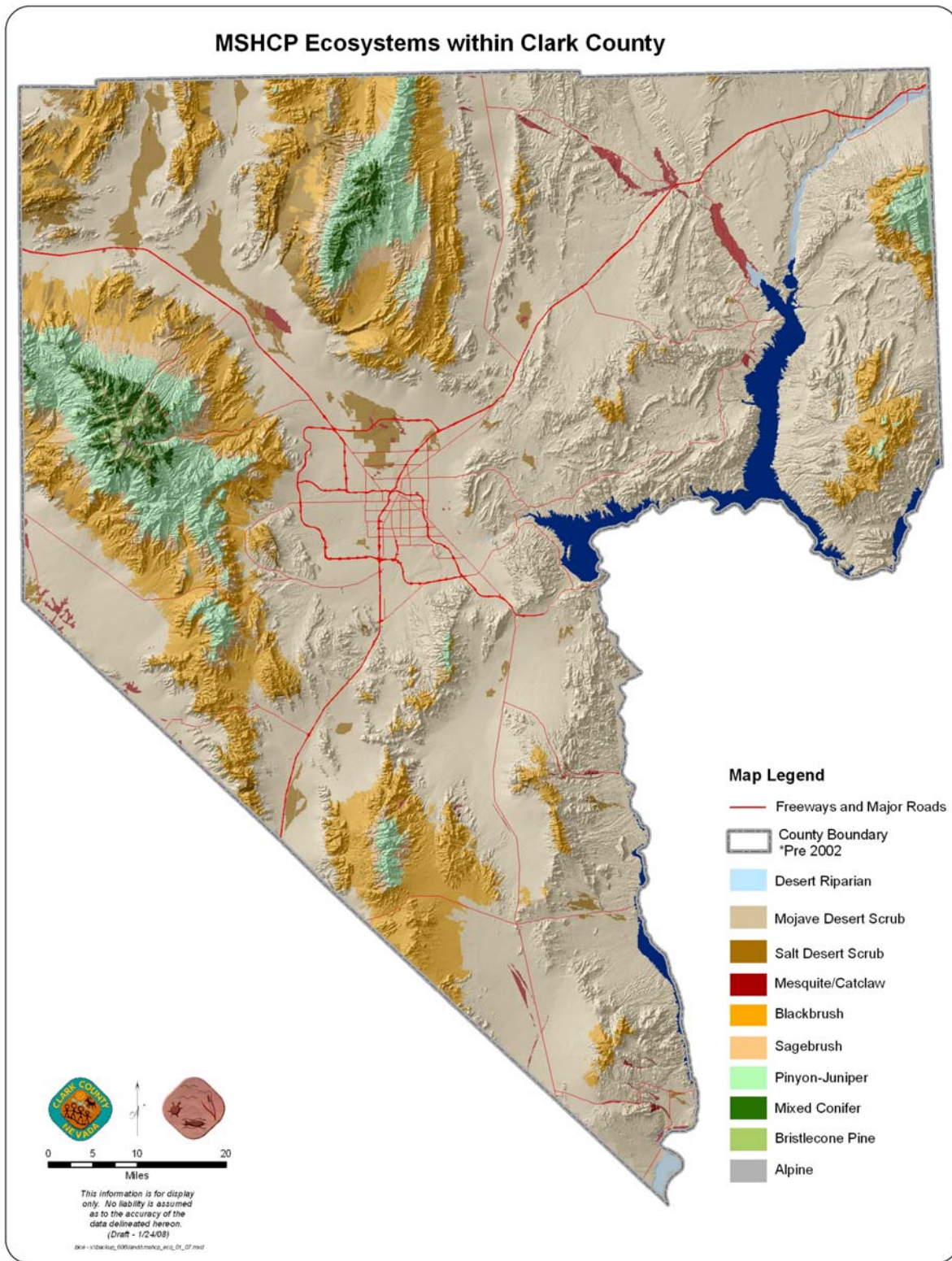


Figure 1. Map of MSHCP Ecosystems in Clark County, Nevada

Table 1. MSHCP covered species and ecosystems. Y indicates the MSHCP (RECON 2000) or Biological Opinion (USFWS 2001a) described the species' habitat occurring within that ecosystem.

COMMON	SCIENTIFIC	TAXON GROUP	Ecosystems												
			Alpine	Bristlecone Pine	Mixed Conifer	Pinyon Juniper	Sagebrush	Blackbrush	Salt Desert Scrub	Mojave Desert Scrub	Mesquite Catclaw Acacia	Desert Riparian and Aquatic	Spring		
relict leopard frog	<i>Rana onca</i>	Amphibian												Y	Y
yellow-billed cuckoo	<i>Coccyzus americanus</i>	Bird												Y	
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	Bird												Y	
American peregrine falcon	<i>Falco peregrinus anatum</i>	Bird			Y	Y	Y							Y	
blue grosbeak	<i>Guiraca caerulea</i>	Bird												Y	
phainopepla	<i>Phainopepla nitens</i>	Bird									Y			Y	
summer tanager	<i>Piranga rubra</i>	Bird												Y	
Vermillion flycatcher	<i>Pyrocephalus rubinus</i>	Bird									Y			Y	
Arizona bell's vireo	<i>Vireo bellii arizonae</i>	Bird												Y	
Spring Mountains springsnail	<i>Pyrgulopsis deaconi</i>	Invertebrate Aquatic													Y
Southern Nevada springsnail	<i>Pyrgulopsis turbatrix</i>	Invertebrate Aquatic													Y
Spring Mountains acastus checkerspot	<i>Chlosyne acastus robusta</i>	Invertebrate Butterfly													
dark blue butterfly	<i>Euphyllotes enoptes purpurea</i>	Invertebrate Butterfly			Y	Y	Y								
Morand's checkerspot butterfly	<i>Euphydryas anicia morandi</i>	Invertebrate Butterfly		Y	Y	Y									Y
Spring Mountains comma skipper	<i>Hesperia comma mojavensis</i>	Invertebrate Butterfly		Y	Y	Y	Y								Y
Spring Mountains icarioides blue	<i>Icaricia icarioides austinorum</i>	Invertebrate Butterfly		Y	Y	Y	Y								Y
MT Charleston blue butterfly	<i>Icaricia shasta charlestonensis</i>	Invertebrate Butterfly		Y	Y										
Nevada admiral	<i>Limenitis weidemeyerii nevadae</i>	Invertebrate Butterfly		Y	Y	Y									Y
Carole's silverspot butterfly	<i>Speyeria zerene carolae</i>	Invertebrate Butterfly		Y	Y	Y	Y								
Silver-haired bat	<i>Lasiorycteris noctivagans</i>	Mammal			Y	Y			Y			Y		Y	Y
long-eared myotis	<i>Myotis evotis</i>	Mammal			Y	Y	Y		Y			Y		Y	Y
long-legged myotis	<i>Myotis volans</i>	Mammal			Y	Y	Y								Y
Palmer's chipmunk	<i>Tamias palmeri</i>	Mammal		Y	Y	Y									
Anacolia menziesii	<i>Anacolia menziesii</i>	Plant Non-vascular				Y	Y								
Claopodium whippleanum	<i>Claopodium whippleanum</i>	Plant Non-vascular				Y									
Dicranoweisia crispula	<i>Dicranoweisia crispula</i>	Plant Non-vascular			Y	Y									
Syntrichia princeps	<i>Syntrichia princeps</i>	Plant Non-vascular				Y									
rough angelica	<i>Angelica scabrida</i>	Plant Vascular			Y										Y
Charleston pussytoes	<i>Antennaria soliceps</i>	Plant Vascular	Y	Y											
sticky ringstem	<i>Anulocaulis leisolenus</i>	Plant Vascular							Y	Y					
Las Vegas bearpoppy	<i>Arctomecon californica</i>	Plant Vascular							Y	Y					
white bearpoppy	<i>Arctomecon merriamii</i>	Plant Vascular						Y	Y	Y					
rosy king sandwort	<i>Arenaria kingii ssp. rosea</i>	Plant Vascular		Y	Y										
Clokey milkvetch	<i>Astragalus aequalis</i>	Plant Vascular			Y	Y	Y								
threecorner milkvetch	<i>Astragalus geyeri var. triquetrus</i>	Plant Vascular								Y					
Clokey eggvetch	<i>Astragalus oophorus var. clokeyanus</i>	Plant Vascular			Y	Y									
Spring Mountain milkvetch	<i>Astragalus remotus</i>	Plant Vascular				Y	Y	Y		Y					
alkali mariposa lily	<i>Calochortus striatus</i>	Plant Vascular								Y					Y
Clokey paintbrush	<i>Castilleja martinii var. clokeyi</i>	Plant Vascular		Y	Y										
Clokey thistle	<i>Cirsium clokeyi</i>	Plant Vascular	Y	Y	Y										Y
Jaeger whitlowgrass	<i>Draba jaegeri</i>	Plant Vascular	Y	Y											

Table 1. continued.

COMMON	SCIENTIFIC	TAXON GROUP	TAXON GROUP													
			Alpine	Bristlecone Pine	Mixed Conifer	Pinyon Juniper	Sagebrush	Blackbrush	Salt Desert Scrub	Mojave Desert Scrub	Mesquite Catclaw Acacia	Desert Riparian and Aquatic	Spring			
Charleston draba	<i>Draba pauciflora</i>	Plant Vascular	Y	Y												
inch high fleabane	<i>Erigeron uncialis</i> ssp. <i>conjugans</i>	Plant Vascular		Y	Y	Y	Y									
forked (Pahrump Valley) buckwheat	<i>Eriogonum bifurcatum</i>	Plant Vascular							Y		Y					
sticky buckwheat	<i>Eriogonum viscidulum</i>	Plant Vascular								Y						
Clokey greaseweed	<i>Glossopetalon clokeyi</i>	Plant Vascular			Y											
smooth pungent greaseweed	<i>Glossopetalon pungens</i> var. <i>glabra</i>	Plant Vascular				Y	Y									
pungent dwarf greaseweed	<i>Glossopetalon pungens</i> var. <i>pungens</i>	Plant Vascular				Y	Y									
Red Rock Canyon aster	<i>Ionactis caelestis</i>	Plant Vascular			Y											
hidden ivesia	<i>Ivesia cryptocaulis</i>	Plant Vascular	Y													
Jaeger ivesia	<i>Ivesia jaegeri</i>	Plant Vascular		Y	Y											
Hitchcock bladderpod	<i>Lesquerella hitchcockii</i>	Plant Vascular	Y	Y	Y											
blue diamond cholla	<i>Opuntia whipplei</i> var. <i>multigeniculata</i>	Plant Vascular								Y						
Charleston pinewood lousewort	<i>Pedicularis semibarbata</i> var. <i>charlestonensis</i>	Plant Vascular		Y	Y											
white-margined beardtongue	<i>Penstemon albomarginatus</i>	Plant Vascular						Y		Y						
Charleston beardtongue	<i>Penstemon leiophyllus</i> var. <i>keckii</i>	Plant Vascular	Y	Y	Y											
Jaeger beardtongue	<i>Penstemon thompsonae</i> var. <i>jaegeri</i>	Plant Vascular			Y	Y										
Parish's phacelia	<i>Phacelia parishii</i>	Plant Vascular							Y							
Clokey mountain sage	<i>Salvia dorrii</i> var. <i>clokeyi</i>	Plant Vascular		Y	Y	Y										
Clokey catchfly	<i>Silene clokeyi</i>	Plant Vascular	Y	Y												
Charleston tansy	<i>Sphaeromeria compacta</i>	Plant Vascular	Y	Y												
Charleston kittentails	<i>Synthyris ranunculina</i>	Plant Vascular	Y	Y	Y											Y
Charleston grounddaisy	<i>Townsendia jonesii</i> var. <i>tumulosa</i>	Plant Vascular	Y	Y	Y	Y										
limestone violet	<i>Viola purpurea</i> var. <i>charlestonensis</i>	Plant Vascular		Y	Y	Y										
glossy snake	<i>Arizona elegans</i>	Reptile				Y			Y	Y						
banded gecko	<i>Coleonyx variegatus</i>	Reptile				Y	Y	Y		Y	Y	Y	Y		Y	
sidewinder	<i>Crotalus cerastes</i>	Reptile							Y	Y	Y					
speckled rattlesnake	<i>Crotalus mitchellii</i>	Reptile				Y	Y	Y	Y	Y						
Mojave green rattlesnake	<i>Crotalus scutulatus</i> <i>scutulatus</i>	Reptile						Y		Y						
Great Basin collared lizard	<i>Crotaphytus insularis</i> <i>bicinctores</i>	Reptile				Y	Y	Y	Y	Y	Y	Y	Y		Y	
desert iguana	<i>Dipsosaurus dorsalis</i>	Reptile							Y	Y	Y	Y	Y			
western red-tailed skink	<i>Eumeces gilberti</i> <i>rubricaudatus</i>	Reptile			Y	Y	Y	Y				Y	Y		Y	
large-spotted leopard lizard	<i>Gambelia wislizenii</i> <i>wislizenii</i>	Reptile				Y	Y	Y	Y	Y						
desert tortoise	<i>Gopherus agassizii</i>	Reptile					Y	Y	Y	Y						
California (common) king snake	<i>Lampropeltis getulus</i> <i>californiae</i>	Reptile							Y	Y						
western leaf-nosed snake	<i>Phyllorhynchus decurtatus</i>	Reptile							Y	Y						
western long-nosed snake	<i>Rhinocheilus lecontei</i> <i>lecontei</i>	Reptile							Y	Y						
Sonoran lyre snake	<i>Trimorphodon biscutatus</i> <i>lambda</i>	Reptile			Y	Y				Y						

Approximately 100,000 acres of Federal lands within Clark County are currently within designated Federal Disposal Areas and are eligible for transfer from Federal ownership to private or municipal ownership (personal communication to Sue Wainscott from Ron Gregory, Clark County Department of Air Quality and Environmental Management, January 3, 2008). These lands may be transferred via sale, exchange for other acres, or Recreational and Public Purpose lease to municipalities. Upon transfer to non-Federal ownership, these lands become eligible to be permitted for disturbance under the MSHCP's Section 10(a) Incidental Take Permit. The MSHCP, USFWS analysis of the MSHCP and the Section 10(a) Incidental Take Permit anticipated that some or all of these acres might be transferred to non-Federal ownership at some point during the term of the permit and be eligible for disturbance (habitat loss) (RECON 2000, USFWS 2001a and 2001b).

The MSHCP (RECON 2000) categorized the landscape of the area covered by the Section 10(a) Incidental Take Permit in four basic conservation Management Area categories Intensively Managed Areas (IMA), Less Intensively Managed Areas (LIMA), Multiple Use Managed Areas (MUMA), and Unmanaged Areas (UMA). The MSHCP's goals for species management are described in terms of the habitat quality in each of these Management Area categories (RECON 2000). The MSHCP, USFWS analysis of the MSHCP and the Section 10(a) Incidental Take Permit anticipated that changes in MSHCP Management Area designation might take place during the term of the permit (RECON 2000, USFWS 2001a and 2001b), such as through disposal of Federal lands as described above, or legislative and administrative changes in land designation that would reclassify the acreage into a different Management Area category. A process for evaluating such changes in MSHCP Management Areas location and extent was described in the MSHCP (RECON 2000 p. 2.292). Such an analysis is currently being completed by the Bureau of Land Management, but the data were not available for analysis in this report.

Clark County, Nevada, Department of Air Quality and Environmental Management, Desert Conservation Program staff have tracked the acres permitted for disturbance (incidental take) under the Section 10(a) Incidental Take Permit since issuance of the permit. These data are not spatially tracked and provide a cumulative number of acres permitted for incidental take (habitat loss) under the permit (61,987.46 acres as of December 31, 2007: Clark County 2008).

In August 2007, the first spatial analysis was conducted of habitat loss that had occurred to date during the term (March 2001 to September 2006) and within the geographic extent of the Section 10(a) Incidental Take Permit (Clark County 2007). This analysis was recently updated using available imagery for the period of March 2001 to March 2007 (Clark County 2008) and showed that during this time period 56,512 acres of habitat had actually been lost. Data are also available on the spatial extent of the ecosystems and Management Area categories defined in the MSHCP, and these data are compared to the above habitat loss dataset.

Spatial Analysis of MSHCP Habitat Loss by Ecosystem

As described above, the intent of this analysis was to spatially analyze MSHCP covered species habitat loss by ecosystem between March 2001 and March 2007 within Clark County. For the purpose of this analysis the 2001 and 2007 land use data sets created under the Land Use Trends Tracking System (Clark County 2008) and the RECON ecosystem data set were used. As in the MSHCP (RECON 2000), ecosystems are used as surrogate measures of the spatial extent of species habitat (table 1).

A spatial analysis was performed between the land use data sets and the RECON ecosystem data set and a summary of acres lost by ecosystem were produced. No polygon-based layer is currently available for the springs ecosystem, so a point-based data set was used. This point-based springs dataset was based on an aquatic and riparian site dataset from the US Environmental Protection Agency (Bradford 2001). All non-springs locations were clipped from that dataset to create the springs point-based dataset which was compared to the habitat loss and MSHCP ecosystem datasets.

The results of the analyses are shown below. Figure 2 and table 2 show habitat loss within ecosystems from March 2001 to March 2007 within Clark County.

Table 2: Acres of habitat loss (numbers of springs) by MSHCP ecosystem within Clark County, Nevada.

ECOSYSTEM	County Total	2001	2007	% Ecosystem	
				Acres Lost	Extent Lost
Alpine	479	0	0	0	0
Blackbrush	831,531	0	23	23	0.003
Bristlecone pine	15,856	0	0	0	0
Desert aquatic	21,599	3,451	4,053	602	2.79
Mesquite/Catclaw	34,466	6,727	7,674	947	2.75
Mixed conifer	56,413	5	6	1	0.002
Mojave desert scrub	3,467,118	186,333	234,573	48,240	1.39
Pinyon-juniper	281,695	52	53	1	0.000003
Sagebrush	138,949	0	0	0	0
Salt desert scrub	208,565	7,472	14,171	6,699	3.21
Springs	754	16	16	0	0
Total Acres Lost				56,512	

Results of this habitat loss analysis indicate that the majority of habitat loss (48,240 of a total of 56,512 acres of habitat loss) has occurred in the Mojave Desert Scrub ecosystem, and those 48,240 acres represent 1.39% of that ecosystem's distribution within Clark County. The ecosystem which incurred the largest percentage lost (3.21%) was Salt Desert Scrub with 6,699 of 208,564 acres of that ecosystem lost. Species' habitats that are described in the MSHCP as occurring within these two ecosystems are: sticky ringstem, Las Vegas bearpoppy, white bearpoppy, threecorner milkvetch, Spring Mountain milkvetch, alkali mariposa lily, sticky buckwheat, blue diamond cholla, glossy snake, banded gecko, sidewinder, speckled rattlesnake, Mojave green rattlesnake, Great Basin collared lizard, desert iguana, large-spotted leopard lizard, desert tortoise, California (common) king snake, western leaf-nosed snake, western long-nosed snake, and Sonoran lyre snake (RECON 2000). Species' habitats described in the MSHCP as occurring in the Salt Desert Scrub ecosystem are: silver-haired bat, long-eared myotis, sticky ringstem, Las Vegas bearpoppy, white bearpoppy, forked (Pahrump Valley) buckwheat, Parish's phacelia, glossy snake, sidewinder, speckled rattlesnake, Great Basin collared lizard, desert iguana, large-spotted leopard lizard, desert tortoise, California (common) king snake, western leaf-nosed snake, and western long-nosed snake (RECON 2000).

Habitat Loss and MSHCP Ecosystems between 2001 and 2007 in Clark County, Nevada

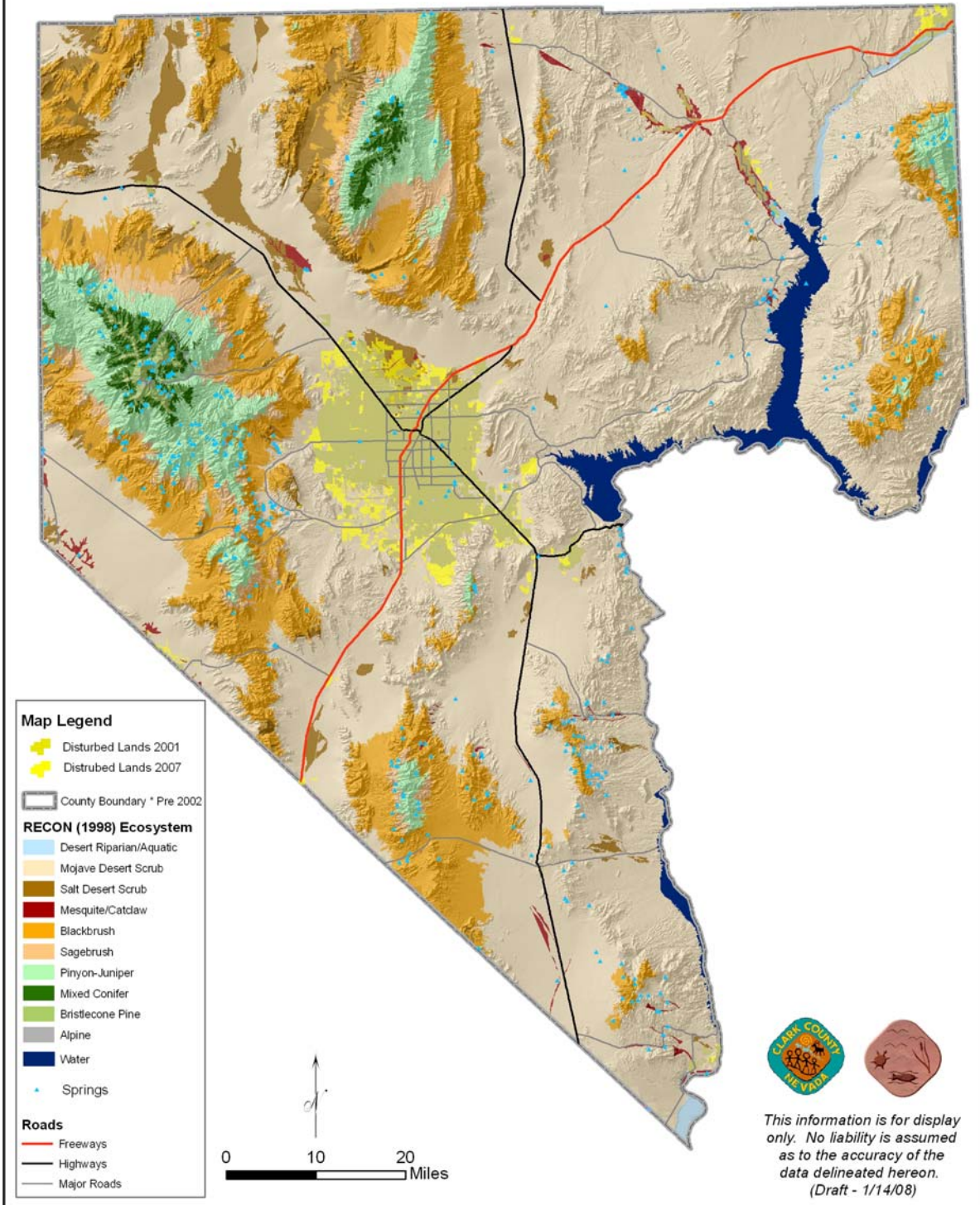


Figure 2: Map of habitat loss and MSHCP ecosystems between 2001 and 2007 in Clark County, Nevada.

A total of 16 springs were known from lands disturbed prior to the term of the MSHCP's Section 10(a) Incidental Take Permit. Of the 16 springs previously lost, 13 were located within Mojave Desert Scrub, 1 in Salt Desert Scrub, and 1 in Desert Riparian ecosystems. No additional springs were lost during the term examined in this analysis.

Spatial Analysis of Habitat Loss by Ecosystem within MSHCP Management Area Categories

The habitat loss by ecosystem analyses results were also compared to the MSHCP Management Area categories dataset. Table 3 shows the percent of total habitat loss in each Management Area category for each ecosystem from March 2001 to March 2007 for all of Clark County.

Table 3. Acres (number of springs) and percentage (%) of habitat loss in MSHCP ecosystems and MSHCP land management categories between March 2001 and March 2007, in Clark County, Nevada.

MSHCP Ecosystem	Acres (Number of Springs) Lost				% Ecosystem Extent Lost
	IMA	LIMA	MUMA	UMA	
Alpine	0	n/a	n/a	n/a	0
Blackbrush	0	0	0	23	0.003
Bristlecone pine	0	0	n/a	0	0
Desert aquatic	58	n/a	91	453	2.79
Mesquite/Catclaw	1.3	n/a	361	585	2.75
Mixed conifer	0.2	0	n/a	0.7	0.002
Mojave desert scrub	463	79	17,753	29,946	1.39
Pinyon-juniper	0	0	0	0.8	0.000003
Sagebrush	0	0	0	0	0
Salt desert scrub	0.2	0	1,644	5,055	3.21
Springs	0	0	0	0	0
Total Acres Lost	523	79	19,849	36,063	

The majority (36,063 of 56,512) of acres of habitat loss occurred in UMA, followed by 19,849 in MUMA. A total of 602 acres of habitat loss occurred in areas defined as IMA and LIMA.

Of the 16 springs lost prior to the term of the MSHCP's Section 10(a) Incidental Take Permit, 15 were located in UMA and 1 in IMA boundaries. No additional springs were lost during the term examined in the analysis.

Conclusions

The results of the spatial habitat loss by ecosystem analysis are consistent with the expected habitat loss in each ecosystem (table 4) as described by the MSHCP and USFWS analysis of the potential impacts of the MSHCP's Section 10(a) Incidental Take Permit (RECON 2000 and USFWS 2001b).

Table 4. Expected potential percentage (%) habitat loss in MSHCP ecosystems and expected potential acreages (number of springs) of ecosystem loss in MSHCP Management Area categories during term of the Section 10(a) Incidental Take Permit (USFWS 2001b)

MSHCP Ecosystem	Potential Acreage (Number of Springs) Loss in Each Category				Overall Potential % Ecosystem Extent Loss
	IMA	LIMA	MUMA	UMA	
Alpine	0	0	0	0	0.0
Blackbrush	0	0	0	8,700	1.0
Bristlecone pine	0	0	0	1,000	6.3
Desert aquatic	0	0	0	2700	16.0
Mesquite/Catclaw	0	0	3,035	5,000	37.0
Mixed conifer	0	0	0	1,500	2.6
Mojave desert scrub	0	0	0	145,000	4.0
Pinyon-juniper	0	0	0	4,200	<1.0
Sagebrush	0	0	0	900	<1.0
Salt desert scrub	0	0	0	19,800	10.0
Springs	0	0	0	78	16
Total Potential Acres Lost	0	0	3,035*	188,800*	*up to a maximum of 145,000 in any category

The largest number of acres lost occurred within Mojave Desert Scrub ecosystem. The largest percentage loss occurred within the Salt Desert Scrub ecosystem. The losses of habitat within each ecosystem are each less than the anticipated potential losses of 4% and 10% respectively, as anticipated by the USFWS analysis of the potential impact of the MSHCP's Section 10(a) Incidental Take Permit (USFWS 2001a).

The results of the spatial habitat loss by ecosystem in Management Area categories analysis show habitat loss occurring primarily within UMA and MUMA (36,063 and 19,849 acres respectively). In addition, several (602) acres of habitat loss has occurred within areas designated as IMA (523) and LIMA (79). It is not possible with the available data to determine how many of these acres were in areas disposed of by Federal agencies (thus changing their Management Category to UMA), or how many of these acres were in areas that experiences a change in management designation that may have caused a reclassification of the MSHCP Management Area category. As previously described, the BLM is conducting an analysis of MSHCP Management Area changes, but the data were not available for this report. It would be premature to accept the results of the spatial analysis of habitat loss by ecosystem within MSHCP Management Area categories until the classification of acres has been updated. Recommendations are made below for use of those data when they become available.

Recommendations

This analysis shows that as anticipated in the MSHCP (RECON 2000) and Biological Opinion (USFWS 2001a), the majority of habitat loss occurred within the Mojave Desert Scrub ecosystem. No ecosystem experienced habitat loss in excess of that anticipated in the Biological Opinion (USFWS 2001a). The MSHCP's goal is to ensure no net unmitigated loss or

fragmentation of covered species habitats (RECON 2000). To provide a more direct analysis of each covered species' habitat losses, data on species occurrence, more detailed habitat parameters, and species viability could be assessed to evaluate the status of each affected species and extrapolate the impacts of the present habitat loss under the MSHCP. Available species occurrence data have been compiled and should be assessed for their applicability in such analyses. A few current MSHCP projects include creation and refinement of conceptual or predictive habitat models for several covered species, and within two years those refined models will be available to provide a more robust analysis of species habitat and test the ecosystem-as-habitat-surrogates for those species as described in the MSHCP (RECON 2000). No species viability assessments are planned to date, but could be initiated if any species are shown to be experiencing a greater loss of habitat than predicted by the ecosystem analysis.

This analysis also showed that the majority of habitat loss occurred within the MSHCP Management Area categories of UMA and MUMA, but several acres of habitat loss occurred within areas classified as IMA and LIMA. This analysis used the Management Area classification dataset that described the status of land at the time the MSHCP's Section 10(a) Incidental Take Permit was issued (February 2001). As described above, it was anticipated that changes would occur in Management Area classifications, and a process for evaluating such changes was described in the MSHCP (RECON 2000 p. 2.292). Such an analysis is currently being completed by the Bureau of Land Management, and once those data are available, this spatial analysis of habitat loss by ecosystem within Management Area categories should be updated. Any areas of habitat loss that occurred within the updated IMA, LIMA and MUMA categories should be investigated to determine if that loss occurred under the MSHCP's Section 10(a) Incidental Take Permit, or under a separate Federal action. Habitat loss or disturbance that occurred under separate Federal actions should not be included in this analysis of the MSHCP's Section 10(a) Incidental Take Permit habitat loss by ecosystem.

In order to address the MSHCP goal of no net loss or fragmentation of species habitat (RECON 2000), the results of this habitat loss by ecosystem analysis should be compared with mitigation and conservation actions implemented by the MSHCP. A database of implementation actions funded by the MSHCP and a comprehensive GIS geodatabase depicting the locations of those actions are being developed. Many of the early MSHCP projects did not collect spatial data, and the metadata associated with most projects implemented prior to 2007 are of poor quality. Current projects are required to submit detailed data management plans for approval prior to implementation, and these data management plans meet minimal guidelines for metadata. When the MSHCP implementation database and GIS geodatabase are completed, a spatial analysis should be performed of the spatial extent of habitat loss by ecosystem and species habitat, and compared to the spatial extent of implementation actions funded to mitigate the impacts of that habitat loss.

Recommendations for future land use trends analysis focus on improving the resolution and reducing the potential for errors in land use classification, as well as incorporation of anticipated future datasets. It has been recommended by Science Advisor (DRI 2007) that future analyses of land use trends include refining the land use classification schema to include a more robust and finer classification system. A combination of land use/land cover classification system could be used. A common land use/land cover classification system that could be used is the Anderson Level I land use/land cover. In time this could be developed into a more complex classification system like the one used in Anderson Level II or in the USFS National Land Cover Dataset (NLCD) products. To achieve this level of classification the land use data sets would have to be enhanced by use of GIS reference data such as parcel data from Clark County and

other MSHCP permit holders, US Department of Agriculture National Agriculture Imagery Program (NAIP) imagery, Digital Ortho Quarter Quads (DOQQs), other imagery data such as Quickbird, roads, government lands data sets, and color infrared aerial photography. However, because this report is concerned primarily with the quantification of land disturbance under the Section 10(a) Incidental Take Permit, it is not clear whether the benefits of a more refined land use classification would result in more accurate or finer resolution of a binary dataset consisting of disturbed and nondisturbed classes.

The Clark County and Southern Nevada Water Authority (SNWA) aerial photography acquisition period occurs twice yearly, in March and September. Beginning with the March, 2007 aerial photography acquisitions, the County and SNWA aerial contractors began providing 4 band (1 color IR) 6 inch resolution imagery instead of the previous 1 foot 3 band imagery. Higher resolution imagery with the additional IR band may provide the analyst a means to extract more visual information from the imagery. With the addition of the IR band, vegetation data may be extractable. These new aerial acquisitions have not yet been reviewed for relevance for this application.

An additional recommendation would be to refine and update the 1998 RECON Vegetation and Ecosystem data set. Since 1998 several new vegetation (SWREGAP, USGS/EPA and LANDFIRE, USGS) data sets have been completed. Refining the RECON data set with new vegetation data sets with newer satellite and aerial imagery data sets (NAIP, DigitalGlobe) a more accurate vegetation and ecosystem data set could be created.

The RECON vegetation data set was clipped to an older (pre-2002) Clark County boundary. The Clark County boundary was realigned in the early 2000s. The BLM's current analysis of changes in MSHCP Management Area categories includes incorporation of this post 2002 County boundary. In future analyses the post 2002 Clark County boundary should be used.

A possible improvement to this Habitat Loss by Ecosystem Tracking System would be a customized GIS or Internet based application that would perform on-the-fly landscape analysis. The ideal application would allow a user to input various GIS data sets along with land use/ land cover data sets and have the ability to run and summarize various landscape metrics. Having the ability to generate and output maps and summary data such as, land use proportion, patch analysis, and fragmentation metrics within a custom application would enable non GIS users to generate output data and maps simply.

There are a number of software packages that claim to have some of these capabilities. A few of the software packages that have been identified are Habitrak, ATtiLA, Fragstats, Patch Analyst, NatureServe, and IDRIS Andes. A few of these packages are free or can be purchased at a low cost but others may be expensive and would need significant upgrades to them to meet our needs. Habitrak has been integrated with the California Division of Fish and Game web site (<http://www.dfg.ca.gov/nccp/habitrak/>) and shows a lot of promise. A comprehensive software search and cost assessment was recommended in the 2007 Habitat Loss by Ecosystem Tracking System report (Clark County 2007), and has not yet been completed to identify various software packages that would meet the MSHCP needs.

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