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# Clark County Rare Plant 2021 Survey Report



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## **Final Survey Report**

**Submitted to:**  
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## Acronyms

ac	acre
BLM	Bureau of Land Management
DCP	Desert Conservation Program
EO	element occurrence
ft	feet
GIS	Geographic Information System
ha	hectare
Ironwood	Ironwood Consulting, Inc.
km	kilometer
m	meter
Mi	Mile
MSHCP	Multiple Species Habitat Conservation Plan
PM	Project Manager
NNHP	Nevada Natural Heritage Program
USDA	U.S. Department of Agriculture

## Executive Summary

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This report provides the results from 2021 field surveys within Clark County, Nevada, completed by Ironwood Consulting, Inc. between April 24 and 28 and October 22 and 30, 2021. The project goals were to (1) survey for critically endangered and special-interest plant species where habitat has been modeled, but presence has not yet been verified, and (2) survey for other rare plant species that are protected by the State of Nevada under the Clark County Multispecies Habitat Conservation Plan and/or have special status with the Bureau of Land Management.

Ironwood used a composite version of the Clark County Desert Conservation Program's species distribution models to identify potential general survey locations and optimize field efforts. Botany teams targeted these survey locations and used a combination of coarse- and fine-scale ground surveys to search for species of interest. The resulting data includes comprehensive floristic inventory lists for each survey area, element occurrence records for target species encounters, diagnostic and habitat photos for target species encounters, and GIS data for element occurrence records and survey tracks.

Ironwood surveys resulted in 81 rare plant occurrence records, occupying 1,703 of the 10,168 acres (ac) (689 hectares [ha]) surveyed within Clark County. Of the 16 locations surveyed, target species were observed at 10 locations. A brief review of the composite species distribution model suggests that the model's habitat suitability predictions for *Cylindropuntia multigeniculata* (Blue Diamond cholla) would benefit from refinement.

Recommendations include completing future surveys to target *Eriogonum corymbosum* var. *nilesii* (Las Vegas buckwheat) since associated element occurrences are currently limited. We also suggest that voucher specimens of this taxon be collected during future encounters so positive identification is more easily confirmed, and more material is available for taxonomic study. Ironwood also recommends additional surveys for *Cylindropuntia multigeniculata* so that this data can be used to update the species' habitat suitability model, since 41% of the occupied area encountered during 2021 was modeled as having low habitat suitability.

## 1. Introduction

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### 1.1 Project Description

Clark County Desert Conservation Program (DCP) contracted Ironwood Consulting, Inc. (Ironwood) to complete surveys within Clark County, Nevada (County) for five primary target plant species where habitat has been modeled, but presence has not yet been verified. The five primary target plant species list is comprised of four critically endangered species and one special interest species (see Table 1-1). In addition to these five modeled primary target species, Ironwood was tasked to complete surveys for rare plant species that are protected by the State of Nevada, covered under the Clark County Multispecies Habitat Conservation Plan, or have Bureau of Land Management (BLM) sensitive or special status. All modeled and non-modeled primary and secondary species are tracked by the Nevada Natural Heritage Program (NNHP). The project required focused field surveys that implemented a rigorous data collection protocol using existing habitat models to determine survey areas.

This annual survey report describes the approach that Ironwood used to meet the project objectives and complete surveys during the spring and fall of 2021 for the primary target species that have had suitable habitat modeled, outlined in Table 1-1. Non-modeled primary target species and secondary target species outlined in Table 1-1 were surveyed for and documented when suitable habitat was present in the survey areas. Spring surveys for spring blooming and perennial species were completed between April 24 and 28, 2021. Autumn surveys for fall blooming and perennial species were completed between October 22 and 30, 2021.

The 2021 surveys were a continuation of spring 2020 surveys that are described in the 2020 Clark County Rare Plant Survey Report and Data Deliverable (Ironwood 2020a). While surveys for autumn-flowering species were not completed in 2020 due to below-average precipitation during the last half of the year, they were completed in the fall of 2021.

### 1.2 Background and Need for the Project

To expand knowledge about species abundance throughout the County, specifically site occupancy in areas that may be at risk for future development or disturbance, the DCP commissioned targeted survey efforts for critically endangered and special interest plants. Before the rare plant surveys were completed in 2020, the DCP commissioned the development of species distribution models for five targeted rare plant taxa to support management decisions and the conservation of species vulnerable to habitat loss in the County (see Table 1-1 and Appendix A). *Arctomecon californica* (Las Vegas bear poppy), *Astragalus geyeri* var. *triquetrus* (threecorner milkvetch), *Cylindropuntia multigeniculata* (Blue Diamond cholla), and *Eriogonum viscidulum* (sticky buckwheat) are listed as critically endangered by the state of Nevada, and the fifth modeled taxon, *Penstemon albomarginatus* (white-margined beardtongue), is a special interest and BLM sensitive species. The DCP's goal for the models was to inform natural resource managers of the potential locations of suitable habitat for sensitive plant species within the County.

Spatial modeling contractors for the DCP produced species distribution models for the five State of Nevada listed plant species at the top of Table 1-1. Species occurrence records were used to train the models by correlating them with environmental variables such as slope, elevation, ground surface roughness and greenness using the Normalized Difference Vegetation Index and precipitation variables (USGS 2018; Nussear and Simandle 2019). Up to 10 environmental variables were used, where uninformative variables were

excluded. The final step was to test a subset of occurrence records against the models, but it is important to note that this process did not include a field-based accuracy assessment. The 2020 targeted plant surveys took the next step in using the models to predict species distribution by ground truthing them. The 2021 surveys and results described in this report were a non-statistical method to help the DCP determine whether the models accurately predicted species presence on the ground. Figures for each of the rare plant species habitat suitability models, referred to herein as the “2019 models,” are included in Appendix A.

Surveys for non-modeled primary species and secondary species are used to inform the DCP’s conservation planning. Primary target species are those listed as critically endangered by the state of Nevada or are being considered for coverage under the multiple species habitat conservation plan (MSHCP) Permit Amendment. Secondary target species are known to occur in southern Nevada, and some are of special concern to Clark County and/or the BLM. In many cases habitat for the non-modeled primary and secondary species is similar to habitat for the modeled species, and surveys for multiple primary and secondary target species listed in Table 1-1 occurred simultaneously based on the presence of habitat at any given location.

**Table 1-1. Primary target species for Clark County rare plant surveys**

Scientific Name	Common Name	Species USDA Code
<b>Modeled Primary Target Species</b>		
<i>Arctomecon californica</i> <sup>1,2,3,4</sup>	Las Vegas bearpoppy	ARCA
<i>Astragalus geyeri</i> var. <i>triquetrus</i> <sup>1,2,3,4</sup>	Threecorner milkvetch	ASGET
<i>Cylindropuntia multigeniculata</i> <sup>1,2,3,4</sup>	Blue Diamond cholla	CYMU
<i>Eriogonum viscidulum</i> <sup>1,2,3,4</sup>	Sticky buckwheat	ERV17
<i>Penstemon albomarginatus</i> <sup>2,3,4</sup>	White-margined beardtongue	PEAL3
<b>Non-Modeled Primary Target Species</b>		
<i>Anulocaulis leiosolenus</i> var. <i>leiosolenus</i> <sup>2,3,4</sup>	Sticky ringstem	ANLEL2
<i>Calochortus striatus</i> <sup>2,3,4</sup>	Alkali mariposa lily	CAST2
<i>Enceliopsis argophylla</i> <sup>3,4</sup>	Silverleaf sunray	ENAR
<i>Eriogonum bifurcatum</i> <sup>2,3,4</sup>	Pahrump Valley buckwheat	ERBI2
<i>Eriogonum corymbosum</i> var. <i>nilesii</i> <sup>3,4</sup>	Las Vegas buckwheat	ERCONI
<i>Phacelia parishii</i> <sup>2,3,4</sup>	Parish phacelia	PHPA2
<i>Sisyrinchium radicum</i> <sup>3,4</sup>	St. George blue eyed grass	SIRA3
<b>Secondary Target Species</b>		
<i>Arctomecon merriamii</i> <sup>2,3</sup>	White bearpoppy	ARME
<i>Astragalus funereus</i> <sup>3</sup>	Black woolly-pod	ASFU2
<i>Astragalus lentiginosus</i> var. <i>stramineus</i> <sup>3</sup>	Straw milkvetch	ASLES6
<i>Astragalus mohavensis</i> var. <i>hemigyris</i> <sup>3</sup>	Halfring milkvetch	ASMOH
<i>Astragalus mokiensis</i> <sup>3</sup>	Mokiak milkvetch	ASMO6
<i>Atriplex argentea</i> var. <i>longitrichoma</i> <sup>3</sup>	Pahrump silverscale	ATARL
<i>Cirsium virginense</i> (or <i>C. mohavense</i> ) <sup>3</sup>	Virgin River thistle (Mojave thistle)	CIVI6 or CIMO
<i>Didymodon nevadensis</i> <sup>3</sup>	Gold Butte moss	DINE4
<i>Mentzelia polita</i> <sup>3</sup>	Polished blazingstar	MEPO2
<i>Pediomelum castoreum</i> <sup>3</sup>	Beaver Dam breadroot	PECA24
<i>Penstemon bicolor</i> ssp. <i>bicolor</i> <sup>3</sup>	Yellow twotone beardtongue	PEBIB2

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Scientific Name	Common Name	Species USDA Code
<i>Penstemon bicolor</i> ssp. <i>roseus</i> <sup>3</sup>	Rosy twotone beardtongue	PEBIRO
<b>Other NNHP Species</b>		
<i>Ergigonum hermannii</i> var. <i>clokey</i> <sup>4</sup>	Heermann's buckwheat	ERHECL

<sup>1</sup> Listed as Critically Endangered by the State of Nevada.

<sup>2</sup> MSHCP Covered Species.

<sup>3</sup> BLM Sensitive or Status Species.

<sup>4</sup>Species tracked by the NNHP, but not listed by State of Nevada or on the MSHCP or the BLM Sensitive Lists.

### 1.3 Management Actions Addressed by the Project

Improved knowledge of the species' distributions may be used to identify potential areas where conservation could occur, aid in locating new populations, and ultimately help land managers evaluate the status of sensitive species. Species with conservation status are protected under the MSHCP. The state protects species with State of Nevada status; the BLM sensitive species are managed and protected on BLM-administered lands.

### 1.4 Goals and Objectives of the Project

The goals of the project, as identified by the DCP, are to:

- Expand the known occurrence datasets for critically endangered plant species.
- Ground truth species distribution models developed for each species.
- Secure information about rare plant presence in areas at risk for development or disturbance by human activities.



## 2. Methods and Materials

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Ironwood completed a project Work Plan (Ironwood 2020d) and a Data Management Plan (Ironwood 2020c) that detailed the rare plant survey methods, including pre-field coordination, survey area selection, equipment and materials, data management protocols, injury and illness prevention plans, and contingency plans for unexpected events. Field methods, data management practices, and analysis methods are outlined below.

### 2.1 Survey Area Determination

At the beginning of pre-survey planning, the County provided Ironwood with the following Geographic Information System (GIS) data:

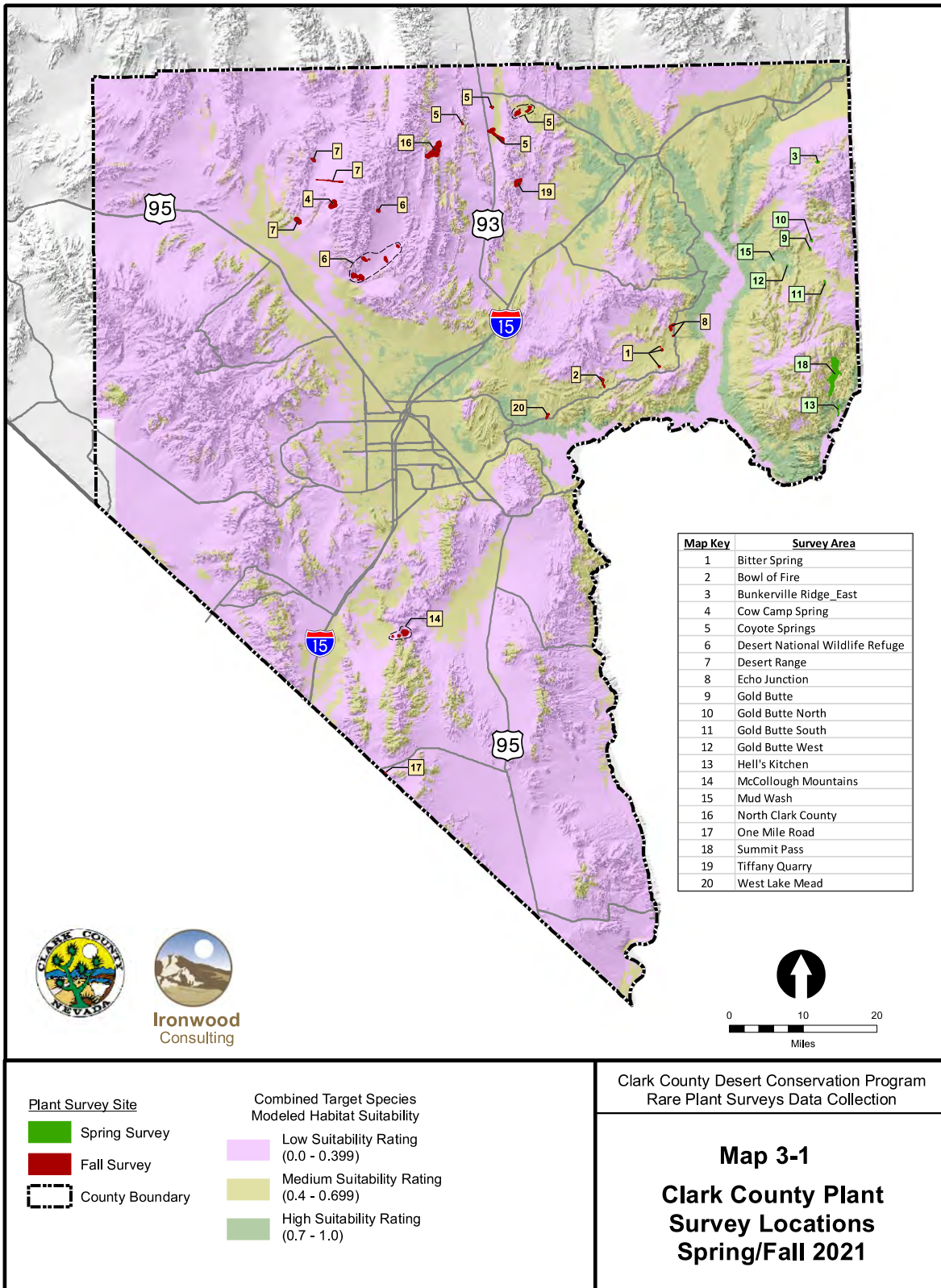
- Habitat models for each of the modeled primary species shown in Figure 2-1.
- Known element occurrence (EO) records for primary and secondary species listed in Table 4-1
- County proposed disposal and development areas.
- Roads and land ownership data.
- Modeling for gypsum and aeolian soils to help identify habitat for non-modeled species.

Individual species distribution models for five of the targeted primary plant species were combined in GIS into a composite model used to optimize field efforts. The composite model effectively showed areas within the County where there was a higher probability of encountering more than one target species. The combined model was coded into three classes illustrated by high, medium, and low probability pixels (Figure 2-1). Potential survey areas were then prioritized by (1) distance from known EO records to locate new occurrences and (2) ease of access.

Criteria for distance from known EO records was determined by buffering occurrences by 1 kilometer (km) (0.62 mile [mi]) and eliminating those areas from consideration as potential sites. Ease of access was determined by identifying areas where modeled habitat for one or more species occurred within 4 km (2.5 mi) of a road or other access route; other variables for consideration included land ownership. Public and tribal lands were considered for survey with the condition that permits for access to restricted areas would be obtained, while private lands were excluded as well as areas that had been well surveyed and documented for target species. County-proposed disposal and development areas were considered but ultimately excluded from consideration due to lack of modeled habitat. Areas where habitat for more than one species had been modeled were identified as high-priority sites, along with areas where little information is known about the status of the modeled habitat for a species (e.g., Blue Diamond cholla, white-margined beardtongue). Necessary permits, including access to the Moapa Indian Reservation and the Lake Meade Recreation Area, which is administered by the National Park Service, were then obtained.

A meeting on January 20, 2020, with DCP biologist Stefanie Ferrazzano and Resource Management Officer Cayenne Engel of the Nevada Department of Conservation and Natural Resources division further helped envision field efforts by using institutional knowledge of areas soon to be developed and locales where data voids exist (e.g., Moapa Indian Reservation, Mesquite Valley). Twenty-four potential general survey areas were identified that meet the criteria outlined above, and five additional areas were added later based on field habitat assessments. Of these, 20 sites were surveyed during the spring and fall of 2021 field effort. Figure 2-1 illustrates the combined modeled habitat for target species at each of the surveyed areas. Survey area locations

are named after prominent landscape features identified in or nearby the area based on U.S. Geological Survey and BLM maps.



P:\GIS\Ironwood\Shared\Projects\Projects\Clark County\ 2021\Location.mxd

Figure 2-1. General Survey Areas Shown on Combined Habitat Model

## 2.2 Field Survey Equipment

The following necessary materials, vehicles, and equipment were used to fulfill the contract:

- Sub-meter and recreational GPS units and data collection devices – Each crew (three to five botanists) used an EOS Arrow 100 submeter GPS receiver, a recreational GPS unit, or an iPad/iPhone integrated GPS with a Bluetooth-enabled data collection device to input field data into a pre-designed data dictionary.
- Data collection interface – ESRI Collector was used as a data collection interface on tablets in the field for spatial all data collection.
- Miscellaneous field equipment, including plant presses and collection equipment (for species that do not have State of Nevada endangered or federal status), hand lenses, data sheets, copies of maps (electronic and paper), compasses, non-submeter GPS units (for navigation and collecting tracks), and other field equipment.
- Ironwood-created and maintained project binder, containing the project work plan and all other relevant information (maps, figures, protocols, contact information, worker injury and illness prevention plan; the binder was distributed to the field crews for reference and guidance for the project protocol, safety, and methods.

## 2.3 Field Data Collection

Field data collection focused on areas where habitat for at least one target species had been modeled. Where possible, surveys were also completed at locations where multiple primary and/or secondary target species had the potential to occur.

Survey and data collection methods follow BLM Rare Plant Sampling Methods for intuitive controlled surveys, and survey and documentation guidelines set by the NNHP's Standard Field Survey Methods (see Appendix B). Survey collection consisted of coarser scaled surveys that assessed the quality of habitat in an area and focused surveys that more thoroughly cover high-quality habitat areas for the presence/absence of target species, per BLM survey guidance.

A typical survey of a site consisted of the following:

- The botanist team would begin surveys by assessing the site for habitat characteristics and quality. Habitat for more than one target species may be present at any site, based on the habitat models and habitat requirements.
- One to five sample sites were evaluated for habitat at specific sites within the general areas shown in Figure 2-1. Habitat for each of the primary and secondary species was reviewed to determine if suitable habitat for any particular species may have been present at a particular site (see Appendix C for brief descriptions of each species' habitat). Each surveyed site would be a unique, spatially discrete area ranging between 50 and 500 ac (20.2 and 202 ha). During the survey effort, additional survey areas were identified for survey based on local knowledge of the area, habitat evaluations, and to optimize efficiency.
- Assessment of a site may have taken place at a coarse scale and would utilize intuitive controlled survey methods outlined in the BLM guidance. The botanist team determined habitat quality using survey

intervals of up to 50 meters (m; 164 feet [ft]), depending on the species, in areas where habitat characteristics for target species were not present or habitat quality was poor.

- The botanist team conducted more focused surveys using smaller survey intervals in areas where habitat quality for target species was moderate or high. A wider survey interval (20 to 30 m) was used for larger, more charismatic species. For small-statured species, a narrow interval (5 to 10 m) was used.
- When a target species individual or population was observed, the botanist team searched the area for individuals, flagging each with a pin flag. After the population boundaries were determined, data was collected using GPS and the Collector form. An EO record form was completed for each population as the official record for the NNHP.
- Populations were generally considered to be all individuals separated by less than a 0.8 km (0.5 mi) radius; if individuals were greater than 0.8 km apart, a new EO record was collected.
- All electronic data were saved and uploaded immediately to Ironwood's Cloud interface. If cellular signals were not available, data were collected locally on field tablets and uploaded upon re-entering cellular or internet service.
- A comprehensive list of plant species observed regardless of status was collected at each survey site.
- During all surveys, the botanist team used GPS units with a 5-m accuracy to document the survey site location, coverage, and acreage.
- Survey intervals varied based on terrain, habitat quality, and vegetation cover/visibility. The professional judgement of highly qualified botanists was used in the field to determine the survey interval at each site. For example, a large species such as Blue Diamond cholla can be detected from a distance due to its size and distinct characteristics, and the survey interval would be more extensive. A small annual species like Pahrump Valley buckwheat would require a smaller survey interval.
- Photo documentation of each survey site and each EO record was taken using the geo-referencing application Solocator, which provides a copy of the photo with UTM location, aspect, elevation, date, time, project name, and a brief description. Based on the NNHP guidance, photos included the species code on the photo (if applicable), project name, and survey location name. Because no herbarium specimens of critically endangered species were collected, photo documentation of each species was taken for each EO record and is included in the 2021 Project Data Deliverable Ironwood 2021 (Ironwood 2021c).

## **2.4 Data Management and Quality Control**

### **2.4.1 Spatial Data**

Data for all observed occurrences of sensitive species were collected using ESRI Collector. All spatial data collected on ESRI Collector is accessed through ArcGIS Online. All data was saved as shapefiles, and the file data product was packaged as a geodatabase, with all metadata and feature attributes included and labeled according to NNHP data standards (Ironwood 2021).

### **2.4.2 Element Occurrence Records Datasheets**

A digital copy of the EO Record datasheet was filled out for each target species occurrence. All data collected on tablets, such as the NNHP species occurrence forms, were uploaded to a remote server at the end of each

survey day or onto a computer and external hard drive if cellular service was not available in remote survey site locations. All datasheets were reviewed for accuracy and completeness, cleaned up where required, and submitted digitally to the County with the 2021 Project Data Deliverable (Ironwood 2021).

### **2.4.3 Tabular Data**

Tabular data includes species lists, attribute tables for spatial data, and summaries of EO records. All tabular data, unless noted otherwise, was saved in Microsoft Excel and is included in the results and discussion sections below, as an appendix to this report, or in the 2021 Project Data Deliverable Ironwood 2021. Tabular data includes all fields necessary so that the data is broadly useful, including dates, UTM's, descriptions, associated files, data type, survey site, species, etc. Tabular data was compiled after the field data collection was completed, from both digital and paper data forms, and submitted digitally to the County with the 2021 Project Data Deliverable (Ironwood 2021).

### **2.4.4 Data Accuracy and Quality**

To ensure data was collected accurately, all botanists and botany technicians were trained on data collection methodology and familiarized with the species' phenology and habitat. For each crew, a botanist or staff biologist was assigned the role of data collection lead. This person was tasked with assuring that each data field was populated accurately and completely. One person on the crew was assigned to fill out and keep the species list, including making digital copies each day and after each survey site was completed. A senior botanist reviewed the species list at the end of each week, updated, and distributed it to the field botany team for review and reference. After the 2021 surveys were completed, each site's entire floristic inventory list was compiled, reviewed, and assigned a floristic authority for nomenclatural convention.

Data was reviewed in the field at the end of each field day by the Project Manager (PM) and/or Assistant PM to ensure completeness, accuracy, and quality. Inaccurate or incomplete data was rectified within 24 hours of original data collection. The GIS/Data Lead also reviewed data collected by ESRI Collector to assure that all fields were filled out correctly and completely. The PM and/or Assistant PM were in the field during data collection to ensure the work plan was followed, and that the data documentation followed standardized procedures approved by the County.

### 3. Results

#### 3.1 Survey Sites, Habitat, and Acreages

Surveys took place between April 24 and 28 and again between October 22 and 30, 2021. Ironwood botanists surveyed in teams of three to five and covered approximately 10,169 ac (1,445 ha) in the 20 general survey areas outlined in Table 3-1. Maps of each of the survey areas with survey sites delineated and EO record locations shown are included in Appendix D. Representative photographs of each of the survey sites are included in Appendix E. EO records for each rare plant documented during the 2021 surveys and described below in Sections 3.3, 3.4, 3.5. All EO records with photo documentation and specific geospatial data for each are included in the 2021 Project Data Deliverable (Ironwood 2021).

It is beneficial to survey areas with a low-to-medium probability of multiple target species occurrence and high-suitability areas. For example, areas that were surveyed but returned negative results can provide useful feedback to future versions of the model. In terms of spatial modeling, negative data is also good data. No extra effort was required to field survey high, medium, and low probability pixels since they were often adjacent.

**Table 3-1. Acreage of modeled suitable habitat surveyed at the general survey areas**

Survey Area	Surveyed Acreage Modeled Habitat			Total Acres Surveyed
	Low 0.01 – 0.39	Medium 0.40 – 0.69	High 0.70 – 1.0	
Bitter Spring	0.0	110.9	0.0	110.9
Bowl of Fire	23.6	193.3	6.7	223.6
Bunkerville Ridge East	31.4	59.8	0.0	91.2
Cow Camp Spring	592.7	0.0	0.0	592.7
Coyote Springs	526.7	882.0	30.3	1,439.0
Desert National Wildlife Refuge	1,192.1	10.5	0.0	1,202.6
Desert Range	677.2	28.3	0.0	705.5
Echo Junction	0	259.9	4.0	263.9
Gold Butte	4.9	69.9	0.0	74.8
Gold Butte North	82.3	0.8	0.0	83.0
Gold Butte South	0.0	96.9	0.0	96.9
Gold Butte West	0.0	0.0	20.7	20.7
Hell's Kitchen	45.3	25.7	79.1	150.1
McCollough Mountains	500.1	13.9	0.0	514.0
Mud Wash	0.0	0.0	19.3	19.3
North Clark County	1,333.3	168.1	0.0	1501.3
One Mile Road	24.6	0.0	0.0	24.6
Summit Pass	224.3	2,180.2	0.0	2,404.5
Tiffany Quarry	435.2	76.1	0.0	511.4
West Lake Mead	0.0	138.8	0.0	138.8
<b>Total Survey Acres</b>	<b>5,693.8</b>	<b>4,315.1</b>	<b>160.1</b>	<b>10,169.0</b>

## 3.2 Comprehensive Floristic Inventory List

A running list of every vascular plant taxon encountered within each survey area was recorded to document the survey area's floristic diversity. Where applicable, taxa were identified to the subspecies and variety. However, plant phenology sometimes prevented identification to that level, so several taxa were only identified to the specific or generic (species or genus) level. The taxonomic authority for species was the *Flora of North America* Flora of North America Editorial Committee 1993+. Taxonomic sources for identifying species included *A Flora of Nevada* Kartesz 1987, *The Jepson Desert Manual: Vascular Plants of Southeastern California* (Baldwin et al. 2012; Welsh et al. 2015). The NNHP's Information, Tracking Lists, Survey Report forms, and Other Forms website was referenced for species information and floristic survey protocols (NDNH 2022). The U.S. Department of Agriculture (USDA) PLANTS database was consulted for four-letter species codes (USDA and NRCS 2021).

Over 240 unique taxa were identified during the 2021 survey. Appendix F lists the encountered species by survey area. Note that the species lists for each individual sample site within the larger survey area were combined to produce the overall Survey Area Species List.

## 3.3 Primary Modeled Target Species Occurrences

### 3.3.1 *Arctomecon californica* (Las Vegas Bearpoppy)

*Arctomecon californica* was found at two locations within Echo Junction, three locations at Bitter Spring, and one location within Gold Butte West, as summarized in Table 3-2. All occupied areas surveyed were modeled as medium or high habitat suitability. Total occupied area modeled as medium and high habitat suitability were 22.5 and 0.4 ac (9.1 and 0.2 ha), respectively. The survey area included a total of approximately 22.9 ac (9.3 ha) of occupied area and 579 individuals. The full elevation range across occurrences was 464 to 621 m (1,522 to 2,037 ft). Common associated species encountered at multiple occurrences included *Anulocaulis leiosolenus* var. *leiosolenus*, *Enceliopsis argophylla*, *Ephedra torreyana*, and *Psorothamnus fremontii*. Co-occurring invasive species of note were observed at occurrences 6017 and 4001. At these locations, invasive weeds had relatively low cover and included *Bromus rubens*, *Schismus barbatus*, and *Strigosella africana*. The overall quality of each occurrence varied from good to excellent, with some mortality observed, with multiple seasons of drought likely being a contributing factor. Proximity to other *A. californica* occurrences was commonly observed and this suggests that gene flow may be occurring between subpopulations.

**Table 3-2. 2021 Survey occurrence summary for *Arctomecon californica* (Las Vegas bearpoppy)**

Plant Code	Survey Area	Project-specific Internal EO No.	Combined Target Species Modeled Habitat Suitability	Area Occupied (ac)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)	Zone 11S	
								UTM Easting	UTM Northing
ARCA	Echo Junction	6017	Medium	11.5	344	Excellent	523	724324	4023392
		6020	Medium - High	2.8	121	Excellent	469	724883	4021702
	Bitter Spring	6023	Medium	2.8	21	Good	543	722510	4018602
		6026	Medium	2.8	17	Good	599	722098	4019269
		6029	Medium	2.8	42	Excellent	615	721975	4014961
	Gold Butte West	4001	High	0.15	34	Good	582	749823	4036805
<b>Summary</b>				<b>22.85</b>	<b>579</b>	<b>Good - Excellent</b>	<b>469-615</b>		

### 3.3.2 *Cylindropuntia multigeniculata* (Blue Diamond Cholla)

*Cylindropuntia multigeniculata* was observed at six locations in 2021: three within North Clark County, one in the Desert National Wildlife Refuge, one in the McCollough Mountains, and one in Summit Pass, as summarized in Table 3-3. Interestingly, all six occurrence locations included occupied areas modeled as low habitat quality according to the combined model, and none of the occurrences included areas modeled as high habitat suitability. Total occupied area modeled as low and medium habitat suitability were 588 and 840.5 ac (238 and 339.9 ha), respectively. Plant counts varied from 11 individuals in the North Clark County survey area to an estimated 14,000 individual at Summit Pass. Total occupied area is estimated at 1,428 ac (578 ha). The elevation range for these occurrences was between 614 and 1,802 m (2,014 and 5,912 ft). Common associated species encountered at multiple occurrences included *Cylindropuntia acanthocarpa*, *Ephedra nevadensis*, *Prunus fasciculata*, *Senegalia greggii*, *Yucca baccata*, and *Yucca brevifolia*. Co-occurring invasive species were observed included *Bromus tectorum* and/or *Schismus* sp. at occurrences 6013, 6014, and 6031. The overall quality of these occurrences was described as good to excellent. Wildfire should be considered a potential threat for all occurrences, particularly during periods of drought. Evidence of previous fire was noted at occurrences 4007 and 6031. Occurrences 6014 and 6031 were observed to have relatively high ground cover of *Bromus tectorum* and *Schismus* sp., which may enable future wildfires to spread more easily. The presence of transmission lines at occurrence 6014 may also act as a future wildfire ignition.



**Table 3-3. 2021 Survey occurrence summary for *Cylindropuntia multigeniculata* (Blue Diamond cholla)**

Plant Code	Survey Area	Project-specific Internal EO No.	Combined Target Species Modeled Habitat Suitability	Area Occupied (ac.)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)	Zone 11S	
								UTM Easting	UTM Northing
CYMU	North Clark County	6012	Low - Medium	124.6	768	Good	1,613	673535	4061876
		6013	Low - Medium	67.9	> 600	Good	1,504	673698	4063407
		6031	Low	2.9	11	Good	1,775	671398	4060853
	Desert National Wildlife Refuge	6002	Low - Medium	68.1	200	Excellent	1,357	656743	4034012
	McCollough Mtns	6014	Low - Medium	162.7	> 900	Good	1,098	666068	3957073
	Summit Pass	4007	Low - Medium	1,001.5	14,000	Good	999	760028	4014298
<b>Summary</b>				<b>1,427.6</b>	<b>&gt; 16,772</b>	<b>Good - Excellent</b>	<b>999 - 1,775</b>		

### 3.4 Primary Non-modeled Target Species Occurrences

#### 3.4.1 *Anulocaulis leiosolenus* var. *leiosolenus* (Sticky Ringstem)

*Anulocaulis leiosolenus* var. *leiosolenus* was encountered at one location in Mud Wash, two locations in Echo Junction, and two locations at Bitter Spring, as summarized in Table 3-4. The survey area included a total of approximately 19.2 ac (7.8 ha) of occupied area and 90 individuals. The full elevation range across occurrences was 464 m to 620 m (1,522 to 2,034 ft) Common associated species encountered at multiple occurrences included *Arctomecon californica*, *Enceliopsis argophylla*, *Ephedra torreyana*, and *Psorothamnus fremontii*. Co-occurring invasive species were observed with relatively low cover and included *Bromus rubens* and/or *Strigosella africana* at occurrences 4005, 6018, and 6021. The overall quality of each occurrence was rated from good to excellent. Both occurrences rated as good noted potential trampling resulting from either recreational foot traffic (6024) or wild burros (6027).

**Table 3-4. 2021 Survey occurrence summary for *Anulocaulis leiosolenus* var. *leiosolenus* (Sticky ringstem)**

Plant Code	Survey Area	Project-specific Internal EO No.	Area Occupied (ac.)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)	Zone 11S	
							UTM Easting	UTM Northing
ANELE	Mud Wash	4005	0.2	9	Excellent	532	746849	4038160
	Echo Junction	6018	10.7	26	Excellent	523	724323	4023408
		6021	2.8	40	Excellent	470	724889	4021703
	Bitter Spring	6024	2.8	12	Good	543	722510	4018602
		6027	2.8	3	Good	600	722098	4019269
<b>Summary</b>			<b>19.2</b>	<b>90</b>	<b>Good - Excellent</b>	<b>470-600</b>		

### 3.4.2 *Enceliopsis argophylla* (Silverleaf Sunray)

*Enceliopsis argophylla* was encountered at nine locations: one in Gold Butte, one in Gold Butte West, one in Mud Wash, two at Echo Junction, three at Bitter Spring, and one at West Lake Mead, as summarized in Table 3-5. In total, these occurrences included 1,494 individuals occupying 38.1 ac (15.4 ha), across an overall elevation range of 463 to 749 m (1,519 to 2,457 ft). Common associates included *Arctomecon californica*, *Anulocaulis leiosolenus* var. *leiosolenus*, *Atriplex confertifolia*, *Ephedra torreyana*, *Eriogonum inflatum*, and *Psoralea fremontii*. Additional associated species included *Phacelia palmeri* and *Ambrosia dumosa*. Co-occurring invasives included *Bromus rubens* (occurrences 4004 and 6016) and *Strigosella africana* (occurrence 6019); these were noted as being generally low cover or only occurring along the population margins. Each occurrence was given an overall quality rating of poor to excellent. The most immediate threats to these occurrences include trampling from burro presence (occurrences 4004, 6025, and 6028), nearby OHV road access (4002), and cattle grazing (4002). The invasive weed populations may flourish with increased recreational traffic and/or impacts from grazing. Heavy insect herbivory from grasshoppers was noted at occurrences 6016, 6019, 6022, and 6028. Grasshoppers are typically generalist feeders with variable seasonal abundance and therefore likely serve as a stochastic variable in the environment. However, higher plant mortality may occur when intense insect herbivory is compounded by drought conditions. Occurrence 6030 was described as having an overall poor occurrence quality due to high mortality and substantial impacts from insect herbivory.

**Table 3-5. 2021 Survey occurrence summary for *Enceliopsis argophylla* (Silverleaf sunray)**

Plant Code	Survey Area	Project-specific Internal EO No.	Area Occupied (ac.)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)	Zone 11S	
							UTM Easting	UTM Northing
ENAR	Gold Butte	4009	2.0	72	Excellent	745	754914	4040682
	Gold Butte West	4002	1.0	52	Good	582	749833	4036808
	Mud Wash	4004	9.6	200	Excellent	531	746851	4038139
	Echo Junction	6016	11.6	376	Good	523	724323	4023393
		6019	2.8	203	Good	469	650936	4495095
	Bitter Spring	6022	2.8	238	Good	543	722510	4018602
		6025	2.8	251	Good	599	722098	4019269
		6028	2.8	91	Excellent	614	721975	4014961
	West Lake Mead	6030	2.8	5	Poor	490	697448	4004601
<b>Summary</b>			<b>38.1</b>	<b>1,494</b>	<b>Poor - Excellent</b>	<b>490-745</b>		

### 3.4.3 *Eriogonum corymbosum* var. *nilesii* (Las Vegas Buckwheat)

*Eriogonum corymbosum* var. *nilesii* was potentially encountered at one location in Gold Butte during the spring of 2021, as summarized in Table 3-6. This occurrence included 232 individuals occupying 1.7 ac (0.6 ha), across an elevation range of 740 to 746 m (2,428 to 2,448 ft). Associates observed at this occurrence included *Ambrosia Salsola*, *Ephedra torreyana*, *Hilaria rigida*, *Krameria* sp., *Psoralea fremontii*, and *Yucca brevifolia*. The overall quality at this occurrence was rated as excellent, however minor OHV disturbance was noted adjacent the occupied habitat.

Distinguishing between *Eriogonum corymbosum* var. *nilesii* and *Eriogonum corymbosum* var. *aureum* in the field is exceedingly difficult because of strong phenotypic similarities (Ellis et al. 2018). This challenging overlap in morphological features was compounded by the presence of poor specimens due to drought conditions during fieldwork. Consequently, the individuals encountered in the field for this taxon were lacking sufficient vigor and morphological features for confident field identification. Therefore, this occurrence should be revisited again during improved conditions so the identity can be verified. We also recommend making a voucher collection of plant material to deposit in a regional herbarium when encountering new occurrences of this taxon. This facilitates review of specimens by taxonomic experts and provides more plant material for ongoing and much needed genetic and morphological research.

**Table 3-6. 2021 Survey occurrence summary for *Eriogonum corymbosum* var. *nilesii* (Las Vegas buckwheat)**

Plant Code	Survey Area	Project-specific Internal EO No.	Area Occupied (ac.)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)	Zone 11S	
							UTM Easting	UTM Northing
ERCONI	Gold Butte	4008	1.7	232	Excellent	742	754837	4040517
<b>Summary</b>			<b>1.7</b>	<b>232</b>	<b>Excellent</b>	<b>742</b>		

### 3.5 Secondary Target Species Occurrences

#### 3.5.1 *Arctomecon merriamii* (White Bearpoppy)

*Arctomecon merriamii* was encountered at one location in the Desert National Wildlife Refuge and two locations in Desert Range, as summarized in Table 3-7. These occurrences included 135 individuals occupying 37.5 ac (15.2 ha), across an elevation range of 1,269 to 1,558 m (4,163 to 5,112 ft). Common associates observed at multiple occurrences included *Atriplex confertifolia*, *Echinocactus polycephalus*, *Ephedra* spp., and *Yucca brevifolia*. Each occurrence was given an overall quality rating of fair to good. The occurrence 6000 was rated as fair due to high observed mortality from unknown causes.

**Table 3-7. 2021 Survey occurrence summary for *Arctomecon merriamii* (White bearpoppy)**

Plant Code	Survey Area	Project-specific Internal EO No.	Area Occupied (ac.)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)	Zone 11S	
							UTM Easting	UTM Northing
ARME	Desert National Wildlife Refuge	6000	1.4	7	Fair	1,288	655352	4034951
	Desert Range	6005	33.5	100	Good	1,427	646656	4059933
		6010	2.6	28	Good	1,546	649983	4055434
<b>Summary</b>			<b>37.5</b>	<b>135</b>	<b>Fair - Good</b>	<b>1,288 - 1,546</b>		

#### 3.5.2 *Cirsium mohavense* (Mojave Thistle)

*Cirsium mohavense* was encountered at one location within the Gold Butte West survey area, summarized in Table 3-8. This occurrence included an estimated 300 individuals occupying 0.1 ac (0.04 ha) across an elevation range of 573 to 579 m (1,880 to 1,900 ft). Associates included *Anemopsis californica*, *Muhlenbergia asperifolia*, *Pluchea sericea*, *Prosopis glandulosa*, *Sporobolus airoides*, and *Washingtonia filifera*. Overall habitat quality was described as excellent, but it was noted that drift fences in the area were being breached by cattle, giving them access to this wetland, and *Tamarix* was observed at a nearby location.

**Table 3-8. 2021 Survey occurrence summary for *Cirsium mohavense* (Mojave thistle)**

Plant Code	Survey Area	Project-specific Internal EO No.	Area Occupied (ac.)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)	Zone 11S	
							UTM Easting	UTM Northing
CIMO	Gold Butte West	4003	0.1	300	Excellent	576	749834	4037024
<b>Summary</b>			<b>0.1</b>	<b>300</b>	<b>Excellent</b>	<b>573-579</b>		

### 3.5.3 *Penstemon bicolor* ssp. *roseus* (Rosy Twotone Beardtongue)

*Penstemon bicolor* ssp. *roseus* was encountered at one location within the McCollough Mountains survey area, summarized in Table 3-9. This occurrence included an estimated 75 individuals occupying 17.3 ac (7.0 ha) across an elevation range of 1,069 to 1,203 m (3,507 to 3,947 ft). Associates included *Ambrosia salsola*, *Encelia virginensis*, *Larrea tridentata*, *Psilostrophe cooperi*, *Sengalia greggii*, *Sphaeralcea ambigua*, and *Yucca schidigera*. This small population is located along a transmission line access road. Overall habitat quality was described as fair due to proximity to roadside and associated disturbance from vehicular traffic.

**Table 3-9. 2021 Survey occurrence summary for *Penstemon bicolor* ssp. *roseus* (Rosy twotone beardtongue)**

Plant Code	Survey Area	Project-specific Internal EO No.	Area Occupied (ac.)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)	Zone 11S	
							UTM Easting	UTM Northing
PEBIRO	McCollough Mountains	6015	17.3	75	Fair	1,127	665365	3956347
<b>Summary</b>			<b>17.3</b>	<b>75</b>	<b>Fair</b>	<b>1,069-1,203</b>		

## 3.6 Other Nevada Natural Heritage Program Tracked Species Occurrences

### 3.6.1 *Eriogonum heermannii* var. *clokeyi* (Clokey Buckwheat)

*Eriogonum heermannii* var. *clokeyi* was not included in the target species list for this project. However, it is tracked as an at-risk variety by the NNHP. Its NatureServe state rank is S2 (imperiled variety), and it is also listed as a sensitive species by the Nevada BLM and the USDA Forest Service – Intermountain Region. During these surveys, it was encountered at four locations within the Desert National Wildlife Refuge administrative area (specifically, one location at the Desert Range, one at Cow Camp Spring, and two at the survey site we called Desert National Wildlife Refuge, as summarized in Table 3-10. In total, these occurrences included 369 individuals occupying 139.7 ac (56.5 ha) across an elevation range of 1,256 to 1,784 m (4,121 to 5,853 ft). Common associates included *Coleogyne ramosissima*, *Ephedra nevadensis*, *Ephedra torreyana*, *Yucca baccata*, and *Yucca brevifolia*. The overall quality of each occurrence ranged from fair to excellent. Occurrence 6001 was rated as Fair due to its small population of only three individuals, although no obvious disturbances were noted. Historic dumping of refuse was observed at occurrence 6004. Occurrence 6011 is located immediately adjacent to a road, where associated impacts include excessive dust and physical disturbance from road maintenance (e.g., road grading).

**Table 3-10. 2021 Survey occurrence summary for *Eriogonum heermannii* var. *clokeyi* (Clokey buckwheat)**

Plant Code	Survey Area	Project-specific Internal EO No.	Area Occupied (ac.)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)	Zone 11S	
							UTM Easting	UTM Northing
ERHECL	Cow Camp Spring	6004	1.6	100	Good	1,635	651145	4050223
	Desert Range	6011	134.4	200	Good	1,656	651587	4055195
	Desert National Wildlife Refuge	6001	0.2	3	Fair	1,264	655315	4034908
		6003	3.5	66	Excellent	1,627	664943	4041107
<b>Summary</b>			<b>139.7</b>	<b>369</b>	<b>Fair - Excellent</b>	<b>1,264-1,656</b>		

### 3.7 Primary Target Species Not Encountered During 2021 Surveys

Three of the primary target species (*Astragalus geyeri* var. *triquetrus*, *Eriogonum bifurcatum*, and *Eriogonum viscidulum*) were encountered during 2020 surveys, but not again in 2021, despite targeting suitable habitat for surveys during both years. The absence these target species during the 2021 season was attributed to drought conditions. The annual precipitation during both 2020 and 2021 were below the 30-year average of 4.2 inches (Figure 3-1), receiving only approximately 2.4 and 1.9 inches, respectively (NOAA 2022). The above-average precipitation received in 2019 (6.9 inches) likely stimulated the germination of annual plants during the spring 2020 season. However, two consecutive years of below-average moisture conditions resulted in a noticeable absence of annual plants and even reduced the abundance and vigor of perennials during the 2021 growing season.

*Penstemon albomarginatus* was another primary target species that was encountered in 2020, but not during 2021 surveys. This plant has very specific habitat requirements that typically include deep accumulation of wind-blown sand and the areas of true suitable habitat in Clark County are limited. While sandy habitat was visited in 2021, this target taxon was not observed.

*Calochortus striatus* (Alkali mariposa lily), *Phacelia parishii* (Parish phacelia), and *Sisyrinchium radicum* (St. George blue eyed grass) require relatively moist to wet habitats. These taxa were noted as being relatively low priority among the primary target species, while testing the habitat models for modeled primary target taxa and surveying areas where multiple species may co-occur were identified as higher priorities. While dry lakes, springs/seeps, riparian areas, and valley bottoms were visited, particularly when they occurred adjacent to targeted suitable habitat for the other primary taxa, these moist habitats are relatively scarce in Clark County and the areas of potential habitat that were visited were not found to harbor these plants. *P. parishii* is additionally known to occasionally occur on gypsum deposits, however it was not encountered at any of the several targeted survey locations with gypsiferous soils.

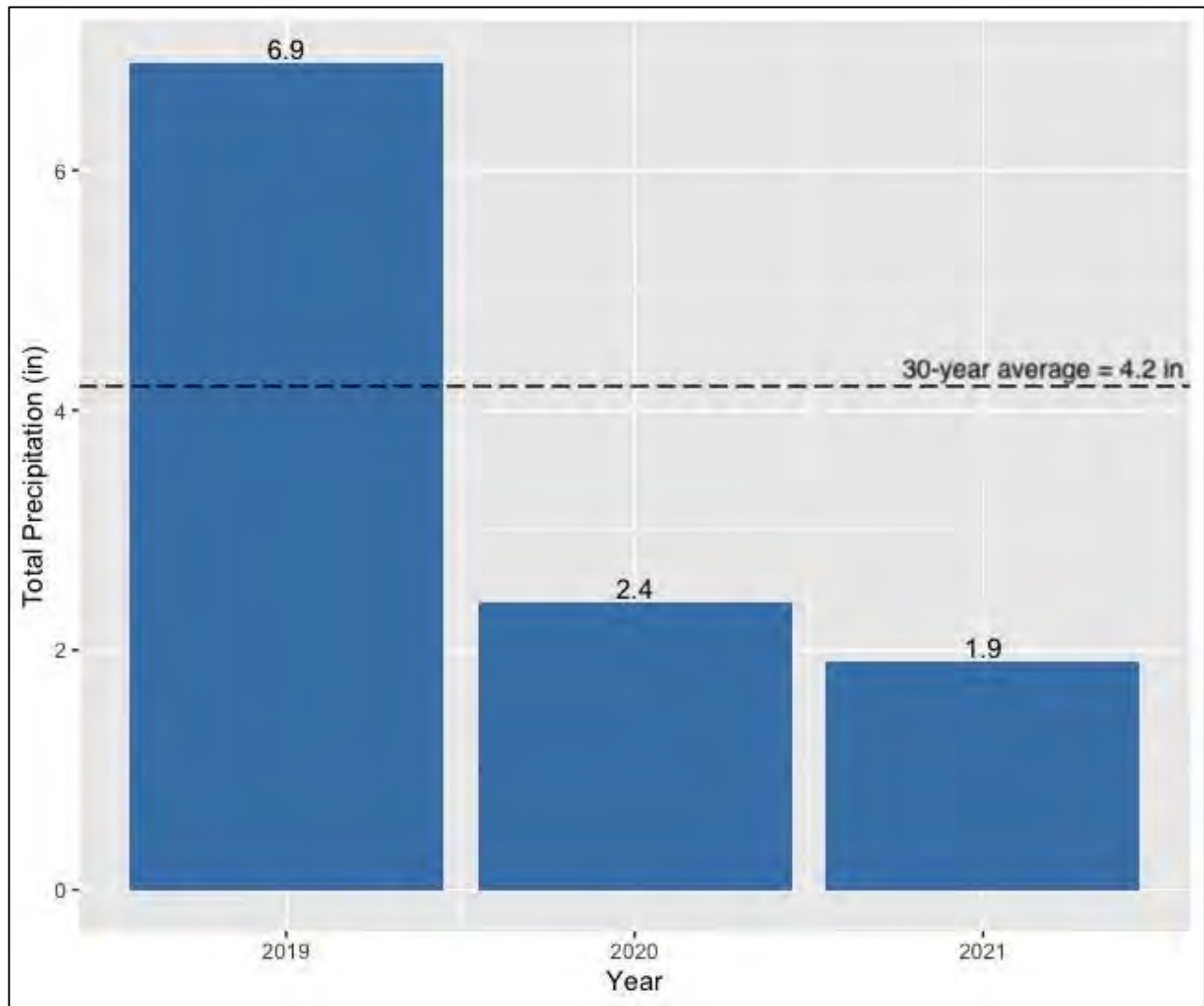


Figure 3-1. Annual Precipitation for Las Vegas Area from 2019 – 2021.

## 4. Discussion

### 4.1 Rare Plant Element Occurrences

In total, the 2021 field surveys recorded 36 rare plant occurrences across more than 1,704 ac (689.6 ha) of occupied area. Table 4-1 summarizes 2021 EO records by species.

Twelve of the 20 areas surveyed included occupied habitat for one or more of the project's target species. The survey areas with the greatest diversity of target species encountered were Bitter Spring, Desert National Wildlife Refuge, Echo Junction, and Gold Butte West, with three target species encountered at each. The survey areas with the greatest number of rare plant occurrences (regardless of diversity) were Bitter Spring, Echo Junction, and Desert National Wildlife Refuge with a total of 8, 6, and 4 occurrences, respectively. Other survey areas, such as McCollough Mountains also resulted in important data since these areas host species (i.e., *Cylindropuntia multigeniculata*) for which little information is currently known about the quality or accuracy of the associated habitat models. These encounters contribute to informing and improving future performance of the predictive habitat models.

**Table 4-1. Summary of 2021 Element occurrences by species**

Species	Total No. Occurrences	Total No. Individuals Observed	Total Occupied Area (ac)
<b>Modeled Primary Target Species</b>			
<i>Arctomecon californica</i>	6	579	22.9
<i>Cylindropuntia multigeniculata</i>	6	> 16,772	1,427.6
<b>Subtotal</b>	<b>12</b>	<b>&gt; 17,351</b>	<b>1,450.5</b>
<b>Non-modeled Primary Target Species</b>			
<i>Anulocaulis leiosolenus</i> var. <i>leiosolenus</i>	5	90	19.2
<i>Enceliopsis argophylla</i>	9	1,494	38.1
<i>Eriogonum corymbosum</i> var. <i>nilesii</i>	1	232	1.7
<b>Subtotal</b>	<b>15</b>	<b>1,816</b>	<b>59.0</b>
<b>Secondary/Other Target Species</b>			
<i>Arctomecon merriamii</i>	3	135	37.5
<i>Cirsium mohavense</i>	1	300	0.1
<i>Eriogonum heermannii</i> var. <i>clokeyi</i>	4	369	139.7
<i>Penstemon bicolor</i> ssp. <i>roseus</i>	1	75	17.3
<b>Subtotal</b>	<b>9</b>	<b>879</b>	<b>194.6</b>
<b>Total</b>	<b>36</b>	<b>20,046</b>	<b>1,704.1</b>

The EO record 4007 for *Cylindropuntia multigeniculata* at Summit Pass within the Gold Butte National Monument is now the largest contiguous known population of the species – it was not known prior to this study. It is important to note that the estimated 14,000 individuals here were artificially cut off at some of the margins of the occurrence – it was simply too large to map by traditional methods for the time allotted. Subsequent attempts to continue the mapping and tally effort may benefit from remotely sensed data, whether by drone, fixed wing, or satellite platforms.



## 4.2 Accuracy of Habitat Suitability Models

Table 4-2 summarizes the occurrences of primary target species by occurrence in low, medium, and high suitability combined model habitats. Over 10,159 ac (4,111 ha) of habitat were surveyed across high, medium, and low suitability areas, as predicted by the habitat models, respectively. Of the high suitability habitats that were surveyed, approximately 0.24% were occupied by modeled rare plant species. Of the medium suitability habitats, 20% were occupied; of the low suitability habitats, 10.3% were occupied. While the *Arctomecon californica* occurrences were found entirely within areas modeled as medium to high habitat suitability (Table 4-3), *Cylindropuntia multigeniculata* occurrences were only found in areas modeled as low to medium habitat suitability. This suggests that the model may benefit from additional ‘training’ for *C. multigeniculata*.

**Table 4-2. Summary of occupied habitat by combined model habitat suitability**

Combined Modeled Habitat Suitability	Total Acres Surveyed Across All Locations	Occupied Acres for Modeled Species	% Occupied
High (0.70 – 1)	150.4	0.4	0.2
Medium (0.40 – 0.60)	4,315.1	863.0	20
Low (0.00 – 0.39)	5,693.8	588.0	10.3
<b>Total</b>	<b>10,159.3</b>	<b>1,451.4</b>	

**Table 4-3. Summary of occupied habitat for each modeled species encountered**

Combined Modeled Habitat Suitability	<i>Arctomecon californica</i> Occupied Acres	<i>Cylindropuntia multigeniculata</i> Occupied Acres	Total Occupied Acres
High (0.70 – 1)	0.4	0.0	0.4
Medium (0.40 – 0.60)	22.5	840.5	863.0
Low (0.00 – 0.39)	0.0	588.0	588.0
<b>Total</b>	<b>22.9</b>	<b>1,428.5</b>	<b>1,451.4</b>

## 5. Conclusion

These field surveys have contributed to the known distribution of the target species in Clark County, Nevada, by adding 36 EO records for nine of the target species. Both positive and negative field results can be used to inform the existing habitat suitability models. The results from these surveys are also useful for identifying areas within the County with unique habitat capable of hosting a diversity of rare plant taxa, and/or a relatively large number of target species occurrences regardless of diversity (Table 5-1). Further, the notes about disturbance included in the EO records may also provide insight into visible disturbances/impacts and potential threats to these rare plant populations. In summary, this improved knowledge of the species distributions and associated habitat quality may be used to identify potential areas where conservation could take place, aid in locating new populations, and ultimately help land managers evaluate the status of sensitive species populations.

**Table 5-1. Summary of 2021 survey Sites where 36 EO records were collected**

Survey Area	No. Target Species Encountered	No. Target Species Occurrences	Target Species Encountered
Bitter Spring	3	8	ANLELE, ARCA, ENAR
Cow Camp Spring	1	1	ERHECL
Desert National Wildlife Refuge	3	4	ARME, CYMU, ERHECL
Desert Range	2	3	ARME, ERHECL
Echo Junction	3	6	ANLELE, ARCA, ENAR
Gold Butte	2	2	ERCONI, ENAR
Gold Butte West	3	3	ARCA, ENAR, CIMO
McCollough Mountains	2	2	CYMU, PEBIRO
Mud Wash	2	2	ANLELE, ENAR
North Clark County	1	3	CYMU
Summit Pass	1	1	CYMU
West Lake Mead	1	1	ENAR

## 6. Recommendations

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### 6.1 Ongoing Surveys

In 2021, Ironwood surveys followed the recommendations made in the 2020 Ironwood report (Ironwood 2020b), which included surveying areas stated in the work plan but were not surveyed in 2020, in addition to focused surveys for *Eriogonum corymbosum* var. *nilesii*, *Anulocaulis leiosolenus* var. *leiosolenus*, and *Cylindropuntia multigeniculata*. Drought conditions contributed to difficulty confirming whether a positive identification was made for *E. corymbosum* var. *nilesii* and may have obscured evidence of occupied habitat for the *Eriogonum viscidulum*, as fewer individuals may have germinated because of poor growing conditions. Future surveys should continue to target *E. corymbosum* var. *nilesii* since associated EOs are currently limited. We also suggest that voucher specimens of this taxon be collected during future encounters so that positive identification is more easily confirmed, and more material is available for taxonomic study. Ironwood also recommends future surveys for *Cylindropuntia multigeniculata* so additional data can be included in the species' habitat suitability model, since 41% of the occupied area encountered during 2021 was modeled as low habitat suitability. The Summit Pass population of *C. multigeniculata* was so extensive that it has not been completely mapped and tallied; this location is an ideal site to initiate a remote sensing pilot project for this species.

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**Appendix A – 2019 Habitat Models**

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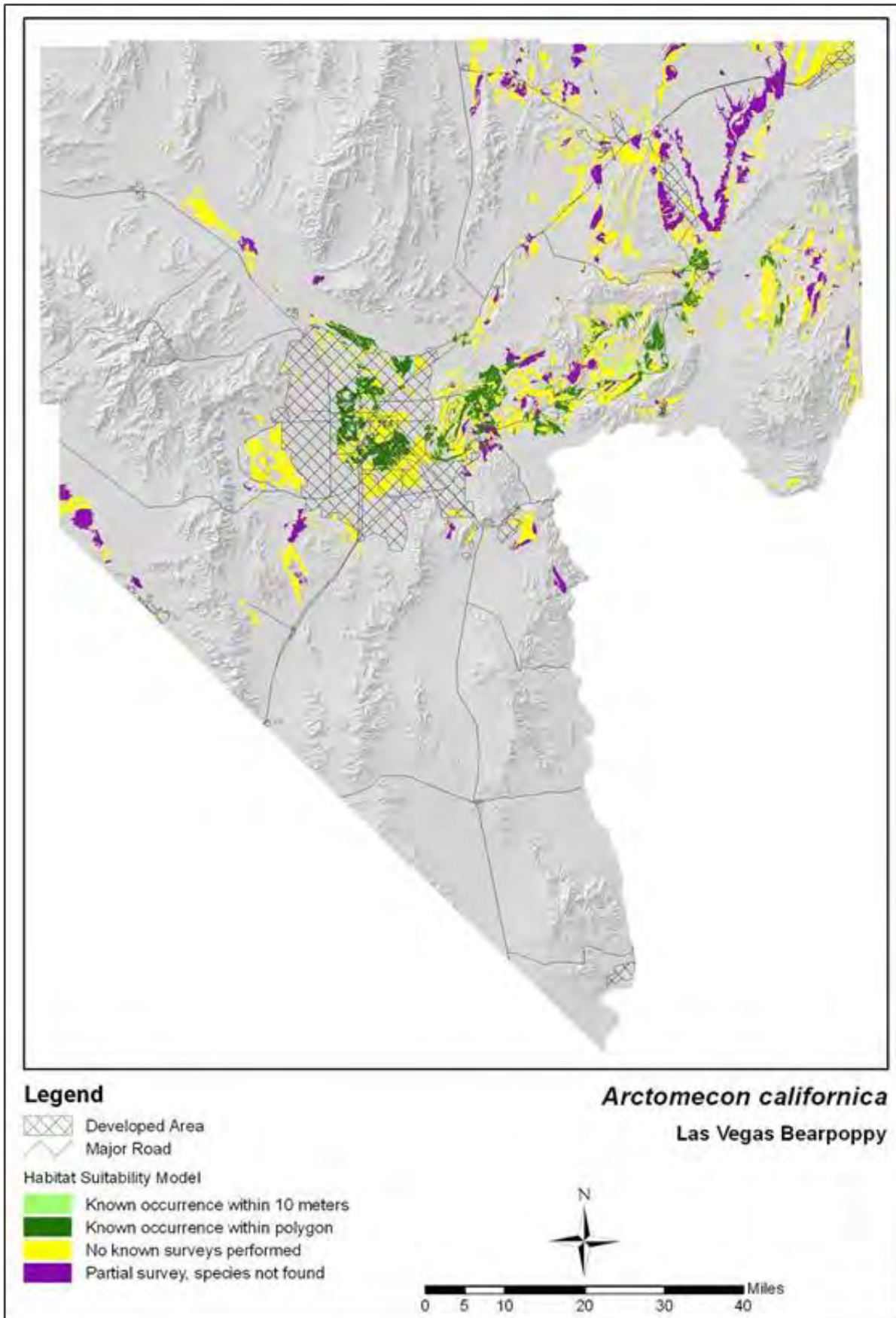


Figure A 1. Las Vegas Bearpoppy Modeled Habitat and Known Occurrences

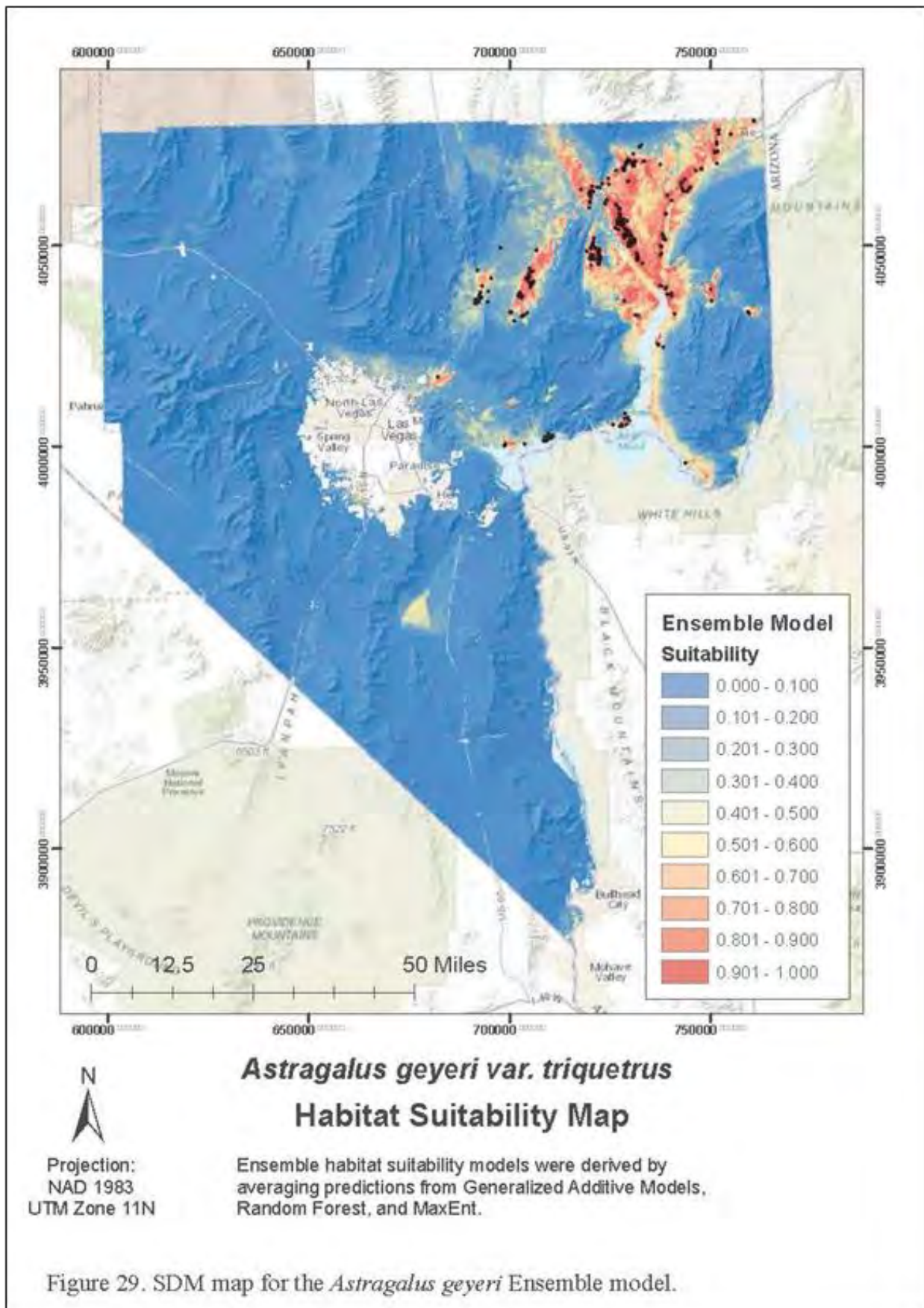


Figure A 2. Threecorner Milkvetch Modeled Habitat



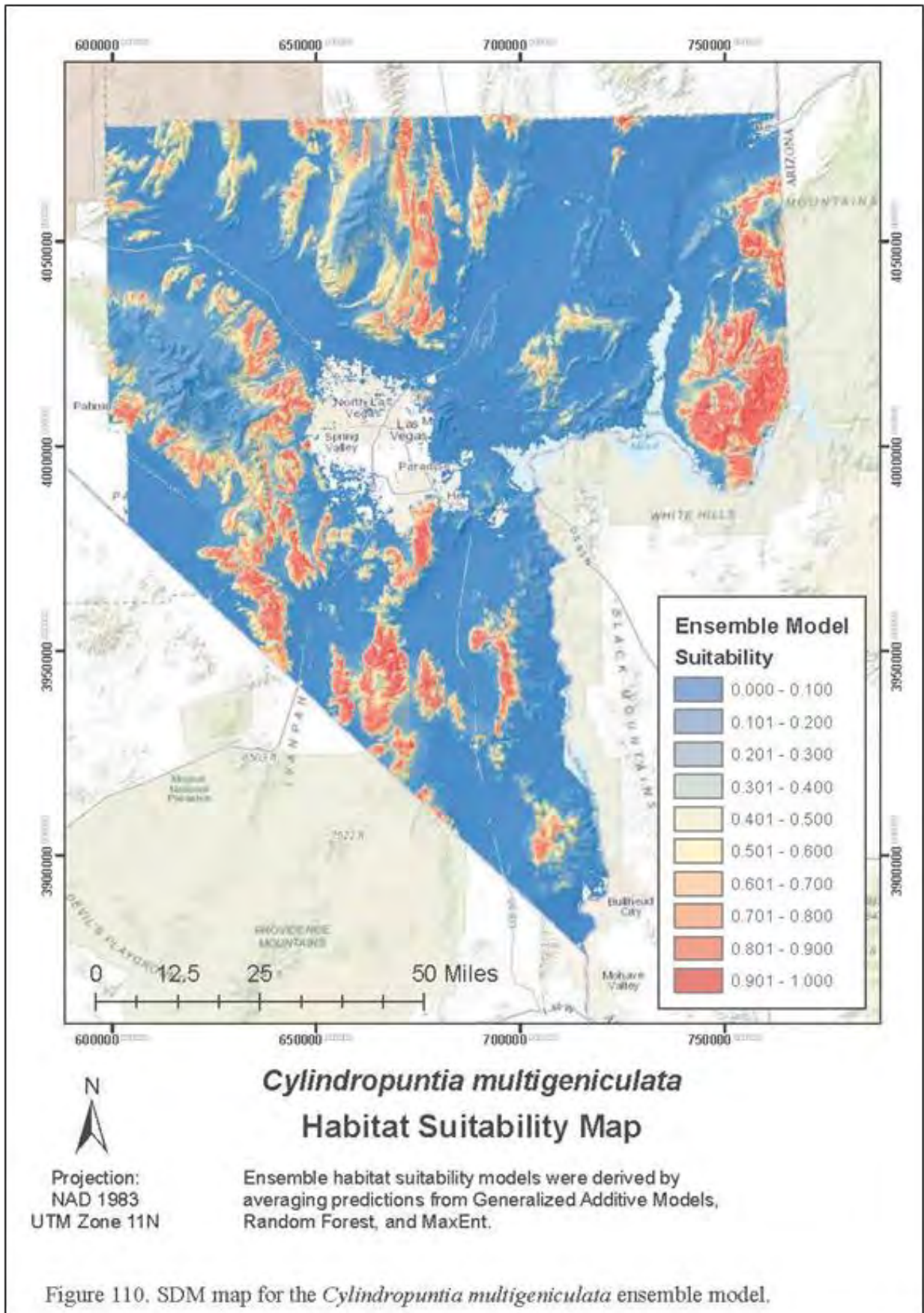


Figure A 3. Blue Diamond Cholla Modeled Habitat

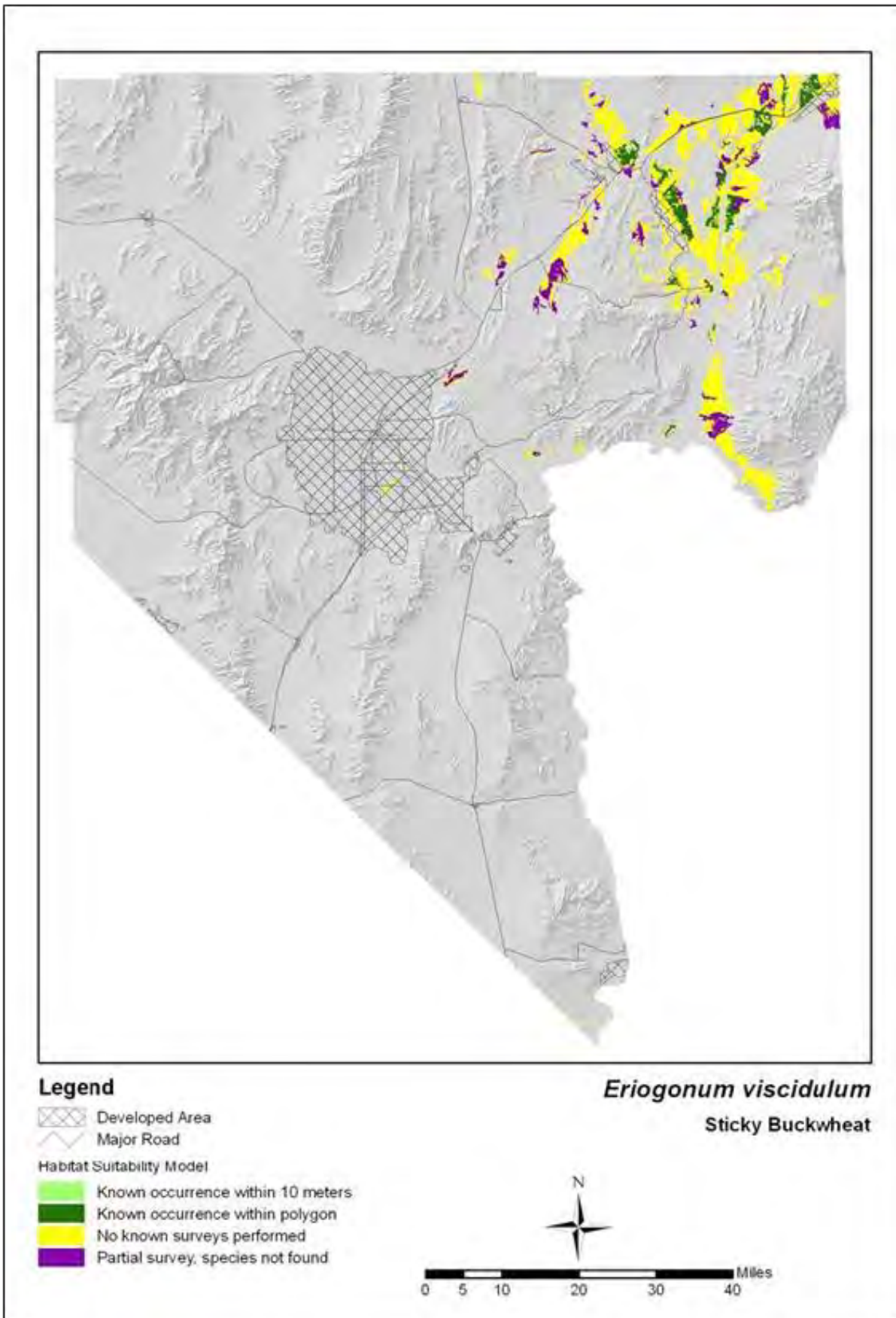


Figure A 4. Sticky Buckwheat Modeled Habitat and Known Occurrences

**Appendix B – BLM and NNHP Rare Plant Survey  
Field Methodologies**

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## BLM Rare Plant Sampling Methods

Botanical surveys should be conducted in a manner that will locate any special status or locally significant plants or plant communities that may be present. Specifically, botanical surveys should be:

- Conducted in the field at the proper times of year when special status and locally significant plants are both evident and identifiable. When special status plants are known to occur in the type of habitat present in the project area, nearby accessible occurrences of the plants (reference sites) should be observed to determine that the plants are identifiable at the time of survey.
- Floristic in nature. A floristic survey requires that every plant observed be identified to species, subspecies, or variety, as applicable. To properly characterize the site, a complete list of plants observed on the site shall be included in every botanical survey report. In addition, a sufficient number of visits spaced throughout the growing season is necessary to prepare an accurate inventory of all plants that exist on the site. The number of visits and the timing between visits must be determined by geographic location, the plant communities present, and the weather patterns of the year(s) in which the surveys are conducted.
- Conducted in a manner that is consistent with conservation ethics and accepted plant collection and documentation techniques<sup>4,5</sup>. Collections (voucher specimens) of special status and locally significant plants should be made, unless such actions would jeopardize the continued existence of the population. A single sheet should be collected and deposited at a recognized public herbarium for future reference. All collections shall be made in accordance with applicable state and federal permit requirements. Photography may be used to document plant identification only when the population cannot withstand the collection of voucher specimens.
- Conducted using systematic field techniques in all habitats of the site to ensure thorough coverage of potential impact areas. All habitats within the project site must be surveyed thoroughly to properly inventory and document the plants present. The level of effort required per given area and habitat is dependent upon the vegetation and its overall diversity and structural complexity.
- Well documented. When a special status plant (or rare plant community) is located, a California Native Species (or Community) Field Survey Form or equivalent written form, accompanied by a copy of the appropriate portion of a 7.5-minute topographic map with the occurrence mapped, shall be completed, included within the survey report, and separately submitted to the California Natural Diversity Database. Population boundaries should be mapped as accurately as possible. The number of individuals in each population should be counted or estimated, as appropriate.

### Field Survey – Methodology

Field surveys will be floristic in nature; i.e., the contractor identifies every plant taxon observed in the project area to the taxonomic level necessary to determine rarity and listing status. Surveys will be conducted so they will ensure a high likelihood of locating all the plant taxa in the project area. The survey must be focused solely on plants – an individual should not combine multiple survey elements (e.g., tortoise, other wildlife, etc.). Depending on the size of the project area and the heterogeneity of the habitats within the project area, surveys will involve one or a combination of the following survey methods:

## 1. Complete Survey

A complete survey is a 100% visual examination of the project area (Figure B 1) using transects. The length of the transect and distance between transects might change as the topography changes throughout the project area. Transects should be spaced so all of the area between transects is visible and so the smallest rare plant expected to occur is visible. The surveyor (1) compiles a species list while traversing the project area and keeps track of the plant community or habitat type where each taxon occurs; (2) maps the locations of all rare taxa encountered using a GPS unit; and (3) fills out a NNHP Nevada Native Species Site Survey Report ([http://heritage.nv.gov/sites/default/files/other\\_docs/surv\\_pdf2013.pdf](http://heritage.nv.gov/sites/default/files/other_docs/surv_pdf2013.pdf)) for each location of each rare taxon encountered.

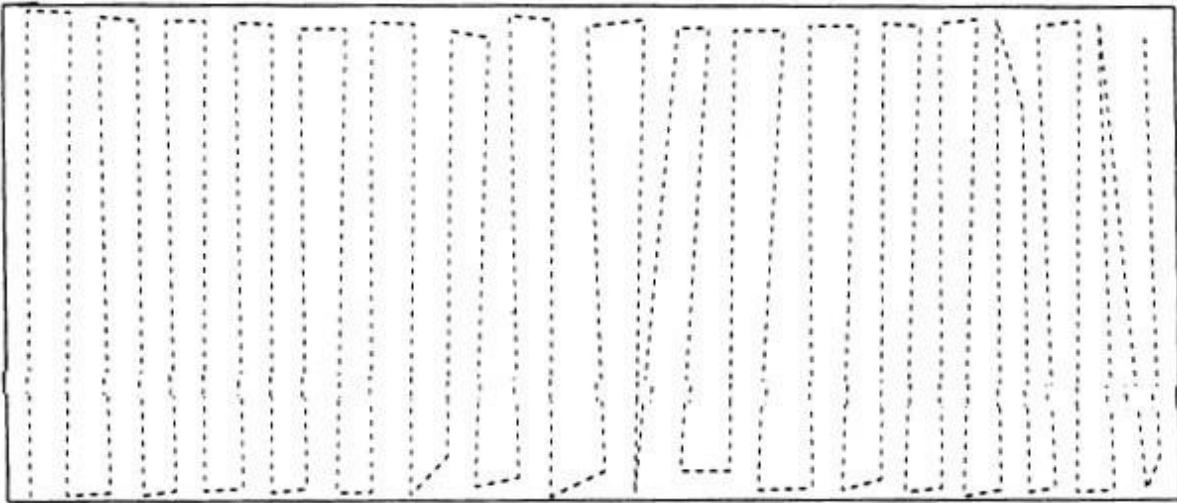


Figure B 1. Complete survey.

## 2. Intuitive Controlled Survey

An intuitive controlled survey is a complete survey of habitats with the highest potential for supporting rare plant populations and a less intensive survey of all other habitats present (Figure B 2). This type of survey can only be accomplished by botanists familiar with the habitats of all the plant species that may reasonably be expected to occur in the project area. The botanist traverses through the project area enough to see a representative cross section of all the major plant habitats and topographic features. During the survey, the botanist compiles a species list of all plant taxa seen en route and keeps track of the plant community or habitat type where each taxon occurs. The surveyor maps the locations of all rare taxa encountered using a GPS unit and fills out a NNHD Nevada Native Species Site Survey Report ([http://heritage.nv.gov/sites/default/files/other\\_docs/surv\\_pdf2013.pdf](http://heritage.nv.gov/sites/default/files/other_docs/surv_pdf2013.pdf)) for each location of each rare taxon encountered. When the surveyor arrives at an area of “high potential” habitat, s/he surveys that area completely as described above and shown in Figure B 1. High potential habitat areas include areas defined in a pre-field review of potential rare plants and habitat and other habitats where a rare species appears during the course of initial field work traversing the project area. Areas within the project area that are not the focus of a complete survey must be surveyed sufficiently so the botanist and BLM reasonably believe that few if any additional species would be added to the complete species list for the project area. The report must justify why the botanist did not consider these areas to have a high potential for supporting rare plant species and thus did not subject the area to a complete survey.

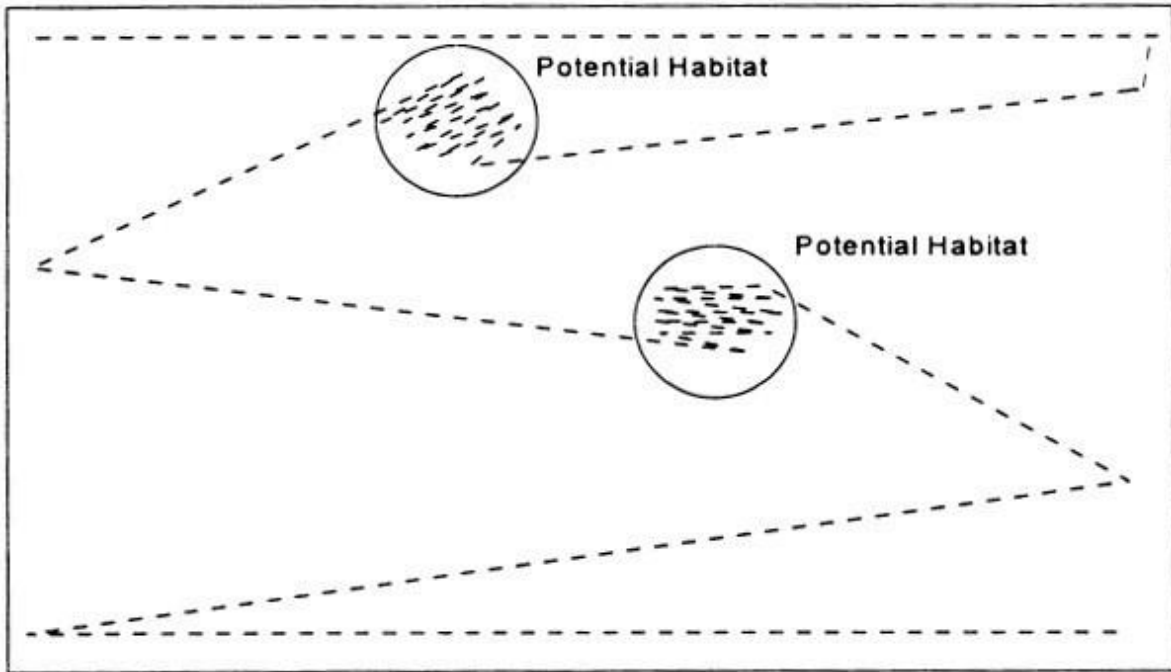


Figure B 2. Intuitive Controlled Survey.

## Documenting the Results of Surveys

The results of special status plant inventories should be well documented. This documentation must include, as a minimum, the completion and submission of Field Survey Forms and shapefiles/geodatabases of all special status plants found by BLM personnel or consultants.

Occurrences are defined as being separated from other plant locations by 0.25 mile. These forms are submitted to the BLM Southern Nevada District Office Botanist.

Most special status plant inventories of public lands conducted to assess the impacts of a project are performed by consultants hired by project proponents. These inventories must meet or exceed the intensity level required for the project by BLM. Personnel conducting the inventory must meet the qualifications outlined in this document. For BLM to adequately determine the quality of third-party inventories, the following information must appear in a detailed report to BLM from the consultant or project proponent.

- Project description:
  - Detailed map of the project location and study area
  - Direct and indirect actions that may impact the special status plant communities
  - Acreage of proposed disturbance and buffer area acreage of anticipated indirect impacts
- Plant communities:

A written description of the biological setting, including descriptions of the plant communities found in the project area and a vegetation map. Plant communities should be described and mapped to at least the alliance level using the vegetation classification system of the Nevada Natural Heritage Program (Heritage). A list and description of the alliances currently recognized by Heritage can be found at: <http://heritage.nv.gov/node/174>

- Pre-project review:
  - Describe the intensity of the review process
  - Identify which known populations were visited, which flora were used to identify the species, what experts were consulted, and which herbaria were visited
  - If soil surveys were used to determine suitable habitat, include those references
  - Identify which reference populations were visited, the timing of those visits, if rainfall patterns and temperatures were identified for the area from the nearest available weather station, and if any other climatic conditions were taken into account.
  - Identify which resources were used to identify target special status plants in the project area
- Survey methodology:
  - A detailed description of the inventory methodology, including techniques and intensity of the inventory
  - Distance(s) between transects throughout the study area, and how those distances were justified
  - The methodology of special status plant identification (in the field or in a lab) and if the plant was sent to a specialist to be identified, which characteristics distinguished the plant from look-alikes in the area)
  - Maps showing areas searched. This will also include areas searched but no special status plants found (negative survey data)
  - Identify type of GPS unit used
- Survey timing:
  - How inventory timing was determined
  - Exact dates of all the surveys and which special status plants were identified on those dates
  - Timing of visits to reference populations
- Survey results:
  - The type and number of special status plants identified
  - Phenological stage(s) the special-status plant was in when identified
  - Habitat, soil type, vegetation type, and associated species of the special status plant
  - Population boundaries
  - Condition of the population (disease, predation, etc.)
  - Current threats to the population (off-road vehicles, erosion, non-native species, etc.)
- Discussion:

The assessments of the health, population size, and protective status of any special status plants found. A discussion of any range extensions discovered as a result of the survey. A discussion of the significance of any special-status plant occurrences found, with consideration of other nearby occurrences and the distribution of the species as a whole.
- Contractor qualifications:
  - The name(s) and qualifications of the persons conducting the surveys
  - Include a copy of the email or letter for contractor approval for each surveyor.

- References:
  - List of references cited
  - Persons contacted
  - Herbaria or reference sites visited
- Data:
  - Copies of field data forms
  - Photos
  - Maps (special status plant locations, survey areas, vegetation maps)
  - Shapefiles (special status plants, negative survey areas, total area surveyed)
  - Plant vouchers
  - Any site-specific additional information required by contractor

Voucher specimens of special-status plants should be collected if necessary to conclusively document the occurrence of the species and if the collection will not adversely affect the health of the population at the site. Collection of federally listed plants on federal lands requires a permit from the Fish and Wildlife Service. If voucher specimens are collected, they should be deposited in major recognized herbaria for future reference.

Photographs should be taken of the areas inventoried, of all special status plants found (including of identifying characteristics of special-status plants, or look-alikes), and of the habitat associated with each special status plant occurrence.

## **Data Collection – Data Submission**

Data should be collected using a Mapping Grade GPS Receiver with an accuracy of < 3 meters Horizontal Root Mean Squared (HRMS).

All positions should be logged according to the following specifications:

- Maximum PDOP of 6
- Minimum of 5 Satellites
- Minimum elevation mask of 15 degrees
- Datum: NAD83
- Coordinate System: UTM Zone 11
- ESRI compliant formats (Geodatabase, Coverage or Shapefile)

Metadata must be included with the data. The following must be included in the metadata:

- Project Name
- Purpose – Summary of the intentions with which the data set was developed
- Abstract Information – Brief narrative summary of the data set
- Location – What area(s) does your data cover? i.e., list statewide, regions, city, county
- Developer – Who collected the data?



- Data Dictionary – A data dictionary must be used for all projects. The dictionary should include the data that is requested on the Heritage forms. This ensures that the botanist is collecting (electronically) the same data as is requested by DFG. This also ensures that all inventories are collecting the same level/standard of data. An example of the data dictionary and metadata standard can be found at <http://heritage.nv.gov/gis> under “Species Data: Sample of At-risk Species Occurrence Records.”

## **Qualifications of Personnel Conducting Inventories**

All persons conducting special status plant inventories **MUST** be approved by the contracting agency prior to surveys taking place.

All personnel conducting special status plant inventories must have the following:

- Strong backgrounds in plant taxonomy and plant ecology
- Strong background in field sampling design and methods
- Knowledge of the floras of the survey area including the special status plant species
- Familiarity with natural communities of the area
- Familiarity with state and federal laws and agency policies that pertain to rare plant protection

These qualifications help ensure that all special status plants in the survey area will be located, including taxa that BLM or project proponents did not predict at the start of the inventory. All survey efforts must be coordinated with the BLM botanist. Approvals for changes to protocols or other survey methodology must be approved in writing by the BLM botanist.

## Nevada Natural Heritage Program's Standard Field Survey – Methods

### Pre-Survey Preparation

- Select species of interest
  - If the project does not specify which plants to survey for, search a large surrounding area to identify any species that may be present in the survey area. Use county species lists to identify species that may be present.
  - If the project does specify particular plants, keep in mind other rare plants that may be found in the same location as the target species and be familiar enough with them to identify them if encountered.

- Review species file

Prior to beginning field surveys, review the species file to familiarize yourself with the biology of the target species. All surveyors should particularly note the following:

- Key identifying features. This usually flowers and fruits but may include leaves, stems, bulbs, or other parts.
- Phenology as it corresponds to those features. For example, if flowers are needed to positively identify the plant, when does the plant normally bloom?
- Distinctive habitat features. If the plants are found on a particular soil type or in association with particular vegetation this should be noted and used in section 1.c.ii.

- Review reported locations

Thoroughly review information regarding previously documented locations prior to field visits. The quality of data varies from very old herbarium records with very inaccurate location data to recent surveys with high precision GPS data.

- Chose locations to visit based on the reason for the survey. For a re-survey of a known location, use data from all available dates to note changes over time at that location. For survey an area that does not have documented populations, plan to visit nearby sites using the most recent data to verify phenological stage and form a search image.
- If the purpose of the visit is to more precisely map an old, inaccurate location, note inconsistencies in the location description that lead to a larger search area. For very old collections that use road names and mileage to describe the location, review old highway atlases and aerial imagery to account for changes in road names/numbers and possible road realignments.

- Prepare maps

Maps should include all of the features necessary for finding the plant location. Include primary and alternate access routes in case the road is impassable on your selected route. Note potential hazards such as stream crossings and private land which may have locked gates.

- Reported locations

Prepare paper or electronic maps that include both the mapped location plus any locational uncertainty (See Biotics website for locational uncertainty mapping methodology

<http://www.natureserve.org/prodServices/biotics/biotics-learn-more.jsp#method>)

- Habitat features

If the survey includes searching for a poorly documented location or general surveys for rare plants in a previously undocumented area, highlight areas of potential habitat on the maps. A quick model for guiding surveys can be produced by mapping the intersection of the known elevation band with distinctive habitat features such as soil and vegetation types that the plant is known to occupy.

- Contact the landowner for permission before surveying on private land or public land that is subject to travel restrictions, such as wildlife refuges and state parks.

## Field Surveys

Conduct surveys in a manner that is safe and consistent with accepted plant collection and documentation techniques.

- Vehicle travel
  - When travelling in vehicles, state employees must adhere to the policies in the State of Nevada Motor Pool Division Vehicle use Handbook, the State Administrative Manual, and state driving laws.
  - State employees must also have a current Defensive Driving certificate on file.
  - Carry adequate safety equipment for emergencies including a fire extinguisher, shovel, emergency supplies backpack, first aid kit, list of county emergency dispatch phone numbers, and the satellite phone if traveling outside of cell phone coverage areas.
- Foot travel
  - Be familiar with hazards associated with outdoor work. See <http://www.cdc.gov/niosh/topics/outdoor/> to review potential Physical and Biological hazards that may be encountered outdoors.
  - Wear appropriate protective clothing such as a wide-brimmed hat, long sleeves and pants, and boots or closed toe shoes to avoid sunburn, thorns, poisonous plants and animals, and insect bites.
  - Carry adequate water, first aid kit, and communication devices when traveling more than a few minutes' walk from the vehicle.
- Search methods
  - Census or re-survey of a well-documented location.
    - ✓ Plan out a search method that is appropriate for the goals of the survey.
      - If a census is desired, divide populations into smaller sections to reduce error in counting.
      - If a complete census is not feasible, use the methods outlined in "Instructions for Estimating Patch Density"
      - Refer to project guidelines if using a particular transect method or duplicating previous surveys.
      - Decide beforehand whether it is more appropriate to collect point locations of individual plants or polygon locations.

- Document evidence of threats and changes in biological processes as these factors are important in determining species ranks.
- ✓ Search method should be able to accurately locate plants in their environment. For small plants or dense vegetation, areas should be searched very closely and thoroughly. For larger plants or very sparse vegetation, walking more widely spaced transects may be appropriate.
- ✓ For widely scattered plants, it may be helpful to flag or mark plants or patches to avoid double counting.
- Locating a poorly documented population.
- Familiarize yourself with the target plant(s).
  - ✓ Visit a known location of the target species to observe the current phenology of the plants. Pay careful attention to non-flowering individuals as these may be encountered without flowering individuals nearby. Note particular habitat or vegetation affinities that may help in locating new populations. If the plant is very unfamiliar, make sure you can identify the key features that distinguish it from other species. When visiting any known population, take a few notes and photographs and submit a Species Survey Report.
  - ✓ Keep in mind other rare plants that may be found in the same location as the target species and be familiar enough with them to identify them if encountered.
  - ✓ Travel to the approximate documented location. Take into account ambiguous landmarks or directions that may lead to other sites.
  - ✓ If the habitat is appropriate, search the immediate area in a spiral pattern, adjusting for terrain and vegetation if necessary. Multiple surveyors can divide the search area to work more quickly.
  - ✓ If the habitat is not appropriate, search the surrounding area for suitable habitats. Use maps from 1.C.ii to locate suitable landforms and vegetation types. Repeat search pattern in suitable habitats.
  - ✓ If search is not successful, repeat steps 2-4 in any alternate locations that the directions could refer to.
  - ✓ If there are multiple areas of suitable habitat within the area of locational uncertainty, search several, even if plants are located. Don't assume that the first population encountered is the one referred to in the original collection.
- Searching an undocumented area for rare plants.
  - ✓ Familiarize yourself with the target plant(s).
    - Visit a known location of the target species to observe the current phenology of the plants. Pay careful attention to non-flowering individuals as these may be encountered without flowering individuals nearby. Note particular habitat or vegetation affinities that may help in locating new populations. If the plant is very unfamiliar, make sure you can identify the key features that distinguish it from other species.
    - Travel around the area of interest and identify areas with suitable habitats for rare plants. You can informally rank by decreasing suitability in order to prioritize search areas.

- Search suitable habitat areas, adjusting the size and walking speed of transects to account for plant size and vegetation density.
- ✓ Verifying plant identity
  - If you are unfamiliar with the target species, carry along a key (or copies of the relevant sections) and photographs to aid in identification. Use step 2.c.ii.(1) to observe the plant at a known location and familiarize yourself with the current phenological stage. Plants can appear very different from drawings and photos as juveniles or during drought years.
  - If there are multiple species present and you are unable to determine which plant is the target species, thoroughly document and collect each species to submit to an expert for identification.
  - xii) For new locations, collect voucher specimens to submit to a herbarium. See 2.e.iv.(1).
- Documentation

Adequate documentation is essential to the survey process. Without documentation the work cannot be used by others.

  - Notes

Take notes in a field notebook, survey form, or electronic format. Notes should include observations about both the target species and the environment. See the Nevada Native Species Survey Report for a list of types of we collect data.

    - ✓ Phenology, associated species, and habitat description are very useful for searching for the species in the future.
    - ✓ Threats, changes in biotic and abiotic processes, pollinator types and numbers, and population count or estimate are all helpful in ranking the viability of the occurrence and species.
- GPS
  - Learn how to use the equipment and store the appropriate data before going out to survey for plants. Set a datum that is appropriate for the project. The standard NNHP datum is now UTM NAD83 Zone 11N.
  - Carry all of the accessories needed to use the device, including data cables, chargers, and spare batteries. For remote work where power is not available, consider a solar charging unit.
  - Decide beforehand whether it is more appropriate to collect point locations of individual plants or polygon locations.
  - Store the data in a way that is not easily confused, either by using unique names for points or by keeping good notes about data collected.
  - If using the GPS to geotag photographs, turn on the track log and synchronize the time on the camera and/or photograph the time display on the GPS.
- Camera
  - Learn how to use the equipment and store the appropriate data before going out to survey for plants.

- Carry all of the accessories needed to use the device, including data cables, chargers, and spare batteries. For remote work where power is not available, consider a solar charging unit.
- If using the GPS to geotag photographs, synchronize the time on the camera and/or photograph the time display on the GPS.
- Take photos of details useful for identifying the plants. Know the key characteristics and try to show them in the photos.
- Take photos of the habitat, in particular any unique or unusual habitat features or evidence of threats.
- If using the photos to document plant locations (by geotagging) try to take consistent photos by holding the camera at the same height and angle each time. Try to stand as close to the plant as possible and avoid shading the plants with your body or the camera.
- Voucher Specimens
  - For new locations, collect voucher specimens to submit to a herbarium. See <http://www.ibiblio.org/unc-biology/herbarium/courses/chpt18.html> for more information about collecting specimens for submission to a herbarium. Key points include:
    - ✓ Collect material appropriate for identifying the species.
    - ✓ Store and press the material in a way that avoid excessive damage to the plant tissues and makes the parts that are important for identification easy to find.
    - ✓ Label specimens with location information and date.
    - ✓ Note and/or photograph flower color or three dimensional shapes that will be lost by pressing.
    - ✓ Do not collect more than 5% of the plants at a site (1 out of 20). For very small populations, collect only enough material to identify the species (i.e. collect a small piece of the stem with a few leaves or flowers instead of collecting the entire plant) OR take detailed photographs of the diagnostic parts of the plant.
  - If there are multiple species present and you are unable to determine which plant is the target species, thoroughly document and collect each species to submit to a specialist for identification.
- Post-Survey Documentation
  - Transcribe notes
    - ✓ Transcribe any paper notes into the Species Survey Report form.
    - ✓ Review electronically collected notes for errors soon after the survey.
  - Review GPS data
    - ✓ Download data and make a backup copy.
    - ✓ Apply differential correction to points if higher accuracy is desired.
    - ✓ Export to a shapefile for use in Biotics.
  - Review Photographs
    - ✓ Download photos and make a backup copy.
    - ✓ Use PhotoTracker, RoboGeo, or Microsoft Pro Photo Tools to geotag photos, adjusting the time and date of the photo if necessary to match the GPS track.

- ✓ Tag photos with keywords including: Scientific and common names and EST\_ID of species in the photo, project name (if any), location name.
- ✓ Use caption field to describe anything special about the subject of the photo.
- ✓ Copy the photos to an appropriate location on the T:// drive for inclusion in the photo library. Send Janel an email if any of the new photos should be added to the website.
- ✓ Post good quality photos to public online repositories such as CalPhotos. For species that are very rare or subject to poaching (such as cacti) avoid giving detailed location data or posting photos with recognizable landmarks.
- Enter data into Biotics
  - ✓ See documentation at Natureserve.com and NNHP Mapping Methodology Manual.
- References and Additional Resources

California Native Plant Society Survey Guidelines.

[http://www.cnps.org/cnps/rareplants/pdf/cnps\\_survey\\_guidelines.pdf](http://www.cnps.org/cnps/rareplants/pdf/cnps_survey_guidelines.pdf) Natureserve

Mapping and Ranking Methodology <http://www.natureserve.org/prodServices/biotics/biotics-learn-more.jsp#method>

NNHP Nevada Native Species Survey Report forms and other forms <http://heritage.nv.gov/submit>

J. R. Massey. COLLECTION AND FIELD PREPARATION OF SPECIMENS from Chapter 18 in Vascular Plant Systematics by A. E. Radford, W.C. Dickison, J. R. Massey and C. R. Bell, Harper and Row Publisher, 1974. <http://www.ibiblio.org/unc-biology/herbarium/courses/chpt18.html>

Centers for Disease Control. NIOSH Workplace Safety and Health Topics. Hazards to Outdoor Workers. <http://www.cdc.gov/niosh/topics/outdoor/>

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**Appendix C – Primary and Secondary Target Species  
Habitat Requirements**

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**Table C- 1. Primary Target Species – Treated as Priorities Taken Together**

Scientific Name	Common Name	Typical Habitat
<i>Arctomecon californica</i> <sup>1,2,3,4</sup>	Las Vegas bearpoppy	<ul style="list-style-type: none"> <li>Open, dry, spongy, or powdery, often dissected ("badland") or hummocked soils with high gypsum content, often with well-developed soil crust, in areas of generally low relief on all aspects and slopes, with a sparse cover of other gypsum-tolerant species</li> <li>Well documented from previous surveys; survey where it overlaps with other species, but not necessarily as a single species</li> </ul>
<i>Astragalus geyeri</i> var. <i>triquetrus</i> <sup>1,2,3,4</sup>	threecorner milkvetch	<ul style="list-style-type: none"> <li>Open, deep, sandy soil or dunes, generally stabilized by vegetation and/or a gravel veneer; dependent on sand dunes or deep sand</li> <li>Data is limited- include as priority.</li> </ul>
<i>Cylindropuntia multigeniculata</i> <sup>1,2,3,4</sup>	Blue Diamond cholla	<ul style="list-style-type: none"> <li>Dry, open carbonate ledges crevices, and rocky colluvium on gentle to steep slopes of all aspects, but predominantly on northerly exposures, canyon walls, or other cooler or more protected exposures, in close proximity to overlying gypsum beds up-slope, and associated with numerous other succulent and shrub species of the creosote bush and blackbrush vegetation zones</li> <li>Target as model validation</li> </ul>
<i>Eriogonum viscidulum</i> <sup>1,2,3,4</sup>	Sticky buckwheat	<ul style="list-style-type: none"> <li>Deep, loose, sandy soils in washes, flats, roadsides, steep aeolian slopes, and stabilized dine areas; annual plant endemic to Clark and Lincoln Counties in southern Nevada.</li> <li>Shares habitat with ASGE, data is limited.</li> </ul>
<i>Anulocaulis leiosolenus</i> var. <i>leiosolenus</i> <sup>2,3,4</sup>	Sticky ringstem	<ul style="list-style-type: none"> <li>Sandy washes and gravelly slopes to 3,000 ft; creosote bush scrub.</li> <li>Near ENAR, but not in same exact habitat.</li> </ul>
<i>Calochortus striatus</i> <sup>2,3,4</sup>	Alkali mariposa lily	<ul style="list-style-type: none"> <li>Wetland-riparian in shadscale scrub or chaparral; often with St. George blue eyed grass.</li> </ul>

Appendix C — Primary and Secondary Target Species Habitat Requirements

Scientific Name	Common Name	Typical Habitat
<i>Enceliopsis argophylla</i> <sup>3,4</sup>	Silverleaf sunray	<ul style="list-style-type: none"> <li>• Clay and gypsum cliffs to gravelly slopes in southern deserts at elevations 1,200 to 2,000 ft; partial to eroded soils containing gypsum</li> <li>• Near ANLE, but not in same exact habitat</li> </ul>
<i>Eriogonum bifurcatum</i> <sup>2,3,4</sup>	Pahrump Valley buckwheat	<ul style="list-style-type: none"> <li>• Mostly in barren, saline, heavy clay or silty hardpan soils on and near dry playa margins, and on adjacent shore terraces and stabilized sand dunes</li> <li>• Habitat modeled in Sandy Valley; predicted area outside of town that might be suitable habitat; disturbance associated</li> </ul>
<i>Eriogonum corymbosum</i> var. <i>nilesii</i> <sup>3,4</sup>	Las Vegas buckwheat	<ul style="list-style-type: none"> <li>• Confined to gypsum-rich soils in central and eastern Clark County and southern Lincoln County, Nevada</li> <li>• Similar habitat to bearpoppy, sometimes in same areas; less dependent on gypsum</li> <li>• Prioritize where makes sense and overlaps with other species, but not as high-graded</li> </ul>
<i>Penstemon albomarginatus</i> <sup>2,3,4</sup>	White-margined beardtongue	<ul style="list-style-type: none"> <li>• Prefers the base of hills and mountains in wind-blown sand dune-like areas, but are also found in deep loose sand in wash bottoms; may also occur in fine alluvial sand in a wide canyon within a creosote bush scrub community where deep and stabilized sands hold the long taproot in place</li> <li>• Sample the habitat areas for this species.</li> </ul>
<i>Phacelia parishii</i> <sup>2,3,4</sup>	Parish phacelia	<ul style="list-style-type: none"> <li>• Moist to superficially dry, open, flat to hummocky, mostly barren, often salt-crust silty clay soils on valley bottom flats, lake deposits, and playa edges, often near seepage areas, sometimes on gypsum deposits</li> <li>• Only known on test site; look for local knowledge and soils; occurrence near Nye county border</li> </ul>

Appendix C — Primary and Secondary Target Species Habitat Requirements

Scientific Name	Common Name	Typical Habitat
<i>Sisyrinchium radicum</i> <sup>3,4</sup>	St. George blue eyed grass	<ul style="list-style-type: none"> <li>• Open places where there is some moisture, particularly grassy areas, though it can also be found in woodlands, often with alkali mariposa lily</li> <li>• Lowest priority among the primary species; closely associated with Mariposa lily</li> </ul>

<sup>1</sup> Listed as Critically Endangered by the State of Nevada.

<sup>2</sup> MSHCP Covered Species.

<sup>3</sup> BLM Sensitive or Status Species.

<sup>4</sup> Being considered for coverage under MSHCP Permit Amendment.

**Table C- 2. Secondary Target Species**

Scientific Name	Common Name	Typical Habitat
<i>Arctomecon merriamii</i> <sup>2,3</sup>	White bearpoppy	Rocky limestone slopes and gravel washes in northeast Mojave Desert from 29 to 4,600 ft
<i>Astragalus funereus</i> <sup>3</sup>	Black woollypod	Dry, open scree, talus, or gravelly alluvium derived from light-colored volcanic tuff, on east, south, less commonly west, rarely north aspects
<i>Astragalus lentiginosus</i> <i>var. stramineus</i> <sup>3</sup>	Straw milkvetch	Sandy and gravelly valley flats, washes, and dunes in the creosote-bursage, blackbrush, and mixed-shrub zones
<i>Astragalus mohavensis</i> <i>var. hemigyris</i> <sup>3</sup>	Halfring milkvetch	Carbonate gravels and derivative soils on terraced hills and ledges, open slopes, and along washes in the creosote-bursage, blackbrush, and mixed-shrub zones
<i>Astragalus mokiaceus</i> <sup>3</sup>	Mokiak milkvetch	Loose, sandy to gravelly soils, mostly in and near dry drainages or other periodic disturbances, sometimes on bluffs, cliff terraces, badlands, or basalt talus, in the creosote-bursage, blackbrush, and mixed-shrub zones
<i>Atriplex argentea</i> <i>var. longitrichoma</i> <sup>3</sup>	Pahrump silverscale	Alkaline or gypsiferous, sometimes seasonally moist, often disturbed silty clay soils of valley bottoms in salt desert vegetation surrounded by the creosote-bursage zone, or on roadsides or in abandoned fields
<i>Cirsium virginense</i> (or <i>C. mohavense</i> ) <sup>3</sup>	Virgin River thistle (Mojave thistle)	Damp soils around desert springs, streams, and ditches; 1,500 to 9,000 ft elevation; open, moist, alkaline clay soils of seep and spring areas or gypsum knolls; aquatic or wetland dependent in Nevada

Appendix C — Primary and Secondary Target Species Habitat Requirements

Scientific Name	Common Name	Typical Habitat
<i>Didymodon nevadensis</i> <sup>3</sup>	Gold Butte moss	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
<i>Mentzelia polita</i> <sup>3</sup>	Polished blazingstar	Occurs on limestone or gypseous soils between 3,900 to 4,900 ft
<i>Pediomelum castoreum</i> <sup>3</sup>	Beaver Dam breadroot	Found in sandy washes and roadcuts in the eastern Mojave of Nevada
<i>Penstemon bicolor</i> <i>ssp. bicolor</i> <sup>3</sup>	Yellow twotone beardtongue	Calcareous or carbonate soils in washes, roadsides, rock crevices, outcrops, or similar places receiving enhanced runoff, in the creosote-bursage, blackbrush, mixed-shrub, and lower juniper zones
<i>Penstemon bicolor</i> <i>ssp. roseus</i> <sup>3</sup>	Rosy twotone beardtongue	Rocky calcareous, granitic, or volcanic soils in washes, roadsides, scree at outcrop bases, rock crevices, or similar places receiving enhanced runoff, in the creosote-bursage, blackbrush, and mixed-shrub zones

<sup>1</sup> Listed as Critically Endangered by the State of Nevada.

<sup>2</sup> MSHCP Covered Species.

<sup>3</sup> BLM Sensitive or Status Species.

<sup>4</sup> Being considered for coverage under MSHCP Permit Amendment.

## **Appendix D — 2020 Survey Maps with Element Occurrence**

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Confidential

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## **Appendix E — Survey Site Representative Photos**

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**Appendix F — 2021 Survey Comprehensive Floristic  
Inventory List**

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Appendix F — 2021 Survey Comprehensive Floristic Inventory List

Species	Bunkerville Ridge East	Coyote Springs	Tiffany Quarry	Cow Camp Spring	Desert National Wildlife Refuge	Desert Range	Gold Butte	Hell's Kitchen	McCullough Mountains	Summit Pass	Bitter Spring	Bowl of Fire	West Lake Mead	Echo Junction	North Clark County
<i>Acamptopappus sphaerocephalus</i> (Harvey & A. Gray ex A. Gray) A. Gray var. <i>sphaerocephalus</i>	x			x	x		x	x		x					
<i>Achnatherum hymenoides</i> (Roem. & Schult.) Barkworth			x		x	x	x								
<i>Achnatherum speciosum</i> (Trin. & Rupr.) Barkworth	x									x					x
<i>Acleisanthes nevadensis</i> (Standl.) B.L. Turner						x									
<i>Acmispon rigidus</i> (Benth.) Brouillet								x		x					
<i>Adenophyllum cooperi</i> (A. Gray) Strother							x								
<i>Agave utahensis</i> Engelm.	x		x		x										x
<i>Amaranthus fimbriatus</i> (Torrey) Bentham ex S. Watson					x										x
<i>Ambrosia deltoidea</i> (Torrey) W. W. Payne															
<i>Ambrosia dumosa</i> (A. Gray) W.W. Payne	x	x	x		x	x	x	x		x	x	x			
<i>Ambrosia eriocentra</i> (A. Gray) W.W. Payne										x			x	x	
<i>Ambrosia salsola</i> (Torr. & A. Gray) Strother & B.G. Baldwin	x	x	x		x	x	x	x		x					
<i>Amphipappus fremontii</i> Torr. & A. Gray subsp. <i>fremontii</i>							x								
<i>Amsinckia tessellata</i> A. Gray var. <i>tessellata</i>	x				x		x	x		x					
<i>Amsonia tomentosa</i> Torr. & Frém. var. <i>tomentosa</i>						x									



Appendix F — 2021 Survey Comprehensive Floristic Inventory List

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<i>Anemone tuberosa</i> Rydb.	x														
<i>Antheropeas wallacei</i> (A. Gray) Rydb.	x									x					
<i>Anulocaulis leiosolenus</i> (Torrey) Standley var. <i>leiosolenus</i>											x				
<i>Arctomecon californica</i> Torr. & Frém.											x			x	
<i>Arctomecon merriamii</i> Coville					x									x	
<i>Argemone</i> sp. L.										x					
<i>Aristida adscensionis</i> L.					x			x							
<i>Aristida purpurea</i> Nutt.	x	x	x		x			x			x	x			
<i>Artemisia bigelovii</i> A. Gray													x	x	x
<i>Artemisia ludoviciana</i> Nutt.	x														x
<i>Asclepias erosa</i> Torr.											x				
<i>Astragalus preussii</i> A. Gray var. <i>preussii</i>											x				
<i>Astragalus</i> sp. L.															
<i>Atriplex canescens</i> (Pursh) Nutt. var. <i>canescens</i>				x	x		x				x				
<i>Atriplex confertifolia</i> (Torr. & Frém.) S. Watson					x	x	x								x
<i>Baccharis brachyphylla</i> A. Gray															
<i>Baccharis sergiloides</i> A. Gray										x				x	
<i>Bahiopsis parishii</i> (Greene) E. E. Schilling & Panero										x					
<i>Baileya multiradiata</i> Harvey & A. Gray	x					x	x			x					
<i>Baileya pleniradiata</i> Harvey & A. Gray						x				x					
<i>Baileya</i> sp. Harvey & A. Gray ex Torrey											x				
<i>Bebbia juncea</i> (Bentham) Greene		x	x		x			x		x		x			
<i>Berberis fremontii</i> Torrey					x								x		

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<i>Boechnera sp.</i> Á. Löve & D. Löve	x														x
<i>Brassica tournefortii</i> Gouan*								x							
<i>Brickellia atractyloides</i> A. Gray var. <i>atractyloides</i>	x		x		x					x					
<i>Brickellia longifolia</i> S. Watson					x										
<i>Brickellia microphylla</i> (Nuttall) A. Gray					x										
<i>Brickellia oblongifolia</i> Nuttall	x														
<i>Bromus rubens</i> L.*	x		x		x		x	x		x	x	x			
<i>Bromus tectorum</i> L.*	x		x		x		x	x	x	x				x	
<i>Buddleja utahensis</i> Coville					x	x								x	x
<i>Castilleja chromosa</i> A. Nelson	x				x	x									x
<i>Caulanthus lasiophyllus</i> (Hooker & Arnott) Payson							x	x		x					
<i>Ceanothus pauciflorus</i> de Candolle		x													
<i>Chaenactis carphoclinia</i> A. Gray var. <i>carphoclinia</i>		x													
<i>Chaenactis stevioides</i> Hooker & Arnott	x				x								x		
<i>Chaenactis sp.</i> de Candolle								x		x					
<i>Cheilanthes feei</i> T. Moore			x					x							
<i>Chilopsis linearis</i> (Cav.) Sweet					x					x	x	x			
<i>Chorizanthe brevicornu</i> Torrey							x			x					x
<i>Chorizanthe rigida</i> (Torrey) Torrey & A. Gray		x			x	x	x	x				x	x		
<i>Chrysothamnus viscidiflorus</i> (Hook.) Nutt.													x	x	
<i>Chylismia brevipes</i> (A. Gray) Small								x							x

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<i>Chylismia claviformis</i> (Torr. & Frém.) A. Heller					x										
<i>Chylismia multijuga</i> (S. Watson) Small							x	x		x					
<i>Chylismia</i> sp.								x							
<i>Cirsium mohavense</i> (Greene) Petrak							x								
<i>Cirsium neomexicanum</i> A. Gray	x		x		x	x				x					
<i>Coleogyne ramosissima</i> Torrey	x	x	x	x	x					x					x
<i>Coryphantha chlorantha</i> (Engelmann) Britton & Rose							x								x
<i>Coryphantha vivipara</i> (Nuttall) Britton & Rose						x									
<i>Croton californicus</i> Müller Arg.								x							
<i>Cryptantha angustifolia</i> (Torr.) Greene								x							
<i>Cryptantha barbiger</i> (A. Gray) Greene								x		x					
<i>Cryptantha maritima</i> (Greene) Greene var. <i>maritima</i>								x							
<i>Cryptantha micrantha</i> (Torr.) I.M. Johnst. subsp. <i>micrantha</i>										x					
<i>Cryptantha nevadensis</i> A. Nelson & P.B. Kenn.							x								
<i>Cryptantha pterocarya</i> (Torr.) Greene	x														
<i>Cryptantha</i> sp. Lehman ex G. Don			x												
<i>Cucurbita palmata</i> S. Watson										x					
<i>Cuscuta</i> sp. L.		x				x						x			
<i>Cylindropuntia acanthocarpa</i> (Engelmann & J. M. Bigelow) F. M. Knuth subsp. <i>acanthocarpa</i>	x						x	x	x	x			x	x	

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<i>Cylindropuntia echinocarpa</i> (Engelmann & J. M. Bigelow) F. M. Knuth		x		x	x	x	x	x		x					
<i>Cylindropuntia multigeniculata</i> (Clokey) Backeb.					x								x	x	x
<i>Cylindropuntia ramosissima</i> (Engelmann) F. M. Knuth					x										x
<i>Dasyochloa pulchella</i> (Kunth) Willd. ex Rydb.				x	x	x									
<i>Delphinium parishii</i> A. Gray subsp. <i>parishii</i>			x										x	x	x
<i>Dieteria canescens</i> (Pursh) Nuttall var. <i>leucanthemifolia</i> (Greene) D. R. Morgan & R. L. Hartman															
<i>Diplacus bigelovii</i> (A. Gray) G.L. Nesom						x									x
<i>Draba cuneifolia</i> Nuttall ex Torrey & A. Gray								x							
<i>Dudleya arizonica</i> Rose										x					
<i>Echinocactus polycephalus</i> Engelm. & J.M. Bigelow		x		x	x	x		x				x			
<i>Echinocereus engelmannii</i> (Parry ex Engelm.) Lem.	x	x	x	x	x	x	x	x	x	x					
<i>Echinocereus triglochidiatus</i> Engelm					x										x
<i>Elymus elymoides</i> (Raf.) Swezey															
<i>Encelia farinosa</i> A. Gray ex Torr.								x		x		x			x
<i>Encelia frutescens</i> (A. Gray) A. Gray					x				x						
<i>Encelia resinifera</i> C. Clark	x	x													
<i>Encelia virginensis</i> A. Nelson			x		x		x			x				x	x

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<i>Enceliopsis argophylla</i> (D.C. Eaton) A. Nelson											x				x
<i>Enceliopsis nudicaulis</i> (A. Gray) A. Nelson						x							x	x	
<i>Enneapogon desvauxii</i> P. Beauv.									x						
<i>Ephedra nevadensis</i> S. Watson	x	x			x	x				x					
<i>Ephedra torreyana</i> S. Watson var. <i>torreyana</i>		x		x		x	x				x	x			x
<i>Ephedra viridis</i> Coville	x				x			x		x			x	x	
<i>Eremalche rotundifolia</i> (A. Gray) Greene															x
<i>Eremogone</i> sp. Fenzl					x								x		
<i>Eremogone macradenia</i> (S. Watson) Ikonn. var. <i>macradenia</i>	x														
<i>Eremothera boothii</i> (Douglas) W.L. Wagner & Hoch subsp. <i>condensata</i> (Munz) W.L. Wagner & Hoch		x				x	x								
<i>Eriastrum diffusum</i> (A. Gray) H. Mason	x														
<i>Eriastrum eremicum</i> (Jeps.) H. Mason subsp. <i>eremicum</i>							x								
<i>Ericameria cooperi</i> (A. Gray) H. M. Hall					x										
<i>Ericameria linearifolia</i> (de Candolle) Urbatsch & Wussow	x									x					
<i>Ericameria nauseosa</i> (Pall. ex Pursh) G.L. Nesom & Baird var. <i>mohavensis</i>					x										
<i>Ericameria paniculata</i> (A. Gray) Rydb.					x		x			x		x			x
<i>Erigeron concinnus</i> (Hook. & Arn.) Torr. & A. Gray var. <i>concinnus</i>						x									

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<i>Eriogonum corymbosum</i> Bentham							x								
<i>Eriogonum deflexum</i> Torr. var. <i>deflexum</i>					x	x		x							
<i>Eriogonum fasciculatum</i> Benth. var. <i>polifolium</i> (Benth.) Torr. & A. Gray	x	x	x					x	x	x		x			
<i>Eriogonum heermannii</i> Durand & Hilg. var. <i>clokeyi</i> Reveal				x	x										
<i>Eriogonum heermannii</i> Durand & Hilg. var. <i>sulcatum</i> (S. Watson) Munz & Reveal			x		x										
<i>Eriogonum inflatum</i> Torr. & Frém.		x	x	x	x	x		x		x	x	x			x
<i>Eriogonum insigne</i> S. Watson											x		x	x	x
<i>Eriogonum nidularium</i> Coville					x									x	
<i>Eriogonum plumatella</i> Durand & Hilgard										x					
<i>Eriogonum trichopes</i> Torr. var. <i>trichopes</i>		x					x	x		x					
<i>Erodium cicutarium</i> (L.) L'Hér. ex Aiton*	x						x	x		x			x		
<i>Eschscholzia glyptosperma</i> Greene								x							
<i>Eucnide urens</i> (Parry ex A. Gray) Parry					x			x		x	x	x			
<i>Eucrypta micrantha</i> (Torr.) A. Heller								x						x	
<i>Euphorbia albomarginata</i> (Torr. & A. Gray) Small							x								
<i>Euphorbia polycarpa</i> Bentham				x				x		x	x	x			
<i>Fallugia paradoxa</i> (D. Don) Endl. ex Torr.	x				x								x	x	

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<i>Ferocactus cylindraceus</i> (Engelmann) Orcutt	x		x		x	x		x	x	x					x
<i>Galium stellatum</i> Kellogg subsp. <i>eremicum</i> (Hilend & J.T. Howell) Ehrend.			x		x					x					
<i>Gilia</i> sp. Ruiz & Pav.							x	x							
<i>Gilia stellata</i> A. Heller												x			
<i>Glandularia gooddingii</i> (Briq.) Solbrig										x					
<i>Grusonia parishii</i> (Orcutt) Pinkava					x										
<i>Gutierrezia microcephala</i> (DC.) A. Gray	x						x								
<i>Gutierrezia sarothrae</i> (Pursh) Britton & Rusby			x		x			x	x		x	x			x
<i>Halogeton glomeratus</i> (M. Bieb.) C.A. Mey.*							x								
<i>Heliotropium convolvulaceum</i> (Nutt.) A. Gray								x							
<i>Heliotropium curassavicum</i> L.								x							
<i>Hesperostipa comata</i> (Trin. & Rupr.) Barkworth				x											
<i>Hilaria jamesii</i> (Torr.) Benth.							x								
<i>Hilaria rigida</i> (Thurb.) Benth. ex Scribn.		x	x		x		x	x				x			
<i>Juniperus osteosperma</i> (Torrey) Little	x				x								x		x
<i>Krameria bicolor</i> S. Watson	x	x					x			x					x
<i>Krameria erecta</i> Willd. ex Schult.			x		x	x	x	x	x	x	x	x			
<i>Krascheninnikovia lanata</i> (Pursh) A. Meeuse & Smit	x	x			x		x						x	x	
<i>Langloisia setosissima</i> (Torr. & A. Gray ex Torr.) Greene subsp. <i>setosissima</i>					x										

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Species	Bunkerville Ridge East	Coyote Springs	Tiffany Quarry	Cow Camp Spring	Desert National Wildlife Refuge	Desert Range	Gold Butte	Hell's Kitchen	McCullough Mountains	Summit Pass	Bitter Spring	Bowl of Fire	West Lake Mead	Echo Junction	North Clark County
<i>Larrea tridentata</i> (DC.) Coville		x	x		x	x	x	x	x	x	x	x			
<i>Lepidium densiflorum</i> Schrader*		x											x	x	x
<i>Lepidium fremontii</i> S. Watson			x	x	x	x					x				
<i>Lepidium lasiocarpum</i> Nutt. var. <i>lasiocarpum</i>							x	x							x
<i>Lepidium</i> sp. L.								x					x		
<i>Leptodactylon pungens</i> (Torrey) Rydb.					x										
<i>Linanthus</i> sp.								x							
<i>Lupinus concinnus</i> J. Agardh	x														
<i>Lupinus</i> sp. L.								x							
<i>Lycium andersonii</i> A. Gray	x						x								
<i>Lycium cooperi</i> A. Gray	x														
<i>Lycium pallidum</i> Miers var. <i>oligospermum</i> C. L. Hitchc.							x								
<i>Malacothrix glabrata</i> (A. Gray ex D.C. Eaton) A. Gray								x							
<i>Mammillaria tetrancistra</i> Engelm.		x						x				x			
<i>Menodora spinescens</i> A. Gray		x		x	x	x									
<i>Mentzelia pterosperma</i> Eastw.					x										
<i>Mentzelia</i> sp. L.								x							
<i>Mirabilis laevis</i> (Benth.) Curran var. <i>villosa</i> (Kellogg) Spellb.										x					
<i>Mirabilis multiflora</i> (Torr.) A. Gray	x														
<i>Mortonia utahensis</i> (Coville ex A. Gray) A. Nelson			x					x				x			
<i>Muhlenbergia porteri</i> Scribn. ex Beal		x					x			x					



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<i>Nemacladus glanduliferus</i> Jeps. var. <i>orientalis</i> McVaugh							x								x
<i>Nicotiana obtusifolia</i> M. Martens & Galeotti var. <i>obtusifolia</i>					x							x			
<i>Oenothera suffrutescens</i> (Ser.) W.L. Wagner & Hoch			x												
<i>Opuntia basilaris</i> Engelm. & J.M. Bigelow var. <i>basilaris</i>	x	x	x		x		x	x		x		x			x
<i>Opuntia chlorotica</i> Engelmann & J. M. Bigelow	x												x		
<i>Opuntia xcurvispina</i> Griffiths					x										
<i>Opuntia diploursina</i> A.D. Stock, N. Hussey, & M.D. Beckstrom					x	x									
<i>Opuntia phaeacantha</i> Engelm.	x				x					x				x	x
<i>Opuntia polyacantha</i> Haw. var. <i>erinacea</i> (Engelm. & J.M. Bigelow ex Engelm.) Parfitt	x	x	x		x					x					x
<i>Oxytheca perfoliata</i> Torr. & A. Gray	x														x
<i>Penstemon palmeri</i> A. ray var. <i>palmeri</i>										x					
<i>Penstemon petiolatus</i> Brandegee					x										
<i>Penstemon</i> sp. Schmidel.							x								
<i>Perityle emoryi</i> Torr.								x							
<i>Petalonyx linearis</i> Greene		x													
<i>Petalonyx parryi</i> A. Gray							x				x				
<i>Petrophytum caespitosum</i> (Nuttall) Rydberg					x									x	
<i>Peucephyllum schottii</i> A. Gray								x		x	x	x			x
<i>Phacelia crenulata</i> Torr. ex S. Watson					x		x	x		x					

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<i>Phacelia fremontii</i> Torr.	x														
<i>Phacelia palmeri</i> Torr. ex S. Watson							x				x				
<i>Phacelia</i> sp.					x								x	x	
<i>Phacelia vallis-mortae</i> J. Voss	x									x					
<i>Phoradendron californicum</i> Nutt.			x							x	x	x			
<i>Physalis crassifolia</i> Benth.															
<i>Pinus monophylla</i> Torr. & Frém.	x				x									x	
<i>Plantago ovata</i> Forssk.		x					x	x		x		x			x
<i>Plantago patagonica</i> Jacq.										x				x	
<i>Pluchea sericea</i> (Nutt.) Coville								x							
<i>Pleurocoronis pluriseta</i> (A. Gray) R.M. King & H. Rob.												x			
<i>Porophyllum gracile</i> Benth.							x			x		x			
<i>Prosopis glandulosa</i> Torr. var. <i>torreyana</i> (L.D. Benson) M.C. Johnst.		x			x										
<i>Prunus fasciculata</i> (Torr.) A. Gray var. <i>fasciculata</i>	x		x	x	x					x					
<i>Psathyrotes annua</i> (Nutt.) A. Gray					x										x
<i>Psilostrophe cooperi</i> (A. Gray) Greene															
<i>Psoralea fremontii</i> (Torr. ex A. Gray) Barneby var. <i>fremontii</i>	x	x	x		x	x	x	x		x	x	x			
<i>Purshia stansburiana</i> (Torr.) Henrickson	x				x										x
<i>Quercus turbinella</i> Greene	x														x
<i>Rhus aromatica</i> Nutt. var. <i>trilobata</i>					x										
<i>Salazaria mexicana</i> Torr.	x		x		x	x	x		x	x					x
<i>Salix goodingii</i> C.R. Ball								x							

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<i>Salsola tragus</i> L.*		X					X	X							
<i>Salvia columbariae</i> Benth.	X							X		X					X
<i>Salvia dorrii</i> (Kellogg) Abrams	X		X		X										
<i>Schismus barbatus</i> (Loefl. ex L.) Thell.*		X	X		X	X	X	X				X			
<i>Sclerocactus johnsonii</i> (Parry ex Engelm.) E.M. Baxter											X		X	X	
<i>Senecio flaccidus</i> Less.					X		X			X				X	
<i>Senegalia greggii</i> (A. Gray) Britton & Rose	X	X	X				X		X	X	X	X			
<i>Senna armata</i> (S. Watson) Irwin & Barneby														X	
<i>Senna covesii</i> (A. Gray) H. Irwin & Barneby										X			X		
<i>Silene antirrhina</i> L.								X							
<i>Sphaeralcea ambigua</i> A. Gray	X	X	X		X	X	X			X	X				
<i>Sphaeralcea grossulariifolia</i> (Hook. & Arn.) Rydb.	X													X	X
<i>Sphaeralcea</i> sp. A. St.-Hil.								X							
<i>Sporobolus cryptandrus</i> (Torr.) A. Gray							X					X			
<i>Stanleya</i> sp. Nuttall					X										X
<i>Stanleya pinnata</i> (Pursh) Britton					X		X			X		X			
<i>Stephanomeria pauciflora</i> (Torr.) A. Nelson	X	X	X		X	X		X		X					X
<i>Streptanthella longirostris</i> (S. Watson) Rydb.		X										X			
<i>Strigosella africana</i> (L.) Botsch.*		X					X				X				
<i>Suaeda moquinii</i> (Torr.) Greene							X							X	

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<i>Tamarix chinensis</i> Lour.*								X		X					
<i>Tetradymia axillaris</i> A. Nelson var. <i>longispina</i> (M.E. Jones) Strother					X										
<i>Thamnosma montana</i> Torr. & Frém.	X	X	X		X		X			X		X			
<i>Thymophylla pentachaeta</i> (DC.) Small		X	X		X		X								X
<i>Tidestromia suffruticosa</i> (Torr.) Standl.												X			
<i>Tiquilia canescens</i> (DC.) A.T. Richardson var. <i>canescens</i>			X		X		X	X							
<i>Tiquilia latior</i> (I.M. Johnst.) A.T. Richardson							X				X	X		X	
<i>Trichoptilium incisum</i> (A. Gray) A. Gray								X		X				X	
<i>Xanthisma spinulosum</i> (Pursh) D. R. Morgan & R. L. Hartman var. <i>gooddingii</i> (A. Nelson) D. R. Morgan & R. L. Hartman								X							
<i>Xylorhiza tortifolia</i> (Torr. & A. Gray) Greene					X					X					
<i>Yucca baccata</i> Torrey	X			X	X	X				X					
<i>Yucca brevifolia</i> Engelm. var. <i>jaegeriana</i> McKelvey	X			X	X		X								X
<i>Yucca schidigera</i> Roez. ex Ortgies	X	X	X		X				X	X					

\*Introduced species.

Taxonomic Authority is Flora of North America. When no Flora of North America treatment existed, *Desert Jepson Manual: Vascular Plants of southeastern California* (Baldwin et al. 2012), [USDA PLANTS Database](#) were consulted.