Appendix D: Integrated Assessment

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INTEGRATED ASSESSMENT

D-1 Model Approach

D-1.1 Conceptual Models

The conceptual model for integrated assessment with development CAs draws from the ecosystem conceptual model in terms of CA influence on CEs. These influences were listed in Appendix A Conceptual Models and describe known or expected effects of development CAs on the extent and condition of CEs generally. This rapid ecoregional assessment did not attempt to derive specific cause and effect models on individual CEs.

D-1.2 Spatial Models

Spatial models follow the graphic conventions per [Figure].

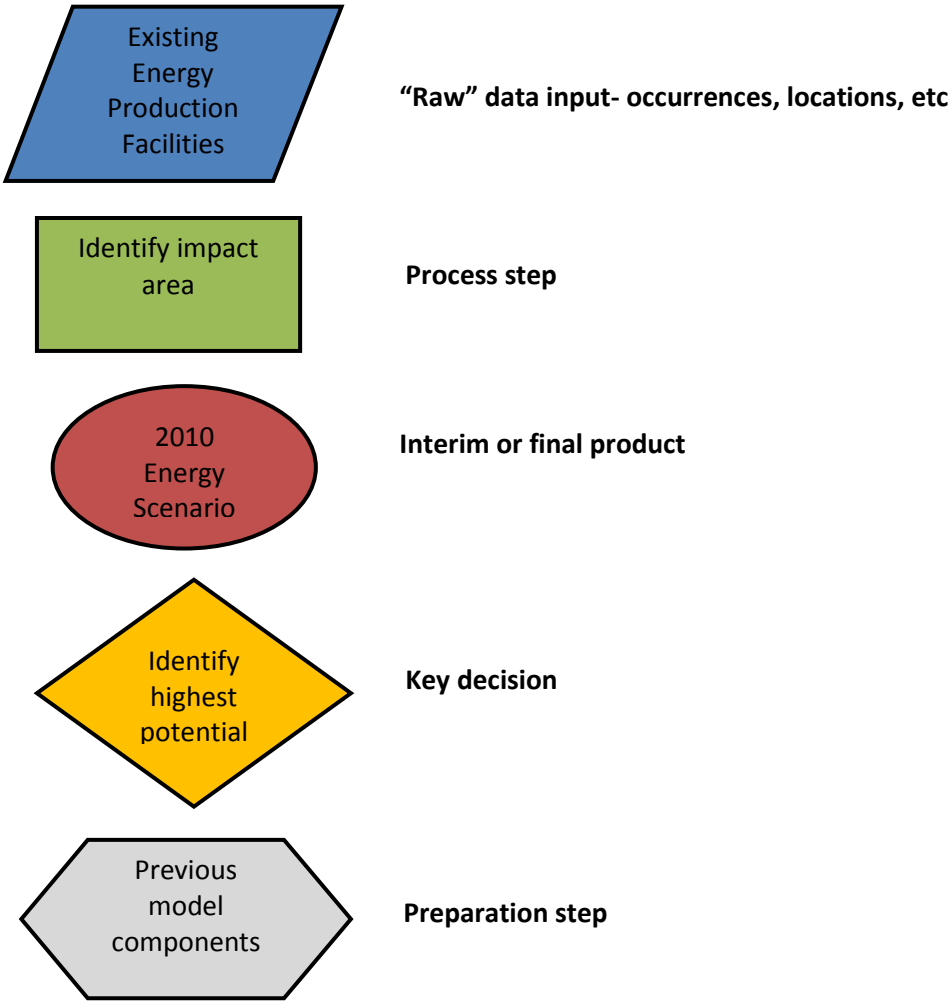

Figure D - 1. Spatial model graphic convention

D-1.2.1 **Basic Assessment Model**

Many MQs can be summarized as "Where will X coincide with Y?" seeking to identify areas where, for example, CEs will be coincident with CAs that may cause impacts (but do not attempt to model the impact). These types of MQs can be answered by a basic assessment model (Figure D - 2) that will intersect the distribution map of a CE with a mapped or modeled distribution of a CA. Areas or portions of overlap between the CE and CA can be displayed as a map and accompanied by summary statistics. This same model was used to intersect the CAs with other units such as the sensitive soils, high biodiversity sites, herd management areas and grazing allotments.

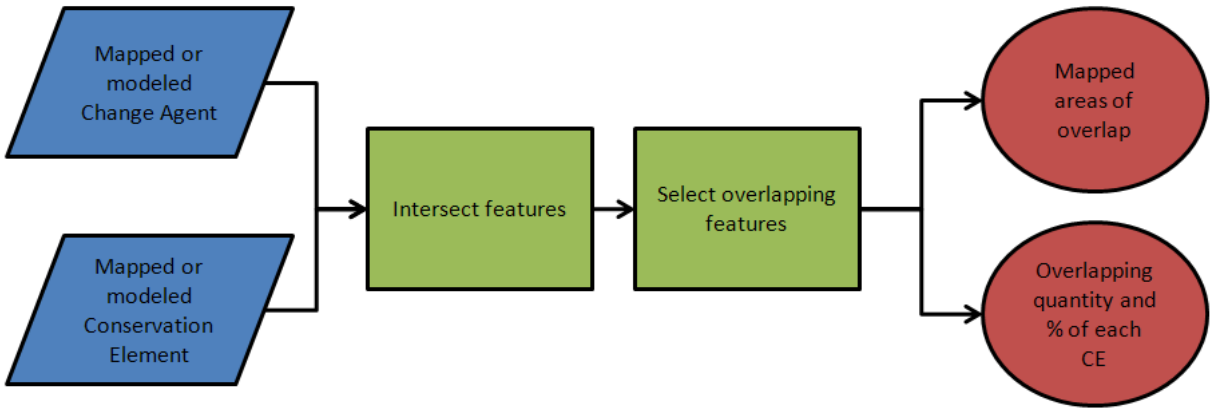

Figure D - 2. Basic Assessment Model

Inputs: Spatial distributions of CAs and CEs

Analytic process & tools: GIS intersect function were used to integrate these layers.

Outputs: A summary map that shows areas of overlap and summary statistics

Issues: This assessment model is quite simple and is not intended to represent actual response of the CEs to the CAs. Those more complex issues are addressed in different MQs and through different models. This model, however, is foundational in many other models which first require the intersection between CEs and CAs.

D-1.2.2 **Other Assessment Models**

Other assessment models include all those needed to answer MQs not answered by the Basic Assessment Model. These models sometimes begin with the Basic Assessment Model and or combine multiple models depending on the complexity of the MQ.

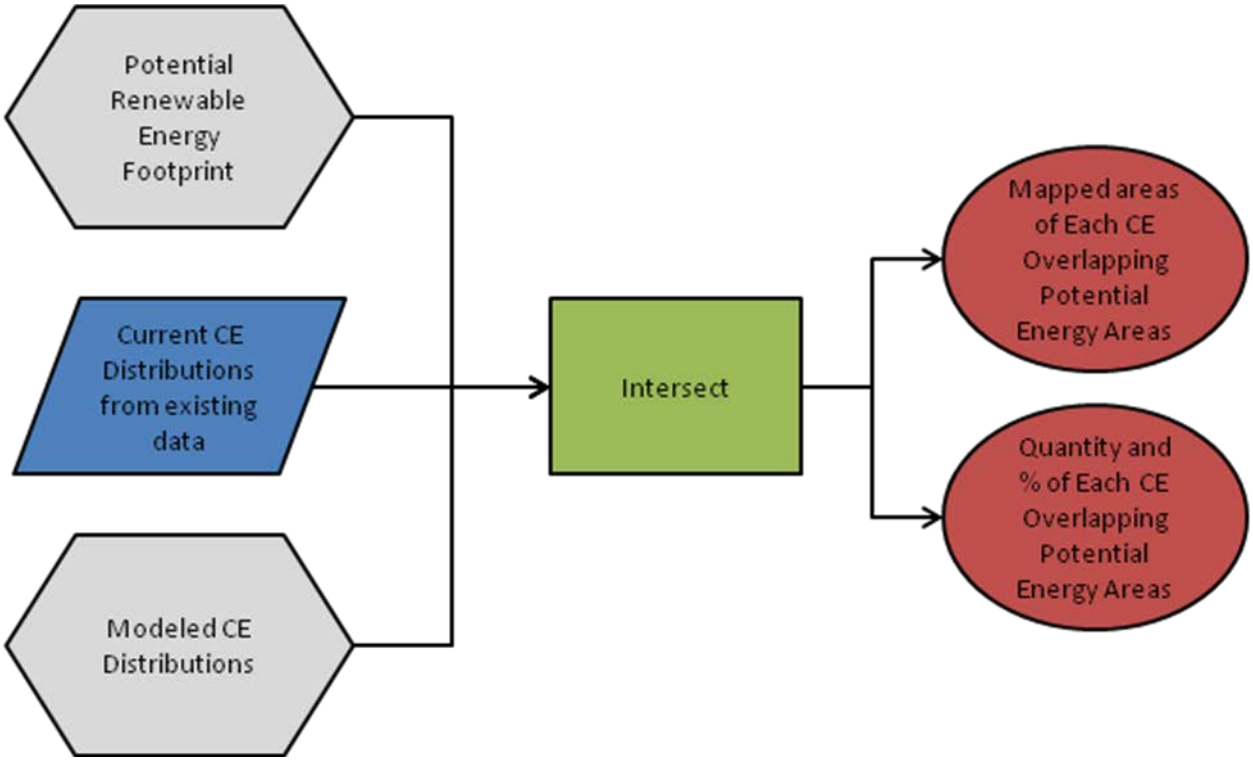

Figure D - 3. Spatial Model for Potential Renewable Energy Area intersecting with CEs. This corresponds to MQ 90

Inputs: Total renewable energy development model output, current CE distributions from existing data or from distribution models.

Analytic process & tools: A GIS intersect were used

Outputs: The distribution of each CE overlapping potential energy areas and the quantity and percent of each CE that overlaps those areas.

Issues: see issues of other input models

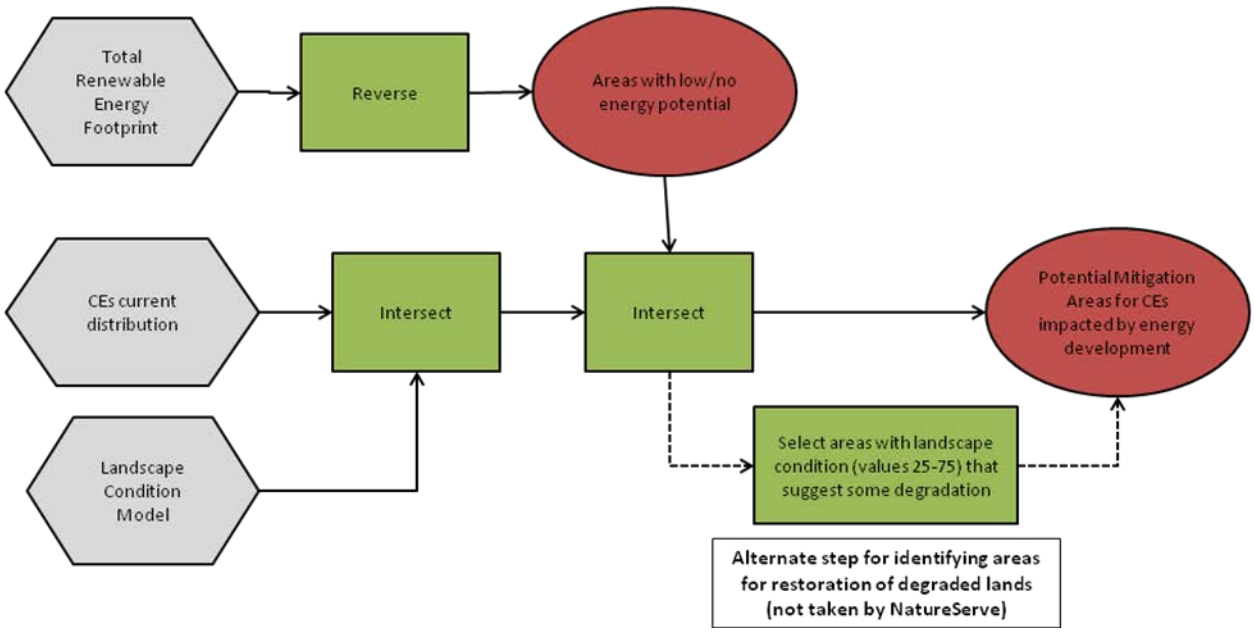

Figure D - 4. Conceptual model for the MQ89, "Where are the areas of low renewable and non-renewable energy development that could potentially mitigate impacts to CEs from potential energy development?"

Inputs: Outputs from the Total Renewable Energy Footprint, CE current distributions and the landscape condition model

Analytic process & tools: Analytical processes consisted of intersecting the layers and selecting relevant features/attributes. By selecting a narrower range of landscape condition model values, BLM could further narrow the scope of areas that offer mitigation opportunities through the restoration of currently degraded sites.

Outputs: An intermediate output is a map of natural areas with low-no energy potential. Intersecting that output with the distributions of CEs potentially affected by energy development identifies locations that contain CEs that may need mitigation and have low potential for future energy development. The final map then serves as a potential mitigation sites map.

Issues: See MQ89 below for a discussion of limitations and issues associated with this model.

D-2 Findings in terms of Management Questions

D-2.1 Current Distribution and Footprint Analysis

D-2.1.1 Terrestrial CE distributions, overlain with current CAs

MQ55 - WHERE DO CURRENT LOCATIONS OF CES OVERLAP WITH DEVELOPMENT CAS?

MQ4 - WHERE ARE EXISTING CHANGE AGENTS POTENTIALLY AFFECTING THIS CURRENT HABITAT AND/OR MOVEMENT CORRIDORS, FOR LANDSCAPE SPECIES AND SPECIES ASSEMBLAGE CES?

CEs were intersected with the scenarios (current and 2025 – see Appendix A for details) to answer this specific MQ using the basic assessment model described in Figure D - 2 above. Statistics on the area and proportion of the CE overlapped by each CA and total area and proportion of the CE are in Table D - 1 (current scenario) and Table D - 6 (2025 scenario) below.

The footprint analysis (CA/CE intersect) illustrates that the ecoregion is still overwhelmingly rural in nature and most impacts do not come from development CAs at this time. Most development in the ecoregion concentrated in Western Mojave and around the greater Las Vegas area. Findings for this MQ are consistent with urban patterns such that most development impact occurs among the coarse-filter riparian types (North American Warm Desert Lower Montane Riparian Woodland and Shrubland) and the obligate landscape species (bald eagle and golden eagle nesting sites). However a few elements not associated with riparian areas also show a relatively high degree of overlap (Mojave Ground Squirrel, Sonora-Mojave Semi-Desert Chaparral, Sonora-Mojave Mixed Salt Desert Scrub).

Table D - 1. Percent of CEs overlapped by development CAs in the current scenario; CEs are sorted by the % of distribution overlapped by current development.

Element Name	TOTAL (ac)	Total Development Footprint	No Change Agent	Multiple Change Agents	Urban Development	Renewable Energy Geothermal	Renewable Energy Solar	Renewable Energy Wind	Mine or Landfill	Oil or Gas Well	Military Urbanized Area	Railroad	Water Canal or Ditch	Primary Electic Utility Line	Pipeline	Crops or Irrigated Pasture	Roads Principle or Secondary	Roads Rural Neighborhood or Private	Roads Unimproved 4wd	Non motorized trail	Roads Unknown Type
Golden Eagle (nesting sites)	1,123	37.35	62.65	10.16	20.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.97	0.16	1.01	0.61	3.19	0.93	0.00	0.00
Bald Eagle (nesting sites)	866	33.37	66.63	9.42	18.58	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.13	0.18	0.00	1.31	0.59	2.54	0.59	0.00	0.00
Mojave Ground Squirrel	202,719	32.46	67.54	5.67	23.20	0.00	0.00	0.00	0.00	0.00	0.19	0.10	0.00	0.30	0.11	0.82	0.17	1.71	0.11	0.00	0.07
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	4,871	32.05	67.95	11.31	11.31	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.05	0.00	5.38	1.04	2.08	0.41	0.03	0.20
Sonora-Mojave Semi-Desert Chaparral	66,218	28.75	71.25	3.35	23.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.20	0.02	0.09	0.18	0.80	0.71	0.07	0.00
Sonora-Mojave Mixed Salt Desert Scrub	410,283	23.67	76.33	2.96	18.76	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.01	0.15	0.04	0.20	0.03	1.07	0.32	0.01	0.06
North American Warm Desert Badland	218,161	20.90	79.10	5.94	11.51	0.00	0.00	0.33	0.01	0.00	0.01	0.10	0.05	0.46	0.14	0.01	0.78	1.37	0.15	0.02	0.04
Gypsum Soils Species Assemblage	47,305	18.14	81.86	5.66	10.07	0.00	0.03	0.00	0.03	0.00	0.13	0.08	0.02	0.37	0.08	0.08	0.53	0.99	0.07	0.00	0.01
North American Warm Desert Riparian Woodland and Shrubland/Stream includes Mesquite Bosque	151,753	17.95	82.05	3.37	10.78	0.00	0.00	0.01	0.01	0.00	0.03	0.10	0.03	0.17	0.05	1.28	0.17	1.58	0.35	0.03	0.01
Cooper's hawk	4,068,475	16.48	83.52	4.59	9.39	0.00	0.01	0.00	0.01	0.00	0.12	0.03	0.01	0.09	0.04	0.30	0.39	1.25	0.19	0.02	0.02
Montane Conifer Species Assemblage	78,228	15.99	84.01	4.64	8.19	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.09	0.06	0.02	0.25	0.32	1.67	0.60	0.06	0.03
Springs and Seeps	12	14.81	85.19	1.85	7.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.85	0.00	3.70	0.00	0.00	0.00
Mohave Rattlesnake	8,845,254	13.15	86.85	1.71	9.19	0.00	0.08	0.00	0.01	0.00	0.03	0.07	0.01	0.25	0.17	0.19	0.06	1.22	0.10	0.00	0.06
Migratory Shorebirds and Waterfowl Species Assemblage	12,074	12.20	87.80	1.77	7.75	0.00	0.00	0.00	0.00	0.00	0.31	0.04	0.03	0.09	0.00	0.64	0.19	1.15	0.20	0.01	0.01
Northern Rubber Boa	35,088	11.27	88.73	1.39	5.22	0.00	0.00	0.00	0.01	0.00	0.00	0.06	0.05	0.29	0.00	1.33	0.22	1.53	1.06	0.10	0.02
Brewer's Sparrow (Breeding)	4,842,047	11.06	88.94	1.50	7.73	0.00	0.00	0.01	0.00	0.00	0.02	0.04	0.01	0.08	0.03	0.26	0.05	1.16	0.12	0.01	0.03
Desert Tortoise - Mohave Population	14,141	10.99	89.01	1.68	7.17	0.00	0.11	0.14	0.02	0.00	0.05	0.06	0.00	0.25	0.12	0.06	0.15	1.05	0.09	0.00	0.05
Lake / Reservoir	3,418	10.53	89.47	3.16	4.68	0.00	0.00	0.00	0.55	0.00	0.00	0.00	0.00	0.03	0.01	0.05	0.00	1.73	0.30	0.01	0.00
Great Basin Pinyon-Juniper Woodland	3,109,608	10.03	89.97	1.55	6.73	0.00	0.01	0.00	0.00	0.00	0.03	0.03	0.01	0.09	0.03	0.29	0.05	0.97	0.20	0.02	0.02
Sand Dunes and Sandy Soils Species Assemblage	149,612	9.81	90.19	1.67	5.67	0.00	0.01	0.00	0.03	0.00	0.08	0.09	0.01	0.38	0.12	0.20	0.29	1.10	0.13	0.01	0.03
Big brown bat	19,657,761	9.52	90.48	1.78	5.86	0.00	0.04	0.01	0.02	0.00	0.04	0.04	0.01	0.17	0.09	0.21	0.13	0.96	0.12	0.01	0.03

Element Name	TOTAL (ac)	Total Development Footprint	No Change Agent	Multiple Change Agents	Urban Development	Renewable Energy Geothermal	Renewable Energy Solar	Renewable Energy Wind	Mine or Landfill	Oil or Gas Well	Military Urbanized Area	Railroad	Water Canal or Ditch	Primary Electic Utility Line	Pipeline	Crops or Irrigated Pasture	Roads Principle or Secondary	Roads Rural Neighborhood or Private	Roads Unimproved 4wd	Non motorized trail	Roads Unknown Type
Brazilian free-tailed bat	22,140,016	9.37	90.63	1.67	5.74	0.00	0.04	0.02	0.02	0.00	0.03	0.04	0.01	0.16	0.09	0.22	0.12	1.03	0.13	0.01	0.03
North American Warm Desert Playa	1,102,190	8.63	91.37	1.85	4.48	0.00	0.45	0.00	0.00	0.00	0.15	0.03	0.11	0.08	0.05	0.08	0.14	1.08	0.07	0.00	0.04
North American Warm Desert Pavement	1,318,593	8.29	91.71	1.47	4.16	0.00	0.01	0.07	0.05	0.00	0.07	0.07	0.02	0.25	0.12	0.01	0.31	1.49	0.14	0.00	0.05
Kit Fox	28,473,064	8.13	91.87	0.93	5.43	0.01	0.08	0.09	0.02	0.00	0.02	0.04	0.01	0.18	0.09	0.07	0.05	0.98	0.14	0.00	0.03
Prairie Falcon	17,785,988	7.85	92.15	1.01	5.03	0.00	0.04	0.02	0.03	0.00	0.01	0.04	0.01	0.18	0.10	0.24	0.05	0.93	0.12	0.01	0.04
Common Kingsnake	36,616,731	7.84	92.16	1.01	5.05	0.01	0.06	0.07	0.02	0.00	0.02	0.03	0.01	0.16	0.08	0.16	0.06	0.94	0.14	0.01	0.03
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	14,248,141	7.82	92.18	0.87	5.41	0.00	0.05	0.01	0.02	0.00	0.01	0.05	0.00	0.20	0.12	0.05	0.04	0.84	0.09	0.00	0.04
Coachwhip	19,947,286	7.63	92.37	0.90	5.13	0.00	0.04	0.01	0.02	0.00	0.02	0.04	0.00	0.17	0.09	0.09	0.05	0.92	0.11	0.01	0.03
North American Warm Desert Wash	1,254,483	7.55	92.45	0.59	4.44	0.01	0.03	0.07	0.02	0.00	0.01	0.04	0.00	0.15	0.06	0.05	0.10	1.60	0.32	0.02	0.03
Glossy Snake	16,982,246	7.49	92.51	0.80	5.04	0.00	0.04	0.02	0.02	0.00	0.01	0.04	0.00	0.19	0.10	0.06	0.05	0.96	0.11	0.00	0.04
Desert Tortoise - Sonoran Population	1,771,874	7.45	92.55	0.65	4.05	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.30	0.16	0.00	0.11	1.82	0.31	0.00	0.00
Mule Deer Class F Year Round Range	5,219,490	7.42	92.58	0.85	4.86	0.00	0.00	0.01	0.01	0.00	0.00	0.03	0.01	0.15	0.05	0.07	0.08	0.96	0.32	0.02	0.01
Northern Harrier	70,176	7.40	92.60	2.78	1.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.26	0.04	1.79	0.02	0.01	0.00
Western Patch-nosed Snake	26,461,026	7.15	92.85	0.78	4.81	0.01	0.06	0.08	0.02	0.00	0.01	0.03	0.00	0.17	0.09	0.06	0.04	0.84	0.12	0.00	0.03
Great Basin Collared Lizard	30,003,739	6.89	93.11	0.72	4.59	0.01	0.06	0.07	0.02	0.00	0.01	0.03	0.00	0.16	0.08	0.06	0.04	0.89	0.13	0.00	0.03
Mojave Mid-Elevation Mixed Desert Scrub	12,768,442	6.31	93.69	0.62	4.16	0.02	0.07	0.16	0.00	0.00	0.00	0.02	0.00	0.14	0.05	0.05	0.03	0.82	0.15	0.01	0.01
Gila Monster	8,376,158	6.16	93.84	0.52	3.72	0.00	0.13	0.24	0.00	0.00	0.00	0.03	0.00	0.28	0.09	0.01	0.05	0.92	0.14	0.00	0.01
North American Warm Desert Active and Stabilized Dune	17,746	6.07	93.93	2.24	1.61	0.00	0.00	0.00	0.04	0.00	0.75	0.01	0.00	0.02	0.00	0.00	0.24	1.04	0.07	0.00	0.04
Sonoran Mid-Elevation Desert Scrub	424,960	6.02	93.98	0.42	4.05	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.07	0.09	0.00	0.08	1.14	0.13	0.00	0.00
Western Banded Gecko	7,349,968	5.97	94.03	0.48	3.77	0.00	0.00	0.11	0.00	0.00	0.00	0.03	0.01	0.21	0.09	0.03	0.07	1.01	0.16	0.01	0.00
Sage Thrasher	1,159,642	4.45	95.55	0.43	1.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.02	0.21	0.04	1.76	0.24	0.03	0.01
Azonal Carbonate Rock Crevices Species Assemblage	171,642	4.21	95.79	0.85	1.62	0.00	0.08	0.46	0.01	0.00	0.00	0.02	0.02	0.09	0.03	0.01	0.26	0.59	0.12	0.01	0.02
Clay Soil Patches Species Assemblage	6,862	4.02	95.98	0.25	0.92	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.08	0.00	0.11	0.13	2.37	0.09	0.01	0.00
Mule Deer Class D Winter Range	1,296,533	3.32	96.68	0.25	1.53	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.12	0.01	0.10	0.04	0.83	0.39	0.04	0.00
Inter-Mountain Basins Mixed Salt Desert Scrub	382,555	3.08	96.92	0.15	0.80	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.06	0.05	0.01	0.08	0.05	1.73	0.11	0.00	0.00
Desert big horn	12,430,572	3.02	96.98	0.28	1.84	0.00	0.00	0.02	0.04	0.00	0.00	0.01	0.00	0.09	0.03	0.01	0.04	0.51	0.12	0.01	0.02

Element Name	TOTAL (ac)	Total Development Footprint	No Change Agent	Multiple Change Agents	Urban Development	Renewable Energy Geothermal	Renewable Energy Solar	Renewable Energy Wind	Mine or Landfill	Oil or Gas Well	Military Urbanized Area	Railroad	Water Canal or Ditch	Primary Electic Utility Line	Pipeline	Crops or Irrigated Pasture	Roads Principle or Secondary	Roads Rural Neighborhood or Private	Roads Unimproved 4wd	Non motorized trail	Roads Unknown Type
North American Warm Desert Bedrock Cliff and Outcrop	388,934	2.80	97.20	0.21	1.44	0.01	0.00	0.10	0.15	0.00	0.00	0.01	0.00	0.13	0.03	0.00	0.09	0.51	0.09	0.00	0.02
Brewer's Sparrow (Migratory)	13,224,753	2.79	97.21	0.24	1.25	0.00	0.09	0.00	0.01	0.00	0.00	0.01	0.00	0.14	0.03	0.01	0.05	0.81	0.10	0.00	0.03
Mogollon Chaparral	230,430	2.60	97.40	0.08	1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.06	0.00	0.07	0.01	0.78	0.29	0.09	0.00
Carbonate Alpine Species Assemblage	6,407	2.50	97.50	0.08	1.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.47	0.73	0.05	0.15
Northern Sagebrush Lizard	11,226,057	2.30	97.70	0.10	0.88	0.00	0.08	0.00	0.00	0.00	0.00	0.01	0.00	0.09	0.02	0.03	0.03	0.87	0.15	0.01	0.01
Sage Sparrow	223,610	1.75	98.25	0.04	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.01	0.50	0.48	0.05	0.03
Great Basin Xeric Mixed Sagebrush Shrubland	304,916	1.44	98.56	0.12	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.03	0.02	0.59	0.09	0.00	0.00
Mule Deer Class B Summer Range	932,360	1.37	98.63	0.02	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.02	0.62	0.14	0.07	0.01
Azonal Noncarbonate Rock Crevices Species Assemblage	9,802	0.78	99.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.04	0.02	0.01
Noncarbonate Alpine Species Assemblage	3,298	0.13	99.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.07	0.00

D-2.1.2 High Biodiversity Sites, Sensitive Soils, HMAs and GAs overlap with CAs

MQ 15 - WHERE WILL DEVELOPMENT CAS POTENTIALLY AFFECT SITES OF HIGH BIODIVERSITY UNDER EACH TIME SCENARIO?

MQ 26 - WHERE WILL DEVELOPMENT CAS OVERLAP HAS, HMAS, AND GAS UNDER EACH TIME SCENARIO?

MQ 29 - WHERE WILL TARGET SOIL TYPES OVERLAP WITH DEVELOPMENT CAS UNDER EACH TIME SCENARIO?

These MQs are addressed in this separate document because of the thousands of grazing allotments requiring an extensive table to communicate results. The tables here report the degree of development CA overlap for the current, near future (2025) and change in percent for high biodiversity sites, sensitive soils, HMAs, and GAs. The development CA category is a roll-up of all anthropogenic change agents. All of these assessments followed the Basic Assessment Model (found in Appendix D) and applied a basic footprint assessment of anthropogenic features (urban development, roads, etc) represented in the near-future scenario intersected with these places and features. It does not model actual response or condition of these features to the CAs (another MQ assessed landscape condition against GAs and HMAs). The CAs consist of 19 classes which represent different types of human infrastructure on the landscape. Some types are easily defined, precise footprints (pipelines, roads, energy development areas) while others are broader land cover types derived from spatial models (development, mining and refuse areas). During the construction of the layer, we observed that many CAs will overlap and per agreement by the AMT, where overlapping CAs were detected these were reclassified as "multiple CAs." The geospatial layers and metadata that were turned in BLM contain more detail information.

D-2.1.3 Uncertainty, Limitations and Data Gaps

A full description of the development change agents and their uncertainty and limitations is detailed in Appendix A. All of the data inputs to these assessments are considered to have high confidence; see however Appendix A for sensitive soils modeling for additional information on those features.Grazing allotment and herd management areas were used as they were received from BLM. It was noted during the analysis that the grazing allotment layer included areas of private or non-federal land and this resulted in some unlikely results, namely the presence of urban development overlap with the (federally owned) grazing allotments. The allotment data did not specify the status of each allotment (open, closed, retired, etc.) so all were treated as open. No additional verification was done regarding the current status of these places by the contractor.

D-2.1.4 High Biodiversity Sites, overlain with current and 2025 scenario CAs

The high biodiversity sites were derived from source data characterizing locations with concentrated at-risk biodiversity or existing source data of a prioritization exercise that identified areas of high conservation significance. Sites of High Biodiversity were derived from a compilation of the following datasets: California Essential Habitat Connectivity (Essential Connectivity Areas – ECA), Portfolio Sites from the Nature Conservancy ecoregional assessments, USFWS Critical Habitat, Nevada Important Bird Areas, and Nevada Priority Conservation Areas 2006. High biodiversity sites show modest impact (about 14% of total) from development change agents. Some change occurs as urban/rural development expands in the near-future scenario. Besides the low percentage of development in the ecoregion, this result is also likely explained by the tendency of conservation planners to avoid areas of current or likely future development.

Table D - 2. Acres and proportion of high biodiversity sites overlain by current and 2025 development CAs.

Change Agent Type	Developed Total 2010 (acres)	Developed 2010 percent	Developed Total 2025 (acres)	Developed 2025 percent	Percent Change
No Development CA	5,765,777	86.63	5,631,065	84.62	-2.02
Urban or Rural Development	543,690	8.17	634,819	9.54	1.37
Multiple Overlapping CAs	132,904	2.00	133,517	2.01	0.01
Roads rural private neighborhood	91,494	1.37	95,932	1.44	0.07
Renewable Energy Wind	21,568	0.32	24,255	0.36	0.04
Crops or irrigated pasture	21,344	0.32	17,682	0.27	-0.05
Electric utility line	17,185	0.26	18,874	0.28	0.03
Roads Unimproved or 4wd	13,845	0.21	14,108	0.21	0.00
Roads principle or secondary	13,519	0.20	14,181	0.21	0.01
Renewable Energy Solar	8,256	0.12	22,457	0.34	0.21
Pipeline	7,910	0.12	7,238	0.11	-0.01
Railroad	5,763	0.09	5,238	0.08	-0.01
Military Urbanized Area	4,657	0.07	4,010	0.06	-0.01
Renewable Energy Geothermal	2,305	0.03	2,305	0.03	0.00
Roads Unknown	2,246	0.03	2,361	0.04	0.00
Water canal or ditch	1,598	0.02	1,502	0.02	0.00
Roads - non motorized trails	651	0.01	658	0.01	0.00
Mine or landfill	549	0.01	487	0.01	0.00
Oil or gas welll	32	0.00	30	0.00	0.00
Renewable Energy SEZ		0.00	23,944	0.36	0.36

D-2.1.5 **Sensitive Soils, overlain with current and 2025 scenario CAs**

This assessment was limited to the most restrictive definition for sensitive soils (except for the hydric soils in which case that used a broader definition) because such soils occupy the majority of the ecoregion. The soils were then overlaid with the development CAs. Most sensitive soils show some impact from development CAs, with four sensitive soil types greater than 13% overlap. These sensitive soil types are overlapped largely by urban/rural development and row crops and irrigated pasture. The geospatial layers and metadata that were turned in BLM contain more detailed information on the types and location of development CA overlap.

Table D - 3. Acres and percent of development change agents by Sensitive Soil, 2010-2025

Sensitive Soil Type	Total Area (acres)	Developed Total 2010 (acres)	Developed 2010 percent	Developed 2025 (acres)	Developed percent 2025	Percent Change
Available water capacity	35,152,542	2,391,146	6.80	2,696,338	7.68	0.87
Soils sensitive to wind erosion	9,430,513	1,466,523	15.55	1,622,838	17.22	1.67
Soils sensitive to water erosion	4,908,800	56,762	1.16	66,989	1.36	0.21

Sensitive Soil Type	Total Area (acres)	Developed Total 2010 (acres)	Developed 2010 percent	Developed 2025 (acres)	Developed percent 2025	Percent Change
Calcium carbonate soils	4,343,982	120,697	2.78	135,107	3.11	0.33
High sodium adsorption ratio soils	1,838,731	220,089	11.97	247,408	13.52	1.55
Hydric soils (inclusive definition)	882,639	109,904	12.45	121,750	13.79	1.34
Gypsum soils	306,056	39,760	12.99	42,120	13.76	0.77

D-2.1.6 **Herd Management Areas, overlain with current and 2025 scenario CAs**

Most HMAs show very little impact from development CAs and the dominant development CAs are rural roads. There is very little change between the current and 2025 scenario for any of the herd management areas. The geospatial layers and metadata that were turned in BLM contain more detailed information on the types and location of development CA overlap. Figure D - 5 shows an image of the herd management areas with the landscape condition model to create a visual illustration of the potential degradation from development and invasive plants. The herd management areas summarized by the landscape condition was not an assessment delivered to BLM but it could be readily created using data delivered by the contractor.

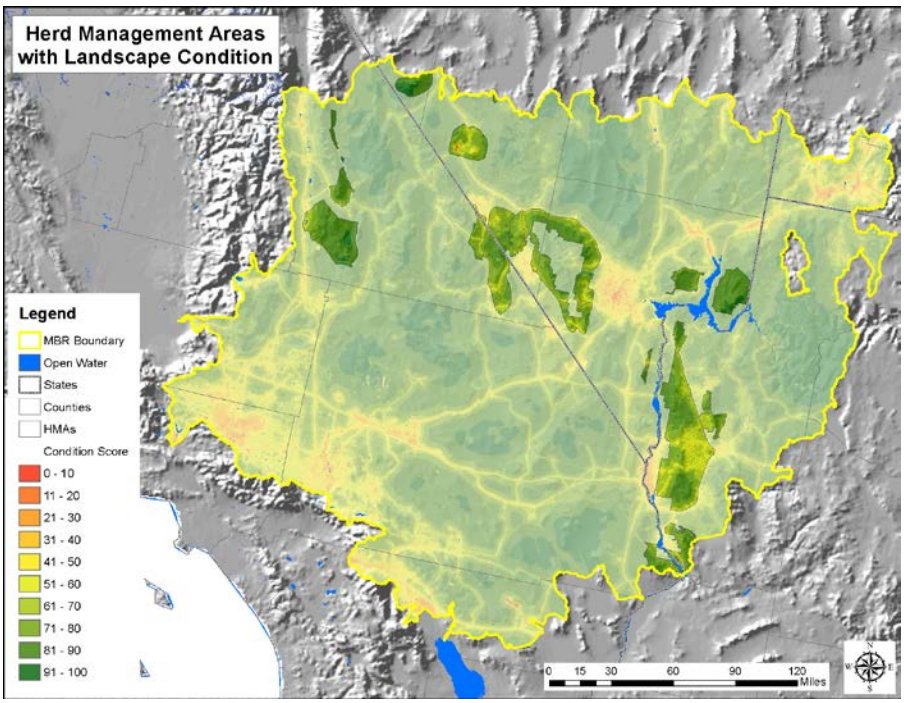

Figure D - 5. Current landscape condition within herd management areas. Location of HMAs and relationship to "development" as represented by the landscape condition model within the Mojave Basin & Range ecoregion. This map shows the full color ramp for the landscape condition model within HMA boundaries; dark green indicates apparently unimpacted condition, red to dark orange apparently highly impacted.

Table D - 4. Acres and percent of development change agents by HMA, 2010-2025.

HMA_NAME	HMA_ID	Total Area (acres)	Developed Total 2010	Percent 2010	Developed Total 2025	Percent 2025	Percent Change
Cerbat Mountain	AZ0002	82,936	6,787	8.18	7,985	9.63	1.44
Black Mountain	AZ0003	772,564	73,892	9.56	81,990	10.61	1.05
Amargosa Valley	NV0511	8,825	700	7.93	787	8.92	0.99
Johnnie	NV0510	179,471	4,785	2.67	5,709	3.18	0.51
El Dorado Mountains	NV0501	16,519	274	1.66	358	2.17	0.51
Bullfrog	NV0629	157,303	8,226	5.23	9,017	5.73	0.50
Red Rock	NV0504	162,020	4,443	2.74	5,110	3.15	0.41
Wheeler Pass	NV0507	275,693	5,755	2.09	6,533	2.37	0.28
Chemehuevi	CA0698	73,746	1,093	1.48	1,228	1.67	0.18
Ash Meadows	NV0509	115,227	4,515	3.92	4,698	4.08	0.16
Waucoba-Hunter Mountain	CA0651	22,647	489	2.16	514	2.27	0.11
Havasu	AZ0010	104,760	2,147	2.05	2,229	2.13	0.08
Chicago Valley	CA0681	278,277	5,489	1.97	5,638	2.03	0.05
Centennial	CA0654	318,724	7,007	2.20	7,046	2.21	0.01
Nevada Wild Horse Range	NV0524	7,155	120	1.68	120	1.68	0.00
Lee Flat	CA0652	73,301	1,329	1.81	1,329	1.81	0.00
Muddy Mountains	NV0503	78,549	251	0.32	251	0.32	0.00
Gold Mountain	NV0628	94,564	1,777	1.88	1,777	1.88	0.00
Gold Butte	NV0502	178,309	554	0.31	554	0.31	0.00

D-2.1.7 **Grazing allotments, overlain with current and 2025 scenario CAs**

Most grazing allotments show very little impact from development CAs however there are a few significant exceptions. The dominant CAs are rural roads, renewable energy, row crops and urban/rural development. The latter is likely due to discrepancies between the BLM's grazing allotment layer and the protected areas database. Change between the current and 2025 scenario is largely due transmission, renewable energy projects and expansion of urban/rural development. Geospatial layers and metadata that were turned in BLM contain more detailed information on the types and location of development CA overlap. Figure D - 6 shows an image of the grazing allotments with the landscape condition model to create a visual illustration of the potential degradation from development and invasive plants. The grazing allotments summarized by the landscape condition was not an assessment delivered to BLM but it could be readily created using data delivered by the contractor.

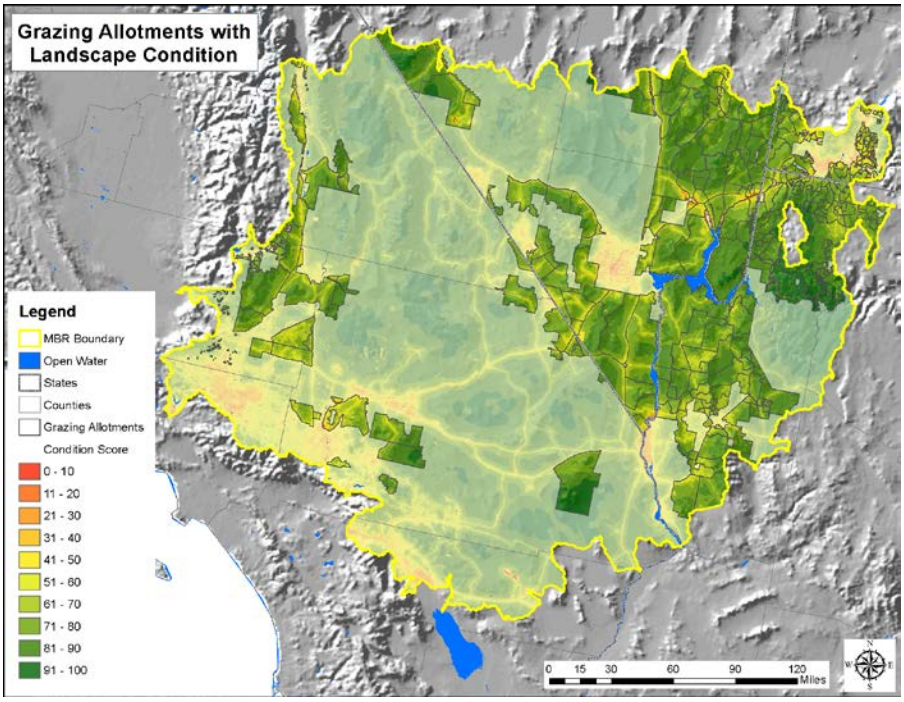

Figure D - 6. Current landscape condition within grazing allotments. Location of GAs and relationship to "development" as represented by the landscape condition model within the Mojave Basin & Range ecoregion. This map shows the full color ramp for the landscape condition model within GA boundaries; dark green indicates apparently unimpacted condition, red to dark orange apparently highly impacted.

Table D - 5. Acres and percent of development change agents by Grazing Allotment, 2010-2025.

Allotment Number	Allotment Name	State Allotment Code	Total Area (acres)	Development Total 2010	Developed Percent 2010	Development Total 2025	Developed Percent 2025	Percent Change
11111	LAMBING-STARVATION	AZ048xx	2,537	222	8.75	990	39.02	30.27
14047	SANTA CLARA CREEK	UT14047	316	22	6.97	108	34.20	27.23
4071	SANTA CLARA CR. CUST	UT04071	614	92	14.98	247	40.21	25.23
7	BIG RANCH UNIT A	AZ0007	173,085	6,565	3.79	38,189	22.06	18.27
14027	HURRICANE	UT14027	1,871	310	16.57	589	31.48	14.91
14051	STOUT CUSTODIAL	UT14051	270	30	11.10	69	25.54	14.43
14021	FORT PEARCE	UT14021	13,293	47	0.35	1,782	13.41	13.05
2007	Dry Lake	NV02007	39,273	1,698	4.32	6,139	15.63	11.31
96	Herd House	AZ00096	18	5	27.42	7	38.38	10.97
4120	OIL WELL	UT04120	2,023	336	16.61	502	24.81	8.20
8012	Buckhorn Canyon	CA08012	7,047	1,887	26.78	2,388	33.88	7.11
14042	SAND	UT14042	7,942	775	9.76	1,323	16.66	6.90
5057	Boron Sheep	CA05057	82,911	36,607	44.15	41,868	50.50	6.35
8011	Shadow Mountains	CA08011	50,390	21,237	42.15	24,203	48.03	5.89
9003	Clark Mountain	CA09003	104,963	6,689	6.37	12,726	12.12	5.75
14045	SAND MOUNTAIN	UT14045	15,479	658	4.25	1,527	9.86	5.61
14092	WARNER VALLEY	UT14092	1,275	243	19.05	310	24.31	5.25
2027	Virgin River Bottom	NV02027	507	318	62.69	344	67.81	5.13
15417	South Point	NV15417	27,849	12,365	44.40	13,791	49.52	5.12
4	CANYON RANCH UNIT B	AZ0004	20,457	11,815	57.75	12,811	62.62	4.87
999	Out	UT00999	8,650	1,304	15.07	1,723	19.92	4.84
14023	GOULD RANCH	UT14023	673	153	22.74	184	27.35	4.61
14053	TRAIL	UT14053	3,938	750	19.04	921	23.39	4.34
14019	DOME	UT14019	2,818	752	26.69	871	30.91	4.22
81	BIG RANCH UNIT B	AZ0081	439,870	5,638	1.28	23,303	5.30	4.02
8001	Valley Well	CA08001	525	38	7.24	59	11.24	4.00

Allotment Number	Allotment Name	State Allotment Code	Total Area (acres)	Development Total 2010	Developed Percent 2010	Development Total 2025	Developed Percent 2025	Percent Change
5050	Bissell	CA05050	48,880	24,709	50.55	26,544	54.30	3.75
14034	LITTLE PLAIN	UT14034	883	251	28.43	282	31.94	3.51
32	FELDSPAR	AZ0032	4,017	879	21.88	1,013	25.22	3.34
8010	Stoddard Mountain	CA08010	160,789	35,117	21.84	40,462	25.16	3.32
6042	Ash Creek	CA06042	3,834	347	9.05	458	11.94	2.89
14057	WARNER RIDGE	UT14057	2,519	350	13.90	422	16.76	2.86
14012	CINDER MOUNTAIN	UT14012	2,068	690	33.37	748	36.18	2.81
52	LAZY YU	AZ0052	19,905	4,113	20.66	4,627	23.25	2.58
14032	LAND HILL	UT14032	1,011	138	13.64	164	16.21	2.57
79	Fay Canyon	CA00079	592	22	3.71	37	6.25	2.53
14084	LINDELL	UT14084	40	10	25.12	11	27.63	2.51
74	Freedom Hill	CA00074	5,077	141	2.78	256	5.04	2.26
24	COOK CANYON	AZ0024	7,277	1,533	21.07	1,697	23.32	2.25
19	ASH CREEK	UT00019	1,030	289	28.05	312	30.29	2.23
15411	Ireteba Peaks	NV15411	328,707	41,082	12.50	48,183	14.66	2.16
4088	TOQUERVILLE	UT04088	6,706	652	9.72	796	11.87	2.15
30	DOLAN SPRINGS	AZ0030	75,061	14,065	18.74	15,610	20.80	2.06
5052	Antelope Valley	CA05052	7,788	343	4.40	501	6.43	2.03
8013	Round Mountain	CA08013	18,108	1,938	10.70	2,291	12.65	1.95
74	WEST PEACOCK	AZ0074	58,559	16,359	27.94	17,486	29.86	1.92
15422	Kyle Canyon	NV15422	26,268	2,081	7.92	2,556	9.73	1.81
4098	RIVERVIEW RANCH	UT04098	944	132	13.98	149	15.78	1.80
UNK	UNK	CAUNK	5,012	536	10.70	625	12.47	1.78
14017	BUTTERMILK	UT14017	1,299	48	3.70	71	5.47	1.77
4009	BOX CANYON	UT04009	1,379	665	48.22	689	49.96	1.74
14056	VIRGIN	UT14056	4,830	579	11.99	663	13.73	1.74
85	Cooks Peak	CA00085	2,487	122	4.90	165	6.63	1.73

Allotment Number	Allotment Name	State Allotment Code	Total Area (acres)	Development Total 2010	Developed Percent 2010	Development Total 2025	Developed Percent 2025	Percent Change
20	CERBAT	AZ0020	25,823	3,013	11.67	3,459	13.40	1.73
78	Airport	CA00078	1,564	141	9.01	168	10.74	1.73
123	Canebrake	CA00123	7,507	213	2.84	336	4.48	1.64
5005	Cantil Common	CA05005	324,622	68,560	21.12	73,872	22.76	1.64
4072	EP CREEK	UT04072	2,106	320	15.19	354	16.81	1.61
68	THUMB BUTTE	AZ0068	34,856	3,778	10.84	4,328	12.42	1.58
17	CANYON RANCH UNIT A	AZ0017	37,264	2,745	7.37	3,331	8.94	1.57
55	MINERAL PARK	AZ0055	17,723	2,463	13.90	2,739	15.45	1.56
60	PINE SPRINGS	AZ0060	7,915	446	5.63	569	7.19	1.55
87	MUD SPRINGS	AZ0087	12,484	755	6.05	945	7.57	1.52
83	Lynch Canyon	CA00083	1,066	23	2.16	39	3.66	1.50
5011	Olancha Common	CA05011	15,595	1,525	9.78	1,754	11.25	1.47
49	Loraine	CA00049	705	51	7.23	61	8.65	1.42
15424	Black Butte	NV15424	56,904	6,642	11.67	7,422	13.04	1.37
18	CASTLE ROCK	AZ0018	6,954	1,640	23.58	1,730	24.88	1.29
4073	EAGLE	UT04073	2,086	103	4.94	130	6.23	1.29
5007	Monolith Cantil	CA05007	15,545	1,097	7.06	1,293	8.32	1.26
14038	NORTH GRAFTON	UT14038	806	45	5.58	55	6.82	1.24
4069	COALPITS UP MES CUST	UT04069	1,810	253	13.98	275	15.19	1.22
10	BLACK MOUNTAIN	AZ0010	80,514	6,902	8.57	7,878	9.78	1.21
5491	County Line	NV05491	11,087	741	6.68	872	7.86	1.18
15413	Mccullough Mtn	NV15413	219,001	9,408	4.30	11,957	5.46	1.16
47	HUALAPAI PEAK	AZ0047	26,918	2,482	9.22	2,792	10.37	1.15
6023	Blackmine	CA06023	1,698	121	7.13	140	8.24	1.12
14024	GRAFTON	UT14024	9,149	256	2.80	354	3.87	1.07
2017	Muddy River	NV02017	27,267	2,732	10.02	3,014	11.05	1.03
11	BOREANA UNIT A	AZ0011	39,634	3,759	9.48	4,163	10.50	1.02

Allotment Number	Allotment Name	State Allotment Code	Total Area (acres)	Development Total 2010	Developed Percent 2010	Development Total 2025	Developed Percent 2025	Percent Change
2009	Glendale	NV02009	22,603	1,388	6.14	1,611	7.13	0.99
5006	Hansen Common	CA05006	72,190	2,948	4.08	3,643	5.05	0.96
14028	HURRICANE FAULT	UT14028	13,860	596	4.30	729	5.26	0.96
15415	Newberry Mtn.	NV15415	76,214	6,994	9.18	7,722	10.13	0.96
2020	Pulsipher Wash	NV02020	5,468	1,449	26.50	1,498	27.40	0.90
2011	Hen Springs	NV02011	22,958	1,830	7.97	2,033	8.86	0.88
2025	Ute	NV02025	31,511	1,544	4.90	1,810	5.74	0.84
23	Hanning Flat West	CA00023	121	18	14.91	19	15.73	0.83
1076	Beacon	NV01076	6,491	366	5.64	419	6.46	0.82
5008	Rudnick Common	CA05008	232,150	7,864	3.39	9,591	4.13	0.74
4075	DIAMOND VALLEY	UT04075	2,032	67	3.30	82	4.03	0.74
66	STOCKTON HILL	AZ0066	3,651	43	1.18	69	1.89	0.71
2006	Jack Rabbit	NV02006	10,577	2,899	27.41	2,973	28.11	0.70
2002	Arrow Canyon	NV02002	114,974	5,108	4.44	5,892	5.12	0.68
4444	Spring Mountain	NV04444	234,046	10,206	4.36	11,780	5.03	0.67
15416	Jean Lake	NV15416	141,714	9,198	6.49	10,136	7.15	0.66
15426	Table Mountain	NV15426	91,521	2,565	2.80	3,149	3.44	0.64
5014	Walker Pass Desert	CA05014	95,726	4,785	5.00	5,392	5.63	0.63
14008	BOOT SPRING	UT14008	2,380	23	0.97	38	1.60	0.63
29	DIAMOND BAR UNIT A	AZ0029	96,039	8,195	8.53	8,793	9.16	0.62
43	HAPPY JACK WASH	AZ0043	40,333	4,048	10.04	4,299	10.66	0.62
4136	SAND WASH CUSTODIAL	UT04136	4,857	344	7.08	373	7.68	0.60
51	Studhorse Canyon	CA00051	535	24	4.49	27	5.05	0.56
9999	SWEET WATER	UT09999	16,107	294	1.83	384	2.38	0.56
4827	Littlefield Community	AZ04827	80,757	5,026	6.22	5,470	6.77	0.55
111	Sand Canyon	CA00111	1,851	71	3.84	81	4.38	0.54
11032	Grapevine	NV11032	34,154	388	1.14	572	1.67	0.54

Allotment Number	Allotment Name	State Allotment Code	Total Area (acres)	Development Total 2010	Developed Percent 2010	Development Total 2025	Developed Percent 2025	Percent Change
2008	Flat Top Mesa	NV02008	7,062	660	9.35	697	9.87	0.52
59	PEACOCK MOUNTAIN	AZ0059	14,557	959	6.59	1,032	7.09	0.50
15412	Hidden Valley	NV15412	64,132	3,299	5.14	3,619	5.64	0.50
14015	CURLY HOLLOW	UT14015	28,036	2,017	7.19	2,153	7.68	0.49
42	HACKBERRY	AZ0042	67,784	2,246	3.31	2,565	3.78	0.47
34	FORT MACEWEN UNIT A	AZ0034	61,317	3,961	6.46	4,248	6.93	0.47
4133	WELLS SPRING	UT04133	3,683	46	1.25	63	1.71	0.46
5492	Mount Sterling	NV05492	129,255	3,979	3.08	4,575	3.54	0.46
5009	Tunawee	CA05009	55,996	3,667	6.55	3,915	6.99	0.44
77	WALAPAI RANCH	AZ0077	29,773	2,693	9.05	2,819	9.47	0.42
80	Smith Canyon	CA00080	5,271	26	0.49	48	0.91	0.42
14102	BLACK RIDGE	UT14102	4,333	286	6.60	304	7.02	0.42
25	CROSSMAN PEAK	AZ00025	130,203	5,285	4.06	5,818	4.47	0.41
2019	Pittman Well	NV02019	43,206	395	0.91	566	1.31	0.40
37	GOLD BASIN	AZ0037	89,681	3,510	3.91	3,853	4.30	0.38
21012	Buckhorn	NV21012	80,661	1,466	1.82	1,769	2.19	0.38
15442	Lucky Strike	NV15442	101,347	2,303	2.27	2,678	2.64	0.37
56	MUD SPRINGS	AZ0056	25,652	1,597	6.23	1,690	6.59	0.36
6050	Poverty Hills	CA06050	4,704	281	5.97	298	6.34	0.36
14048	SCARECROW PEAK	UT14048	75,692	1,374	1.82	1,647	2.18	0.36
93	Eagle'S Nest Peak	CA00093	265,113	9,824	3.71	10,770	4.06	0.36
5431	Wheeler Wash	NV05431	133,302	2,485	1.86	2,940	2.21	0.34
14054	TWIN PEAKS	UT14054	32,801	1,064	3.24	1,175	3.58	0.34
23	CLAY SPRINGS	AZ0023	12,780	181	1.42	224	1.75	0.34
14033	LITTLE CREEK	UT14033	13,352	640	4.79	683	5.12	0.32
2014	Mesa Cliff	NV02014	13,446	70	0.52	113	0.84	0.32
6046	Alabama Hills	CA06046	78,011	3,853	4.94	4,102	5.26	0.32

Allotment Number	Allotment Name	State Allotment Code	Total Area (acres)	Development Total 2010	Developed Percent 2010	Development Total 2025	Developed Percent 2025	Percent Change
15427	Stump Spring	NV15427	53,488	872	1.63	1,042	1.95	0.32
8000	Pahrump Valley	CA08000	32,337	5,808	17.96	5,907	18.27	0.31
14018	DESERT INN	UT14018	39,563	1,293	3.27	1,414	3.57	0.31
9000	Valley View	CA09000	32,275	1,688	5.23	1,786	5.53	0.30
21022	Lower Lake East	NV21022	52,551	662	1.26	821	1.56	0.30
4844	Mormon Well	AZ04844	16,050	446	2.78	494	3.08	0.30
2022	Sunrise Mountain	NV02022	53,468	1,531	2.86	1,690	3.16	0.30
58	MOUNT TIPTON	AZ0058	12,793	804	6.28	842	6.58	0.30
8005	Ord Mountain	CA08005	154,967	3,397	2.19	3,830	2.47	0.28
118	Scobie Meadow	CA00118	6,554	34	0.52	52	0.79	0.27
14035	MOODY WASH	UT14035	377	22	5.84	23	6.11	0.27
57	MUSIC MOUNTAIN	AZ0057	20,402	535	2.62	589	2.89	0.26
5207	Atkin Well	AZ05207	8,768	106	1.21	129	1.47	0.26
5496	Carson Slough	NV05496	12,019	435	3.62	465	3.87	0.25
6125	WET SANDY	UT06125	2,410	153	6.35	159	6.60	0.25
14043	SAND COVE RESERVOIR	UT14043	1,609	40	2.49	44	2.73	0.25
9076	Lazy Daisy	CA09076	311,288	3,909	1.26	4,672	1.50	0.25
77	Walker Pass West	CA00077	15,490	109	0.70	145	0.94	0.23
62	QUAIL SPRINGS	AZ0062	44,351	1,678	3.78	1,780	4.01	0.23
14055	VEYO	UT14055	17,863	754	4.22	794	4.45	0.22
5206	Antelope	AZ05206	9,868	300	3.04	322	3.26	0.22
1083	Delamar	NV01083	242,471	2,794	1.15	3,330	1.37	0.22
15418	Crescent Peak	NV15418	131,791	7,031	5.33	7,319	5.55	0.22
73	WALNUT CREEK	AZ0073	84,273	3,632	4.31	3,815	4.53	0.22
4199	LAVERKIN CREEK	UT04199	11,715	140	1.20	165	1.41	0.21
11027	Pahranagat East	NV11027	31,670	648	2.05	713	2.25	0.21
5264	Black Knolls	AZ05264	15,295	381	2.49	412	2.69	0.20

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8014	Johnson Valley	CA08014	118,413	2,560	2.16	2,794	2.36	0.20
2023	Toquop Sheep	NV02023	24,810	260	1.05	308	1.24	0.19
14030	JACKSON WASH	UT14030	33,368	540	1.62	604	1.81	0.19
71	UPPER MUSIC MOUNTAIN	AZ0071	47,538	898	1.89	989	2.08	0.19
2013	Lower Morman Mesa	NV02013	47,062	427	0.91	516	1.10	0.19
2024	Upper Mormon Mesa	NV02024	45,625	924	2.03	1,010	2.21	0.19
14085	DALTON WASH	UT14085	1,148	30	2.61	32	2.79	0.17
5010	Darwin	CA05010	22,000	1,138	5.17	1,175	5.34	0.17
1064	Sand Hollow	NV01064	34,444	382	1.11	439	1.27	0.17
1050	Oak Springs	NV01050	127,777	4,152	3.25	4,354	3.41	0.16
14007	BOOMER HILL	UT14007	4,629	57	1.23	64	1.38	0.15
14079	LA VERKIN	UT14079	1,985	22	1.11	25	1.26	0.15
1081	Pahranagat West	NV01081	50,219	1,048	2.09	1,123	2.24	0.15
2004	Billy Goat Peak	NV02004	45,919	188	0.41	255	0.56	0.15
2026	White Basin	NV02026	218,592	3,497	1.60	3,806	1.74	0.14
2018	Overton Arm	NV02018	5,808	81	1.39	89	1.53	0.14
4805	Coyote Spring	AZ04805	21,279	450	2.11	479	2.25	0.14
78	YELLOW PINE	AZ0078	49,491	1,851	3.74	1,918	3.88	0.14
5238	Harris Well	AZ05238	3,770	116	3.08	121	3.21	0.13
2016	Muddy Mountains	NV02016	209,607	3,090	1.47	3,355	1.60	0.13
8003	Rattlesnake Canyon	CA08003	29,706	303	1.02	339	1.14	0.12
5210	Antelope Spring	AZ05210	15,972	370	2.32	389	2.44	0.12
125	Kennedy Lamont	CA00125	23,634	514	2.17	540	2.28	0.11
2005	Bunkerville	NV02005	158,562	1,999	1.26	2,173	1.37	0.11
1087	Elgin (lower Riggs)	NV01087	27,480	717	2.61	747	2.72	0.11
51	LA CIENEGA	AZ0051	138,480	2,128	1.54	2,264	1.63	0.10
4857	Lizard	AZ04857	13,439	140	1.04	153	1.14	0.10

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4828	Beaver Dam Slope	AZ04828	32,622	935	2.87	966	2.96	0.10
14010	BULL MOUNTAIN	UT14010	13,909	82	0.59	95	0.68	0.09
75	Kelso Peak	CA00075	3,256	36	1.11	39	1.20	0.09
4833	Diamond Butte	AZ04833	5,479	114	2.08	118	2.15	0.07
11004	Barclay	NV11004	37,138	504	1.36	531	1.43	0.07
4863	Sunshine	AZ04863	16,734	370	2.21	382	2.28	0.07
9007	Horsethief Springs	CA09007	113,443	1,990	1.75	2,067	1.82	0.07
86	CANE SPRINGS	AZ0086	84,915	1,086	1.28	1,142	1.34	0.07
15421	Roach Lake	NV15421	19,958	1,467	7.35	1,480	7.42	0.07
4832	Mesquite Community	AZ04832	38,267	727	1.90	751	1.96	0.06
4838	Lambing-Starvation	AZ04838	12,243	120	0.98	127	1.04	0.06
4813	Blake Pond	AZ04813	21,385	338	1.58	350	1.64	0.06
19	CEDAR CANYON	AZ0019	88,538	1,539	1.74	1,586	1.79	0.05
5012	Lacey-Cactus-McCloud	CA05012	147,048	3,830	2.60	3,903	2.65	0.05
15414	Christmas Tree Pass	NV15414	87,421	1,233	1.41	1,275	1.46	0.05
26	CROZIER CANYON	AZ0026	113,027	3,317	2.93	3,367	2.98	0.04
4812	Highway	AZ04812	11,403	176	1.54	181	1.59	0.04
14025	GUNLOCK	UT1402*	7,261	158	2.18	161	2.22	0.04
1071	Gourd Spring	NV01071	97,468	2,265	2.32	2,303	2.36	0.04
4871	Pocum	AZ04871	9,144	295	3.23	298	3.26	0.03
5159	NEW HARMONY	UT05159	9,181	62	0.68	65	0.71	0.03
94	Unallocated To Livestock/livestock Closure Area	NV00094	3,534	84	2.38	85	2.41	0.03
99	Magruder Mtn.	NV00099	295,217	4,518	1.53	4,580	1.55	0.02
4841	Black Rock	AZ04841	40,248	1,170	2.91	1,177	2.92	0.02
114	Hurricane Rim	AZ00114	31,281	476	1.52	480	1.53	0.01
15	MIDDLE WATER	AZ0015	17,535	313	1.79	315	1.80	0.01

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70	TRUXTON CANYON UNIT A	AZ0070	10,217	115	1.13	116	1.14	0.01
36	GEDIONDIA	AZ0036	20,710	268	1.29	270	1.30	0.01
4808	Mainstreet	AZ04808	188,779	5,748	3.04	5,765	3.05	0.01
11013	Lower Lake West	NV11013	60,086	553	0.92	554	0.92	0.00
14004	BEAVER DAM SLOPE	UT14004	61,221	728	1.19	729	1.19	0.00
6048	West Santa Rita	CA06048	775	10	1.29	10	1.29	0.00
6049	Aberdeen	CA06049	3,461	35	1.01	35	1.01	0.00
6082	George Creek	CA06082	3,191	77	2.41	77	2.41	0.00
5013	Hunter Mt Lee Flat	CA05013	53,960	992	1.84	992	1.84	0.00
6047	Red Mountain	CA06047	5,213	173	3.32	173	3.32	0.00
6015	Sawmill Creek	CA06015	3,783	222	5.87	222	5.87	0.00
84	Cyrus Canyon	CA00084	20	0	0.00	0	0.00	0.00
5053	Oak Creek	CA05053	158	147	92.84	147	92.84	0.00
124	Long Valley	CA00124	6,102	55	0.90	55	0.90	0.00
45	Goldpan Canyon	CA00045	439	7	1.59	7	1.59	0.00
5066	Double Mountain	CA05066	576	2	0.35	2	0.35	0.00
86	Cholla Canyon	CA00086	4,434	0	0.00	0	0.00	0.00
59	Loco Bill Canyon	CA00059	644	1	0.16	1	0.16	0.00
120	Spanish Needle Creek	CA00120	5,087	0	0.00	0	0.00	0.00
76	Sacatar Meadow	CA00076	33	0	0.00	0	0.00	0.00
82	Short Canyon	CA00082	2,750	0	0.00	0	0.00	0.00
5051	Warren	CA05051	556	44	7.91	44	7.91	0.00
81	Nellie'S Nipple	CA00081	4,131	9	0.22	9	0.22	0.00
5054	Lava Mountains	CA05054	20,290	2	0.01	2	0.01	0.00
9013	Crescent Peak	CA09013	6,764	0	0.00	0	0.00	0.00
4116	CAVE	UT04116	383	11	2.88	11	2.88	0.00
4014	COUGAR CANYON	UT04014	8,747	0	0.00	0	0.00	0.00

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4188	CANE BEDS	UT04188	1,615	24	1.49	24	1.49	0.00
4089	GRAFTON WASH	UT04089	1,918	26	1.36	26	1.36	0.00
5200	Rock Canyon	AZ05200	1,936	33	1.70	33	1.70	0.00
5097	KANARRA MOUNTAIN	UT05097	1,533	0	0.00	0	0.00	0.00
5241	Point Of Rock	AZ05241	7,137	172	2.41	172	2.41	0.00
5270	Short Creek	AZ05270	610	25	4.10	25	4.10	0.00
14093	CEDAR MOUNTAIN	UT14093	1,823	50	2.74	50	2.74	0.00
14067	MESA CUSTODIAL	UT14067	1,358	39	2.87	39	2.87	0.00
14039	RED BUTTE	UT14039	1,474	41	2.78	41	2.78	0.00
14087	SEGLER	UT14087	620	10	1.61	10	1.61	0.00
14005	BIG MOUNTAIN	UT14005	9,219	74	0.80	74	0.80	0.00
14068	COALPITS CUSTODIAL	UT14068	976	29	2.97	29	2.97	0.00
6122	ANDERSON JUNCTION	UT06122	611	60	9.82	60	9.82	0.00
14082	HONEYMOON TRAIL	UT14082	20,372	157	0.77	157	0.77	0.00
14016	DAGGET FLAT	UT14016	4,289	83	1.94	83	1.94	0.00
14006	BIG PLAINS	UT14006	712	0	0.00	0	0.00	0.00
14013	COALPITS	UT14013	1,058	28	2.65	28	2.65	0.00
14041	ROCK SPRING	UT14041	3,759	75	2.00	75	2.00	0.00
14083	BIG MOUNTAIN CUST.	UT14083	1,467	11	0.75	11	0.75	0.00
14036	MINERA WASH	UT14036	192	0	0.00	0	0.00	0.00
14049	BLACK CANYON	UT14049	1,072	9	0.84	9	0.84	0.00
24022	GOOSEBERRY	UT24022	4,713	131	2.78	131	2.78	0.00
24020	LAMBS KNOLL	UT24020	397	2	0.50	2	0.50	0.00
14077	PINTURA	UT14077	2,155	162	7.52	162	7.52	0.00
14031	KOLOB TERRACE	UT14031	2,659	12	0.45	12	0.45	0.00
14029	DRY CREEK	UT14029	7,027	46	0.65	46	0.65	0.00
14074	TERRACE	UT14074	5,027	90	1.79	90	1.79	0.00

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24050	HURRICANE MESA LOWER	UT24050	4,826	203	4.21	203	4.21	0.00
14076	CASTLE CLIFFS	UT14076	14,619	102	0.70	102	0.70	0.00
14037	MOUNTAIN DELL	UT14037	1,810	49	2.71	49	2.71	0.00
14050	SMITH MESA	UT14050	2,907	65	2.24	65	2.24	0.00
14090	GRAPEVINE	UT14090	1,538	0	0.00	0	0.00	0.00
14063	HURRICANE MESA UPPER	UT14063	3,021	54	1.79	54	1.79	0.00
4100	CANAAN MOUNTAIN	UT04100	239	0	0.00	0	0.00	0.00
14003	RIVER	UT14003	1,765	22	1.25	22	1.25	0.00
14109	APEX SLOPE	UT14109	6,448	167	2.59	167	2.59	0.00
21006	Bennett Spring	NV21006	1,498	28	1.87	28	1.87	0.00
1052	Pahroc	NV01052	73,008	1,444	1.98	1,444	1.98	0.00
1047	Mustang	NV01047	31	0	0.00	0	0.00	0.00
11031	Enterprise	NV11031	3,222	87	2.70	87	2.70	0.00
21014	Caliente	NV21014	648	229	35.32	229	35.32	0.00
21003	Bald Mountain	NV21003	36,764	358	0.97	358	0.97	0.00
1067	Sawmill Canyon	NV01067	3,756	62	1.65	62	1.65	0.00
1073	Six Mile	NV01073	5,309	46	0.87	46	0.87	0.00
1088	Sand Hills	NV01088	11,796	78	0.66	78	0.66	0.00
1069	Sheep Flat	NV01069	38,193	227	0.59	227	0.59	0.00
1045	Pine Cone	NV01045	3,434	16	0.47	16	0.47	0.00
21005	Lime Mountain	NV21005	62,138	1,146	1.84	1,146	1.84	0.00
21009	Boulder Spring	NV21009	17,750	352	1.98	352	1.98	0.00
1065	Garden Spring	NV01065	39,187	1,104	2.82	1,104	2.82	0.00
1078	White Rock	NV01078	32,964	762	2.31	762	2.31	0.00
1074	Snow Springs	NV01074	44,299	577	1.30	577	1.30	0.00
1077	Summit Spring	NV01077	17,610	343	1.95	343	1.95	0.00
1044	Mormon Peak	NV01044	77,960	317	0.41	317	0.41	0.00

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2021	Rox	NV02021	20,394	0	0.00	0	0.00	0.00
2015	Mesquite Community	NV02015	5,842	8	0.14	8	0.14	0.00
2012	Lime Spring	NV02012	1,967	0	0.00	0	0.00	0.00
2010	Gold Butte	NV02010	269,778	805	0.30	805	0.30	0.00
5494	Grapevin-rocky-valley	NV05494	11,447	302	2.64	302	2.64	0.00
2003	Azure Ridge	NV02003	6,295	0	0.00	0	0.00	0.00
5428	Younts Spring	NV05428	18,080	8	0.04	8	0.04	0.00
72	VALENTINE	AZ0072	6,149	185	3.01	185	3.01	0.00
27	CURTAIN	AZ0027	3,690	206	5.58	206	5.58	0.00
79	BOREANA UNIT B	AZ0079	11,808	181	1.53	181	1.53	0.00
83	HIBERNIA PEAK UNIT B	AZ0083	12,979	238	1.83	238	1.83	0.00
80	DIAMOND BAR UNIT B	AZ0080	61,479	308	0.50	308	0.50	0.00
82	FORT MACEWEN UNIT B	AZ0082	45,024	344	0.76	344	0.76	0.00
61	PORTLAND SPRINGS	AZ0061	44,031	608	1.38	608	1.38	0.00
3067	PLANET	AZ03067	207	0	0.00	0	0.00	0.00
21	CHICKEN SPRINGS	AZ0021	354	25	7.05	25	7.05	0.00
50	HIBERNIA PEAK UNIT A	AZ0050	121	0	0.00	0	0.00	0.00
8	BIG SANDY	AZ0008	47	2	4.22	2	4.22	0.00
4831	Purgatory	AZ04831	4,951	98	1.98	98	1.98	0.00
5211	Lynn & Tone	AZ05211	2,170	0	0.00	0	0.00	0.00
5253	Homestead	AZ05253	8,661	145	1.67	145	1.67	0.00
4810	Sullivan Canyon	AZ04810	20,730	95	0.46	95	0.46	0.00
5243	White Pockets	AZ05243	3,235	76	2.35	76	2.35	0.00
4823	Wolfhole Lake	AZ04823	13,197	191	1.45	191	1.45	0.00
4811	Wolfhole Canyon Sp	AZ04811	36,300	754	2.08	754	2.08	0.00
4839	Wolfhole Mountain	AZ04839	6,906	77	1.11	77	1.11	0.00
4850	Mud and Cane	AZ04850	32,226	148	0.46	148	0.46	0.00

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4842	Cedar Wash	AZ04842	11,871	166	1.40	166	1.40	0.00
4845	Clay Spring	AZ04845	12,987	437	3.36	437	3.36	0.00
5214	Flat Top Well	AZ05214	8,829	142	1.61	142	1.61	0.00
5251	Hurricane Cliff	AZ05251	5,149	95	1.84	95	1.84	0.00
4859	Mustang Spring	AZ04859	9,516	326	3.43	326	3.43	0.00
4866	Cedar Pockets	AZ04866	52	0	0.00	0	0.00	0.00
4856	Quail Canyon	AZ04856	16,288	180	1.11	180	1.11	0.00
4824	Mountain Sheep	AZ04824	2,026	0	0.00	0	0.00	0.00
4830	Jackson Tank	AZ04830	7,777	131	1.68	131	1.68	0.00
5213	Rock Pockets	AZ05213	22,314	482	2.16	482	2.16	0.00
4837	Lower Hurricane	AZ04837	23,534	797	3.39	797	3.39	0.00
4817	Imlay	AZ04817	4,768	102	2.14	102	2.14	0.00
4826	Mt. Trumbull	AZ04826	22,900	185	0.81	185	0.81	0.00
4862	Pat's Pond	AZ04862	1,284	42	3.27	42	3.27	0.00
5220	Tuweep	AZ05220	550	9	1.64	9	1.64	0.00
97	Tuckup	AZ00097	2,715	21	0.77	21	0.77	0.00
4815	Last Chance	AZ04815	162	0	0.00	0	0.00	0.00
4836	Mosby-Nay	AZ04836	29,842	338	1.13	338	1.13	0.00
4854	Wildcat	AZ04854	91,462	1,870	2.04	1,870	2.04	0.00
4800	Pakoon Springs	AZ04800	37,202	751	2.02	751	2.02	0.00
4820	Duncan Tank	AZ04820	8,923	238	2.67	238	2.67	0.00
4849	Belnap	AZ04849	8,220	197	2.40	197	2.40	0.00
5216	Temple Trail	AZ05216	7,462	111	1.49	111	1.49	0.00
4818	Dripping Spring	AZ04818	11,586	171	1.48	171	1.48	0.00
4851	Unavailable	AZ04851	53,981	800	1.48	800	1.48	0.00
4858	Ivanpah	AZ04858	14,470	441	3.05	441	3.05	0.00
4848	Pa's Pocket	AZ04848	8,653	226	2.61	226	2.61	0.00

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4867	Hat Knoll	AZ04867	3,357	31	0.92	31	0.92	0.00
119	Big Warren	AZ00119	9,690	260	2.68	260	2.68	0.00
4803	Hidden Spring	AZ04803	52	0	0.00	0	0.00	0.00
4829	Parashant	AZ04829	54,925	917	1.67	917	1.67	0.00
4822	Belnap West	AZ04822	3,522	147	4.17	147	4.17	0.00
4814	Little Wolf	AZ04814	7,361	167	2.27	167	2.27	0.00
4801	Jump Canyon	AZ04801	5,425	160	2.95	160	2.95	0.00
5219	Crosby Tank	AZ05219	16	0	0.00	0	0.00	0.00
4802	Pakoon	AZ04802	56,263	1,171	2.08	1,171	2.08	0.00
4840	Pocum Tank	AZ04840	8,409	113	1.34	113	1.34	0.00
4804	Whiterock-Soapstone	AZ04804	13,955	445	3.19	445	3.19	0.00
4819	Link Spring	AZ04819	10,074	120	1.19	120	1.19	0.00
4861	Toquer Tank	AZ04861	12,076	475	3.93	475	3.93	0.00
4816	Sullivan Tank	AZ04816	3,481	97	2.79	97	2.79	0.00
5218	Mt. Logan	AZ05218	552	22	3.98	22	3.98	0.00
5217	Fern Tank	AZ05217	3,720	11	0.30	11	0.30	0.00
4821	Mule Canyon	AZ04821	17,349	316	1.82	316	1.82	0.00
4835	Mosby	AZ04835	1,600	29	1.81	29	1.81	0.00
5215	Clayhole	AZ05215	42,385	892	2.10	892	2.10	0.00
4809	Cottonwood West	AZ04809	33,202	434	1.31	434	1.31	0.00
5263	Yellowstone	AZ05263	6,320	268	4.24	268	4.24	0.00
5221	June Tank	AZ05221	5,766	91	1.58	91	1.58	0.00
4825	Hidden Hills	AZ04825	34,471	873	2.53	873	2.53	0.00
5237	Moonshine	AZ05237	868	1	0.12	1	0.12	0.00
4853	Little Tank	AZ04853	5,832	194	3.33	194	3.33	0.00
5248	Swapp Tank	AZ05248	7,378	125	1.69	125	1.69	0.00
4870	Big Spring Pipeline	AZ04870	57,603	1,287	2.23	1,287	2.23	0.00

Allotment Number	Allotment Name	State Allotment Code	Total Area (acres)	Development Total 2010	Developed Percent 2010	Development Total 2025	Developed Percent 2025	Percent Change
4834	Iverson	AZ04834	2,400	120	5.00	120	5.00	0.00
4806	Red Pond	AZ04806	66,548	1,271	1.91	1,271	1.91	0.00
4852	Penns Well	AZ04852	5,348	63	1.18	63	1.18	0.00
5055	Spangler Hills	CA05055	58,660	651	1.11	641	1.09	-0.02
21021	Cottonwood	NV21021	38,428	64	0.17	45	0.12	-0.05
1056	Pennsylvania	NV01056	30,355	478	1.57	457	1.51	-0.07
2001	Acton-farrier	NV02001	47,227	1,758	3.72	1,719	3.64	-0.08
1063	Rox-tule	NV01063	25,584	142	0.56	114	0.45	-0.11
9008	Kessler Springs	CA09008	14,550	866	5.95	850	5.84	-0.11
11010	Breedlove	NV11010	121,046	484	0.40	322	0.27	-0.13
11034	Henrie Complex	NV11034	169,071	1,970	1.17	1,707	1.01	-0.16
9017	Jean Lake	CA09017	9,935	150	1.51	134	1.35	-0.16
21001	Applewhite	NV21001	30,687	539	1.76	471	1.53	-0.22
88	TRUXTON CANYON UNIT B	AZ0088	2,540	62	2.44	48	1.89	-0.55
1068	Schlarman	NV01068	5,420	114	2.10	63	1.16	-0.94
1041	Meadow Valley	NV01041	4,147	315	7.60	250	6.03	-1.57
21002	Ash Flat	NV21002	3,610	226	6.26	126	3.49	-2.77

D-2.1.8 **Aquatic Distributions, overlain with current CAs**

MQ35 - WHERE WILL THE AQUIFERS (RELATING TO AQUATIC CES) IDENTIFIED IN MQ 33 AND THE RECHARGE AREAS (RELATING TO AQUATIC CES) IDENTIFIED IN MQ 37 POTENTIALLY BE AFFECTED BY CHANGE AGENTS?

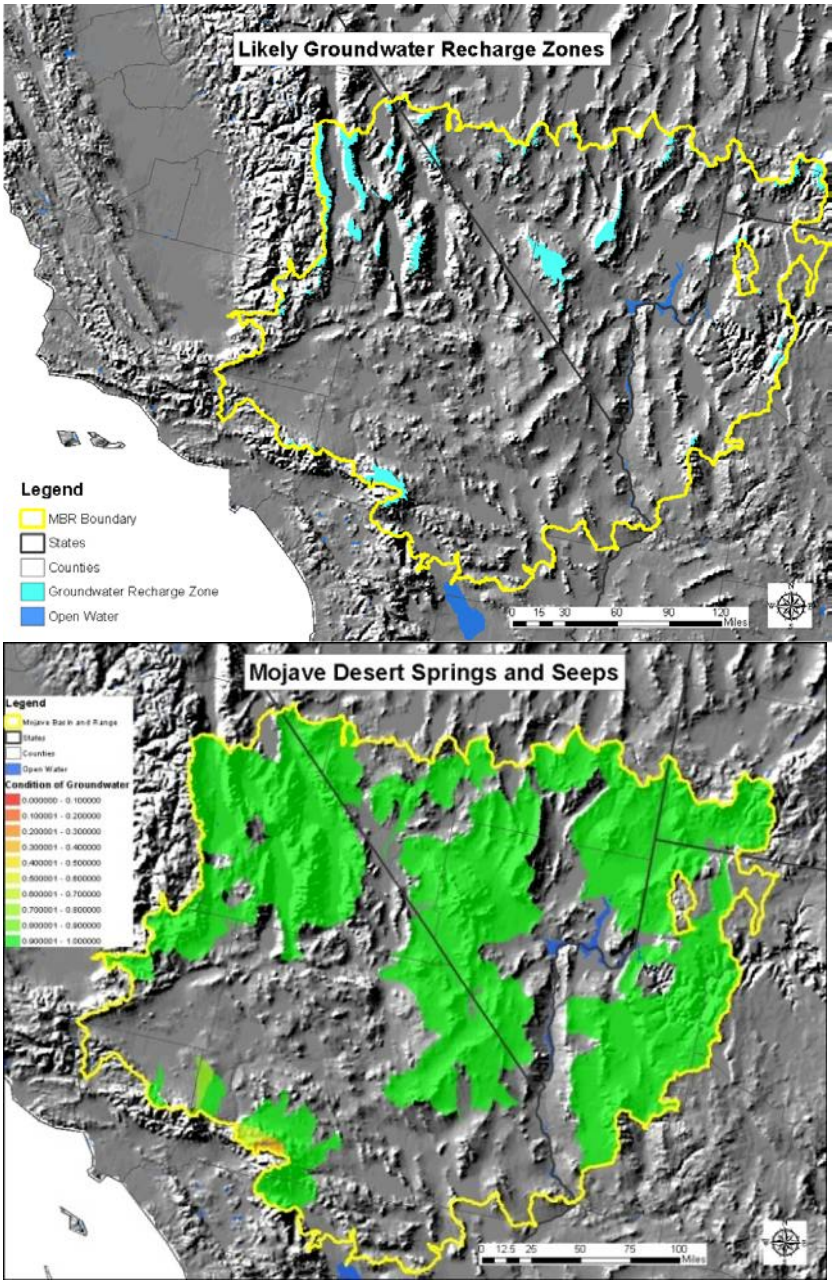

Figure D - 7. Location of likely groundwater recharge zones (top) and their condition (bottom); groundwater recharge zones shown in blue (areas above 2000 m, 6562 feet-- not all areas visible at this scale); reported by watershed score, gray areas are watersheds with no recharge zones. Very little hard-surface development has occurred within the likely recharge zones.

D-2.1.9 **Groundwater consumption**

MQ56 - WHAT IS THE PRESENT DISTRIBUTION OF MUNICIPAL AND AGRICULTURAL WATER USE OF GROUNDWATER RESOURCES IN RELATION TO THE DISTRIBUTION OF AQUATIC CES?

Ground water use is generally low in the MBR ecoregion, as a percentage of natural annual average surface runoff as recorded in the NHD. Five watersheds show use rates above 100% of natural surface runoff, and one additional watershed shows a use rate greater than 75%. The six watersheds with these high rates of ground water use occur in the vicinities of Lancaster and Palm Springs-Indio, California; and in the Ivanpah-Pahrump Valley vicinity straddling the Nevada-California border immediately west of Las Vegas. watersheds with use rates greater than 10% also occur in the vicinities of Victorville, Banning, Pearsonville, and Barstow; in the Owens Valley of California; along the valleys extending northwest and northeast of Las Vegas; and in northwestern Arizona. Although use rates greater than 10% are not absolutely high, they do fall within the second quartile of normalized scores for this indicator. As a result, a large proportion of the watersheds in the ecoregion fall into the lower end of normalized scores for this indicator for each aquatic CE (Figure D - 8). These results are consistent with the distribution of urban and agricultural development within the ecoregion. The agricultural uses involve center-pivot irrigation, which is readily identifiable in satellite imagery. Withdrawals from alluvial, basin fill, and regional aquifers have the potential to affect the hydrologic regime of perennial streams, wetlands, and springs in all affected watersheds, as well as in watersheds that receive or once received surface or ground water from the affected watersheds. Some groundwater use in the ecoregion may also draw from aquifers recharged artificially by infiltration from surface water use and/or long-term leakage from aqueducts.

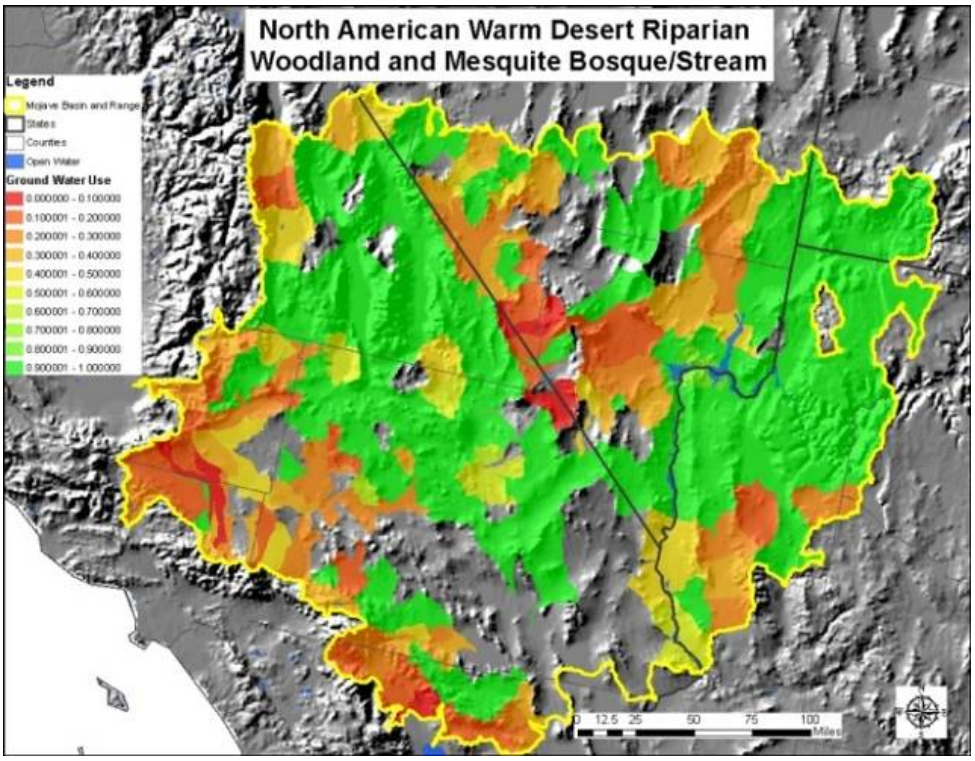

Figure D - 8. Groundwater use scored by watershed. Values were calibrated for watershed size and degree of wetness by dividing annual use by the total annual average surface flow. Results were highly skewed, even after log transformation: some watersheds have no water use, and others have extremely high values due to very low surface wetness values. Index values were calculated by log transformation and normalized to range between 0 (red) with the highest use/impact and 1 (green) with the lowest use/impact to aquatic conservation elements.

These comments pertain to current patterns of water use. Future conditions are addressed elsewhere as they may be affected by changes in the distribution of urban land use and by groundwater withdrawals for inter-basin, such as the Groundwater Development Project proposed by the Southern Nevada Water Authority (SNWA 2011).

D-2.1.10 Places I w/Aquatic Distributions with current Development CAs

MQ 19 - WHERE WILL THESE AQUATIC HIGH BIODIVERSITY SITES BE POTENTIALLY AFFECTED BY CHANGE AGENTS (ASIDE FROM CLIMATE CHANGE)?

Aquatic High Biodiversity sites co-occur with Terrestrial High Biodiversity areas, these are scattered throughout the ecoregion (Figure D - 9). The watershed-level indicator for hydrologic condition is a way to quickly assess where high biodiversity areas overlay with areas of high or low hydrologic stressors (Figure D - 10).

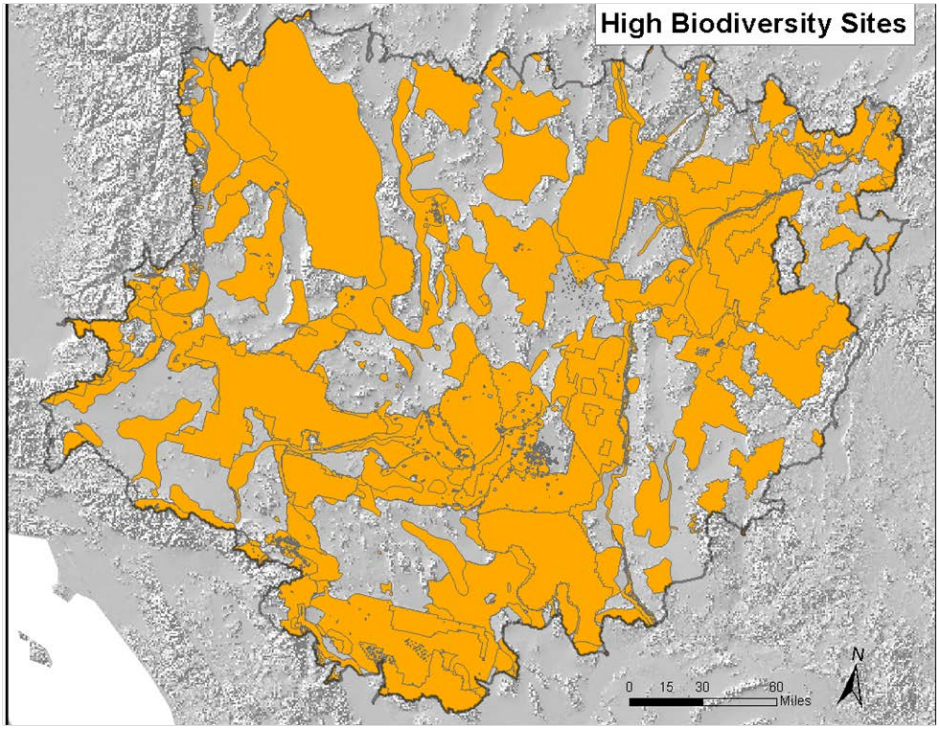

Figure D - 9. High Biodiversity Sites, most of which support occurrences of aquatic coarse filter CEs.

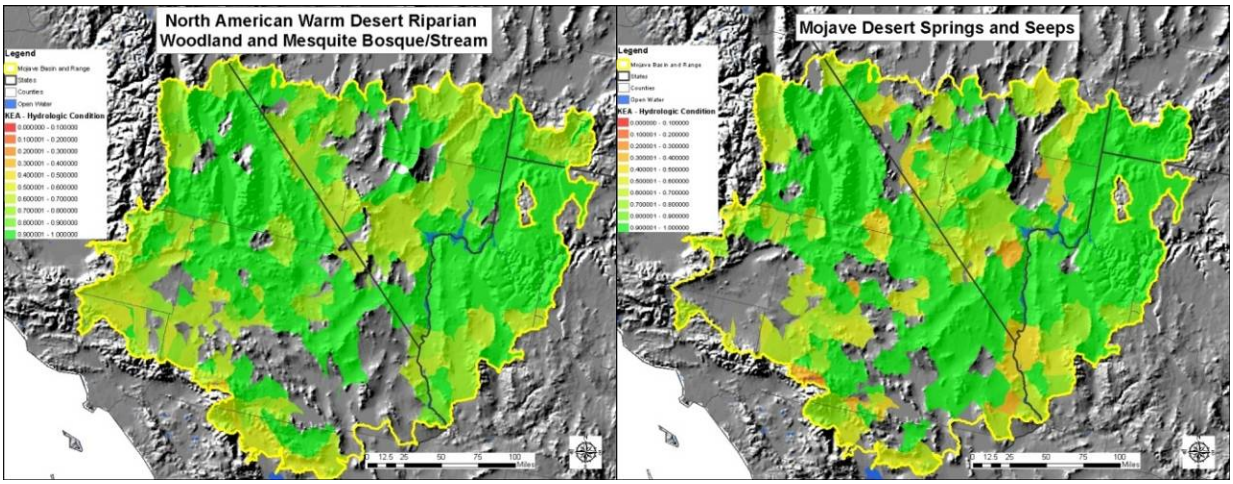

Figure D - 10. The Key Ecological Attribute of Hydrologic Condition for two CEs : North American Warm Desert Riparian Woodland and Mesquite Bosque/Stream (left) and Mojave Desert Springs and Seeps (right). KEA Hydrologic Condition summarizes 5 indicators measuring the degree of stress on hydrologic intactness: Surface water use, Ground Water use, number of aqueducts, flow modification by dams, and condition of groundwater recharge zones. This by- watershed summary of key hydrologic factors gives a quick summary of the condition of watersheds that contain designated Areas of High Biodiversity. Much of the ecoregion is in a moderate state of impact with the highest impact occurring along the western and eastern portions, which corresponds with many high biodiversity sites.

D-2.2 Specialized analyses: Restoration Potential

MQ7 - GIVEN CURRENT AND ANTICIPATED FUTURE LOCATIONS OF CHANGE AGENTS, WHICH HABITAT AREAS REMAIN AS OPPORTUNITIES FOR HABITAT ENHANCEMENT/ RESTORATION?

MQ8 - WHERE ARE POTENTIAL AREAS TO RESTORE CONNECTIVITY FOR MOJAVE DESERT TORTOISE BASED ON CURRENT LOCATIONS OF CHANGE AGENTS?

This analysis addressed a management question that identifies potential habitat connectivity sites, given forecasted future climate impacts and habitat connection.

The location of habitat connectivity enhancement and restoration areas for Mojave desert tortoise in the MBR was addressed via a 3 pronged approach. Analysis parameters were directed to identify areas that are of moderate condition, with moderate connectivity, and low potential for climate shifts (Figure D - 11).

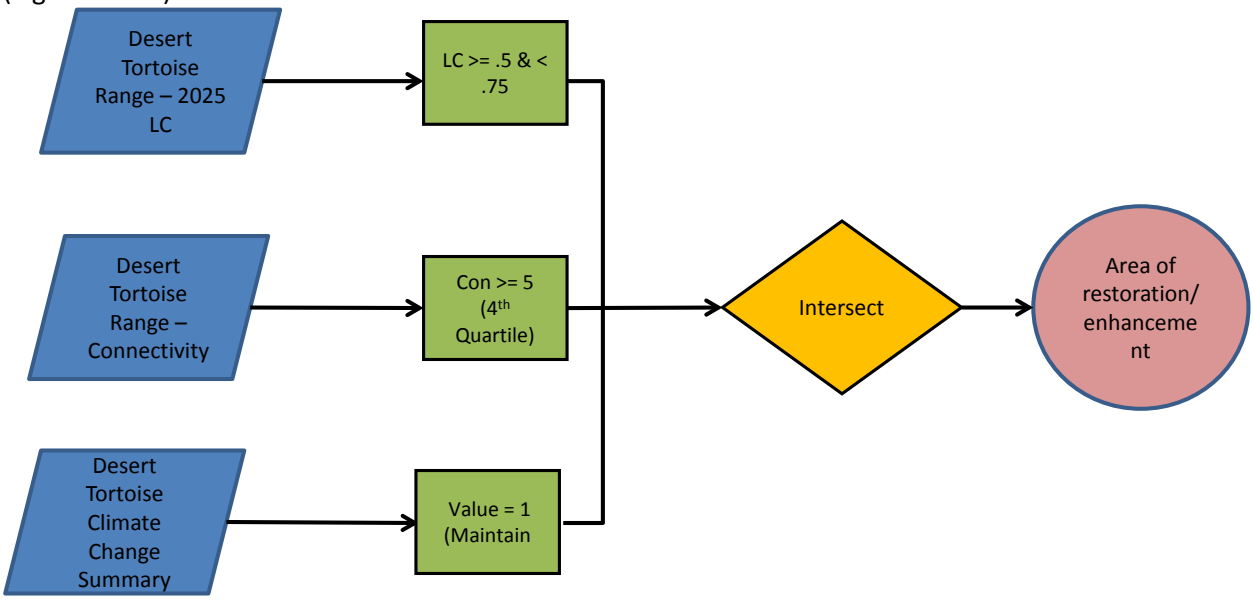

Figure D - 11. Conceptual model for identification or restoration/enhancement areas.

Here we demonstrate how the question was answered for the Mojave desert tortoise habitat (MDT) within the ecoregion. This type of analysis can be repeated for any number of CEs. Robust site selection for this purpose first considered the distribution and relative ecological status of the CE. Output was utilized from the ecological status scores per pixel; for MDT, indicators of landscape condition and landscape connectivity were used. See Appendix B, Ecological Status Spatial Modeling Methods for details on the MDT connectivity modeling and scoring. Those pixels indicating intermediate ecological status for either indicator suggest a need for investment in habitat restoration. This eliminated pixels from the pool that are likely to be developed over the coming decade, or have limited connectivity potential.

We then utilized the output from the Climate Envelope Model for the Mojave desert tortoise that highlights areas of potential change in a CEs distribution, filtering potential sites for those where forecasted climate change is stable. These areas include those where the comparison of the 2012 and 2060 Climate Envelope Models are congruent and identify areas where MDT habitat is unchanged (see Appendix B and for detail on climate envelope models and results). These areas also coincide with "overlap" zones for the Mojave desert tortoise resulting from climate envelope analysis (again see Appendix B of this report for details on these methods).

This series of filters lead to the identification of areas highlighted in Figure D - 12. These areas, located along restrictive corridors in lowland between the basin and range landform, appear to provide a limited set of locations where MDT habitat restoration investments might be concentrated. Of course, given REA data limitations, these results should be considered to be preliminary. Field evaluation of these areas would provide more specific insights into a) the relative severity of existing landscape conditions and invasive species effects, b) the actual distribution of habitat relative to existing and proposed development patterns, and c) local management context, partners, and issues, that could either support or challenge efforts for habitat restoration.

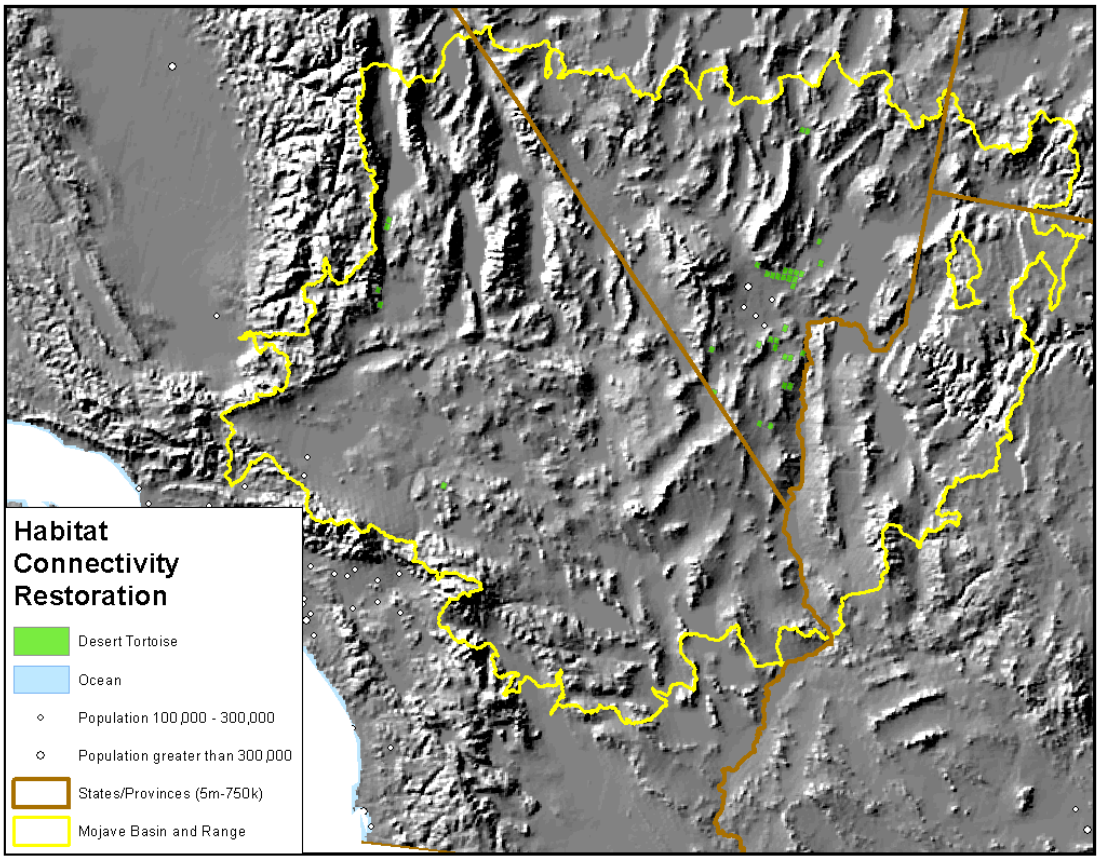

Figure D - 12. Potential habitat connectivity restoration/enhancement sites for Mojave desert tortoise.

D-2.3 2025 Distribution: CEs and CAs

MQ5 - WHERE ARE SPECIES CES WHOSE CURRENT LOCATIONS OR SUITABLE HABITATS OVERLAP WITH THE POTENTIAL FUTURE DISTRIBUTION OF CAS (OTHER THAN CLIMATE CHANGE)?

MQ12 -WHERE ARE EXISTING AND POTENTIAL FUTURE CAS (ASIDE FROM CLIMATE CHANGE) LIKELIEST TO AFFECT CURRENT COMMUNITIES?

The footprint analysis (CA/CE intersect) employs the same basic assessment model as the current scenario. The development footprint is forecasted to increase from 8.8% currently to 9.8% by 2025. While the approximately one percent increase is proportionately small, this represents over 400,000

acres in additional development. The 2025 scenario repeats patterns observed in the current scenario. Overall, while there is relatively little change from the current scenario to the 2025 scenario in terms of the percent of the ecoregion, the pattern of increasing pressure especially on riparian areas and their obligates is consistent. Results for individual CEs are highly variable however, and we provide information on those CEs experiencing >2% (rounded) or more changes in development CA overlap with CEs:

- Bald Eagle (Nesting Sites) (4% increase in development CA overlap)
- Desert Tortoise - Sonoran Population (3% increase)
- Sonora-Mojave Semi-Desert Chaparral (3%)
- Golden Eagle (Nesting Sites) (3%)
- Mojave Ground Squirrel (3%)
- North American Warm Desert Badland (2%)
- North American Warm Desert Lower Montane Riparian Woodland and Shrubland (2%)
- Mojave Springs and Seeps (2%)
- North American Warm Desert Riparian Woodland and Mesquite Bosque/Stream (2%)
- Mojave Rattlesnake (2%)
- Sonora-Mojave Mixed Salt Desert Scrub (2%)
- North American Warm Desert Playa (2%)

The key development CA causing this change for all these CEs is urban and rural development in the same proportion as their overall reported change.

Table D - 6. Percent of CEs overlapped by development CAs in the 2025 scenario; CEs are sorted by the % of distribution overlapped by future development.

Element Name	TOTAL (acres)	Total Development	No Change Agent	Multiple Change Agents	Urban Development	Renewable Energy Geothermal	Renewable Energy Solar	Renewable Energy Wind	Renewable Energy SEZ	Mine or Landfill	Oil or Gas Well	Military Urbanized Area	Railroad	Water Canal or Ditch	Primary Electic Utility Line	Pipeline	Crops or Irrigated Pasture	Roads Principle or Secondary	Roads Rural Neighborhood or Private	Roads Unimproved 4wd	Non motorized trail	Roads Unknown Type
Golden Eagle	1,123	40.28	59.72	9.80	22.65	0.00	0.00	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.73	0.16	0.65	0.81	3.66	1.07	0.00	0.00
Bald Eagle	866	37.29	62.71	9.34	22.51	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.10	0.18	0.00	1.00	0.67	2.82	0.64	0.00	0.00
Mojave Ground Squirrel	202,719	35.12	64.88	5.58	25.81	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.08	0.00	0.33	0.09	0.68	0.23	1.97	0.12	0.00	0.08
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	4,871	34.00	66.00	11.78	13.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.05	0.00	4.28	1.06	2.65	0.45	0.03	0.20
Sonora-Mojave Semi-Desert Chaparral	66,218	31.82	68.18	3.45	26.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.18	0.01	0.09	0.18	0.80	0.66	0.07	0.00
Sonora-Mojave Mixed Salt Desert Scrub	410,283	25.35	74.65	2.96	20.40	0.00	0.02	0.01	0.01	0.00	0.00	0.01	0.02	0.00	0.15	0.03	0.17	0.05	1.12	0.32	0.01	0.06
North American Warm Desert Badland	218,161	23.10	76.90	5.71	13.35	0.00	0.05	0.33	0.06	0.01	0.00	0.01	0.09	0.05	0.63	0.13	0.00	0.81	1.63	0.18	0.02	0.04
North American Warm Desert Riparian Woodland and Shrubland/Stream includes Mesquite Bosque	151,753	19.78	80.22	3.55	12.57	0.00	0.00	0.01	0.00	0.01	0.00	0.02	0.09	0.03	0.19	0.04	1.07	0.17	1.60	0.38	0.03	0.01
Gypsum Soils Species Assemblage	47,305	19.00	81.00	5.35	10.82	0.00	0.04	0.00	0.02	0.03	0.00	0.11	0.08	0.02	0.41	0.07	0.08	0.60	1.28	0.08	0.00	0.02
Lake / Reservoir	3,418	17.76	82.24	3.08	11.91	0.00	0.00	0.00	0.00	0.55	0.00	0.00	0.00	0.00	0.01	0.01	0.04	0.00	1.84	0.30	0.01	0.00
Cooper's hawk	4,068,475	17.37	82.63	4.45	10.22	0.00	0.01	0.00	0.04	0.01	0.00	0.10	0.03	0.01	0.10	0.03	0.26	0.43	1.41	0.21	0.02	0.02
Montane Conifer Species Assemblage	78,228	16.89	83.11	4.50	9.06	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.03	0.08	0.06	0.01	0.20	0.39	1.80	0.62	0.06	0.03
Springs and Seeps	12	16.67	83.33	3.70	9.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.70	0.00	0.00	0.00
Mohave Rattlesnake	8,845,254	14.85	85.15	1.69	10.48	0.00	0.17	0.14	0.15	0.01	0.00	0.03	0.06	0.01	0.28	0.16	0.16	0.07	1.29	0.10	0.00	0.06
Migratory Shorebirds and Waterfowl Species Assemblage	12,074	13.42	86.58	1.77	8.96	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.02	0.03	0.09	0.00	0.59	0.19	1.23	0.21	0.01	0.01
Northern Rubber Boa	35,088	12.64	87.36	1.39	6.58	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.06	0.04	0.29	0.00	1.32	0.23	1.52	1.08	0.10	0.02
Brewer's Sparrow (Breeding)	4,842,047	12.28	87.72	1.52	8.93	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.03	0.01	0.09	0.02	0.20	0.06	1.20	0.13	0.01	0.03
Desert Tortoise - Mohave Population	14,141	12.16	87.84	1.62	8.12	0.00	0.21	0.14	0.07	0.02	0.00	0.04	0.06	0.00	0.29	0.11	0.05	0.17	1.11	0.09	0.00	0.05
Great Basin Pinyon-Juniper Woodland	3,109,608	10.80	89.20	1.51	7.44	0.00	0.01	0.00	0.05	0.00	0.00	0.03	0.03	0.01	0.10	0.03	0.25	0.06	1.03	0.21	0.02	0.02
Desert Tortoise - Sonoran Population	1,771,874	10.73	89.27	0.67	4.81	0.00	0.00	2.49	0.00	0.00	0.00	0.00	0.05	0.00	0.32	0.16	0.00	0.12	1.82	0.29	0.00	0.00
Sand Dunes and Sandy Soils Species Assemblage	149,612	10.65	89.35	1.65	6.28	0.00	0.06	0.01	0.12	0.03	0.00	0.07	0.08	0.01	0.40	0.11	0.18	0.30	1.19	0.13	0.01	0.03
Big brown bat	19,657,761	10.56	89.44	1.74	6.67	0.00	0.08	0.12	0.06	0.02	0.00	0.03	0.04	0.01	0.19	0.09	0.18	0.15	1.03	0.12	0.01	0.04

Element Name	TOTAL (acres)	Total Development	No Change Agent	Multiple Change Agents	Urban Development	Renewable Energy Geothermal	Renewable Energy Solar	Renewable Energy Wind	Renewable Energy SEZ	Mine or Landfill	Oil or Gas Well	Military Urbanized Area	Railroad	Water Canal or Ditch	Primary Electic Utility Line	Pipeline	Crops or Irrigated Pasture	Roads Principle or Secondary	Roads Rural Neighborhood or Private	Roads Unimproved 4wd	Non motorized trail	Roads Unknown Type
Brazilian free-tailed bat	22,140,016	10.39	89.61	1.66	6.53	0.00	0.07	0.12	0.06	0.02	0.00	0.03	0.04	0.01	0.19	0.08	0.17	0.13	1.09	0.14	0.01	0.03
North American Warm Desert Playa	1,102,190	10.28	89.72	1.83	4.99	0.00	0.99	0.00	0.60	0.00	0.00	0.11	0.03	0.11	0.10	0.05	0.07	0.15	1.14	0.07	0.00	0.04
North American Warm Desert Pavement	1,318,593	9.52	90.48	1.39	4.82	0.00	0.18	0.23	0.17	0.05	0.00	0.06	0.07	0.01	0.29	0.11	0.01	0.32	1.60	0.14	0.00	0.05
Kit Fox	28,473,064	9.23	90.77	0.92	6.21	0.01	0.13	0.24	0.07	0.02	0.00	0.01	0.04	0.01	0.21	0.08	0.05	0.06	1.01	0.14	0.00	0.03
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	14,248,141	8.96	91.04	0.86	6.30	0.00	0.11	0.09	0.08	0.02	0.00	0.01	0.04	0.00	0.22	0.11	0.05	0.04	0.87	0.09	0.00	0.04
Prairie Falcon	17,785,988	8.95	91.05	1.04	5.84	0.00	0.09	0.15	0.07	0.03	0.00	0.01	0.04	0.01	0.20	0.09	0.19	0.05	0.97	0.12	0.01	0.04
Mule Deer Class F Year Round Range	5,219,490	8.83	91.17	0.86	5.58	0.00	0.00	0.70	0.00	0.01	0.00	0.00	0.02	0.00	0.15	0.05	0.05	0.09	0.99	0.31	0.02	0.01
Common Kingsnake	36,616,731	8.83	91.17	1.01	5.77	0.01	0.11	0.20	0.06	0.02	0.00	0.01	0.03	0.01	0.19	0.07	0.13	0.06	0.97	0.14	0.01	0.03
Coachwhip	19,947,286	8.64	91.36	0.89	5.90	0.00	0.08	0.11	0.07	0.02	0.00	0.02	0.04	0.00	0.19	0.08	0.08	0.05	0.95	0.12	0.01	0.03
Glossy Snake	16,982,246	8.59	91.41	0.80	5.85	0.00	0.09	0.15	0.07	0.02	0.00	0.01	0.04	0.00	0.21	0.10	0.05	0.05	0.98	0.11	0.00	0.04
North American Warm Desert Wash	1,254,483	8.55	91.45	0.59	5.15	0.01	0.06	0.26	0.04	0.02	0.00	0.01	0.04	0.00	0.18	0.06	0.04	0.10	1.62	0.32	0.02	0.03
Western Patch-nosed Snake	26,461,026	8.16	91.84	0.78	5.53	0.01	0.10	0.25	0.05	0.02	0.00	0.01	0.03	0.00	0.20	0.08	0.05	0.04	0.86	0.12	0.00	0.03
Great Basin Collared Lizard	30,003,739	7.83	92.17	0.72	5.26	0.01	0.09	0.22	0.04	0.02	0.00	0.01	0.03	0.00	0.19	0.07	0.05	0.04	0.91	0.13	0.00	0.03
Northern Harrier	70,176	7.56	92.44	2.86	1.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	1.13	0.04	1.84	0.02	0.01	0.00
Gila Monster	8,376,158	7.50	92.50	0.52	4.43	0.00	0.21	0.75	0.00	0.00	0.00	0.00	0.03	0.00	0.32	0.09	0.01	0.06	0.94	0.14	0.00	0.01
Western Banded Gecko	7,349,968	7.36	92.64	0.49	4.45	0.00	0.02	0.73	0.03	0.00	0.00	0.00	0.03	0.01	0.25	0.08	0.02	0.07	1.02	0.16	0.01	0.00
Mojave Mid-Elevation Mixed Desert Scrub	12,768,442	7.07	92.93	0.62	4.69	0.02	0.09	0.34	0.00	0.00	0.00	0.00	0.02	0.00	0.18	0.05	0.04	0.03	0.84	0.15	0.01	0.01
Sonoran Mid-Elevation Desert Scrub	424,960	6.54	93.46	0.43	4.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.07	0.08	0.00	0.08	1.13	0.13	0.00	0.00
North American Warm Desert Active and Stabilized Dune	17,746	6.23	93.77	1.73	1.78	0.00	0.00	0.00	0.00	0.04	0.00	0.45	0.01	0.00	0.02	0.00	0.00	0.23	1.84	0.08	0.00	0.06
Sage Thrasher	1,159,642	4.76	95.24	0.44	1.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.12	0.02	0.19	0.04	1.77	0.24	0.03	0.01
Azonal Carbonate Rock Crevices Species Assemblage	171,642	4.73	95.27	0.83	2.01	0.00	0.10	0.50	0.01	0.01	0.00	0.00	0.02	0.01	0.16	0.03	0.01	0.28	0.60	0.12	0.01	0.02
Clay Soil Patches Species Assemblage	6,862	4.13	95.87	0.23	1.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.09	0.00	0.11	0.13	2.39	0.09	0.01	0.00
Mule Deer Class D Winter Range	1,296,533	3.68	96.32	0.25	1.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.16	0.01	0.09	0.04	0.84	0.39	0.04	0.00
Brewer's Sparrow (Migratory)	13,224,753	3.30	96.70	0.24	1.54	0.00	0.18	0.05	0.05	0.01	0.00	0.00	0.01	0.00	0.17	0.03	0.01	0.05	0.82	0.10	0.00	0.03
Desert big horn	12,430,572	3.30	96.70	0.27	2.11	0.00	0.00	0.02	0.00	0.04	0.00	0.00	0.01	0.00	0.10	0.03	0.01	0.04	0.52	0.12	0.01	0.02
Inter-Mountain Basins Mixed Salt Desert Scrub	382,555	3.29	96.71	0.14	0.93	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.06	0.13	0.01	0.07	0.05	1.74	0.11	0.00	0.00

Element Name	TOTAL (acres)	Total Development	No Change Agent	Multiple Change Agents	Urban Development	Renewable Energy Geothermal	Renewable Energy Solar	Renewable Energy Wind	Renewable Energy SEZ	Mine or Landfill	Oil or Gas Well	Military Urbanized Area	Railroad	Water Canal or Ditch	Primary Electic Utility Line	Pipeline	Crops or Irrigated Pasture	Roads Principle or Secondary	Roads Rural Neighborhood or Private	Roads Unimproved 4wd	Non motorized trail	Roads Unknown Type
North American Warm Desert Bedrock Cliff and Outcrop	388,934	3.18	96.82	0.20	1.71	0.01	0.00	0.18	0.00	0.14	0.00	0.00	0.01	0.00	0.15	0.03	0.00	0.09	0.54	0.09	0.00	0.02
Mogollon Chaparral	230,430	2.76	97.24	0.09	1.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.06	0.00	0.06	0.01	0.79	0.30	0.09	0.00
Carbonate Alpine Species Assemblage	6,407	2.75	97.25	0.07	1.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.48	0.73	0.05	0.15
Northern Sagebrush Lizard	11,226,057	2.55	97.45	0.09	1.07	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.12	0.02	0.03	0.03	0.88	0.15	0.02	0.01
Sage Sparrow	223,610	1.83	98.17	0.04	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.01	0.50	0.48	0.05	0.03
Great Basin Xeric Mixed Sagebrush Shrubland	304,916	1.52	98.48	0.11	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.03	0.02	0.59	0.09	0.00	0.00
Mule Deer Class B Summer Range	932,360	1.45	98.55	0.02	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.02	0.62	0.14	0.07	0.01
Azonal Noncarbonate Rock Crevices Species Assemblage	9,802	0.78	99.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.04	0.02	0.01
Noncarbonate Alpine Species Assemblage	3,298	0.13	99.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.07	0.00

D-2.3.1 Potential Renewable overlap with CEs

MQ90 - WHERE DO CURRENT LOCATIONS OF LANDSCAPE CES OVERLAP WITH AREAS OF POTENTIAL FUTURE LOCATIONS OF RENEWABLE ENERGY DEVELOPMENT?

This assessment intersected the combined footprint of the landscape species CEs with the total potential renewable energy footprint. Fifty-one percent of the combined landscape species distribution is overlapped by potential renewable energy (Figure D - 13). While this assessment suggests the potential for large numbers of CEs and large areas of habitat to be impacted, as was pointed out in the renewable energy trends assessment earlier, only a small proportion of the total potential is expected to be developed.

In addition to answering this management question, this analysis seeks to address article 1.1.1 in the BLM Statement of Work for the REA:

Areas with High Potential for Renewable Energy Development (Required) (The Contractor shall: a) locate areas identified (e.g., by DOE, USGS) as suitable for wind, solar, geothermal, and biomass energy production and b) compare these with areas of change-agent disturbance, intact native vegetation, conservation elements of concern, and ecological integrity to c) identify and map the geographic distribution of areas that would have that have the fewest environmental effects from renewable energy development.

This analysis looks at the potential (or suitability) for three types of renewable energy development: wind, geothermal, and solar following the spatial model shown in Figure D - 3. The suitability areas were then combined with the landscape condition model which integrates elements of change agent disturbance (specifically development and invasive species) and a summary layer of landscape species richness (reflecting the number of landscape species by pixel). Lower values reflect fewer species and poorer landscape condition while higher scores reflect more species and higher landscape condition. At the landscape scale this would tend to indicate better versus worse places for renewable energy development relative to potential impacts on landscape species. The following figures (Figure D - 13, Figure D - 14, Figure D - 15) are graphics showing energy suitability in the ecoregion according to this method for each type of renewable energy. Higher values in these images show areas with greater numbers of landscape species and higher landscape condition, lower values show fewer landscape species and lower landscape condition. Lower value areas are likely more appropriate for renewable energy development but may not reflect specific species or habitats of concern (e.g. desert tortoise or wetlands). For individual species of concern, assessment for individual proposed projects is necessary.

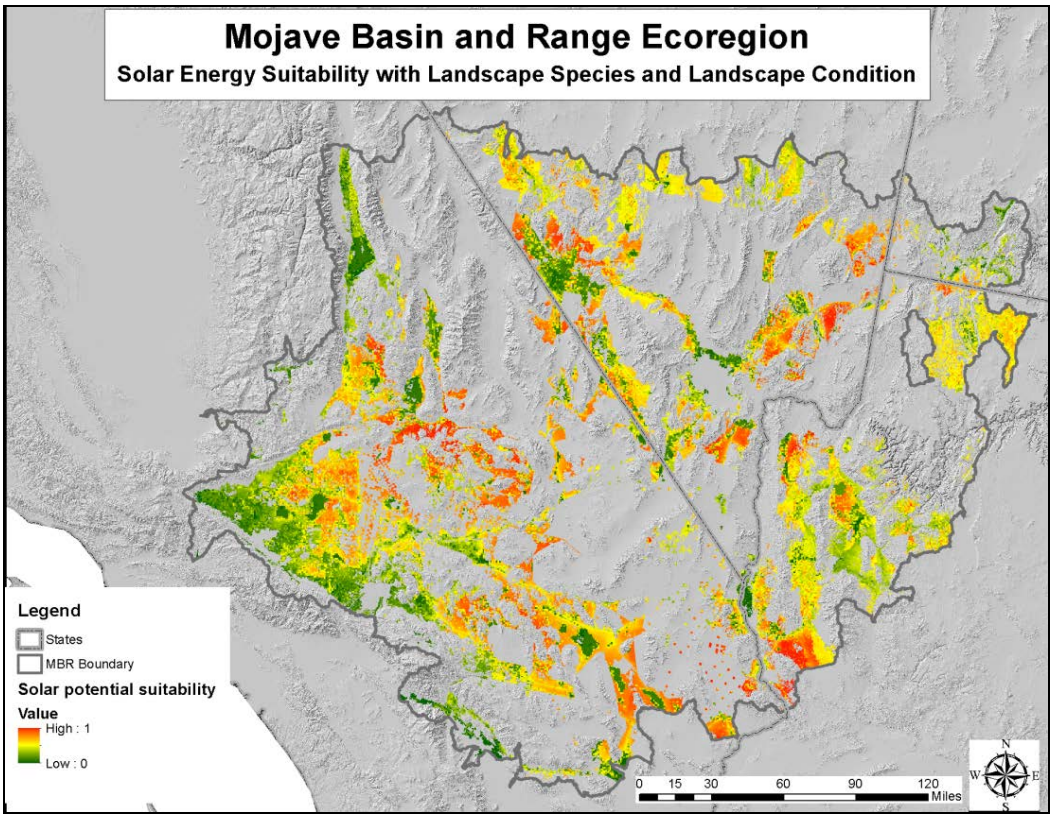

Figure D - 13. Solar Energy Suitability with Landscape Species and Landscape Condition. Lower values reflect fewer species and poorer landscape condition while higher scores reflect more species and higher landscape condition. At the landscape scale this would tend to indicate better versus worse places for renewable energy development relative to potential impacts on landscape species.

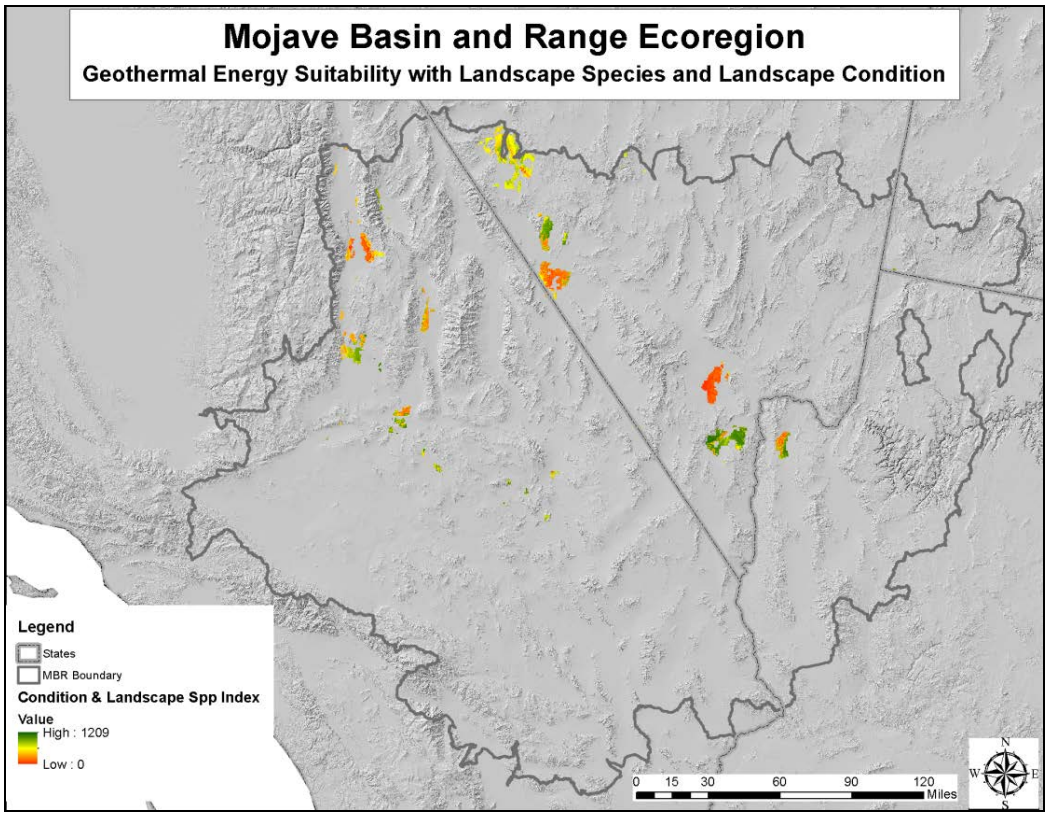

Figure D - 14. Geothermal Energy Suitability with Landscape Species and Landscape Condition. Lower values reflect fewer species and poorer landscape condition while higher scores reflect more species and higher landscape condition. At the landscape scale this would tend to indicate better versus worse places for renewable energy development relative to potential impacts on landscape species.

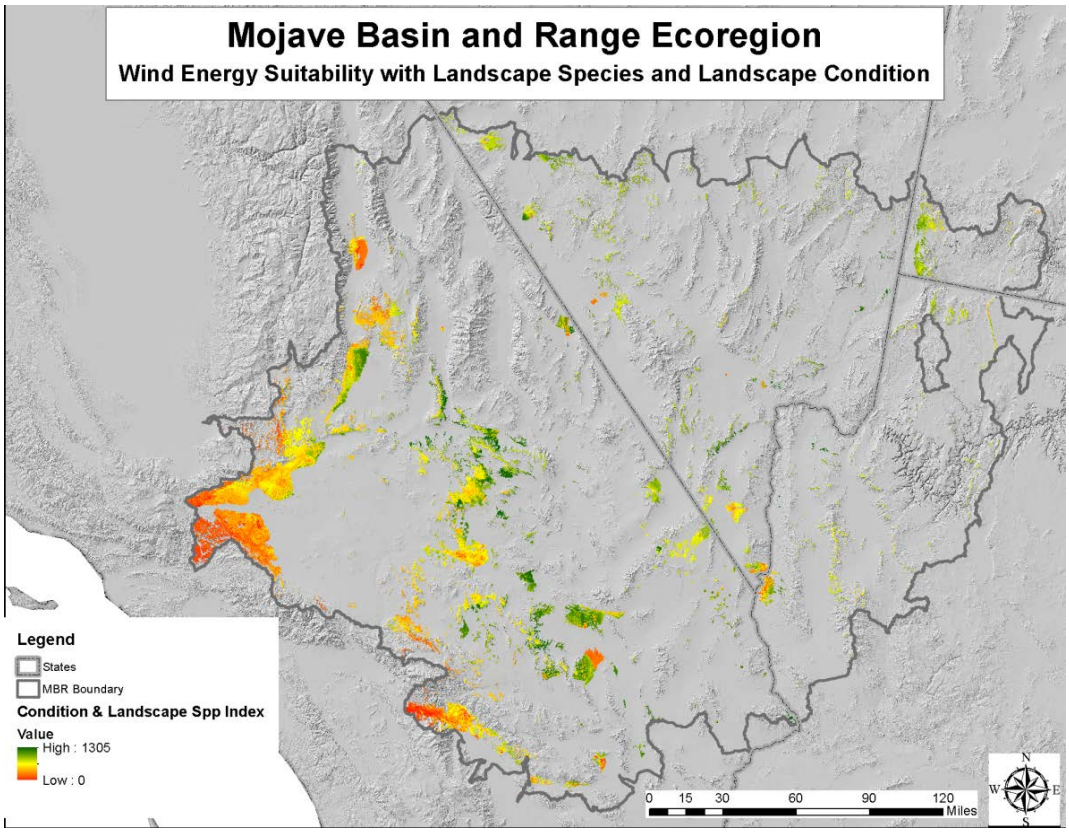

Figure D - 15. Wind Energy Suitability with Landscape Species and Landscape Condition. Lower values reflect fewer species and poorer landscape condition while higher scores reflect more species and higher landscape condition. At the landscape scale this would tend to indicate better versus worse places for renewable energy development relative to potential impacts on landscape species.

D-2.3.2 Energy impact mitigation sites

MQ89 - WHERE ARE THE AREAS OF LOW RENEWABLE AND NON-RENEWABLE ENERGY DEVELOPMENT THAT COULD POTENTIALLY MITIGATE IMPACTS TO CES FROM POTENTIAL ENERGY DEVELOPMENT?

To answer this question, areas with low renewable energy potential (relatively free of such future development) were intersected with the Landscape Condition Model (LCM) results to identify areas unlikely to be developed (with renewables) *and* require and feasibly could accommodate restoration if that is a mitigation requirement. The resulting map (Figure D - 16) displays areas with low renewable energy development potential and their current condition to further inform their suitability for mitigation. While it is not anticipated that the full potential of renewable energy would be developed in the ecoregion, there are ample mitigation opportunities with over 43 million acres in the ecoregion presenting very little potential for renewable energy development. Note that further modeling and filtering of results could provide additional precision to the result (as was described in Memorandum 3c for this MQ) but the AMT concluded that a simpler analysis was appropriate for an REA and mitigation for individual projects takes into account a large number of factors and local information.

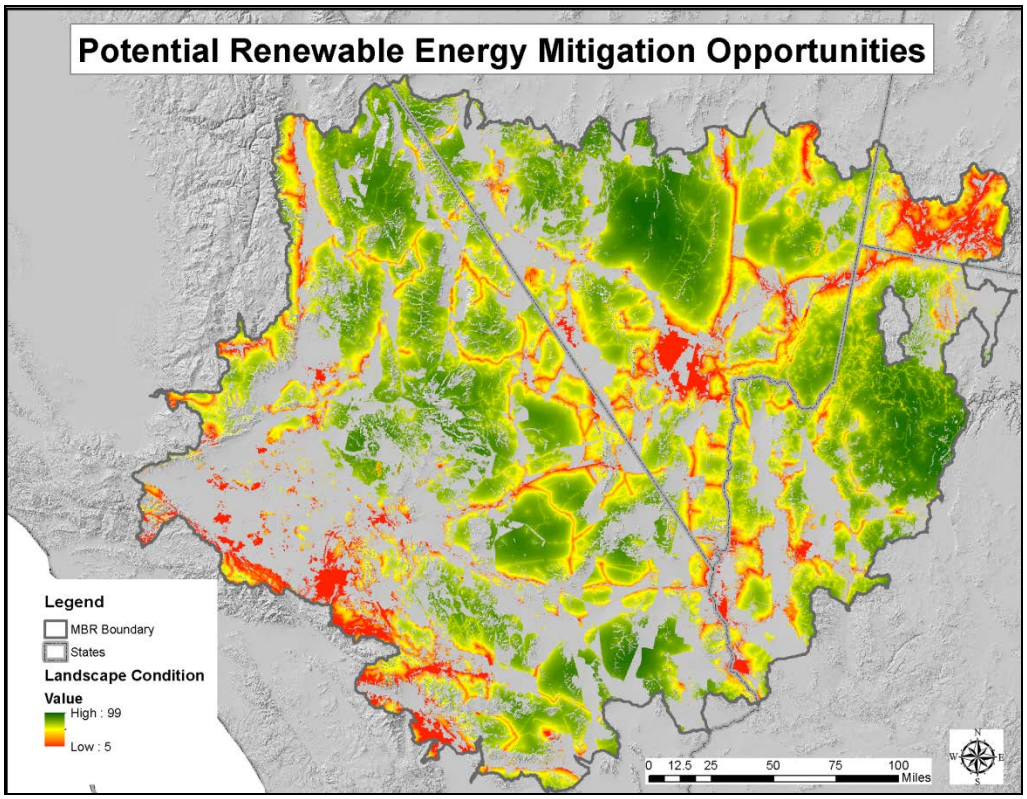

Figure D - 16. Potential mitigation areas for renewable energy development.

All gray-shaded areas have low renewable energy development potential. Areas in red are in very poor condition and thus may not offer suitable mitigation options. Green areas are in very good condition but may not meet requirements if restoration must be conducted for mitigation. Yellow areas have intermediate condition and may represent the most suitable mitigation opportunities where restoration is required.

D-2.4 2060 Distribution

D-2.4.1 Climate change and Places

D-2.4.1.1 HMAs, HAs, Gas

MQ27 - WHICH HA'S, HMA'S AND GA'S WILL EXPERIENCE CLIMATE OUTSIDE THEIR CURRENT CLIMATE ENVELOPE?

For this assessment, the climate space trends data layer was used to ascertain areas of significant climate changes. Cells that represent Near Term (2025) variance of overall counts of all variables with a Standard Deviation of one (SD1<=5) with less than or equal to 5 and a Standard Deviation of two equal to 0 (SD2=0) were identified as areas of stable climate space (Figure D - 17). Above the threshold was identified as areas of significant change.

Places were then intersected with either of the resultant layers to identify areas dependent on the question. For example Herd Management Areas (Figure D - 18) and Grazing Allotments (Figure D - 19) were intersected with the areas of significant change in order to identify areas at risk of climate change.

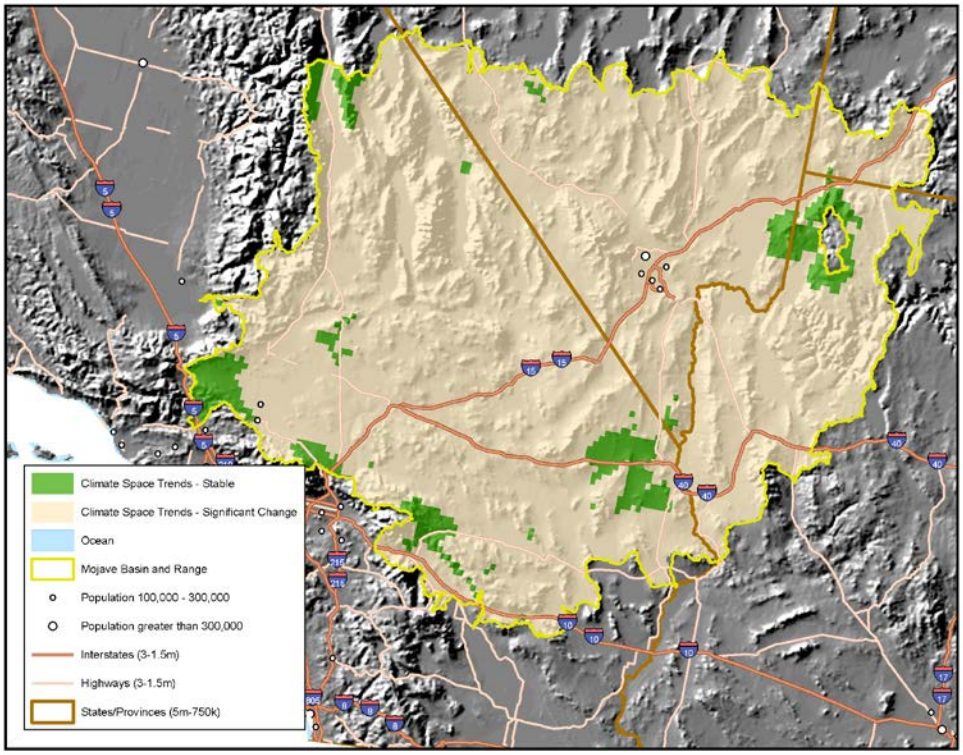

Figure D - 17. Areas with projected significant climate change in the MBR (beige); green areas represent presumed stable climate. See text for explanation of "significant".

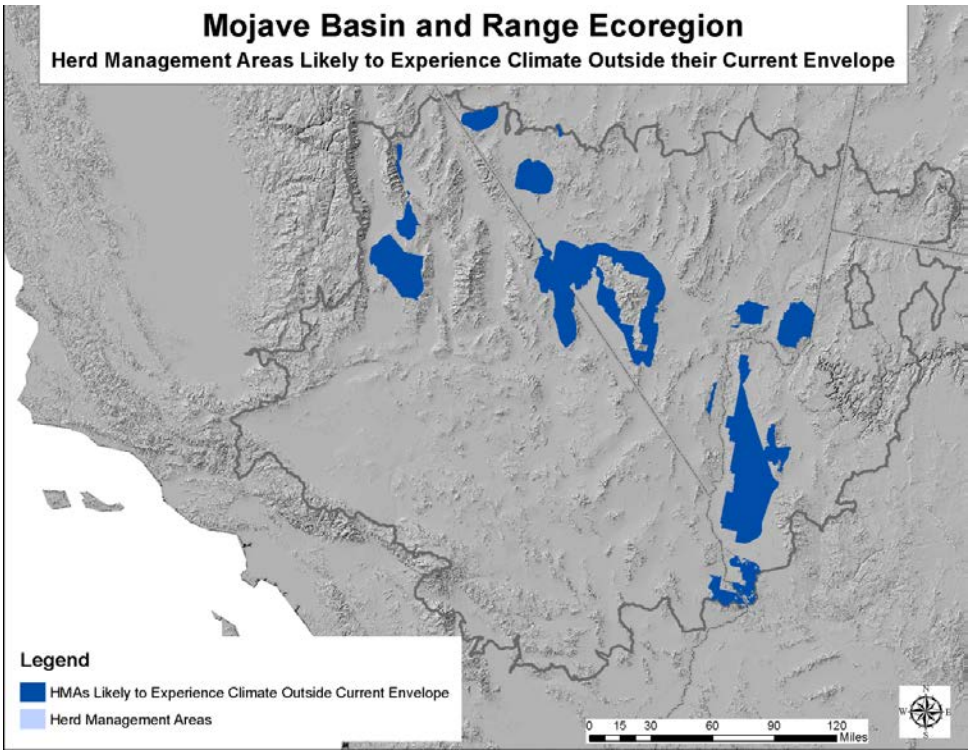

Figure D - 18. Herd management areas likely to experience significant climate change by 2060.

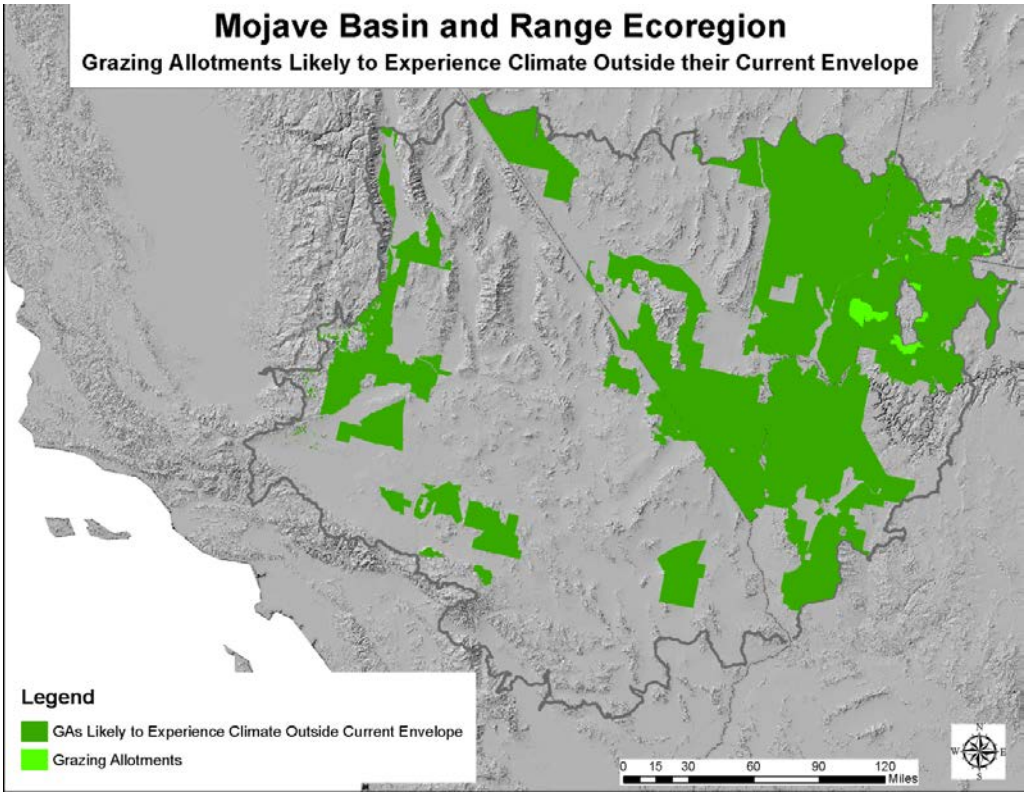

Figure D - 19. Grazing allotments likely to experience significant climate change by 2060.

D-2.4.1.2 Aquatic Places II

MQ 20 - WHERE WILL CURRENT LOCATIONS OF THESE AQUATIC HIGH BIODIVERSITY SITES EXPERIENCE SIGNIFICANT DEVIATIONS FROM NORMAL CLIMATE VARIATION?

Most sites identified as having important biodiversity resources (Places II in Appendix C) support one or more of the aquatic coarse-filter CEs. Significant deviations (meaning increases) in minimum and maximum temperature are projected to occur throughout the entire ecoregion by 2060. The same climate change dataset as shown in Figure D - 17 was intersected with high biodiversity sites to produce Figure D - 20.

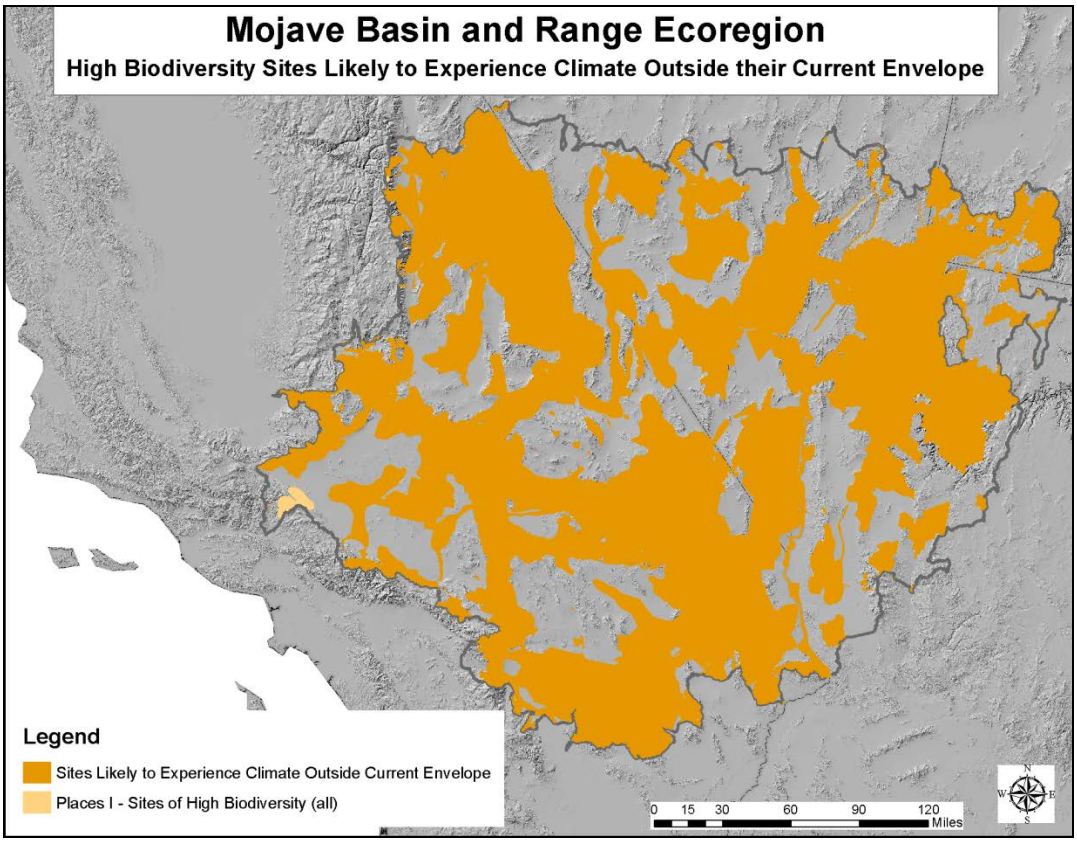

Figure D - 20. High biodiversity sites, many of which support aquatic coarse-filter CEs, which are projected to experience significant climate change by 2060.

D-2.4.2 Climate Change and Aquatic CEs

MQ71 - WHERE WILL AQUATIC CES EXPERIENCE SIGNIFICANT DEVIATIONS FROM HISTORIC CLIMATE VARIATION THAT POTENTIALLY COULD AFFECT THE HYDROLOGIC AND TEMPERATURE REGIMES OF THESE AQUATIC CES?

Significant deviations (meaning increases) in minimum and maximum temperature are projected to occur throughout the entire ecoregion by 2060. Models also indicate that August may experience greater precipitation in small areas of the central-western portion of the ecoregion, during the monsoon (or rather possibly creating a monsoon season for the Mojave). This may increase run off, but it is unknown if the amount of increased precipitation would be enough to offset the higher evaporation due

to higher minimum (night-time) and maximum (day-time) temperatures. Some effects of climatic change on aquatic resources may be:

(1) Higher evapotranspiration rates leading to an earlier, more rapid seasonal drying-down of stream/riparian and lacustrine CE occurrences;

(2) Increased water stress in basin-floor phreatophyte communities (e.g., mesquite bosque, cottonwood woodlands), and later, less frequent, briefer wetting of playas;

(3) Shrinkage of areas of perennial flow/open water, coupled with higher water temperatures at locations/times when water temperatures are not controlled by groundwater discharges or snowmelt;

(4) Persistence of these hydrologic conditions later into the Fall or early Winter; and

(5) Reduced groundwater recharge in the mountains and reduced recharge to basin-fill deposits along the mountain-front/basin-fill interface.

Persistence of these impacts over multiple decades could result in several long-term impacts, including:

(1) Loss of individual plants and area of riparian vegetation at lower elevations where the frequency and spatial extent of seasonal flows determines the spatial limits of this vegetation;

(2) Loss of individual plants and decrease in extent of basin-floor phreatophyte communities;

(3) Declines in the spatial extent and biodiversity of perennial streams and open waters as a result of shrinkage and warmer temperatures; and

(4) Reduced discharge to springs and seeps as a result of reduced aquifer recharge.

(5) The increase in monthly minimum temperatures might result in a continuation of normal "warm-season" aquatic ecological dynamics later into the Fall, since seasonally normal (baseline) overnight near-freezing temperatures will become less common in many areas until later in the Fall.

D-2.4.3 Fire - Forecasted Departure

MQ43 - WHERE ARE AREAS THAT IN THE FUTURE WILL HAVE HIGH POTENTIAL FOR FIRE?

The 2060 time period of fire regime departure for each of the 9 individual terrestrial coarse filter CEs were combined across each 5th-level watershed using an area weighted average score of all CEs occurring within the watershed (Figure D - 21). Two coarse filter CEs (Mojave Mid-Elevation Mixed Desert Scrub and Sonoran Mid-Elevation Desert Scrub) had both a mesic and a thermic variant modeled for departure; both variants were included in the 2060 calculations. The combined score emphasizes watersheds that are likely to undergo the most overall departure in fire regime.

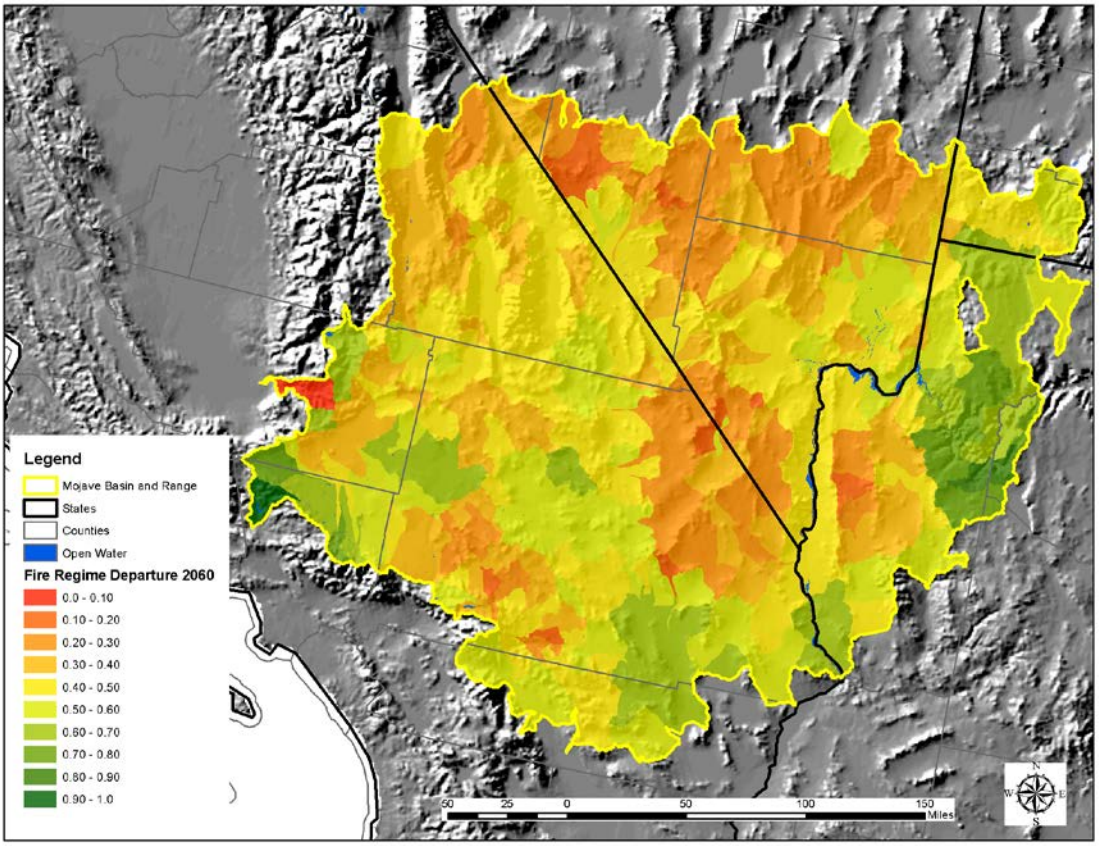

Figure D - 21. Area weighted fire regime departure for 2060; included all terrestrial coarse-filter CEs for which fire regime departure was calculated.

D-2.4.4 Climate Change Vulnerability Index Assessment for Species

Introduction

The Nevada Natural Heritage Program (NNHP) assessed the relative vulnerability, and the relative importance of factors contributing to that vulnerability, for approximately 370 plant and animal species in Nevada using the NatureServe Climate Change Vulnerability Index (CCVI). The wildlife assessments were initiated during the revision of Nevada's State Wildlife Action Plan (SWAP); plant species assessments were conducted within the context of the Bureau of Land Management's (BLM) Rapid Ecoregional Assessment (REA) process for the Central Great Basin and Mohave regions.

The CCVI was chosen for the SWAP project for a number of reasons: 1) it was designed as a rapid way of assessing a large number of species in a relatively short period of time; 2) it is cost-effective (free tool provided by NatureServe); 3) it is packaged as a programmed Excel workbook and is easy to use; 4) it was not overly technical; it was designed to be used by any person with a science background; and, 5) the results are presented in a way that allows the user to group taxa by their relative risk or by specific sensitivity factors, which helps direct management and adaptation.

These CCVI results are directly applicable to the CBR REA, as many of the species of conservation concern were assessed.

Overview of the NatureServe Climate Change Vulnerability Index (CCVI)

The CCVI uses a scoring system that integrates a species' predicted *exposure* (direct and indirect) to climate change within the assessment area (i.e., the state of Nevada) and a series of factors, all supported by published studies, associated with a species' *sensitivity* to changes in climate. The tool also incorporates documented or modeled response to climate change, if available. The tool weighs each sensitivity score depending on the magnitude of projected climate change, incorporates any documented or modeled responses, and calculates a final vulnerability index score.

Direct exposure is the magnitude of projected temperature and moisture change across the species' range within the assessment area. For this project, direct exposure was measured using climate data obtained from The Climate Wizard.[1] The Climate Wizard uses base climate projections previously downscaled by Maurer et al. (2007). As recommended in NatureServe's Guidelines for Using the NatureServe Climate Change Vulnerability Index (Young et al. 2011), a mid-century time line, Medium A1B emissions scenario, and ensemble average[2] of 16 general circulation models were used for the species' vulnerability assessments. Predicted moisture changes were based on the Hamon AET:PET Moisture Metric,[3] also developed by The Climate Wizard team. This metric integrates temperature and precipitation through a ratio of actual evapotranspiration (AET) to potential evapotranspiration (PET) with consideration of total daylight hours and saturated vapor pressure (Young et al. 2011).

Indirect exposure includes phenomena such as sea level rise (not a factor in Nevada), the presence of natural and/or anthropogenic barriers that would hinder or prevent a species from dispersing to a new area with a favorable climate envelope, or human-induced land use changes designed to mitigate greenhouse gases (e.g., the construction of renewable energy projects such as wind farms or solar arrays may remove key habitats or create barriers).

There are six **species-specific sensitivity** factors considered by the CCVI. These factors are listed below with a brief summary/explanation.

1. *Dispersal and movements* – species with poor dispersal abilities may not be able to track shifting favorable climate envelopes.
2. *Predicted sensitivity to temperature and moisture changes* – species requiring specific moisture and temperature regimes may be less likely to find similar areas as the climate changes and previously-associated temperature and precipitation patterns uncouple. Four separate factors are scored here as listed below in a through d:
    a. Historical and physiological sensitivity to changes in temperature.
    b. Historical and physiological sensitivity to changes in precipitation, hydrology, or moisture regime.
    c. Dependence on a specific disturbance regime likely to be impacted by climate change – species dependent on habitats that are maintained by regular disturbances (e.g., fires or flooding) are vulnerable to climate change-induced changes in the frequency and intensity of these disturbances.
    d. Dependence on ice, ice-edge, or snow-cover habitats – the extent of oceanic ice sheets and mountain snow fields are decreasing as temperatures increase, imperiling species dependent on these habitats.
3. *Restriction to uncommon geological features or derivatives* – species requiring specific substrates, soils, or physical features such as caves, cliffs, or sand dunes may become vulnerable

[1] http://www.climatewizard.org/

[2] Ensemble average shows the temperature change projected by the middle model. That is, half of the models project a greater amount of change, and half of the models project less change as compared to the 1961-1990 baseline average.

[3] http://www.natureserve.org/prodServices/climatechange/ccvi.jsp

to climate change if their favored climate conditions shift to areas without these physical elements.

4. *Reliance on interspecific interactions* – because species will react idiosyncratically to climate change, those with tight relationships with other species may be threatened. A series of five factors are scored within this category as listed below in a through e:
    a. Dependence on other species to generate habitat.
    b. Dietary versatility (animals only).
    c. Pollinator versatility (plants only).
    d. Dependence on other species for propagule dispersal.
    e. Forms part of an interspecific interaction not covered above.
5. *Genetic factors* – a species' ability to evolve adaptations to environmental conditions brought about by climate change is largely dependent on its existing genetic variation. Two factors are included in this category:
    a. Measured genetic variation.
    b. Occurrence of bottlenecks in recent evolutionary history.
6. Phenological response to changing seasonal temperature and precipitation dynamics – research suggests that some phylogenetic groups are declining due to lack of response to changing annual temperature dynamics (e.g., earlier onset of spring, longer growing season), including some bird species that have not advanced their migration times, and some temperate zone plants that are not moving their flowering times.

The final section of the CCVI incorporates any available data on **documented or modeled response** to climate change. This is an optional section and is not required for the CCVI to calculate a vulnerability score. If peer-reviewed, published data are available related to a species response to climate change (e.g., range shifts, range contraction, or phenology mismatches), the species response would be scored in this section. Additionally, the results of available species-specific models can be incorporated in this section.

After all of the appropriate factors are scored, an overall CCVI score is automatically calculated by the tool (i.e., Extremely Vulnerable, Highly Vulnerable, Moderately Vulnerable, Not Vulnerable/Presumed Stable, or Not Vulnerable/Increase Likely), and a measure of confidence of the score (Very High, High, Moderate, Low) is provided. This confidence relates specifically to the level of uncertainty indicated by the assessor based on the range of values given for each factor. Checking a range of values for particular factors tends to decrease confidence in species information.

The CCVI does not include factors that are already considered in existing conservation status assessments. Conservation status ranks assess a species vulnerability to extinction from a wide variety of factors such as population size, range size, threats, and demographic factors. These types of factors are not repeated in the CCVI. The CCVI only takes into consideration those factors that are related to a species vulnerability to climate change. The goal is for the CCVI to complement NatureServe Conservation Status Ranks and not to partially duplicate factors. Ideally, CCVI scores and Conservation Status Ranks should be used in concert.

Complex interactions such as shifts in competitive, predator-prey, or host-parasite interactions are likely to be important as well, but they are not included in this rapid assessment because of the difficulty and unpredictability inherent in simultaneous evaluation of climate change on interacting species.

Applying the CCVI to Nevada's Species

Species' range maps and natural history information were obtained from a number of sources including the Nevada State Wildlife Action Plan (SWAP) (Wildlife Action Plan Team 2006), the NNHP Biotics database, The Revised Nevada Bat Conservation Plan (Bradley, et al. 2006), Atlas of the Breeding

Birds of Nevada (Floyd et al. 2007), The Nevada Comprehensive Bird Conservation Plan (GBBO 2010), NatureServe Explorer,[4] federal agency documents (e.g., USGS professional reports or published studies, USFWS Recovery Plans, Federal Register), field guides, and expert input.

Assessments were completed for a representative group of species within each wildlife taxonomic group. After these initial CCVI scores were calculated by NNHP, an expert workshop was held (December 2009 in Reno) to solicit feedback and comments from biologists working throughout Nevada. The two-day workshop was well-attended and included representatives from federal (BLM, EPA, NPS, USFS, and USFWS) and state (NDOW, NNHP) agencies, a non-profit organization (TNC), and academia (UNR). Highly constructive comments and feedback were obtained from the attendees on the scoring of the factors, and additional species information was also obtained to better inform the assessments. All feedback and comments were incorporated into the CCVI for each species and scores were recalculated.

In total, 373 species were assessed using the CCVI (348 animals and 25 plants). A total of 256 of the wildlife species are included in the SWAP as Nevada SOCP. The results of the CCVI assessments can be found under separate cover in a table entitled *CBR_MBR_CCVI_Results_Animals and Plants_BLM REA_04-17-12.xlsx*. The below table provides the results of the CCVI for all species, although not all of them were identified to be in the list of species for this REA.

[4] http://www.natureserve.org/explorer/

Table D - 7. Climate change vulnerability index assessment results for Nevada species.

*EV = Extremely vulnerable; HV = highly vulnerable; MV = moderately vulnerable; PS = Not Vulnerable/Presumed Stable; IL = Not Vulnerable/Increase Likely

Taxonomic Group	Species	English Name	Assessment Approach	CCVI	Conf	MBR Species
Invert-Mollusk	Anodonta californiensis	California floater	Coarse Filter	MV	Mod	
Invert-Mollusk	Assiminea infima	Badwater snail	Coarse Filter	PS	VH	Yes
Invert-Mollusk	Eremopyrgus eganensis	Steptoe hydrobe	Coarse Filter	PS	VH	
Invert-Mollusk	Fluminicola dalli	Pyramid Lake pebblesnail	Coarse Filter	HV	VH	
Invert-Mollusk	Fluminicola turbiniformis	turban pebblesnail	Coarse Filter	HV	VH	
Invert-Mollusk	Fluminicola virginius	Virginia Mountains pebblesnail	Coarse Filter	HV	VH	
Invert-Mollusk	Juga interioris	smooth juga	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis aloba	Duckwater springsnail	Coarse Filter	PS	VH	
Invert-Mollusk	Pyrgulopsis anatina	southern Duckwater springsnail	Coarse Filter	PS	VH	
Invert-Mollusk	Pyrgulopsis anguina	longitudinal gland springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis augustae	elongate Cain Spring springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis aurata	Pleasant Valley springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis avernalis	Moapa pebblesnail	Coarse Filter	PS	VH	Yes
Invert-Mollusk	Pyrgulopsis basiglans	large gland Carico springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis bifurcata	small gland Carico springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis breviloba	Flag springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis bruesi	Fly Ranch springsnail	Coarse Filter	HV	Low	
Invert-Mollusk	Pyrgulopsis bryantwalkeri	Cortez Hills pebblesnail or Carlin springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis carinata	carinate Duckwater springsnail	Coarse Filter	PS	VH	
Invert-Mollusk	Pyrgulopsis carinifera	Moapa Valley springsnail	Coarse Filter	PS	VH	
Invert-Mollusk	Pyrgulopsis coloradensis	Blue Point springsnail	Coarse Filter	MV	VH	Yes
Invert-Mollusk	Pyrgulopsis cruciglans	transverse gland springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis crystalis	Crystal Spring springsnail	Coarse Filter	PS	VH	Yes

Invert-Mollusk	Pyrgulopsis deaconi	Spring Mountains springsnail	Coarse Filter	HV	VH	Yes
Invert-Mollusk	Pyrgulopsis dixensis	Dixie Valley springsnail	Coarse Filter	MV	VH	
Invert-Mollusk	Pyrgulopsis erythropoma	Ash Meadows pebblesnail	Coarse Filter	PS	VH	Yes
Invert-Mollusk	Pyrgulopsis fairbanksensis	Fairbanks springsnail	Coarse Filter	PS	VH	Yes
Invert-Mollusk	Pyrgulopsis fausta	Corn Creek springsnail	Coarse Filter	PS	VH	Yes
Invert-Mollusk	Pyrgulopsis gracilis	Emigrant springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis hovinghi	Upper Thousand Spring springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis hubbsi	Hubbs springsnail	Coarse Filter	PS	VH	
Invert-Mollusk	Pyrgulopsis humboldtensis	Humboldt springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis imperialis	Kings River springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis isolata	elongate-gland springsnail	Coarse Filter	PS	VH	Yes
Invert-Mollusk	Pyrgulopsis landyei	Landyes springsnail	Coarse Filter	PS	VH	
Invert-Mollusk	Pyrgulopsis lata	Butterfield springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis lentiglans	Crittenden springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis leporina	Elko pyrg	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis limaria	squat Mud Meadows springsnail	Coarse Filter	HV	VH	
Invert-Mollusk	Pyrgulopsis lockensis	Lockes springsnail	Coarse Filter	PS	VH	
Invert-Mollusk	Pyrgulopsis marcida	Hardy springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis merriami	Pahranagat pebblesnail	Coarse Filter	PS	VH	
Invert-Mollusk	Pyrgulopsis micrococcus	Oasis Valley springsnail	Coarse Filter	MV	VH	Yes
Invert-Mollusk	Pyrgulopsis militaris	northern Soldier Meadow pyrg	Coarse Filter	HV	VH	
Invert-Mollusk	Pyrgulopsis millenaria	Twentyone Mile springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis montana	Camp Valley springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis nanus	distal-gland springsnail	Coarse Filter	PS	VH	Yes
Invert-Mollusk	Pyrgulopsis neritella	neritiform Steptoe Ranch springsnail	Coarse Filter	PS	VH	
Invert-Mollusk	Pyrgulopsis notidicola	elongate Mud Meadows springsnail	Coarse Filter	HV	VH	
Invert-Mollusk	Pyrgulopsis orbiculata	sub-globose Steptoe Ranch springsnail	Coarse Filter	PS	VH	

Invert-Mollusk	Pyrgulopsis papillata	Big Warm Spring springsnail	Coarse Filter	PS	VH	
Invert-Mollusk	Pyrgulopsis peculiaris	bifid duct springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis pellita	Antelope Valley springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis pictilis	ovate Cain Spring springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis pisteri	median-gland springsnail	Coarse Filter	PS	VH	Yes
Invert-Mollusk	Pyrgulopsis planulata	flat-topped Steptoe springsnail	Coarse Filter	PS	VH	
Invert-Mollusk	Pyrgulopsis ruinosa	Fish Lake springsnail	Coarse Filter	HV	VH	
Invert-Mollusk	Pyrgulopsis sadai	Sada's springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis sathos	White River Valley springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis serrata	northern Steptoe springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis sterilis	sterile basin springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis sublata	Lake Valley springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis sulcata	southern Steptoe springsnail	Coarse Filter	PS	VH	
Invert-Mollusk	Pyrgulopsis turbatrix	southeast Nevada springsnail	Coarse Filter	HV	VH	Yes
Invert-Mollusk	Pyrgulopsis umbilicata	southern Soldier Meadow springsnail	Coarse Filter	HV	VH	
Invert-Mollusk	Pyrgulopsis variegata	northwest Bonneville springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis villacampae	Duckwater warm springs springsnail	Coarse Filter	PS	VH	
Invert-Mollusk	Pyrgulopsis vinyardi	Vinyard's springsnail	Coarse Filter	EV	VH	
Invert-Mollusk	Pyrgulopsis wongi	Wong's pyrg	Coarse Filter	MV	VH	Yes
Invert-Mollusk	Tryonia angulata	sportinggoods tryonia	Coarse Filter	PS	VH	Yes
Invert-Mollusk	Tryonia clathrata	grated tryonia	Coarse Filter	PS	VH	Yes
Invert-Mollusk	Tryonia elata	Point of Rocks tryonia	Coarse Filter	PS	VH	Yes
Invert-Mollusk	Tryonia ericae	minute tryonia	Coarse Filter	PS	VH	Yes
Invert-Mollusk	Tryonia monitorae	Monitor tryonia	Coarse Filter	PS	VH	
Invert-Mollusk	Tryonia porrecta	desert springsnail	Coarse Filter	MV	VH	
Invert-Mollusk	Tryonia variegata	Amargosa tryonia	Coarse Filter	PS	VH	Yes
Fish	Catostomus clarki intermedius	White River desert sucker		HV	VH	

Fish	Catostomus clarkii ssp. 2	Meadow Valley Wash desert sucker		PS	Low	
Fish	Catostomus latipinnis	flannelmouth sucker	Coarse Filter	PS	VH	Yes
Fish	Catostomus sp. 1	Wall Canyon sucker	Coarse Filter	MV	VH	
Fish	Chasmistes cujus	cui-ui	Coarse Filter	MV	VH	
Fish	Crenichthys baileyi albivallis	Preston White River springfish	Coarse Filter	PS	VH	
Fish	Crenichthys baileyi baileyi	White River springfish	Coarse Filter	PS	VH	Yes
Fish	Crenichthys baileyi grandis	Hiko White River springfish	Coarse Filter	PS	VH	
Fish	Crenichthys baileyi moapae	Moapa White River springfish	Coarse Filter	PS	VH	Yes
Fish	Crenichthys baileyi thermophilus	Moorman White River springfish	Coarse Filter	PS	VH	
Fish	Crenichthys nevadae	Railroad Valley springfish	Coarse Filter	PS	VH	
Fish	Cyprinodon diabolis	Devils Hole pupfish	Coarse Filter	PS	VH	Yes
Fish	Cyprinodon nevadensis mionectes	Ash Meadows Amargosa pupfish	Coarse Filter	PS	VH	Yes
Fish	Cyprinodon nevadensis pectoralis	Warm Springs pupfish	Coarse Filter	PS	VH	Yes
Fish	Empetrichthys latos	Pahrump poolfish	Coarse Filter	MV	VH	Yes
Fish	Eremichthys acros	desert dace	Coarse Filter	MV	VH	
Fish	Gila alvordensis	Alvord chub	Coarse Filter	HV	Low	
Fish	Gila bicolor eurysoma	Sheldon tui chub		HV	VH	
Fish	Gila bicolor isolata	Independence Valley tui chub	Coarse Filter	PS	Low	
Fish	Gila bicolor ssp. 4	Fish Lake Valley tui chub	Coarse Filter	PS	VH	
Fish	Gila bicolor ssp. 6	Little Fish Lake Valley tui chub	Coarse Filter	HV	Mod	
Fish	Gila bicolor ssp. 7	Railroad Valley tui chub	Coarse Filter	MV	VH	
Fish	Gila bicolor ssp. 8	Big Smoky Valley tui chub	Coarse Filter	HV	VH	
Fish	Gila bicolor ssp. 9	Dixie Valley tui chub	Coarse Filter	PS	High	
Fish	Gila elegans	bonytail	Coarse Filter	PS	VH	Yes
Fish	Gila robusta jordani	Pahranagat roundtail chub	Coarse Filter	PS	VH	
Fish	Gila seminuda	Virgin River chub	Coarse Filter	PS	VH	Yes
Fish	Lepidomeda albivallis	White River spinedace	Coarse Filter	PS	VH	

Fish	Lepidomeda mollispinis mollispinis	Virgin River spinedace	Coarse Filter	PS	VH	Yes
Fish	Lepidomeda mollispinis pratensis	Big Spring spinedace	Coarse Filter	MV	VH	
Fish	Moapa coriacea	Moapa dace	Coarse Filter	PS	VH	Yes
Fish	Oncorhynchus clarki henshawi	Lahontan cutthroat trout		MV	VH	
Fish	Oncorhynchus clarkii bouvieri	Yellowstone cutthroat trout	Coarse Filter	MV	VH	
Fish	Oncorhynchus mykiss pop. 4	Warner Valley Redband Trout	Coarse Filter	HV	VH	
Fish	Plagopterus argentissimus	woundfin	Coarse Filter	PS	VH	Yes
Fish	Prosopium williamsoni	mountain whitefish		MV	Mod	
Fish	Rhinichthys osculus lariversi	Big Smoky Valley speckled dace	Coarse Filter	HV	VH	
Fish	Rhinichthys osculus lethoporus	Independence Valley speckled dace	Coarse Filter	HV	VH	
Fish	Rhinichthys osculus moapae	Moapa speckled dace	Coarse Filter	PS	VH	Yes
Fish	Rhinichthys osculus nevadensis	Ash Meadows speckled dace	Coarse Filter	PS	VH	Yes
Fish	Rhinichthys osculus oligoporus	Clover Valley speckled dace	Coarse Filter	HV	VH	
Fish	Rhinichthys osculus ssp. 10	Diamond Valley speckled dace	Coarse Filter	HV	VH	
Fish	Rhinichthys osculus ssp. 11	Meadow Valley speckled dace		PS	Mod	
Fish	Rhinichthys osculus ssp. 5	Monitor Valley speckled dace	Coarse Filter	HV	VH	
Fish	Rhinichthys osculus ssp. 6	Oasis Valley speckled dace	Coarse Filter	PS	VH	Yes
Fish	Rhinichthys osculus ssp. 7	White River speckled dace	Coarse Filter	MV	VH	Yes
Fish	Rhinichthys osculus velifer	Pahranagat speckled dace	Coarse Filter	PS	VH	
Fish	Salvelinus confluentus pop. 4	bull trout	Coarse Filter	HV	Low	
Fish	Xyrauchen texanus	razorback sucker	Coarse Filter	IL	Low	Yes
Amphibian	Anaxyrus (=Bufo) boreas boreas	boreal toad		PS	VH	
Amphibian	Bufo cognatus	Great Plains toad	Coarse Filter	PS	VH	Yes
Amphibian	Bufo microscaphus	Arizona toad (southwestern	Coarse Filter	PS	VH	Yes

		toad)				
Amphibian	Bufo nelsoni	Amargosa toad	Coarse Filter	PS	VH	Yes
Amphibian	Rana luteiventris	Columbia spotted frog (Toiyabe sub-population)	Coarse Filter	HV	Low	
Amphibian	Rana luteiventris	Columbia spotted frog (NE sub-population)	Coarse Filter	HV	Low	
Amphibian	Rana onca	relict leopard frog	Coarse Filter	MV	VH	Yes
Amphibian	Rana pipiens	northern leopard frog	Coarse Filter	PS	VH	Yes
Amphibian	Rana sierrae	Sierra Nevada mountain yellow-legged frog	Local	PS	VH	
Amphibian	Spea intermontana	Great Basin spadefoot	Coarse Filter	MV	Mod	Yes
Reptile	Actinemys marmorata	western pond turtle	Coarse Filter	PS	VH	Yes
Reptile	Arizona elegans	glossy snake	Landscape Species	PS	VH	Yes
Reptile	Charina bottae	rubber boa	Landscape Species	PS	VH	Yes
Reptile	Chionactis occipitalis	shovel-nosed snake		MV	VH	
Reptile	Coleonyx varigatus	western banded gecko		MV	VH	
Reptile	Crotalus atrox	western diamond-backed rattlesnake	Local	PS	VH	Yes
Reptile	Crotalus cerastes	sidewinder	Species Assemblage	MV	VH	Yes
Reptile	Crotalus mitchellii	speckled rattlesnake	Local	PS	VH	Yes
Reptile	Crotalus scutulatus scutulatus	Mojave green rattlesnake		PS	VH	
Reptile	Crotalus stephensi	Panamint rattlesnake		PS	VH	
Reptile	Crotaphytus bicinctores	Great Basin collared lizard	Landscape Species	PS	VH	Yes
Reptile	Diadophis punctatus	ringneck snake	Local	MV	Mod	Yes
Reptile	Dipsosaurus dorsalis	desert iguana	Species Assemblage	MV	Mod	Yes
Reptile	Elgaria coerulea palmeri	Sierra alligator lizard	Local	PS	VH	
Reptile	Elgaria coerulea shastensis	Shasta alligator lizard	Local	MV	VH	
Reptile	Elgaria panamintina	Panamint alligator lizard	Local	PS	VH	Yes
Reptile	Gambelia wislizenii	long-nosed leopard lizard	Local	PS	VH	Yes
Reptile	Gopherus agassizii	desert tortoise	Landscape Species	PS	VH	

Reptile	Gopherus agassizii	desert tortoise	Landscape Species	PS	VH	Yes
Reptile	Heloderma suspectum	Gila monster	Landscape Species	HV	Mod	Yes
Reptile	Lampropeltis pyromelana	Sonoran mountain kingsnake	Coarse Filter	HV	VH	
Reptile	Lichanura (=Charina) trivirgata	rosy boa		PS	Mod	
Reptile	Phrynosoma douglasii	pygmy short-horned lizard	Local	MV	Low	
Reptile	Phrynosoma hernandesi	greater short-horned lizard	Local	PS	VH	
Reptile	Phrynosoma platyrhinos	desert horned lizard	Local	PS	Low	Yes
Reptile	Phyllorhynchus decurtatus	spotted leaf-nosed snake	Species Assemblage	PS	Mod	Yes
Reptile	Plestiodon gilberti	Gilbert's skink	Local	PS	VH	Yes
Reptile	Rena humilis	western blind snake		MV	VH	
Reptile	Rhinocheilus lecontei	long-nosed snake	Local	PS	VH	Yes
Reptile	Salvadora hexalepis	western patch-nosed snake	Landscape Species	PS	VH	Yes
Reptile	Sauromalus obesus	common chuckwalla		MV	VH	
Reptile	Tantilla hobartsmithi	Smith's black-headed snake	Local	PS	VH	Yes
Reptile	Thamnophis couchii	Sierra garter snake		PS	VH	
Reptile	Thamnophis sirtalis	common (valley) garter snake	Local	PS	VH	
Reptile	Trimorphodon biscutatus	western lyre snake	Local	MV	VH	Yes
Reptile	Urosaurus graciosus	long-tailed brush lizard	Local	HV	VH	Yes
Reptile	Urosaurus ornatus	ornate tree lizard		PS	Low	
Reptile	Xantusia vigilis	desert night lizard	Coarse Filter	MV	VH	Yes
Bird	Accipiter cooperii	Cooper's hawk	Landscape Species	PS	VH	Yes
Bird	Accipiter gentilis	northern goshawk	Coarse Filter	MV	VH	Yes
Bird	Accipiter striatus	sharp-shinned hawk	Coarse Filter	PS	VH	Yes
Bird	Aechmophorus clarkii	Clark's grebe	Coarse Filter	PS	VH	Yes
Bird	Aechmophorus occidentalis	western grebe	Coarse Filter	PS	VH	Yes
Bird	Aeronautes saxatalis	white-throated swift	Coarse Filter	PS	VH	Yes
Bird	Agelaius tricolor	tricolored blackbird	Local	PS	VH	
Bird	Amphispiza belli	sage sparrow	Landscape Species	MV	Mod	Yes
Bird	Anas acuta	northern pintail	Species Assemblage	PS	VH	Yes

Bird	Anas cyanoptera	cinnamon teal	Species Assemblage	PS	VH	Yes
Bird	Aquila chrysaetos	golden eagle	Landscape Species	PS	VH	Yes
Bird	Asio flammeus	short-eared owl	Local	PS	VH	Yes
Bird	Athene cunicularia hypugaea	western burrowing owl	Local	PS	VH	Yes
Bird	Auriparus flaviceps	verdin	Coarse Filter	PS	VH	Yes
Bird	Aythya americana	redhead	Species Assemblage	PS	VH	Yes
Bird	Aythya valisineria	canvasback	Species Assemblage	PS	VH	Yes
Bird	Bombycilla cedrorum	cedar waxwing		PS	Low	
Bird	Botaurus lentiginosus	American bittern	Local	MV	Low	
Bird	Buteo lineatus	red-shouldered hawk		PS	VH	
Bird	Buteo regalis	ferruginous hawk	Landscape Species	PS	VH	
Bird	Buteo swainsoni	Swainson's hawk	Landscape Species	PS	VH	
Bird	Calidris mauri	western sandpiper	Coarse Filter	PS	Low	
Bird	Calidris minutilla	least sandpiper	Species Assemblage	PS	Low	Yes
Bird	Callipepla gambelii	Gambel's quail	Coarse Filter	PS	VH	Yes
Bird	Calypte costae	Costa's hummingbird	Coarse Filter	IL	VH	Yes
Bird	Campylorhynchus brunneicapillus	cactus wren		PS	VH	
Bird	Caprimulgus vociferus	whip-poor-will		PS	VH	
Bird	Carpodacus cassinii	Cassin's finch	Species Assemblage	PS	VH	Yes
Bird	Catharus ustulatus	Swainson's thrush	Coarse Filter	PS	VH	Yes
Bird	Centrocercus urophasianus	greater sage-grouse	Landscape Species	HV	Low	
Bird	Charadrius alexandrinus nivosus	western snowy plover	Coarse Filter	MV	Mod	
Bird	Chlidonias niger	black tern	Coarse Filter	PS	VH	Yes
Bird	Chordeiles minor	common nighthawk		PS	VH	
Bird	Coccyzus americanus occidentalis	western yellow-billed cuckoo	Coarse Filter	MV	Low	Yes
Bird	Colaptes chrysoides	gilded flicker	Local	PS	VH	Yes
Bird	Contopus cooperi	olive-sided flycatcher	Species Assemblage	IL	VH	Yes

Bird	Cygnus buccinator	trumpeter swan	Local	MV	Low	
Bird	Dendragapus fuliginosus	sooty grouse		PS	VH	
Bird	Dendragapus obscurus	dusky grouse	Species Assemblage	PS	VH	
Bird	Dendroica graciae	Grace's warbler	Species Assemblage	PS	High	Yes
Bird	Dendroica occidentalis	hermit warbler	Local	PS	VH	
Bird	Dendroica petechia	yellow warbler		PS	Mod	
Bird	Dolichonyx oryzivorus	bobolink	Local	PS	Mod	
Bird	Egretta thula	snowy egret	Coarse Filter	PS	VH	Yes
Bird	Empidonax hammondii	Hammond's flycatcher		PS	VH	
Bird	Empidonax traillii adastus	(Great Basin) willow flycatcher	Coarse Filter	PS	VH	
Bird	Empidonax traillii brewsteri	mountain willow flycatcher	Coarse Filter	PS	VH	
Bird	Empidonax traillii extimus	southwestern willow flycatcher	Coarse Filter	PS	VH	Yes
Bird	Falco mexicanus	prairie falcon	Landscape Species	PS	VH	Yes
Bird	Falco peregrinus	peregrine falcon	Local	PS	Low	Yes
Bird	Gavia immer	common loon	Species Assemblage	PS	VH	Yes
Bird	Geothlypis trichas	common yellowthroat	Local	PS	VH	Yes
Bird	Grus canadensis tabida	greater sandhill crane	Coarse Filter	PS	VH	
Bird	Gymnorhinus cyanocephalus	pinyon jay	Coarse Filter	PS	VH	Yes
Bird	Haliaeetus leucocephalus	bald eagle	Landscape Species	PS	VH	Yes
Bird	Himantopus mexicanus	black-necked stilt	Species Assemblage	PS	VH	Yes
Bird	Icteria virens	yellow-breasted chat	Local	PS	Mod	Yes
Bird	Icterus parisorum	Scott's oriole	Local	PS	VH	Yes
Bird	Ixbrychus exilis hesperis	western least bittern		PS	Mod	
Bird	Lanius ludovicianus	loggerhead shrike	Landscape Species	PS	VH	Yes
Bird	Larus pipixcan	Franklin's gull		PS	VH	
Bird	Leucosticte atrata	black rosy-finch	Local	HV	VH	
Bird	Leucosticte tephrocotis	gray-crowned rosy-finch	Local	HV	VH	
Bird	Limnodromus scolopaceus	long-billed dowitcher	Species Assemblage	PS	VH	Yes
Bird	Melanerpes lewis	Lewis's woodpecker	Coarse Filter	PS	VH	
Bird	Numenius americanus	long-billed curlew	Coarse Filter	PS	VH	Yes

Bird	Oreortyx pictus	mountain quail	Coarse Filter	PS	VH	
Bird	Oreoscoptes montanus	sage thrasher	Landscape Species	MV	Mod	Yes
Bird	Oreothlypis celata	orange-crowned warbler		PS	Low	
Bird	Otus flammeolus	flammulated owl	Species Assemblage	PS	VH	Yes
Bird	Pandion haliaetus	osprey	Coarse Filter	PS	VH	Yes
Bird	Patagioenas fasciata	band-tailed pigeon	Species Assemblage	PS	VH	Yes
Bird	Pelecanus erythrorhynchos	American white pelican	Coarse Filter	MV	VH	Yes
Bird	Phainopepla nitens	phainopepla	Coarse Filter	PS	VH	Yes
Bird	Phalaropus lobatus	red-necked phalarope	Species Assemblage	MV	VH	Yes
Bird	Phalaropus tricolor	Wilson's phalarope	Coarse Filter	MV	VH	Yes
Bird	Picoides albolarvatus	white-headed woodpecker	Local	PS	Low	
Bird	Picoides arcticus	black-backed woodpecker		IL	VH	
Bird	Picoides dorsalis	American three-toed woodpecker	Local	IL	VH	
Bird	Pipilo aberti	Abert's towhee	Coarse Filter	IL	VH	Yes
Bird	Pipilo chlorurus	green-tailed towhee	Coarse Filter	PS	VH	Yes
Bird	Plegadis chihi	white-faced ibis	Species Assemblage	PS	VH	Yes
Bird	Podiceps nigricollis	eared grebe	Local	PS	VH	Yes
Bird	Pyrocephalus rubinus	vermilion flycatcher	Coarse Filter	PS	VH	Yes
Bird	Rallus longirostris yumanensis	Yuma clapper rail	Local	PS	VH	Yes
Bird	Recurvirostra americana	American avocet	Species Assemblage	PS	VH	Yes
Bird	Riparia riparia	bank swallow	Local	MV	VH	Yes
Bird	Sayornis nigricans	black phoebe	Coarse Filter	IL	VH	Yes
Bird	Selasphorus platycercus	broad-tailed hummingbird	Local	PS	VH	Yes
Bird	Selasphorus rufus	rufous hummingbird	Local	PS	VH	Yes
Bird	Sphyrapicus ruber	red-breasted sapsucker	Coarse Filter	PS	VH	Yes
Bird	Sphyrapicus thyroideus	Williamson's sapsucker	Coarse Filter	PS	VH	Yes
Bird	Spizella atrogularis	black-chinned sparrow	Coarse Filter	PS	VH	Yes
Bird	Spizella breweri	Brewer's sparrow	Landscape Species	MV	Mod	Yes

Bird	Stellula calliope	calliope hummingbird	Coarse Filter	PS	VH	Yes
Bird	Sterna forsteri	Forster's tern	Coarse Filter	PS	VH	Yes
Bird	Strix occidentalis occidentalis	California spotted owl	Local	MV	VH	
Bird	Toxostoma bendirei	Bendire's thrasher	Coarse Filter	PS	VH	Yes
Bird	Toxostoma crissale	Crissal thrasher	Coarse Filter	IL	VH	Yes
Bird	Toxostoma lecontei	LeConte's thrasher	Coarse Filter	PS	VH	Yes
Bird	Tringa semipalmata	willet	Species Assemblage	PS	VH	Yes
Bird	Tympanuchus phasianellus columbianus	Columbian sharp-tailed grouse	Landscape Species	MV	VH	
Bird	Vermivora luciae	Lucy's warbler	Coarse Filter	PS	VH	Yes
Bird	Vermivora ruficapilla	Nashville warbler		PS	VH	
Bird	Vermivora virginiae	Virginia's warbler	Coarse Filter	PS	VH	Yes
Bird	Vireo bellii arizonae	Arizona Bell's vireo	Coarse Filter	PS	VH	Yes
Bird	Vireo vicinior	gray vireo	Coarse Filter	PS	VH	Yes
Bird	Wilsonia pusilla	Wilson's warbler		PS	VH	
Mammal	Aplodontia rufa californica	aplodontia (mountain beaver)	Local	HV	Low	
Mammal	Bassariscus astutus	ringtail	Coarse Filter	PS	VH	Yes
Mammal	Brachylagus idahoensis	pygmy rabbit	Landscape Species	EV	Mod	
Mammal	Castor canadensis	American beaver	Local	PS	VH	Yes
Mammal	Chaetodipus penicillatus	desert pocket mouse	Coarse Filter	MV	VH	Yes
Mammal	Chaetodipus spinatus	spiny pocket mouse	Local	PS	VH	Yes
Mammal	Corynorhinus townsendii	Townsend's big-eared bat	Local	PS	VH	Yes
Mammal	Dipodomys californicus	California kangaroo rat	Local	PS	VH	
Mammal	Dipodomys deserti	desert kangaroo rat	Species Assemblage	PS	VH	Yes
Mammal	Euderma maculatum	spotted bat	Coarse Filter	PS	VH	Yes
Mammal	Glaucomys sabrinus	northern flying squirrel	Species Assemblage	PS	VH	
Mammal	Idionycteris phyllotis	Allen's big-eared bat	Local	PS	VH	Yes
Mammal	Lasionycteris noctivagans	silver-haired bat	Species Assemblage	PS	VH	Yes
Mammal	Lasiurus blossevillii	western red bat	Coarse Filter	PS	VH	Yes
Mammal	Lasiurus cinereus	hoary bat	Species Assemblage	IL	VH	Yes

Mammal	Lasiurus xanthinus	western yellow bat	Local	PS	VH	Yes
Mammal	Lemmiscus curtatus	sagebrush vole	Local	HV	VH	
Mammal	Lepus americanus tahoensis	Sierra Nevada snowshoe hare	Local	PS	VH	
Mammal	Lepus townsendi	white-tailed jackrabbit		PS	VH	
Mammal	Lontra canadensis	northern river otter	Local	MV	Mod	
Mammal	Macrotus californicus	California leaf-nosed bat	Local	PS	VH	Yes
Mammal	Martes americana	American marten		PS	VH	
Mammal	Microdipodops megacephalus	dark kangaroo mouse	Species Assemblage	HV	Mod	
Mammal	Microdipodops pallidus	pale kangaroo mouse	Species Assemblage	MV	VH	
Mammal	Microtus montanus fucosus	Pahranagat Valley vole	Local	PS	Low	
Mammal	Microtus montanus nevadensis	Ash Meadows montane vole	Local	PS	VH	Yes
Mammal	Mustela erminea	ermine		PS	Mod	
Mammal	Mustela frenata	long-tailed weasel		PS	VH	
Mammal	Myotis ciliolabrum	western small-footed myotis	Local	PS	VH	Yes
Mammal	Myotis evotis	long-eared myotis	Species Assemblage	IL	VH	Yes
Mammal	Myotis lucifugus	little brown bat	Species Assemblage	IL	Mod	Yes
Mammal	Myotis thysanodes	fringed myotis	Local	IL	VH	Yes
Mammal	Myotis velifer	cave myotis	Local	PS	VH	Yes
Mammal	Neotamias amoenus celeris	Humboldt yellow-pine chipmunk		MV	VH	
Mammal	Neotamias palmeri	Palmer's chipmunk	Local	HV	VH	Yes
Mammal	Neotamias senex	Allen's chipmunk		PS	VH	
Mammal	Neotamias umbrinus nevadensis	Hidden Forest Uinta chipmunk	Local	MV	VH	Yes
Mammal	Neovison vison	American mink		PS	VH	
Mammal	Notiosorex crawfordi	Crawford's gray shrew	Local	PS	VH	Yes
Mammal	Nyctinomops macrotis	big free-tailed bat	Local	PS	VH	Yes
Mammal	Ochotona princeps	American pika	Local	MV	Mod	
Mammal	Odocoileus hemionus	mule deer	Landscape Species	PS	VH	Yes

Mammal	Ovis canadensis	bighorn sheep	Landscape Species	MV	VH	
Mammal	Ovis canadensis californiana	California bighorn sheep		PS	VH	
Mammal	Ovis canadensis nelsoni	Nelson bighorn sheep	Landscape Species	PS	VH	Yes
Mammal	Peromyscus boylii	brush mouse	Local	PS	VH	Yes
Mammal	Peromyscus eremicus	cactus deermouse	Local	PS	VH	Yes
Mammal	Scapanus latimanus	broad-footed mole	Coarse Filter	PS	VH	
Mammal	Sorex merriami leucogenys	Merriam's shrew	Local	PS	VH	Yes
Mammal	Sorex monticolus	montane shrew	Coarse Filter	MV	VH	
Mammal	Sorex palustris	water shrew	Coarse Filter	MV	VH	
Mammal	Sorex preblei	Preble's shrew	Local	PS	VH	
Mammal	Sorex tenellus	Inyo shrew	Local	PS	VH	Yes
Mammal	Sorex trowbridgii	Trowbridge's shrew	Local	PS	VH	
Mammal	Sorex vagrans	vagrant shrew	Coarse Filter	PS	VH	
Mammal	Spermophilus beldingi	Belding's ground squirrel	Local	PS	VH	
Mammal	Spermophilus canus	Merriam's ground squirrel		PS	Mod	
Mammal	Spermophilus elegans nevadensis	Wyoming ground squirrel		PS	VH	
Mammal	Spermophilus tereticaudus	round-tailed ground squirrel		PS	High	
Mammal	Tadarida brasiliensis	Brazilian free-tailed bat	Landscape Species	PS	VH	Yes
Mammal	Thomomys bottae	pocket gopher	Local	MV	Mod	
Mammal	Thomomys bottae abstrusus	Fish Spring pocket gopher	Local	MV	Low	
Mammal	Thomomys bottae curtatus	San Antonio pocket gopher	Local	MV	VH	
Mammal	Thomomys monticola	mountain pocket gopher	Local	PS	VH	
Mammal	Vulpes macrotis	kit fox	Landscape Species	PS	VH	Yes
Mammal	Vulpes vulpes necator	Sierra Nevada red fox	Local	PS	VH	
Mammal	Zapus princeps	western jumping mouse	Coarse Filter	PS	Mod	
Vascular Plant	Angelica scabrida		Coarse Filter	HV	Low	Yes
Vascular Plant	Machaeranthera grindelioides var. depressa		Local	PS	Mod	Yes
Vascular Plant	Phacelia glaberrima		Local	MV	Low	

Vascular Plant	Eriogonum esmeraldense var. toiyabense		Local	PS	VH	
Vascular Plant	Anulocaulis leiosolenus var. leiosolenus			PS	Mod	
Vascular Plant	Hulsea vestita ssp. inyoensis		Local	PS	VH	Yes
Vascular Plant	Oxytheca watsonii		Local	PS	VH	Yes
Vascular Plant	Perityle intricata			PS	Mod	
Vascular Plant	Antennaria arcuata		Coarse Filter	MV	Mod	
Vascular Plant	Agastache cusickii		Local	PS	VH	
Vascular Plant	Astragalus callithrix		Species Assemblage	MV	VH	
Vascular Plant	Frasera gypsicola		Species Assemblage	HV	VH	
Vascular Plant	Frasera pahutensis		Local	PS	Low	
Vascular Plant	Gentianella amarella		Local	MV	Mod	
Vascular Plant	Nevada holmgrenii			PS	Mod	
Vascular Plant	Oryctes nevadensis		Species Assemblage	MV	VH	
Vascular Plant	Psorothamnus kingii		Species Assemblage	MV	Mod	
Vascular Plant	Draba pedicellata var. pedicellata			PS	Low	
Nonvascular Plant	Meesia triquetra		Local	EV	VH	
Vascular Plant	Schoenus nigricans		Local	PS	VH	Yes
Vascular Plant	Botrychium lunaria		Local	HV	VH	
Vascular Plant	Astragalus porrectus		Local	PS	VH	
Vascular Plant	Salix nivalis		Local	EV	VH	
Vascular Plant	Abronia nana ssp. covillei			PS	VH	

D-2.5 Uncertainty, Limitations and Data Gaps

All of these integrated assessments build upon data and models described in Appendix's A, B and C. In many cases they are relatively simple GIS overlays of the previous data layers todisplay or answer a particular MQ. In some cases they are a bit more complex, such as the restoration analysis presented for Mojave Desert tortoise (MQs # 7 and #8 presented above), where a series of "filters" were applied to remove grid cells not meeting criteria.

Hence the uncertainty and limitations for these integrated assessments are much the same as those pertaining to the models and data used as the inputs to them. Below we summarize a few of these limitations.

Development - A full description of the development change agents and their uncertainty and limitations is detailed in Appendix A. All of the data inputs to these assessments are considered to have high confidence; see however Appendix A for sensitive soils modeling for additional information on those features.Grazing allotment and herd management areas were used as they were received from BLM. It was noted during the analysis that the grazing allotment layer included areas of private or non-federal land and this resulted in some unlikely results, namely the presence of urban development overlap with the (federally owned) grazing allotments. The allotment data did not specify the status of each allotment (open, closed, retired, etc.) so all were treated as open. No additional verification was done regarding the current status of these places by the contractor.

Areas of high potential hydrocarbon energy development – Given the volatile nature of hydrocarbon markets and technologies for extraction, one should take care in the interpretation of these REA findings as they pertain to potential development zones in this sector.

Areas of most likely renewable energy development (i.e., constrained by transmission access) – with some similarities to hydrocarbon development, the sensitivities of investors to factors such as the existing or planned placement of transmission corridors, or the rapid shifts in technology (e.g., heights of wind turbines), can have dramatic effect on the potential for renewable energy development. Our findings should be carefully considered in this light.

Landscape condition models – Following from development change agents, landscape condition modeling is also vulnerable to incomplete representations of surface disturbance. In particular, older roads that have been closed to traffic have been removed or are no longer maintained in roads data, although the effects from surface disturbance persists for decades after closure. Given the settings for landscape condition modeling fall into the realm of expert judgment, there remains considerable potential to test, calibrate, and customize the model used in this REA

Species Distirbutions - Landscape species distributions are typically somewhat generalized, indicating a range of possible areas where the species might be found. Most of these used in this REA were developed by the regional gap analysis projects. However, in order to provide meaningful answers to most management questions, a more rigorous characterization of habitat usage and quality is needed. Just as Mule deer were represented using seasonal range or habitat components (e.g., sumer, winter and year-round range), most landscape species worthy of REA attention require more specific characterization, mapping, and evaluation of seasonal range and/or populations. With this next level of information developed, tools aimed at evaluating landscape linkages, individually suited to each species, can be appropriately applied.

Fire regime models – While a substantial base existed for this REA, as a result of prior national and regional efforts, this area of both conceptual and spatial modeling remains in early stages. One could

expect substantial benefits from regionally customized and field-validation of models for most vegetation types in the ecoregion.

Climate Change Analyses – as described previously, current climate data are limited in this area by a number of factors. Weather stations, forming the basis for characterizing the 1900-1980 'baseline' at 4km^2, have relatively low density with respect to the size of the CBR. For the ongoing 15km^2 analyses, the baseline is restricted to a shorter time period, 1961-1990, and the baseline climate values are model outputs, although strongly forced by observations. Significant climate change was defined based on the variability of climate over these two baseline periods. Given the observed high variability in this basin and range landscape, one should be careful to not over interpret the findings for climate space trends. These analyses are based not only on these 20th century baselines, but upon the rapidly developing science of climate forecasting.

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