Decision Support for Conservation in the Tehachapis and Southern Sierra Nevada

Final Report

CONSERVATION BIOLOGY INSTITUTE

February 2013

Table of Contents

Abstract

The Tehachapi Mountains and southern Sierra Nevada are valued as a biodiversity hotspot, a bird and bat migration corridor, and as a landscape critical to the linkage and functioning of four distinct ecoregions–the Mojave Desert, Sierra Nevada, South Coast, and Central Valley. Decision-makers are evaluating proposals for wind energy and other development on a project-by-project basis without a regional perspective. Using a study area of 4.8 million acres centered on the high wind resource area of the southern Sierra Nevada and Tehachapis, CBI synthesized over 250 datasets to evaluate landscape-scale conservation values across the region. Our goal was to identify where new wind and other development projects could be most compatible with landscape-scale conservation values, prioritize areas for conservation, and provide a regional dataset to support cumulative impact analyses. CBI integrated >50 datasets into a hierarchical logic model and customized modeling software to assess relative conservation values by section (1 sq. mile), based on intactness, connectivity, biodiversity, and disturbance. To address the paucity of bird and bat data, we used surrogates, such riparian and other wetland communities where birds and bats are likely to congregate, and specially designated areas, such as Important Bird Areas.

Model results are presented as (a) ecological value and (b) biological potential and level of disturbance. Results indicate that 72% of the study area is Very High and High Biological Potential with Very Low and Low Levels of Disturbance, 24% is Very High and High Biological Potential with Moderate Levels of Disturbance, and 4% is Very High and High Biological Potential with Very High and High Levels of Disturbance. The data sets and analytical results can inform macro-siting of wind energy and other forms of development, conservation reserve design, and land management planning. To facilitate project review and make datasets and project results transparent and publically available, CBI developed spatially explicit decision-support tools accessible via Data Basin, a free web-based platform for sharing spatial data and customizing spatial analyses and maps.

The decision-support tools are non-proprietary. A video presentation of the project and tools can be viewed at: http://consbio.org/newsroom/events/decision-support-regional-reserve-design-and-siting-renewable-and-infrastructure. To access the datasets, analyses, and tools, please register in DataBasin (www.databasin.org) and join the Tehachapi Conservation work group. Instructions for joining and getting started are available through http://databasin.org/help. CBI will provide orientation on the use of the tools, if requested (541-757-0687).

1. Introduction

The Tehachapi Mountains and southeastern Sierra Nevada are widely valued as a biodiversity hotspot in California and as a landscape critical to the linkage and functioning of four distinct ecoregions−the Mojave Desert, Sierra Nevada, South Coast, and Central Valley. The Tehachapis and surrounding foothills and valley habitats form the only wildland connection between the Sierra Nevada and the Coast and Transverse ranges. This area's vast landscape and diverse topography supports high levels of endemism, numerous rare and endangered species, wintering habitat and migratory stopovers for birds and bats, evolutionary processes, and large areas of climate stability.

This same complex geography also precipitates the collision of hot air masses from the desert and valley with cool air masses from the Sierra Nevada and Coast Ranges, resulting in turbulent and powerful wind conditions (ranked by the National Renewable Energy Laboratory). For this reason, the State of California has identified the Tehachapis and eastern escarpment of the Sierra Nevada as a top priority for wind energy development and important for achieving the State's 33% renewable energy goal by 2020. Developing low-carbon renewable energy is also a national priority. U.S. Forest Service (USFS) and Bureau of Land Management (BLM) lands comprise a large percentage of this area, and land managers must make decisions about siting wind turbines and associated infrastructure on the public lands they administer. The Mojave Desert has also been identified as important for meeting renewable energy goals. The state-led Desert Renewable Energy Conservation Plan (DRECP) area overlaps the eastern part of CBI's study area (Figure 1).

The Conservation Biology Institute (CBI), through a grant from the David and Lucille Packard Foundation, worked with federal and state land management agencies and resource conservation groups to develop a science-based regional planning framework for the wind energy region of the eastern Tehachapi Mountains and southeastern Sierra Nevada. The study area comprises 4.8 million acres of public and private land centered on the high wind resource area of the Tehachapi Mountains and southeastern Sierra Nevada. This region is characterized by many rugged areas without roads that provide important wildlife habitat. While much of the public lands have been designated as wilderness, there are private lands of equivalent value strategically situated between these public lands that provide the necessary habitat connectivity across this landscape.

Goals and Objectives

Currently, energy development applications are reviewed on a case-by-case basis by permitting agencies. The agencies simultaneously must manage natural resources as well as accommodate wind development, but do not have the benefit of integrated data that crosses jurisdictional boundaries. The U.S. Fish and Wildlife Service (USFWS) Land-Based Wind Energy Guidelines (March 23, 2012) recommend assembling available biodiversity data at a regional scale to inform decision-making, which is referenced in the federal requirements as Tier 1 landscape-level assessments. The goal of this project was to support science-based regional planning and decision-making for conservation and wind energy development.

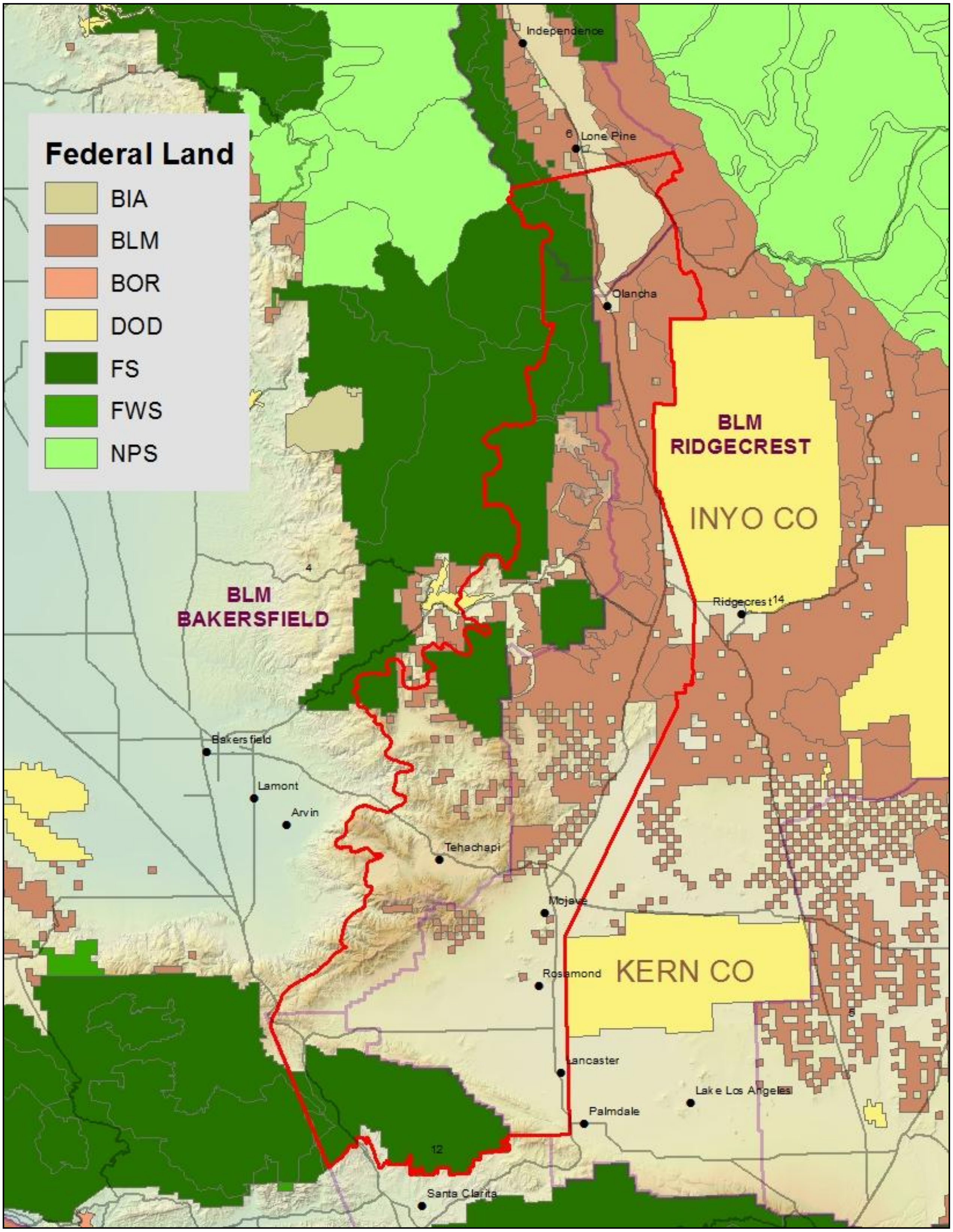

Figure 1. Study Area.

Project objectives were:

- Assemble pertinent available databases of biological resources and disturbance features and make them accessible by multiple agencies, industry, and others on Data Basin (www.databasin.org), a web-based system developed and administered by CBI that connects users with spatial datasets, tools, and expertise.
- Describe impacts of energy development on ecological values and landscape connectivity.
- Develop a customized web-based decision-support logic model to evaluate areas of potential conflict with development on the basis of high ecological values across the landscape as well as for site-specific projects.
- Identify priority data gaps.
- Collaborate with state and federal land management and permitting agencies to develop a regional conservation strategy for avoiding, minimizing, and mitigating impacts to biodiversity and connectivity.
- Apply results to conservation decisions beyond wind, such as DRECP, National Forest planning, wilderness designation, Tehachapi linkage, BLM Areas of Critical Environmental Concern (ACEC), and BLM Regional Management Plans.

2. Overview of the Process

Agency Consultations

Over the course of the project, CBI hosted 10 webinars and workshops in Tehachapi and Sacramento to solicit input and feedback from over 60 agency scientists and managers from the BLM, USFS, USFWS, California Department of Fish and Game (CDFG), California Energy Commission (CEC), and nongovernmental organizations (NGO). The range of agency positions included planning and permitting staff in BLM field offices, eagle and condor biologists, migratory bird specialists, and regulatory staff from USFWS, Threatened and Endangered species biologists and GIS staff from state and federal agencies, members of the California Renewable Energy Action Team (REAT), BLM Project Managers, BLM Deputy State Director, USFS Pacific Crest Trail Director, and numerous biologists and real estate specialists from all four land management agencies. We conducted phone interviews and hosted workshops and webinars throughout the project.

Through discussions with agency staff about their planning and permitting requirements, priorities, and available data, we agreed on the conservation values to be incorporated into a logic model for evaluating the potential of supporting biological values across a large landscape. These include:

- high degree of intactness or integrity
- landscape-scale connectivity, as identified in state and regional analyses
- low level of land use disturbance and few roads
- special vegetation communities and natural features supporting rare species
- areas designated for conservation of birds and other species

These landscape-scale conservation values are threatened by both direct and indirect impacts of any development projects on public and private lands. *Direct impacts* include clearing vegetation for construction, staging areas, helicopter flight areas, access roads and rights-of-way, substations, and power structures. These actions not only result in habitat loss but also pock the landscape with roads, cleared areas, and developed structures, effectively cutting the area into multiple, separate habitat patches. The *indirect or secondary impacts* of this primary action will be realized in habitat fragmentation, disruption of ecological processes, a modified fire regime, reduced resilience to climate change, and air, noise, and water pollution. These indirect impacts are far more insidious, invasive, and difficult to mitigate for or manage than direct impacts.

Data Assembly and Data Gaps

CBI acquired, reviewed, and created over 250 seamless regional data sets pertinent to the focus area from public sources and posted them on Data Basin. We significantly improved the riparian, wetland, and roadless area coverages through review of current aerial imagery. These datasets represent the best available data for defining and evaluating Tier 1 or landscape-level conservation values and potential impacts. Using these datasets, we analyzed intactness and connectivity, one of the primary conservation values for this area. We created a private work group specifically for agencies to upload, download, and view spatial datasets and supporting documents for the project:
http://app.databasin.org/app/groupWorkspace/homePage.jsp?id=173592be2a654205a7e521755c9c375f

CBI assembled a team of science advisors (Appendix A) specifically to help us identify important sources of spatially explicit information on birds and bats. We reviewed all available sources, including Christmas Bird Counts, breeding bird surveys, e-bird lists, California Natural Diversity Data Base, BLM bat population data from mines, and others. Our science advisors concluded that the spotty coverage, spatially and temporally, would not be suitable for inclusion in the logic model. Within 3 months of project initiation, we stressed the following data issues:

- Wind development companies collect data from sites targeted for development, as well as post-installation mortality data (carcass searches). While some of these data are available in report format, there is no centralized GIS database that allows spatial and temporal compilation, peer review and analysis, or use by decision-makers.
- No comparable data are being collected from sites not targeted for wind energy development, yet these are essential for evaluating the overall distribution of birds and bats across the region and the relative significance of wind energy impacts on populations.
- Little if any systematically collected information is available to identify landscape features that may concentrate use by bats and birds, many of which are nocturnal migrants. Data are particularly critical for migrants, considering that different species migrate along different pathways, at different altitudes, and at different times of year and weather conditions. The diverse array of migrants may use a wide range of habitats for stopover, supplying an added level of complexity. This makes modeling of landscape preferences by these species a challenge.
- Publicly available golden eagle and raptor data are limited to nest data on public lands. Eagle and raptor wintering and foraging habitats are not considered, but 17 years of Christmas Bird Counts in Kern County indicate that dozens of migratory, resident, or wintering golden eagles use this area.

- Bat data are limited to point data and mine locations. At least 10 species of bats considered of special concern (Appendix A) are known to breed or migrate through the region, but their numbers and migratory paths are not known. Experts believe that migratory bat species are more vulnerable than resident species, and probably more vulnerable than most passerines.

To compensate for the lack of data, CBI experimented with modeling habitat use by birds and bats based on topographic patterns, using sub-areas with similar geophysical settings, wind, and weather patterns. However, given the complex topography, wide range of seasonal and daily weather patterns, and diverse behavior of bird and bat species, we and our science advisors determined that a modeling approach could not be justified for birds and bats. Therefore, we incorporated the following data layers in the model as surrogates for habitat types and other areas known to be important to birds and bats:

- distance to four different types and sizes of wetland habitats
- density of riparian and wetland habitats
- areas identified as important to birds and bats (e.g., Important Bird Areas designated by Audubon, ACECs identified as important for birds by BLM, Significant Ecological Areas designated for raptors by the County of Los Angeles
- Critical Habitat designated by USFWS

Because of the importance of riparian habitats and other wetlands to these species, we used aerial photography to improve the wetland datasets, especially focusing on canyons with riparian habitat along the eastern Sierra. Birds and bats use the riparian habitats as a source of cover and water during migration and for breeding. We set different thresholds for riparian data in the western and eastern Sierra to further accentuate the importance of wetland habitats in the arid eastern part of the focus area.

As bird and bat data become available, they can be incorporated as a separate component of the model or as an independent overlay to model results to further refine the assessment. For example, the U.S. Geological Survey (USGS) is currently modeling habitat use by California condors in this region, and this will be an important addition to the model.

We initially considered inclusion of human values in the logic model, such as recreational uses, viewshed from the Pacific Crest Trail, military airspace, and residential noise buffers, but the resolution and coverage of the data were not useful in discerning regional patterns.

3. Logic Model and Decision Support Tools

We used 50+ of the datasets we compiled for incorporation into the model. The logic model is a hierarchical description of the decision rules and data sets used to map ecological values; therefore, it serves as the conceptual framework for explicitly defining the logic and datasets used for our evaluation process and for future decision-making based on that process. We used one section of land (1 square mile or 640 acres) as the unit of evaluation. The model allows integration of disparate data sets of differing resolutions, and it scores each section of land for each of the conservation values in the model, as well as levels of disturbance, based on thresholds set by the user. CBI developed new software to run the model using Data Basin.

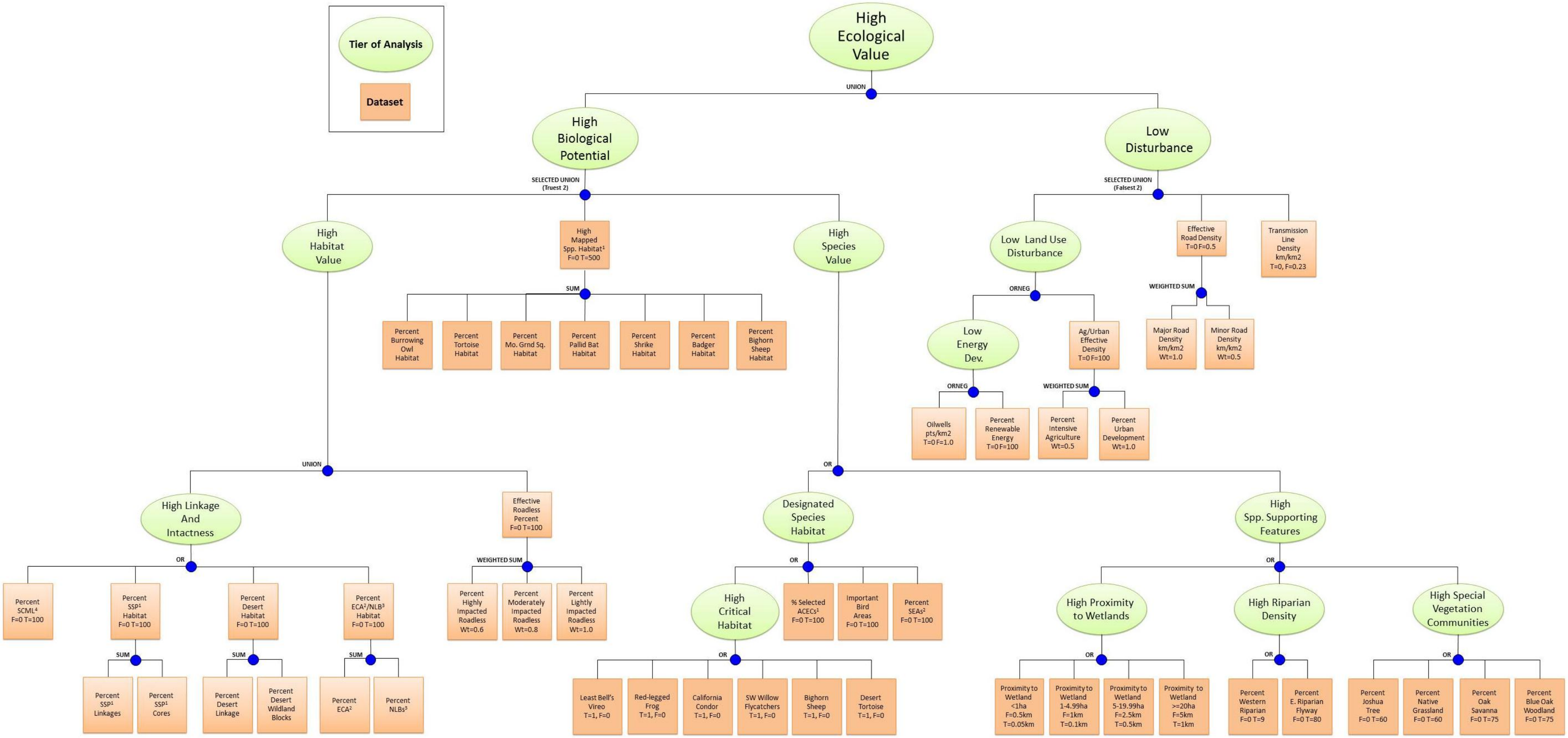

Figure 2. Logic Model.

CBI developed a Logic Model Explorer tool within Data Basin to visualize landscape-scale results at every hierarchical level of the model, the specific data layers that comprise the results, and at every evaluation unit of the model, thus allowing the transparency and flexibility needed by agencies in project review. We also created a Project Impacts Calculator tool for use in Data Basin that calculates linear, point, and polygon features (e.g., roads, streams, wetlands, special habitats, species point locations) within a proposed project area and generates a detailed summary of the results at a site-specific scale.

The decision-support tools are non-proprietary. A video presentation of the project and tools can be viewed at: http://consbio.org/newsroom/events/decision-support-regional-reserve-design-and-siting-renewable-and-infrastructure

Table 1. Logic model results for the Tehachapi and Southern Sierra focus area.

Ecological Value	Acreage	%
Very High	1,916,237	40
High	1,408,218	29
Moderate	1,030,269	21
Low	413,249	9
Very Low	65,774	1
Total	4,833,747	100

4. Results

The model results confirmed the overall ecological value of the 4.8 million-acre focus area, with over 2/3 of the focus area ranking as Very High or High (Table 1).

The two primary intermediate results driving *Ecological Value* in the logic model are *High Biological Potential* and *Level of Disturbance* (Figures 2, 3, 4; Table 2). Understanding the relationship between these two factors can help land managers make decisions about which areas may be more suited for conservation (areas with high biological potential and low disturbance), which areas may be more suited for development (areas with low biological potential and high disturbance), and which areas might benefit from additional management (high biological potential with a moderate to high level of disturbance). For example, there are many portions of public lands that have very high biological value but are currently open for multiple uses. Agencies can use the model results to help determine where the management focus should be on biological resources instead of multiple uses and can develop conservation goals and objectives for different parts of the region, based on the conservation values that score high in a particular area. CBI also developed an example of how the model results could be used to develop a "reserve design" (Figure 5), guided by the sections with very high and high biological potential and moderate, very low, and low disturbance.

Table 2. Biological Potential and Level of Disturbance by percent of total.

Biological Potential	Level of Disturbance			
	Very Low and Low	Mod.	High and Very High	Total
Very Low and Low	3.3%	2.8%	0.1%	6.2%
Moderate	9.6%	5.8%	0.8%	16.2%
High and Very High	72.4%	23.6%	4.0%	100%

The model summarizes landscape-scale conservation values on a relative scale and does not preclude the need for site-specific analyses. Because of the relativity of the results, even lands with high levels of disturbance or low ecological value at this regional scale may be important foraging and movement areas or "steppingstones" for birds, bats, and other species. Cumulative impacts analyses are needed to fully understand direct impacts to populations and indirect impacts to landscape integrity.

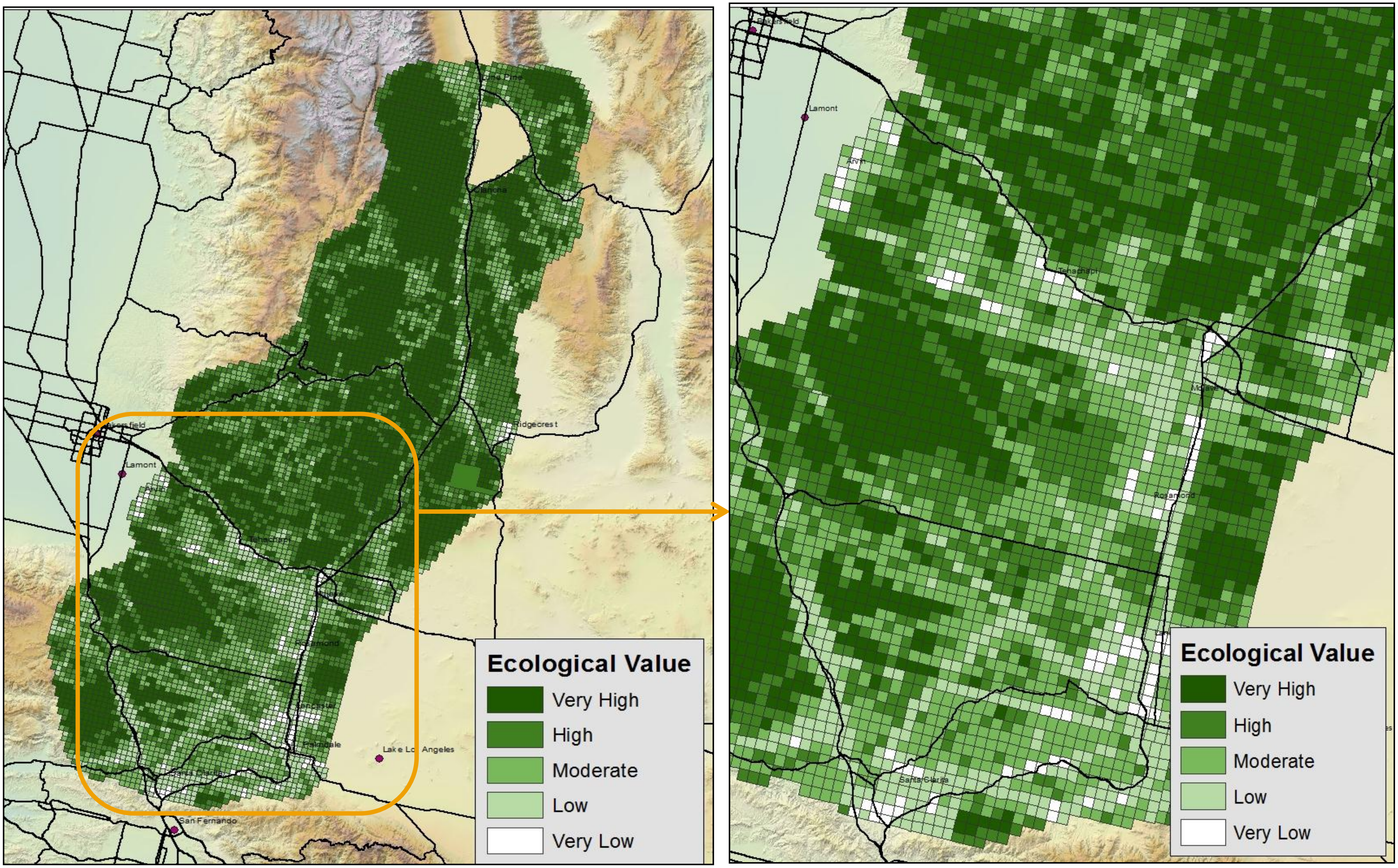

Figure 3. Ecological Value Model Results.

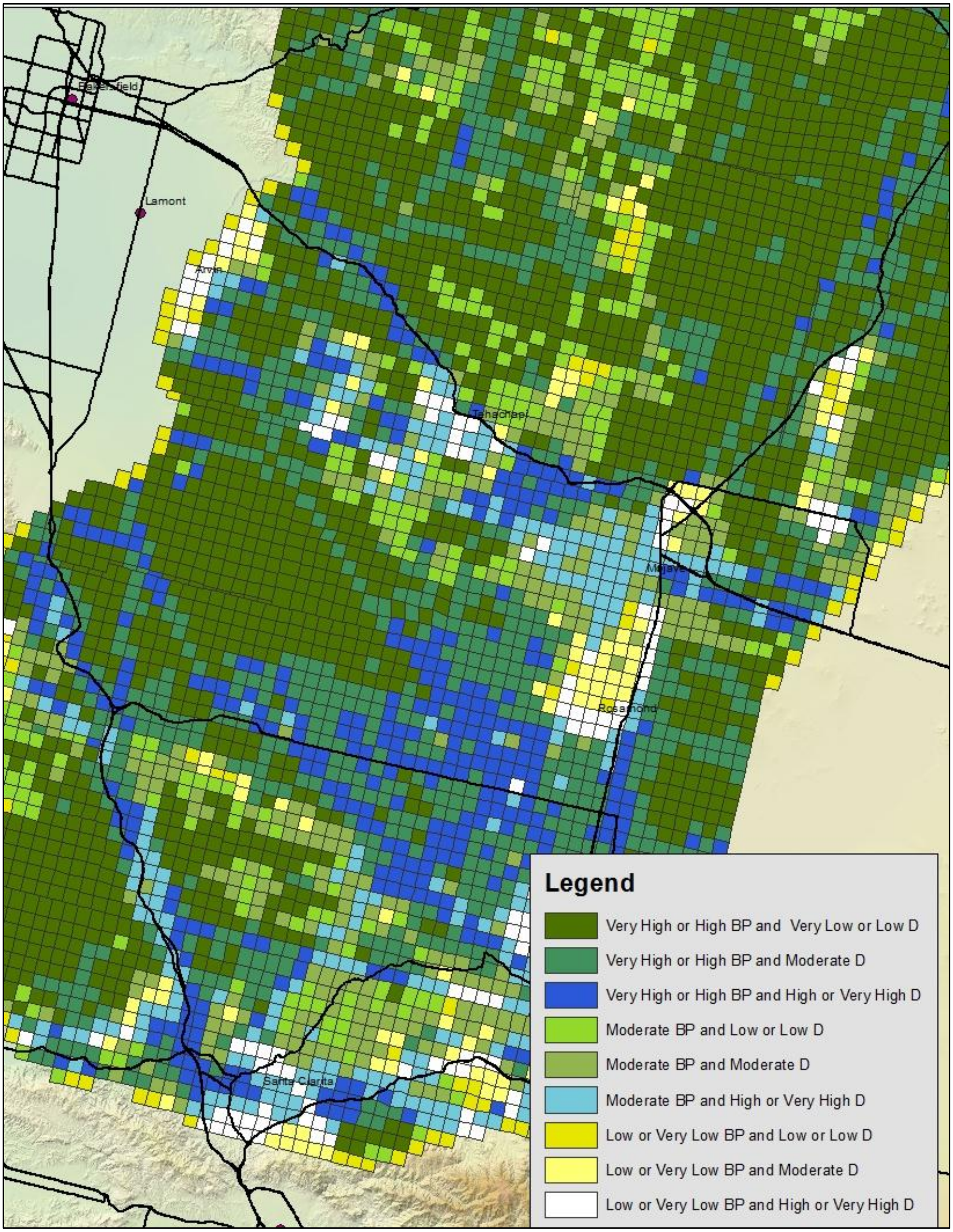

Figure 4. Biological Potential and Level of Disturbance.

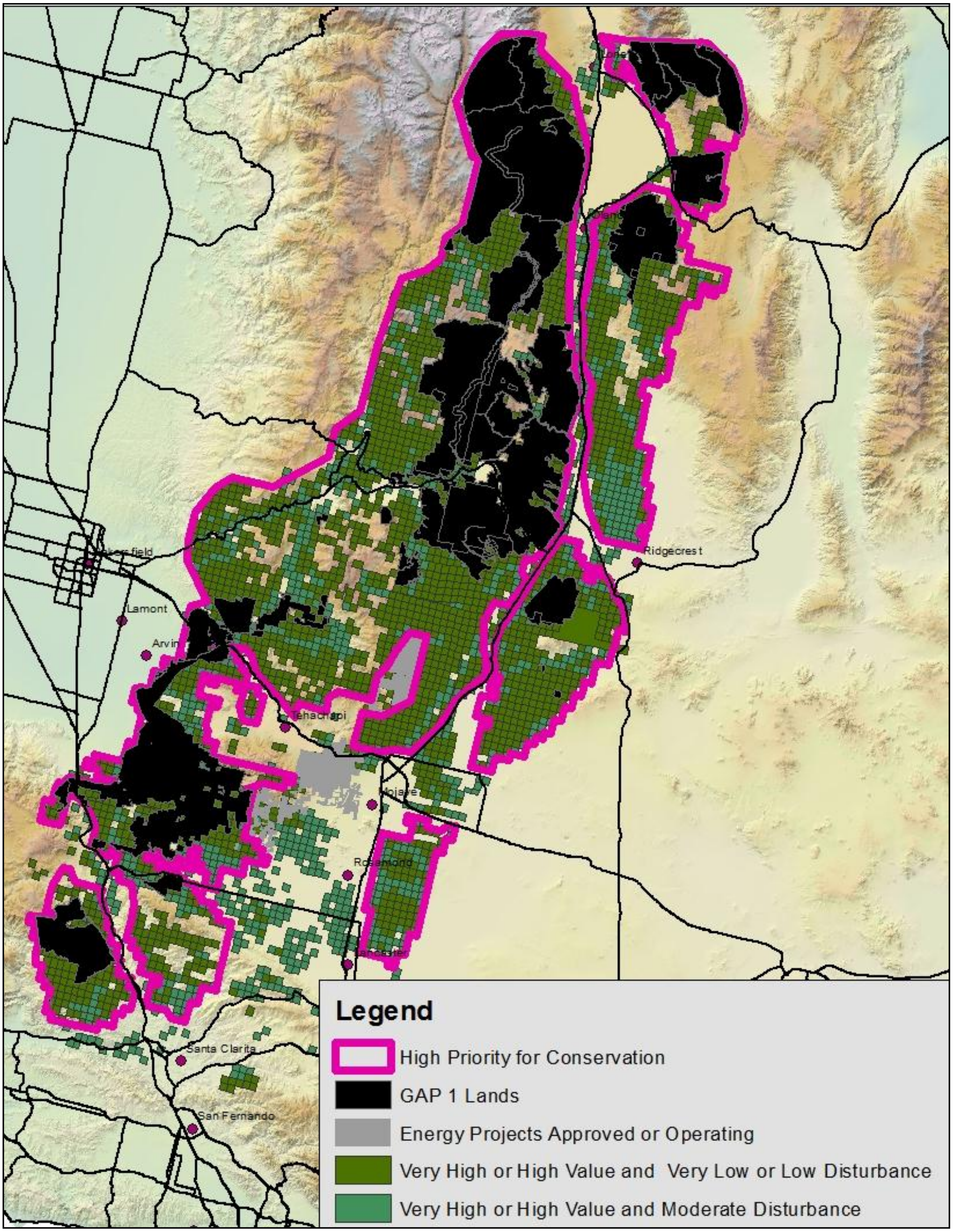

Figure 5. High Priority for Conservation.

Appendices

A. Science Advisors

B. Target Species

APPENDIX A
Science Advisors

Dick Anderson, California Energy Commission (retired)

Pete Bloom, Bloom Biological, Inc.

Frank Davis, Univ. of California, Santa Barbara

Jay Diffendorfer, USGS Rocky Mountain Science Center

Andrew Farnsworth, Cornell Lab of Ornithology

Kimball Garrett, Los Angeles Natural History Museum

Geoff Geupel, PRBO Conservation Science

Judd Howell, American Wind Wildlife Institute (retired)

Joe Kiesecker, The Nature Conservancy, Wyoming

Ted Weller, Pacific Southwest Research Station

Appendix B. Potential target species for analysis of development in the southern Sierra and Tehachapis

Common Name	Scientific Name	Conservation Status
PLANTS		
Piute cypress	*Cupressus nevadensis*	
Kelso Creek monkeyflower	*Mimulus shevockii*	
Alkali mariposa lily	*Calochortus striatus*	Species of concern
Lane Mountain milkvetch	*Astragalus jaegerianus*	Endangered
Parish's Phacelia	*Phacelia parishii*	Species of concern
Bakersfield cactus	*Opuntia basilaris* var. *treleasei*	Endangered
Carbonate endemic plants		
HERPS		
Tehachapi slender salamander	*Batrachoseps stebbinsi*	Under review
Mojave fringe-toed lizard	*Uma scoparia*	
Desert tortoise	Gopherus agassizii	Threatened
Southwestern pond turtle	*Clemmys marmorata*	
California red-legged frog	*Rana draytonii*	Threatened
Foothill yellow-legged frog	*Rana boylii*	Species of concern
BIRDS		
Hummingbird migrants spp.		
California condor	*Gymnogyps californianus*	Federally endangered
Red-tailed hawk		
Turkey vulture	*Cathartes aura*	
Prairie falcon	*Falco mexicanus*	
Golden eagle	*Aquila chrysaetos*	SSC
Swainson's hawk	*Buteo swainsoni*	State Threatened
Ferruginous hawk	*Buteo regalis*	
Rough-legged hawk	*Buteo lagopus*	SSC
Burrowing owl	*Athene cunicularia*	SSC
Mountain quail	*Oreoartyx pictus*	
Southwestern willow flycatcher	*Empidonax traillii extimus*	Federally endangered
Yellow warbler	*Dendroica petechia brewsteri*	SSC
Least Bell's vireo	*Vireo bellii pusillus*	Federally endangered
Loggerhead shrike	*Lanius ludovicianus*	
Bendire's thrasher	*Toxostoma bendirei*	
Grasshopper sparrow	*Ammodramus savannarum*	SSC
Vesper sparrow	*Pooecetes gramineus*	
Brewer's sparrow	*Spizella breweri*	
Sage thrasher	*Oreoscoptes montanus*	
Purple martin	*Progne subis*	SSC
American white pelican	*Pelecanus erythrorhynchos*	SSC

Common Name	Scientific Name	Conservation Status
Long-billed curlew	*Numenius americanus*	
Mountain plover	*Charadrius montanus*	Proposed threatened
MAMMALS		
Townsend's long-eared bat	*Corynorhinus townsendii*	SSC
Pallid bat	*Antrozous pallidus*	SSC
Hoary bat	*Lasiurus cinereus*	None (but a frequent turbine mortality species)
Big free-tailed bat	*Nyctinomops macrotis*	SSC
Pocketed free-tailed bat	*Nyctinomops femorosaccus*	SSC
Western mastiff bat	*Eumops perotis*	SSC
Western red bat	*Lasiurus blossevillii*	SSC
Long-eared bat	*Myotis evotis*	SSC
Fringed myotis	*Myotis thysanodes*	SSC
Long-legged bat	*Myotis volans*	SSC
Tehachapi pocket mouse	*Perognathus alticolus inexpectatus*	SSC
Yellow-eared pocket mouse	*Perognathus parvus xanthonotus*	SSC "Watch List" and likely new MSSC
Mohave ground squirrel	*Xerospermophilus mohavensis*	State threatened
American badger	*Taxidea taxus*	SSC
Sierra Nevada bighorn sheep	*Ovis canadensis californiana*	State and federally endangered
Peninsular bighorn sheep	*Ovis canadensis peninsularis*	SSC and federally endangered
Desert bighorn sheep	*Ovis canadensis nelson*	SSC
Pronghorn	*Antilocapra americana*	SSC