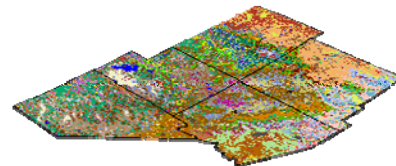
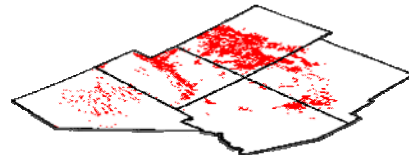
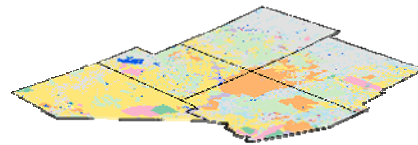
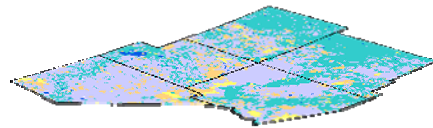




# Ecoregional Gap Analysis of the Southwestern United States



The Southwest Regional  
Gap Analysis Project  
*Final Report*

*December 2007*

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# **Ecoregional Gap Analysis of the Southwestern United States**

## **The Southwest Regional Gap Analysis Project Final Report**

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# DEDICATION

This report is dedicated to the people and wild resources of Arizona, Colorado, Nevada, New Mexico, and Utah.



Photo from SWReGAP Training Site Image Library

# EXECUTIVE SUMMARY

The Gap Analysis Program is a national program with the mission of developing key datasets needed to assess biological diversity across the nation. The primary objectives of the Gap Analysis Program are: (1) Land Cover Mapping – to map the distributions of natural communities; (2) Animal Habitat Modeling and Mapping – to map the predicted habitat of native animal species; (3) Stewardship Mapping – to map the degree of management for biodiversity maintenance of land tracts focusing on intent; (4) Gap Analysis – to analyze the representation of biotic elements in the conservation network to identify “gaps” in long-term security; and (5) Data Distribution – to provide this information to the public and those entities charged with land use research, policy, planning, and management.

The Southwest Regional Gap Analysis Project (SWReGAP) was a mapping and assessment of biodiversity for the five-state region encompassing Arizona, Colorado, Nevada, New Mexico, and Utah. The area comprises approximately 150 million hectares (560,000 square miles) representing 1/5 the coterminous United States. The primary objective of the project was to use a coordinated approach to create detailed, seamless maps of the land cover, habitat for native terrestrial vertebrate species, land stewardship, and management status for the Southwest region. This information was analyzed to identify animal species habitats and natural land cover types that are underrepresented on land managed for their long term conservation. SWReGAP was a multi-institutional effort with scientists based in all five southwest states. Regional land cover mapping activities were coordinated by the Remote Sensing/GIS Lab at Utah State University. Animal habitat modeling, stewardship mapping, and gap analysis activities were coordinated for the region by the U.S. Geological Survey’s New Mexico Cooperative Fish and Wildlife Research Unit at New Mexico State University. Other institutional partners included: U.S. Geological Survey’s Southwest Biological Science Center/Colorado Plateau Research Station, Colorado Division of Wildlife, Bureau of Land Management/National Science and Technology Center, Natural Resource Ecology Lab at Colorado State University, U.S. Environmental Protection Agency/National Exposure Research Laboratory, and NatureServe.

## **Data Development**

### Land Cover

The land cover map for the five-state region was developed using Landsat Enhanced Thematic Mapper (ETM+) imagery selected from 1999-2001 for three seasons: spring, summer, and fall. A total of 237 scenes were selected for the region focusing on optimal representation of seasonal phenology and minimal cloud cover. Approximately 93,000 field samples were collected to train the land cover modeling effort. This “ground truth” data was collected over the course of three field seasons from 2001-2003. The region was divided into 20 ecologically and spectrally similar mapping zones that provided a functional working area for project management, data collection, and modeling.

The focus of the mapping effort was on natural and semi-natural systems. The basic thematic mapping unit was the ecological system concept developed by NatureServe (Comer et al. 2003). Ecological systems represent recurring groups of biological communities that are found in similar physical environments and are influenced by similar dynamic ecological processes. They are intended to provide a thematic mapping unit mappable at a meso-scale level from remotely sensed imagery. Altered and disturbed land cover and land use classes were incorporated into the SWReGAP legend using descriptions adopted from either the National Land Cover Dataset 2001 legend (e.g. Agriculture, Developed-Medium-High Intensity) (Homer et al. 2004) or were given a special “altered or disturbed” designation within the SWReGAP legend (e.g. recently burned, invasive annual grassland, etc).

Several avenues for image classification were investigated before choosing the decision tree classifier. An important consideration was the need to develop a common methodology that could be applied by each state land cover team to create a regionally consistent product. The majority of natural and semi-natural land cover classes were modeled using a decision tree classifier. However, recognizing that the classifier had difficulty discriminating certain classes adequately, other methods were employed to map these classes.

The final SWReGAP land cover map contains 125 land cover classes, 109 of which are ecological systems. The data set retains the 30 meter pixel resolution of the core data sets with a minimum mapping unit of 1 acre (0.40 hectares). The natural land cover of the region is largely dominated by shrub/scrub ecological systems (37% of the region), followed by grassland/herbaceous systems (23%), evergreen forests (22%), barren lands (5%), woody wetlands (3%), deciduous forest (2%), mixed forest (<1%) and emergent herbaceous wetlands (<1%). Agricultural areas compose 5.6% of the region, altered or disturbed areas (1.5%), developed areas (1.1%), and open water (0.8%).

Assessing land cover map quality is an important concern for land cover mapping projects. We consider our approach an internal validation: “validation” in the sense that our purpose is to validate the quality of the map, and “internal” because we use data collected for, and used within, the modeling process (Shtatland et al. 2004). The internal validation involved randomly selecting 20 percent of available samples stratified by land cover class, and withholding them from the decision tree model generation. The intermediate map (generated with 80 percent of the available samples) was assessed with the 20 percent withheld dataset, producing an error matrix and kappa statistic. Of the 125 land cover classes mapped, 40 classes were not assessed regionally because of limited validation plots or they were non-natural classes and not the primary focus of the mapping effort. These 40 classes comprise approximately 9.5% of the region.

The 85 classes that were validated represent 91% of the region and overall correct classification for these classes was 61% (KHAT statistic = 0.60; n = 17, 030). It is important to recognize that validation results vary by land cover class and by mapping zone. Lastly it is important to note that the validation results are based on the

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intermediate land cover map using the 20% withheld dataset. Since the final map was produced using the withheld samples, we assume the final map is an improvement over the intermediate map that was validated.

### Predicted Animal Habitat Distributions and Species Richness

SWReGAP developed models for a total of 819 terrestrial vertebrate species, including 37 species of amphibians, 130 species of reptiles, 437 species of birds, and 215 species of mammals. Taxa inclusion decision rules were developed to identify this final list of 819 species for modeling. These rules described circumstances under which a species would not be modeled. For instance, taxa with only incidental or vagrant occurrence in the region would not be modeled. Taxa allocation decision rules were developed to help in distributing the lead modeling responsibilities among the states. These rules focused on the overall distribution of the species and attempted to capitalize on previous modeling experience and expertise. For instance, if a species occurred in only one state then that state would be assigned lead modeling responsibility for that species.

The Sub-basin hydrological units (8-digit HUC) were used to delineate ranges for each species. A three-character coding system was used to label the HUCs for species ranges. These characters corresponded to distribution, reproduction, and seasonal use. The coding for historic/recent distribution was known (K), potential (P), or extirpated (X). Absence is implied for all polygons not attributed. This base coding system was modified based on reproductive use (breeding, non-breeding, both) and seasonal use (migratory, wintering, summering, year-round). A wide variety of sources were used for species range delineation, emphasizing the most recent published literature.

Wildlife Habitat Relationships (WHRs) are statements describing resources and conditions present in areas where a species persists and reproduces or otherwise occurs. Relationships can be modeled to predict habitat composition. WHRs were developed from a variety of sources including previous state GAP efforts. Project personnel identified a set of standard state and regional references to use as a starting point for the modeling effort. This information, along with online databases such as the NatureServe Explorer database, Biota Information System of New Mexico, and internal databases such as the Colorado Wildlife Species Database was reviewed. WHRs were constructed following a standard protocol that provided a user interface / template, automated tools, and associated reference information for defining range limits and compiling habitat associations for each species. Regional vegetation alliances were one of the primary components of the WHR models. The core set of data layers that were addressed for each WHR model included land cover (SWReGAP land cover map), elevation, slope, aspect, hydrology (distance to hydrologic features), and soils. Other layers addressed in the habitat-modeling protocol were mountain ranges, temperature, precipitation, and landform.

To facilitate habitat modeling a set of Microsoft Access<sup>™</sup> databases were created based on the recommendations of Deitner et al (1999). The resulting databases are a tool for modeling and for end-users. The FrontEndArc9 database provided a series of forms or wizards that guide the modeler through the habitat model. The draft models and

associated data (report, range, model) were then submitted for expert review. Reviewers included staff from Federal and State agencies (such as State wildlife and natural resources agencies), university scientists, and private individuals and groups familiar with species occurrence and natural history in the Southwest (e.g. the Great Basin Bird Observatory in Nevada). The reviewers were asked to identify their level of confidence in the overall model, the range limits, the report content, and the individual datasets used in modeling. SWReGAP received more than 1,000 reviews covering most of the species that were modeled.

The standard Gap Analysis assessment is a measure of agreement to describe the degree of concurrence between habitat model predictions, and species occurrences as documented by inventory studies. We obtained 14 species lists from the National Park Service (NPS) Inventory and Monitoring (I&M) program for the Northern Colorado Plateau network and have identified data from the southern Colorado Plateau Parks (including northern Arizona and Northern New Mexico), and the Sonoran Desert network of National Parks (including southern Arizona and southern New Mexico). We conducted an initial assessment on species lists for the Northern Colorado Plateau NPS network. This assessment, however, identified a bias in the outcome because accidental, rare, and occasional species were included with the species lists. Our protocol for identifying species and mapping habitat eliminated these species based on these factors. Thus, omission error is significantly increased by using this data. We have omitted that analysis from this report in an effort to further refine the assessment and provide more accurate analysis.

GAP has often been associated with the mapping of species-rich areas or “hotspots.” Richness maps identify where the same numbers of elements co-occur in the same geographic locations. Total species richness is highest in southwestern New Mexico and southeastern Arizona (438-492 species). This area includes the Madrean Archipelago and is influenced by species ranging north from Mexico. In New Mexico, relatively high richness (391-437 species) occurs throughout the Rio Grande Valley. The Front Range of the Rocky Mountains in Colorado is identified as having relatively high species richness. This is due in part to the presence of Great Plains species and Rocky Mountains species. The Colorado River including the Lake Mead area is also relatively high in species richness. It is important to note that overall richness is weighted heavily by the number of bird species within the project area.

To our knowledge these models represent the first regional habitat models for vertebrate species at this resolution for the American Southwest. We anticipate that as these models are used the end-users will identify needed modifications. The intent of the dataset and associated GIS tools is to provide the ability for model modification and end-user functionality. The maps of species habitat distributions may be used to answer a wide variety of management, planning, and research questions on individual species or groups of species. In addition to the maps, great utility may be found in the literature references that are assembled into the databases used to produce the maps.



## Land Stewardship and Management

The term "stewardship" is used to describe the quality of land management that is collectively the land ownership of a parcel and the legal and administrative mandates that guide the management of the parcel as it affects the long-term maintenance of biodiversity. Land stewardship was mapped in two phases: (1) documentation of land ownership; and (2) assignment of biodiversity management status codes.

Existing digital ownership datasets provided a baseline of ownership boundaries for each state in the region. Base ownership data came from the Bureau of Land Management (BLM) for the states of Nevada, New Mexico, and Utah. The Arizona ownership data coverage is published by the Arizona State Land Department and Arizona Land Resource Information System. The Colorado ownership data was gathered in coordination with the Colorado Ownership, Management, and Protection (COMaP) project at the Natural Resource Ecology Lab (NREL), Colorado State University. These base ownership data layers distinguished general administrative land ownership by private, state, and federal categories. In most cases, federal and state lands were then further divided by managing entity such as BLM, National Park Service (NPS), or State Trust Lands. Special management areas, such as wilderness, and other internal management units were often not delineated in these baseline ownership datasets. Additional boundary information for special management units or other internal boundaries was also collected via the Internet or from agency GIS personnel.

Base data layers for each state were then converted to a common projection system and loaded into the SWReGAP geographic database (geodatabase). The geodatabase was structured to meet GAP standards and included domains described by the GAP Management Coding System. This Coding System assigns a four-digit code to each land management descriptor. For example, a BLM National Monument would be assigned a code of 1104. Additional attributes such as the GAP biodiversity management status code, individual parcel name, and source of the digital data were added to the geodatabase attribute table for each parcel.

Each stewardship parcel was assigned a GAP management status code using a scale of 1 to 4 to denote relative degree of maintenance of biodiversity for each tract. Status 1 and 2 represent permanently protected lands that are managed for biological diversity, Status 3 lands are those lands under a management plan that prevents conversion to non-natural cover types but are subject to extractive uses of either a broad, low-intensity type or localized intense type, and Status 4 represents those lands that are not managed for biodiversity or are not under a management plan. Status codes were determined by consulting management plans if they existed or interviewing agency personnel using a standardized questionnaire. To minimize variability in assigning management status codes a dichotomous key was used to ensure consistent assignment of codes. The dichotomous key guides users through a series of questions related to management documentation, legal protection, percentage of land in anthropogenic use, and management for natural processes.

External review meetings were held in each state to allow agency experts to review and comment on the stewardship data layer for that state. Attendees were able to provide their comments on the accuracy of boundary and ownership information, as well as the management status codes that were assigned to land parcels.

In the Southwest region, federal agencies account for the largest land steward category managing over 51% of the landscape. BLM is the largest federal land steward accounting for over 30% of the total land area. The U.S. Forest Service (USFS) is the second largest federal land steward accounting for 14% of the area. Private lands are the second largest land steward category in the region comprising 30% of the region's lands. Tribal lands and State managed lands account for 9% and 8% respectively. Regional and local government lands, non-governmental organization lands, and water bodies comprise the smallest proportion of land stewards each contributing less than 1% to the overall area.

A review of the protection status of lands in the region shows that Status 1 lands comprise 3% of the region. Stewards managing these lands include 40% managed by National Park Service, 33% managed by U.S. Fish and Wildlife Service, 21% by USFS, and 7% by BLM. State lands and non-governmental organizations account for less than 1% of Status 1 lands. Status 2 lands comprise 9% of the region. The largest land steward in this category is the BLM which manages 57% of these lands. Other land stewards include 26% managed by USFS, 5% managed by U.S. Fish and Wildlife Service, and 4% managed by state wildlife agencies. Status 3 lands comprise 50% of the region. BLM manages 51% of Status 3 lands, USFS manages 23%, and Native Americans manage 17%. Status 4 lands comprise 38% of the region. Private land stewards manage over 80% of these lands, with State Land Board lands managing 17%.

## **Analyses**

By intersecting the land stewardship and management status maps with the land cover and animal-habitat species distribution maps, estimates were produced of the total area and percent of the mapped distributions for every land cover class and animal species within each land stewardship and management status category. Calculations were generated for the entire 5-state region as well as for each state individually. As a coarse indicator of the conservation status of the elements, we identify for every land cover type and animal species, the proportion of its distribution that falls within Status 1 and 2 lands according to five levels of representation: 0-<1%, 1-<10%, 10-<20%, 20-<50%, and >=50%.

### Land Cover

Approximately 11.5% (160,183 km<sup>2</sup>) of the 5-state region falls within GAP Status 1 or 2. In general, land cover classes at higher elevations are more likely to have a larger proportion of their total distribution within GAP Management Status 1 and 2 than lower elevation land cover classes, because much of the higher elevation land is under government stewardship with a mandate to protect biodiversity (e.g. Wilderness Areas).

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Six ecological systems in the region have less than 1% of their distribution within Status 1 and 2 lands. These include: one barren type, one shrub/scrub type, one emergent herbaceous wetland system, and three grassland/herbaceous systems. With one exception (*Western Great Plains Shortgrass Prairie*) they are mostly rare, small patch types or peripheral types that occur on the edge of their range within the SWReGAP project area. Thirty-four ecological systems have between 1 and <10% of their distribution within Status 1 or 2 lands. Twenty-one of these ecological systems are relatively uncommon (<10,000 km<sup>2</sup> mapped in the region) and all but one (*Inter-Mountain Basins Wash*) of the 6 rarest types (<200 km<sup>2</sup> mapped), are peripheral to the region. Twenty-seven ecological systems have between 10 and <20% of their distribution in Status 1 or 2 lands. These ecological systems occur in a wide variety of environmental settings, from areas of high elevation with subalpine forests and wetlands to playas and salt desert scrub. Types of ecological systems include: 4 riparian systems, 1 aspen and 1 aspen-mixed conifer system, 2 montane grassland systems, 2 dune systems, and 1 badland system. Thirty-five ecological systems have between 20 and <50% of their distribution in Status 1 and 2 lands. Many of these ecological systems include lower- to mid-elevation forests and rock outcrops (e.g. barren lands). Seven ecological systems have greater than 50% of their distribution in Status 1 and 2 lands. With the exception of one somewhat rare system (*Sonora-Mojave Semi-Desert Chaparral*), all occur in higher elevation (alpine and subalpine) zones.

#### Predicted Animal Habitat Distributions

Twenty-five species (3% of those modeled) have less than 1% of their habitat on Status 1 and 2 lands within the region. These include 18 bird species, 4 reptiles, 2 mammals, and 1 amphibian. Several of these species, such as the lesser prairie-chicken, are already the subject of conservation planning. There are 288 species (35% of modeled species) with predicted habitat of between 1 and less than 10% on status 1 and 2 lands. These include 14 amphibian species, 144 bird species, 78 mammal species, and 52 reptile species. There are 385 species (47% of modeled species) with 10-<20% of their predicted habitat on status 1 and 2 lands within the entire region. These include 18 amphibian species, 219 bird species, 107 mammals, and 41 reptiles. There are 108 species (13 % of those modeled) with 20-<50% of their predicted habitat on status 1 and 2 lands. These 108 species include 4 amphibian species, 47 bird species, 26 mammal species, and 31 reptile species. Eleven species (1% of those modeled) have predicted habitat occurring on status 1 and 2 lands greater than 50%. These species include 7 birds, 2 mammals, and 2 reptiles. Birds include Clapper rail, dunlin, black tern, sedge wren, tricolored blackbird, brown-capped rosy-finch, and Mexican chickadee. Mammals include Palmer's chipmunk and mountain goat. Reptiles include Sonoran shovel-nosed snake and ridge-nosed rattlesnake.

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## Conclusions

The Southwest is home to a diverse assemblage of plant and animal species largely, due to the complex topography, geology, soils, and climate patterns that occur throughout the region. This area faces many threats that affect not only biological resources, but the human populations that may directly or indirectly depend on their sustainability. Adverse factors include prolonged drought, invasive plant and animal species, over-utilization by livestock, altered fire regimes, increased land development and recreational demands, soil erosion, stream channelization, consumptive water use, oil and gas exploration, habitat fragmentation and conversion, over-harvesting of certain plants and animals, population isolation, and disease.

Throughout the 5-state region, 11.5% of the total land base has been identified as providing protection for biodiversity in Status 1 and 2 lands. The majority of this (46%) is managed by BLM (largely associated with National Monuments), followed by U.S. Forest Service (25%), U.S. Fish & Wildlife Service (11%), and National Park Service (11%). Forty ecological systems and 309 terrestrial vertebrate species have less than 10% of their regional distribution within Status 1 and 2 lands. An additional 36 ecological systems and 107 terrestrial vertebrate species have greater than 10% of their distribution, but less than 500 km<sup>2</sup> total area within Status 1 and 2 lands. Ecological systems and terrestrial vertebrate species that have less than 10% of their distribution or less than 500 km<sup>2</sup> absolute areal coverage in Status 1 and 2 lands may be under-represented and point to “gaps” in their conservation (Schrupp et al. 2000). Although other major land stewards in the region (e.g. private (comprising 30% of the 5-state area), tribal (9%), and state land board (7%)) may not always achieve the legal mandate for conservation management, their lands may in fact provide protection for certain species and land cover types. It is important to consider the potential that each land steward may provide as a partner in conservation, particularly at local and ecoregional scales.

As a separate effort, but in parallel with SWReGAP, each of the five states recently completed their State Wildlife Action Plan (SWAP). These strategies identify species of greatest conservation need (SGCN) and key habitats specific to each state. Also included in these reports is detailed information about the threats facing the different habitat types. The SWAP is a useful companion to SWReGAP for prioritizing ecological systems and species that require focused conservation efforts both within and between the Southwest states.

We identified three categories of management concern to prioritize ecological systems and terrestrial vertebrate species that may require additional attention. The criteria used for these categories are the following: first priorities are ecological systems and predicted animal habitats with distributions of <1% within Status 1 and 2 lands; second priorities are those with between 1 and 10% in Status 1 or 2 lands; and third priorities are those with >10% but <500 km<sup>2</sup> in Status 1 or 2 lands. We applied these criteria to the region and each state to enumerate their respective priority conservation concerns. Within the region, six ecological systems and 25 terrestrial vertebrate species were identified as first

priority management concern. Of the 25 vertebrate species identified as priorities, 11 species were also identified as SGCN by the State Wildlife Action Plans.

Application of SWReGAP data into conservation planning has already occurred at varying levels within state and federal agencies. An outreach effort has been initiated to provide agencies with help in understanding and implementing SWReGAP data in their conservation activities. These efforts further enhance the SWReGAP data set, providing an even greater foundation for future work by other agencies. For example, state wildlife agency use of SWReGAP animal habitat models should extend beyond the wildlife action plans to planning efforts of state land offices, parks, and other state agencies. SWReGAP data provides another tool for land managers to use in conservation planning and application in concert with current and future data sets (e.g., TNC Ecoregion Analysis, State Wildlife Action Plans). These and other tools when combined with human intellect have the capacity to provide for long term conservation in the Southwest.



Photo from SWReGAP Training Site Image Library

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# CHAPTER 1

## INTRODUCTION

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Photo from SWReGAP Training Site Image Library

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# HOW THIS REPORT IS ORGANIZED

This report is a summation of a scientific project. While we endeavor to make it understandable for as general an audience as practicable, it reflects the complexity of the project it describes. A glossary of terms is provided to aid the reader in understanding the report; and for those seeking a detailed understanding of the subjects, the cited literature should be helpful. The organization of this report follows the general chronology of project development, beginning with the production of the individual data layers and concluding with analysis of the data. It diverges from standard scientific reporting by embedding results and discussion sections within individual chapters. This was done to allow the individual data products to stand on their own as testable hypotheses and provide data users with a concise and complete report for each data and analysis product.

We begin with an overview of the Gap Analysis Program mission, concept, and limitations. We then present a synopsis of how the current biodiversity condition of the project area came to be, followed by chapters describing data development for land cover mapping, predicted animal habitat distribution, species richness, and land stewardship mapping and categorization. Data development leads to the Analysis chapter, which reports on the status of the elements of biodiversity (land cover and animal species), for the Southwest region. Finally, we describe the management implications of the analysis results and provide information on how to acquire and use the data.

## **The Gap Analysis Program Mission**

The mission of the Gap Analysis Program (GAP) is to prevent conservation crises by providing conservation assessments of biotic elements (plant communities and native animal species) and to facilitate the application of this information to land management activities. This is accomplished through the following five objectives:

- 1) map actual land cover as closely as possible to the alliance level (FGDC 1997).
- 2) map the predicted distribution of habitat for those terrestrial vertebrates and selected other taxa that spend any important part of their life history in the project area and for which adequate distributional habitats, associations, and mapped habitat variables are available.
- 3) document the representation of natural vegetation communities and animal species in areas managed for the long-term maintenance of biodiversity.
- 4) make all GAP project information available to the public and those charged with land use research, policy, planning, and management.
- 5) build institutional cooperation in the application of this information to state and regional management activities.

To meet these objectives, it is necessary that GAP be operated at the regional or state level, but maintain consistency with national standards. Within the region, participation by a wide variety of cooperators is necessary and desirable to ensure understanding and

acceptance of the data and forge relationships that will lead to cooperative conservation planning.

### Regional objectives for GAP

The lack of regional datasets and the problems of edge-matching existing state GAP data sets led GAP to initiate regional Gap Analysis Projects. The Southwest Regional Gap Analysis Project is a mapping and assessment of biodiversity for the five-state region encompassing Arizona, Colorado, Nevada, New Mexico, and Utah. The primary objective of the project is to use a coordinated approach to create detailed, seamless maps of the land cover, habitat for native terrestrial vertebrate species, land stewardship, and management status for the entire region.

### **The Gap Analysis Concept**

GAP brings together the problem-solving capabilities of federal, state, and private scientists to tackle the difficult issues of land cover mapping, animal habitat characterization, and biodiversity conservation assessment at the state, regional, and national levels. The program seeks to facilitate cooperative development and use of information. Throughout this report we use the terms "GAP" to describe the national program, "GAP Project" to refer to an individual state or regional project, and "gap analysis" to refer to the gap analysis process or methodology.

Much of the following discussion was taken verbatim from Edwards et al. 1995, Scott et al. 1993, and Davis et al. 1995. The gap analysis process provides an overview of the distribution and conservation status of several components of biodiversity. It uses the distribution of actual vegetation and predicted distribution of terrestrial vertebrates and, when available, invertebrate taxa. Digital map overlays in a GIS are used to identify individual species, species-rich areas, and vegetation types that are unrepresented or underrepresented in existing management areas. It functions as a preliminary step to the more detailed studies needed to establish actual boundaries for planning and management of biological resources on the ground. These data and results are then made available to the public so that institutions as well as individual landowners and managers may become more effective stewards through more complete knowledge of the management status of these elements of biodiversity. GAP, by focusing on higher levels of biological organization, is likely to be both cheaper and more likely to succeed than conservation programs focused on single species or populations (Scott et al. 1993).

Biodiversity inventories can be visualized as "filters" designed to capture elements of biodiversity at various levels of organization. The filter concept has been applied by The Nature Conservancy, which established Natural Heritage Programs in all 50 states. The Nature Conservancy employs a fine filter of rare species inventory and protection and a coarse filter of community inventory and protection (Jenkins 1985, Noss 1987). It is postulated that 85-90% of species can be protected by the coarse filter without having to inventory or plan reserves for those species individually. A fine filter is then applied to the remaining 15-10% of species to ensure their protection. Gap analysis is a coarse-filter method because it can be used to quickly and cheaply assess the other 85-90% of species. GAP is not designed to identify and aid protection of elements that are rare or of very

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restricted distribution; rather it is designed to help "keep common species common" by identifying risk far in advance of actual population decline. These concepts are further developed below.

The intuitively appealing idea of conserving most biodiversity by maintaining examples of all natural community types has never been applied, although numerous approaches to the spatial identification of biodiversity have been described (Kirkpatrick 1983, Margules et al. 1988, Pressey and Nicholls 1989, Nicholls and Margules 1993). Furthermore, the spatial scale at which organisms use the environment differs tremendously among species and depends on body size, food habits, mobility, and other factors. Hence, no coarse filter will be a complete assessment of biodiversity protection status and needs. However, species that fall through the pores of the coarse filter, such as narrow endemics and wide-ranging mammals, can be captured by the safety net of the fine filter. Community-level (coarse-filter) protection is a complement to, not a substitute for, protection of individual rare species.

Gap analysis is essentially an expanded coarse-filter approach (Noss 1987) to biodiversity protection. The land cover types mapped in GAP serve directly as a coarse filter, the goal being to assure adequate representation of all native vegetation community types in biodiversity management areas. Landscapes with great vegetation diversity often are those with high edaphic variety or topographic relief. When elevational diversity is very great, a nearly complete spectrum of vegetation types known from a biological region may occur within a relatively small area. Such areas provide habitat for many species, including those that depend on multiple habitat types to meet life history needs (Diamond 1986, Noss 1987). By using landscape-sized samples (Forman and Godron 1986) as an expanded coarse filter, gap analysis searches for and identifies biological regions where unprotected or underrepresented vegetation types and animal species occur.

More detailed analyses were not part of this project but are areas of research that GAP as a national program is pursuing. For example, a second filter could combine species distribution information to identify a set of areas in which all, or nearly all, mapped species are represented. There is a major difference between identifying the richest areas in a region (many of which are likely to be neighbors and share essentially the same list of species) and identifying areas in which all species are represented. The latter task is most efficiently accomplished by selecting areas whose species lists are most different or complementary. Areas with different environments tend to also have the most different species lists for a variety of taxa. As a result, a set of areas with complementary sets of species for one higher taxon (e.g., mammals) often will also do a good job representing most species of other higher taxa (e.g., trees, butterflies). Species with large home ranges, such as large carnivores, or species with very local distributions may require individual attention. Additional data layers can be used for a more holistic conservation evaluation. These include indicators of stress or risk (e.g., human population growth, road density, rate of habitat fragmentation, distribution of pollutants) and the locations of habitat corridors between wildlands that allow for natural movement of wide-ranging animals and the migration of species in response to climate change.

## General Limitations

Limitations must be recognized so that additional studies can be implemented to supplement GAP. The following are general project limitations; specific limitations for the data are described in the respective sections:

1. GAP data are derived from remote sensing and modeling to make general assessments about conservation status. Any decisions based on the data must be supported by ground-truthing and more detailed analyses.
2. GAP is not a substitute for threatened and endangered species listing and recovery efforts. A primary argument in favor of gap analysis is that it is proactive: it seeks to recognize and manage sites of high biodiversity value for the long-term maintenance of populations of native species and communities before they become critically rare. Thus, it should help to reduce the rate at which species require listing as threatened or endangered. Those species that are already greatly imperiled, however, still require individual efforts to assure their recovery.
3. GAP data products and assessments represent a snapshot in time generally representing the date of the satellite imagery. Updates are planned on a 5-10 year cycle, but users of the data must be aware of the static nature of the products.
4. GAP is not a substitute for a thorough national biological inventory. As a response to rapid habitat loss, gap analysis provides a quick assessment of the distribution of vegetation and associated species before they are lost, and provides focus and direction for local, regional, and national efforts to maintain biodiversity. The process of improving knowledge in systematics, taxonomy, and species distributions is lengthy and expensive. That process must be continued and expedited, however, in order to provide the detailed information needed for a comprehensive assessment of our nation's biodiversity. Vegetation and species distribution maps developed for GAP can be used to make such surveys more cost-effective by stratifying sampling areas according to expected variation in biological attributes.

## The Study Area

The following sources were used in preparing this description of the SWReGAP study area: DesertUSA 2006, Halvorson et al. 2002, Nevada Department of Wildlife 2005, Schrupp et al. 2000, The Official Website of the State of Utah 2005, Thompson et al. 1996, United States Geological Survey 2006, and West and Young 2000.

The Southwest Regional Gap Analysis Project (SWReGAP) area encompasses approximately 150 million hectares (560,000 square miles) and covers the states of Arizona, Colorado, Nevada, New Mexico, and Utah (see [Figure 1-1](#)). The region is 93% of the size of Alaska and approximately 20% of the area of the contiguous United States.

With elevations ranging from 21 meters along the Colorado River near Yuma, Arizona to 4,399 meters at Mount Elbert in the state of Colorado, the project area comprises an incredible diversity of landforms and ecosystems in four major physiographic provinces: the Basin and Range, Colorado Plateau, Rocky Mountains, and Great Plains (see [Figure 1-2](#)). Small portions of the Columbia Plateau and Sierra Nevada ecoregions are also included in the northwest part of the project area.

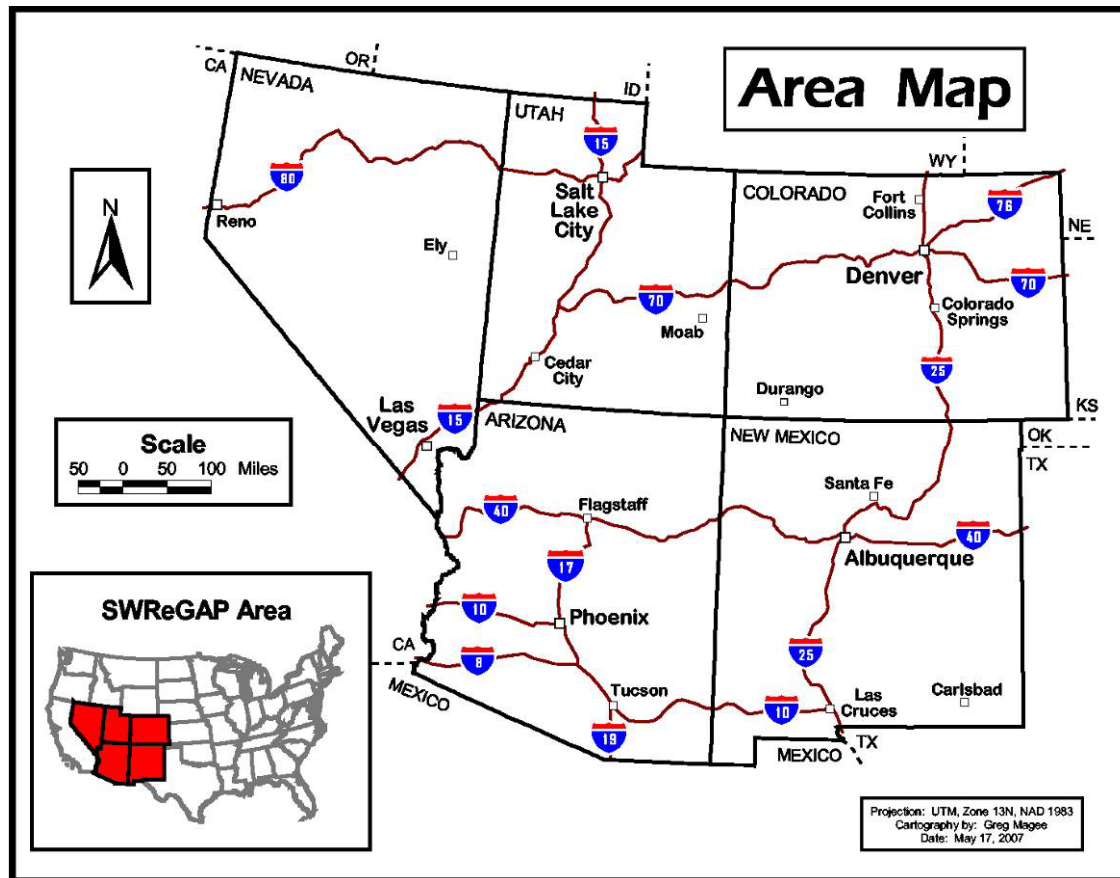


Figure 1-1 SWReGAP area map showing major municipalities and roads

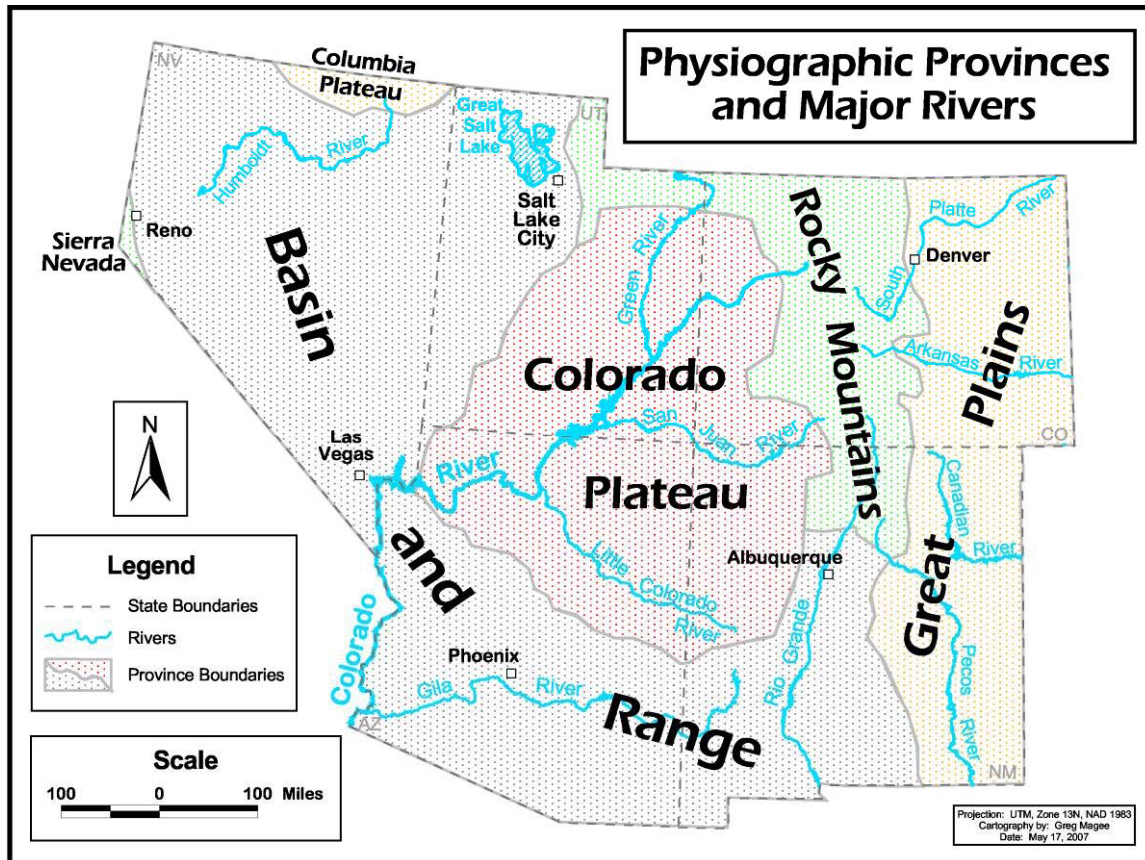


Figure 1-2 Physiographic provinces and major rivers in the SWReGAP area

### Columbia Plateau and Sierra Nevada

These two ecoregions barely cross into the project area in Nevada, with the Columbia Plateau in the extreme northeast part of the state, and the Sierra Nevada in the extreme western. The Columbia Plateau is a broad expanse of semi-arid sagebrush covered volcanic plains and valleys and lies mostly north of Nevada.

Slopes on the east side of the Sierra Nevada partially descend upon Nevada along its western border. Vegetation here is characterized by conifer communities mixed with sagebrush and pinyon-juniper in the lower elevations and an alpine zone characterized by bare rock, permanent snow fields, and few grass or forb species, including the Hidden Forest of the Sheep Range, home of the Hidden Forest Uinta chipmunk. Though Sierra Nevada barely comes into the project area, its physical presence dominates the western portion of the project area by dictating rainfall patterns and vegetation patterns, which in turn strongly influences the distribution of wildlife.



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## Basin and Range

The Basin and Range of central and southern Nevada, eastern Utah, southern and western Arizona, and southwestern New Mexico comprises the largest portion of the project area and includes the great deserts of the southwest: the Great Basin, Mojave, Sonoran, and Chihuahuan. The major landforms in this province are a series of discrete, fault-block, north-south trending mountains interrupted by lower lying valleys or basins. This topography is the product of crustal stretching between the Sierra Nevada to the west and the Rocky Mountains to the east. Over time, erosion has steadily chipped away at the higher elevations, filling the basins between the ranges with sediments that are typically thousands of meters thick. Many of the valleys in the Basin and Range are closed drainage basins and at various times in geologic history, extensive lakes filled the basins. Because of the arid to semi-arid climate that exists today, most of the undrained basins now contain dry lakebeds or “playas.” Yet some lakes still exist in the province as evidenced by the Great Salt Lake, a remnant of the much larger ancient Lake Bonneville.

Climate within the Basin and Range is quite varied. While the province as a whole is generally in a rain shadow created by the Sierra Nevada to the west, individual mountain ranges within the region can lift air masses, wringing out whatever moisture is left in them and creating precipitation at higher elevations. This local orographic effect creates a rainfall gradient, with mountains receiving noticeably more precipitation than adjacent basins. This climatic effect has been cited as contributing to the biotic diversity in the province, resulting in a “sky island and desert sea” aspect to the landscape. This condition also contributes to the high level of endemism found within the region. Since the crustal stretching and faulting are not uniform across the Basin and Range, the elevations of the mountains and basins vary considerably across the province. These regional differences have strongly influenced the flora and fauna communities and this large province can be further divided into different ecoregions.

The Great Basin ecoregion includes much of central Nevada and eastern Utah, from the eastern slopes of the Sierra Nevada near Reno, Nevada to the western slopes of the Wasatch Range near Salt Lake City, Utah. The entire region is a closed drainage basin with no outlet to the sea. Nevada is the most mountainous state in the U.S. with over 300 mountain ranges separated by long, broad valleys. The Great Basin is characterized by large expanses of salt desert scrub and sagebrush shrublands. Mountainous areas include pinyon-juniper woodlands, mountain sagebrush, open coniferous forests, and alpine areas in the highest elevations. Remote mountaintops, isolated aquatic habitats in valley bottoms, weathered badlands, and sand dunes highlight the Great Basin’s unique biological diversity. While winters in the Great Basin are cold, summers are conversely hot and dry. A temperature swing of 40 degrees in any given summer day is not unusual. On average, the Great Basin receives between 18 and 30 centimeters of precipitation per year. Much of this falls as snow in the winter; while summer rains are often brief torrents that runoff before much moisture can soak into the soil.

The Mojave Desert occupies southern Nevada, extreme southwestern Utah, northwestern Arizona, and southeastern California. Creosotebush, succulents, and yucca-blackbrush community types dominate the ecoregion. Joshua tree, a yucca species, is considered the

indicator plant of the Mojave. As in other areas of the Basin and Range, upper elevation mountain communities also exist where there is a more mesic environment. This is where some of the ecoregion's most isolated communities and species are found. About 200 plant species are endemic to this desert. The Mojave is hotter and drier than the Great Basin, yet cooler than the Sonoran Desert. Precipitation here averages less than 13 centimeters per year and falls more typically as rain in the winter.

The Sonoran Desert of northwest Mexico, southwestern Arizona, and southeastern California is the hottest of the Southwest's deserts. Freezing temperatures occur only for a few nights in the winter, while summers are extremely hot. Rainy periods occur in both winter and summer and produce a high biodiversity and a higher occurrence of trees than any of the adjacent deserts. Palo verde, ironwood, catclaw, and saguaro are some of the trees that dominate the landscape, while cholla cactus, saltbush, creosotebush, and bursages are common shrubs. Mesquite bosques, or woodlands, are found in areas where the water table is high. The Sonoran Desert is also the only ecoregion in the Basin and Range where thru-flowing streams and rivers are more common than undrained basins. The Gila River, a tributary of the Colorado crosses the Sonoran Desert from east to west and collects runoff from several side streams. Where water is not diverted for irrigation or other human uses, the streamside vegetation consists of Fremont cottonwood, Arizona ash, Arizona walnut, and willow species. The fauna of the Sonora is rich as well with many species derived from tropical and subtropical areas.

Covering over 500,000 square kilometers, the Chihuahuan Desert is the largest desert in North America. Though most of this desert lies in Mexico, its northern limits extend into west Texas, southern New Mexico, and extreme southeast Arizona. This is shrub desert of creosotebush, mesquite, yuccas, agaves, prickly pear cactus, Mormon tea, and tarbush. Though historically more prevalent than today, grasslands are also an important vegetational component of this desert. With cool winters and hot summers, most of the area receives less than 25 centimeters of rainfall per year, most of which falls in torrential summer storms. Though most drainage basins here are closed as in the Great Basin, two major rivers do traverse the project area in New Mexico: the Rio Grande and Pecos River. Though severely impacted by human activities, these riparian systems do maintain limited areas of woodland comprised of cottonwood, willow, and ash trees.

Another ecoregion found in the Basin and Range portion of the project area is the transitional area between the Sonoran and Chihuahuan Desert in southeast Arizona and southwest New Mexico. Here, components of the Sierra Madrean ecoregion extend into the U.S. from Mexico. An exceptionally large diversity of vegetation types is found from desert basin to mountaintop. Mammal diversity in this area is among the highest in the U.S., with influences from the Sierra Madre to the south, Rocky Mountains to the north, Sonoran Desert to the west, and Chihuahuan Desert to the east.

The Basin and Range formation also includes the transitional areas of central and southern New Mexico where tall mountain ranges rise more than a 1,000 meters above the Chihuahuan Desert. The San Mateo, Magdalena, Sandia, Manzano, and Sacramento Mountain ranges exemplify this transitional area between the Basin and Range and

adjacent provinces to the north and east. These ranges have peaks over 3,000 meters in elevation and biologically are in stark contrast to the desert environs below. Here the flora and fauna is more closely associated with the Rocky Mountains to the north with coniferous forests and woodlands, lush mountain meadows and grasslands, and permanent streams and springs.

### Colorado Plateau

The Colorado Plateau occupies the Four Corners region of the project area: southeast Utah, northern Arizona, northwest New Mexico, and southwest Colorado. It is the only physiographic province that lies totally within the project area.

The sculptured beauty and brilliant colors of the Colorado Plateau's sedimentary rock layers have captured the imaginations of countless geologists. This is a vast region of plateaus, mesas, and deep canyons whose walls expose rocks ranging in age from billions to just a few hundred years old. In addition, volcanic cones dot the landscape and large volcanic mountains rise from the plateau to over 3,500 meters elevation. San Francisco Peaks of northern Arizona, the Abajo and La Sal Mountains of southeast Utah, and Mount Taylor of northwest New Mexico are examples of these volcanic highlands.

One of the most geologically intriguing features of the Colorado Plateau is its remarkable stability. Relatively little faulting and folding has affected this high, thick crustal block within the last 600 million years or so. Although the Basin and Range and Colorado Plateau may seem to have little in common, their geological stories are intimately intertwined. In the early part of the Cenozoic Era, both regions had low elevations of probably less than 1 kilometer. Although geologists are still debating what came next, it is theorized that beginning about 20 million years ago, both the Basin and Range and Colorado Plateau regions were uplifted as much as 3 kilometers. Great tension developed in the crust, probably related to changing plate motions far to the west. As the crust stretched, the Basin and Range Province broke up into a multitude of down-dropped valleys and elongate mountains. Yet for some reason not fully understood, the neighboring Colorado Plateau was able to preserve its structural integrity and remained a single tectonic block. Eventually, the great block of Colorado Plateau crust rose a kilometer higher than the Basin and Range.

As the land rose, the streams responded by cutting ever-deeper stream channels. The most well known of these watercourses, the Colorado River, began to carve the Grand Canyon less than 6 million years ago. Other major tributaries of the Colorado River in the Plateau include the Green River of eastern Utah, the Gunnison and Dolores Rivers of southwest Colorado, the San Juan River of northwest New Mexico and southeast Utah, and the Little Colorado River of northeast Arizona. With the exception of the Little Colorado, most of the major rivers of the Plateau have their headwaters high in the Rocky Mountains to the north and east. Millions of years of down cutting by these and other rivers have created a maze of brilliantly colored canyons exposing the plateau's rich geologic history.

With the exception of the higher and colder mountains, most areas of the plateau have cold winters, yet hot summers. Large tracts of the province receive less than 25 cm of precipitation annually. Moisture comes primarily as rain during mid to late summer months, often associated with convection currents rising from the Gulf of California or the Gulf of Mexico. However, snow is not uncommon in winter, especially in the higher mountains. Significant year-to-year variation occurs more often than not, and severe drought and flooding are not uncommon occurrences. This variation has a profound effect on plant and animal life.

Vegetation types in the Colorado Plateau include alpine tundra, subalpine and montane forests, lush mountain meadows, and montane grasslands in the high elevation mountains. However, more area is covered in pinyon-juniper woodland and shrubland, including sagebrush and semi-desert shrubland. Riparian habitats are associated with the river systems of the plateau.

### Rocky Mountains

The Rockies form a majestic mountain barrier on the west side of the Great Plains that stretches from Canada to northern New Mexico. Though not obvious to the casual observer, the Rockies are actually a discontinuous series of mountain ranges with distinct geological origins. Within the project area, north-central New Mexico and central Colorado are associated with the Southern Rockies, northwest Colorado with the Wyoming Basin, and northeast Utah with the Middle Rockies.

The Rocky Mountains took shape during a period of intense plate tectonic activity from about 170 to 40 million years ago. The last mountain building event during this time was the Laramide orogeny (about 70 to 40 million years ago) and is responsible for raising the Rocky Mountains. Before the Laramide orogeny, western North America suffered the effects of repeated collisions as slabs of ocean crust, carried along by subducting ocean plates, were swept into the subduction zone and onto North America's edge. Inland from the coast, magma above the subducting slab rose into the North American continental crust and created great arc-shaped volcanic mountain ranges as lava and ash spewed out of dozens of volcanoes. Beneath the surface, great masses of molten rock were injected and hardened in place. Initially the effects of these plate collisions focused near the edge of the continent, but about 70 million years ago, the mountain building reached further inland where the present-day Rocky Mountains are found.

The tallest peaks within the project area are found in the Rocky Mountains, with many ranges exceeding 4,000 meters in elevation. Though there is climatic variation within the province, much of the area is considered to be humid with some areas receiving over 100 cm of rain annually. Winters are long and very cold with permanent snowfields found in the higher elevations. Summers are short and cool and afternoon rain showers are common during the warmer months. The extremes of elevation and relief are reflected in its diversity of habitats, ranging from alpine tundra, through sub-alpine, and montane forests, to montane grasslands and shrublands, and pinyon-juniper woodlands. Riparian habitats are dispersed throughout the area. The Rockies are the source of most of the major rivers in the intermountain West and the Great Plains to the east.

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## Great Plains

The Interior Plains is a vast region that spreads across the stable core of North America. This area formed when several small continents collided well over a billion years ago. Most of this region remained relatively unaffected by mountain building episodes and it has low relief, reflecting more than 500 million years of relative tectonic stability. During its long geologic history, the plains were periodically inundated by shallow seas that deposited marine sediments. The flatness of the plains is a reflection of the platform of mostly flat-lying marine and stream deposits laid down in the Mesozoic and Cenozoic Eras. In east New Mexico and west Texas, the Llano Estacado is considered one of the flattest, most featureless landscapes in the United States. Most of the western portion of the Interior Plains is referred to as the Great Plains and these high plains of eastern Colorado and New Mexico are included within the project area. This portion of the province also received deposits from the eroding Rocky Mountains to the west. Though nearly flat, the landscape is occasionally interrupted by sand hills and erosion along stream courses to form canyons, cliffs, and escarpments.

Ranging in elevation from over 1,500 meters in the north to less than 1,000 meters in the south, the high plains portion of the project area exhibit quite a variation in climate and ecology. Though still considered semi-arid, northern areas are wetter and have longer and colder winters. Southern areas have short, mild winters and extremely hot summers. Eastern Colorado and northeast New Mexico are primarily covered in plains grasslands, while southeast New Mexico is actually considered part of the Chihuahuan Desert (previously described in the Basin and Range section). Rivers that originate in the Rocky Mountains to the west traverse the plains, the major ones being the South Platte, Arkansas, Canadian, and Pecos Rivers.

## Land Management and Human Impacts to the Landscape

There is evidence of human habitation within the project area that dates back nearly 13,000 years. Lifestyles of the native peoples evolved from nomadic hunter-gathering to more sedentary as the climate became drier and subsistence farming became important. Until the time of European immigration, human influence on the vegetation was relatively slight. Contrasted with the 300-150 yrs of occupation by Euro-Americans, dramatic changes in the landscape and vegetation have since occurred (West and Young 2000). Human influences are now seen as significant drivers of change on the landscape.

Currently, federal agencies account for the largest land steward category managing over 51% of the landscape. BLM is the largest federal land steward accounting for over 30% of the total land area. The U.S. Forest Service (USFS) is the second largest federal land steward accounting for 14% of the area. Private lands are the second largest land steward category in the region comprising 30% of the region's lands. Private lands have particularly been impacted with direct conversion of large areas of wildland to agriculture and urban areas. Some regions within the project area are among the fastest growing in the nation and this pressure will only continue to increase. Most public lands are managed under multiple use and sustained yield policies, which requires the federal agencies to manage its resources for a combination of diverse uses while balancing long-term needs for renewable and non-renewable resources. Much of the federal lands are

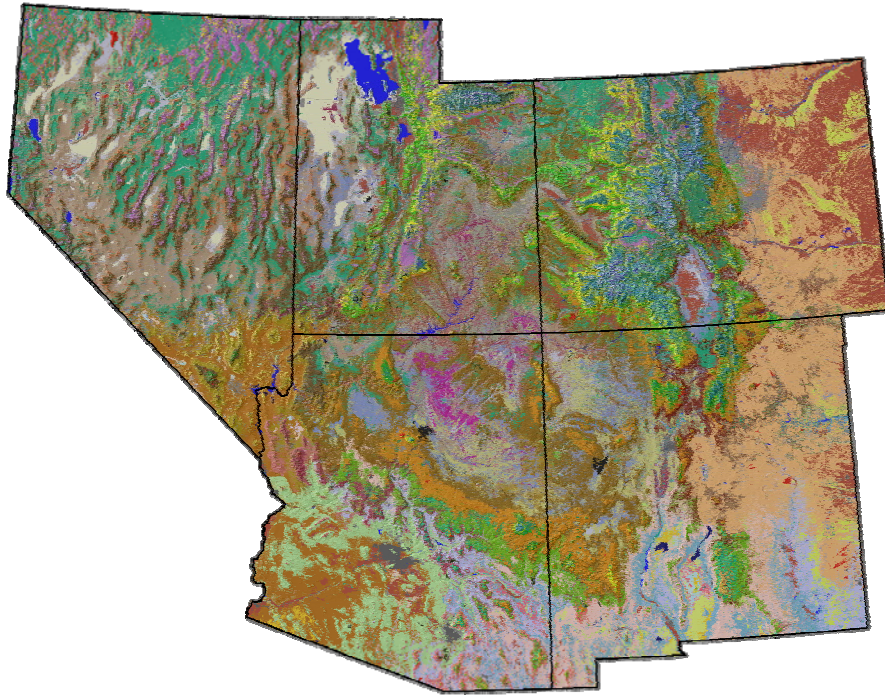
managed for recreation, livestock grazing, mining, logging, and energy development. These uses have and continue to alter the natural character of the land. In addition, desertification as related to water extraction and diversion projects, suppression of wild fire, and introduction of exotic weeds are ongoing threats to biodiversity of the landscape. There are some who suggest that human's heaviest imprint may come from seemingly indirect consequences of developed infrastructures (roads, pipelines) within and between habitats.

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# CHAPTER 2

## LAND COVER CLASSIFICATION AND MAPPING

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# INTRODUCTION

In its "coarse filter" approach to conservation biology (Jenkins 1985, Noss 1987) gap analysis relies on maps of dominant land cover as the most fundamental spatial component of the analysis for terrestrial environments (Scott et al. 1993). For the purposes of GAP, most of the land cover of interest can be characterized as natural or semi-natural vegetation defined by the dominant plant species.

Vegetation patterns are an integrated reflection of physical and chemical factors that shape the environment of a given land area (Whittaker 1965). Often vegetation patterns are determinants for overall biological diversity patterns (Franklin 1993, Levin 1981, Noss 1990) which can be used to delineate habitat types in conservation evaluations (Specht 1975, Austin 1991). As such, dominant vegetation types need to be recognized over their entire range of distribution (Bourgeron et al. 1994) for beta-scale analysis (*sensu* Whittaker 1960, 1977). Various methods may be used to map vegetation patterns on the landscape, the appropriate method depending on the scale and scope of the project. Projects focusing on smaller regions, such as national parks, may rely on aerial photo interpretation (USGS-NPS 1994). Mapping vegetation over larger regions has commonly been done using digital imagery obtained from satellites, and may be referred to as land cover mapping (Lins and Kleckner 1996).

Generally, land cover mapping is done by segmenting the landscape into areas of relative homogeneity that correspond to land cover classes from an adopted or developed land cover legend. Technical methods to partition the landscape using digital imagery-based methods vary. Unsupervised approaches involve computer-assisted delineation of homogeneity in the imagery and ancillary data, followed by the analyst assigning land cover labels to the homogenous clusters of pixels (Jensen 2005). Supervised approaches utilize representative samples of each land cover class to partition the imagery and ancillary data into clusters of pixels representing each land cover class. Supervised clustering algorithms assign membership of each pixel to a land cover class based on some rule of highest likelihood (Jensen 2005). Supervised-unsupervised hybrid approaches are common and often offer advantages over both approaches (Lillesand and Kieffer 2000).

It is important to point out that a land cover map is never considered a perfect representation of the landscape. Improvements to land cover maps can, and should be made as additional "ground truth" information about actual land cover components and spatial patterns is acquired through time. These improvements should be based on independent assessments of the map's quality (Stoms 1994).

This chapter is divided into three main sections. The first section discusses land cover map development. It begins by providing background information on the regional division of labor and the regional land cover legend. It then focuses on our land cover mapping methods, including a description of data sources, the land cover modeling approach, and the general flow of the mapping process. It concludes with a description



of the resulting land cover map product. The second section describes the process of validating the land cover product. Background information on our approach is presented along with descriptions of the methods and results of the land cover product validation. The final section provides a discussion of the land cover mapping experience in general. In this section we discuss some of the “lessons learned” from the regional mapping effort with hopes that future mapping efforts of this nature will benefit from our experience.

## METHODS

### Land Cover Map Development

#### Background

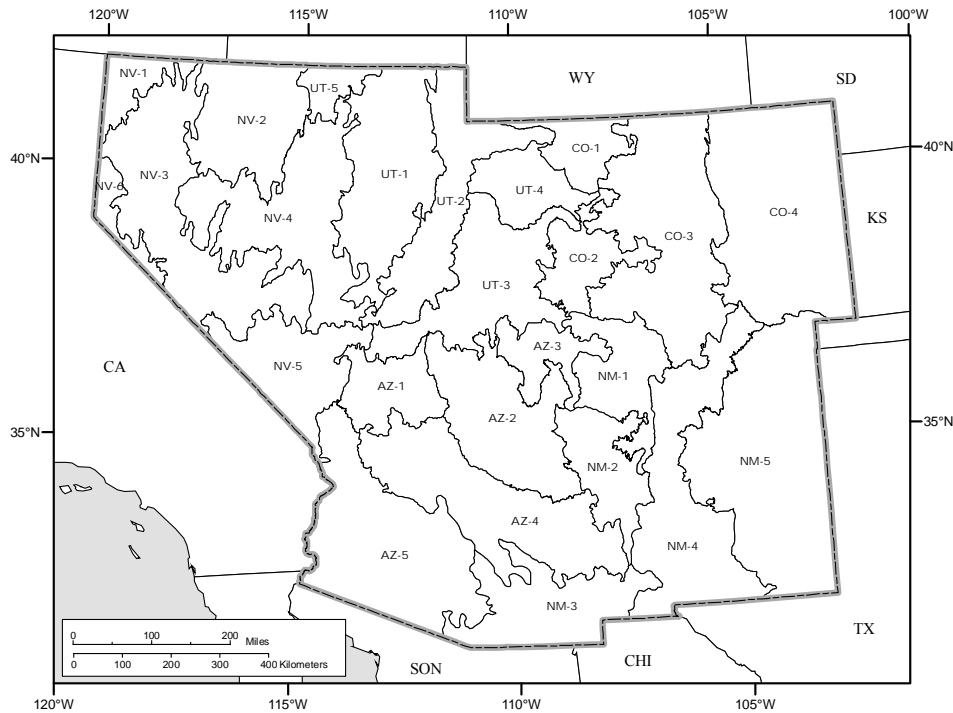
##### *Division of Regional Responsibilities*

The use of “spectro-physiographic” mapping areas has proven useful for satellite-based land cover mapping by maximizing spectral differentiation between areas with relatively uniform ecological characteristics (Bauer et al. 1994, Homer et al. 1997, Lillesand 1996, Reese et al. 2002). Dividing the 1.4 million square kilometer region into spectro-physiographic “mapping zones” provided working units distributed among the five collaborating states. With the diversity of biogeographic divisions across the region, we recognized the importance of leveraging local knowledge of the biota in each sub-region. We consequently determined that a geographical approach, assigning state teams to work in their local landscapes was the most appropriate means for distributing regional mapping responsibilities. Overall project tracking and management was conducted by the regional land cover lab at Utah State University.

Ecoregions defined by Bailey et al. (1994) and Omernik (1987) provided a starting point for determining the project mapping zone boundaries. These boundaries were refined by screen digitizing at a scale of approximately 1:500,000 using a regional mosaic of Landsat TM imagery resampled to 90 meters. Initial efforts yielded 73 mapping zones for the region. Through a process of iterative and collaborative steps involving all land cover mapping teams and NatureServe, the final number of mapping zones was reduced to 25 (Figure 2-1). A more detailed explanation of mapping zone development is found in Manis et al. (2000).

Each state was responsible for between four and six mapping zones roughly corresponding to state jurisdictional boundaries. Initial field data collection protocols were established at a workshop in Las Vegas, Nevada in the spring of 2001. Field data collection occurred during 2002 and 2003. Land cover workshops dedicated to ensuring regionally consistent mapping methods were conducted during the winters of 2002 and 2003. Yearly meetings and monthly teleconferences involving key land cover mapping personnel from all five states and NatureServe ecologists proved invaluable throughout the collaborative mapping process. Mapping efforts were completed on a mapping zone by mapping zone basis by individual states, with the final integration of all mapping

zones performed by the regional land cover lab. The seamless land cover map was completed and made available to the public in September 2004.



**Figure 2-1. Mapping zone boundaries for SWReGAP land cover mapping effort.**

### *Land Cover Legend*

The US National Vegetation Classification System (US-NVCS) has been adopted by the Federal Geographic Data Committee as the classification standard for all federal mapping projects (FGDC 1997)<sup>1</sup>. A nested hierarchical structure of the US-NVCS defines classification units at the highest levels as heterogeneous units based solely on vegetative physiognomy and at the lower levels as more narrow and homogenous floristic units

<sup>1</sup> The FGDC set standards and policy for vegetation classification and map products to enable agencies to collect, report and map vegetation information in a standard format (FGDC 1997). Although the policy for applying the standard is only through the formation level (physiognomy only), agencies are encouraged to aid in the development of the floristic alliance and the association levels (FGDC 1997, pg. 4, 7). FGDC recognized that mapping applications need to be based on the requirement of the project, "The specific application of this standard to any mapping activities is dependent on the goals and objectives of the mapping activities...the classification standard merely sets a hierarchical list of classes that should be intelligently employed by the user based on the specifications and limitations of their particular mapping program" (FGDC 1997, pg. 9). Thus, the current FGDC standard is primarily for describing and classifying vegetation, whereas mapping units will reflect (1) the needs of the mapping project, (2) the technical tools, methods, and data available for mapping, and (3) the interactions of those factors with the vegetation classification concepts. The nested hierarchical structure was intended to ease applications of these classification concepts to the many and varied circumstances of vegetation mapping. At the time of its adoption, however, there had been limited experience in its mapped application at each hierarchical level. Because of difficulties in mapping at all levels, 'compliance' with the FGDC standard almost always requires some sort of crosswalk between resultant mapping units and classification units from one or more levels of the current FGDC hierarchy.

(Table 2-1). The upper physiognomic levels of the NVCS framework are adapted from the World Physiognomic Classification of Vegetation (UNESCO 1973) and later modified for application to the United States by Driscoll et al. (1983, 1984). The lower floristic levels (e.g. Alliance and Association) are based on both structural and compositional characteristics of vegetation derived by Mueller-Dombois and Ellenberg (1974). The Nature Conservancy, and now NatureServe—along with the network of Natural Heritage Programs—have worked with others since 1985 on the systematic development, documentation, and description of vegetation types across the United States (Grossman et al. 1994, 1998). NatureServe and the Natural Heritage Network have been improving upon this system in recent years with significant funding supplied by GAP. Products from this on-going effort include a hierarchical vegetation classification standard (FGDC 1997) and the description of vegetation Alliances for the United States (Drake and Faber-Langendoen 1997, Reid et al. 1999, Sneddon et al. 1994, Weakley et al. 1996). An alliance is a physiognomically uniform group of Associations sharing one or more dominant or diagnostic species, that as a rule are found in the uppermost strata of the vegetation (see Mueller-Dombois and Ellenberg (1974). The basic assumptions and definitions for this system have been described by Jennings (1993) and Grossman et al. (1998).

**Table 2-1. Hierarchical structure of the U.S. National Vegetation Classification and the linkage with ecological systems.**

| <i>Link to FGDC standard</i> | <i>Hierarchy level</i> | <i>U.S. National Vegetation Classification</i>  | <i>Ecological systems</i> |
|------------------------------|------------------------|---|---------------------------|
| Included                     |                        | Division<br>Order   |                           |
| Included                     | Physiognomic levels    | Formation Class<br>Formation Subclass<br>Formation Group<br>Formation Subgroup<br>Formation |                           |
| Hierarchically linked        |                        |   | Ecological systems        |
| Proposed                     | Floristic levels       | Alliance<br>Association   |                           |

When the SWReGAP project began in 1999 the intended thematic mapping unit was the NVC alliance. However, recognizing that over 500 alliances occur in the project area and that many alliances would be difficult to map as they do not occur in large and distinctive patches, we anticipated the need for a “meso” scale thematic mapping unit. In response to this need for a regionally consistent meso-scale land cover legend, NatureServe developed the Terrestrial Ecological Systems Classification framework for the conterminous United States (Comer et al. 2003). Ecological systems are defined as “groups of plant community types that tend to co-occur within landscapes with similar ecological processes, substrates and/or environmental gradients” (Comer et al. 2003).

Although distinct from the US-NVC, the vegetation component of an ecological system is described by one or more NVC alliances or associations, though this relationship is not strictly hierarchical. While the ecological system concept emphasizes existing dominant vegetation types, it also incorporates physical components such as landform position, substrates, hydrology, and climate. In this manner, ecological system descriptions are modular, having multiple diagnostic classifiers used to identify several ecological dimensions of the mapping unit (Di Gregorio and Jansen 2000). Diagnostic classifiers include environmental and biogeographic characteristics, which are incorporated in the ecological system name thus providing descriptive information about the system through a standardized naming convention. More detailed information about the Terrestrial Ecological Systems Classification for the United States is available at <http://www.natureserve.org/publications/usEcologicalsystems.jsp>.

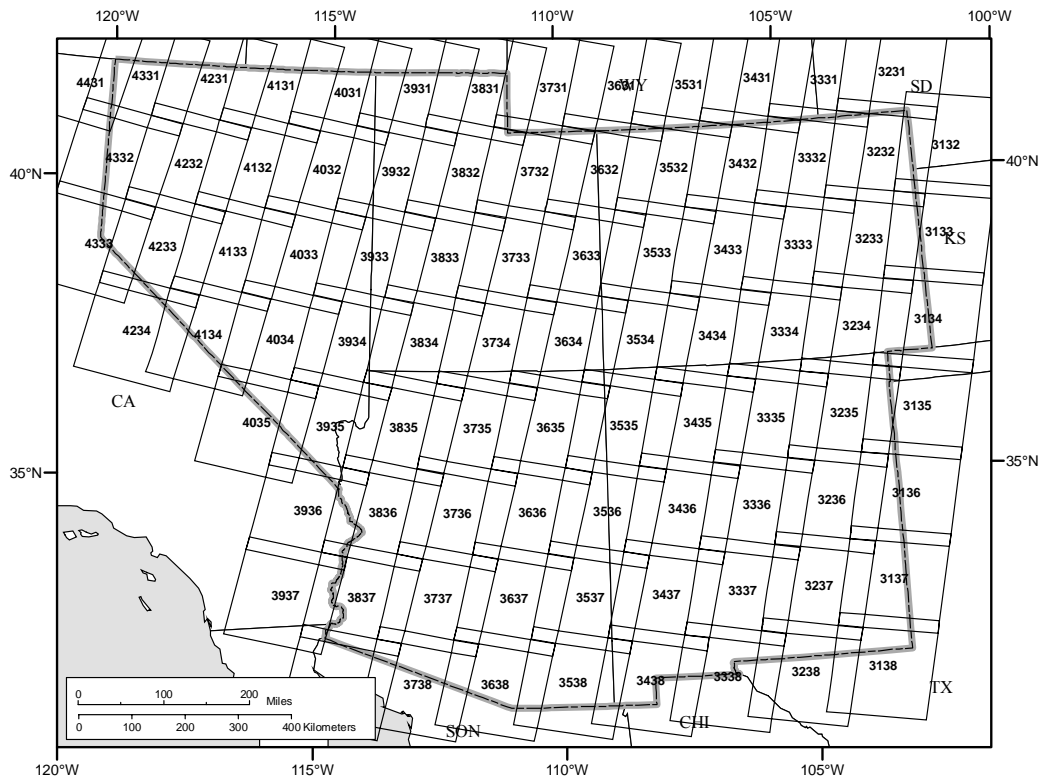
NatureServe Terrestrial Ecological Systems present one approach for mapping efforts to comply with Federal Geographic Data Committee standards. They are defined in terms of the base units (alliances and associations) of the US-NVC, and may be readily attributed to the upper-most levels of the FGDC hierarchy (e.g., Division, Order, Class, Subclass). We follow this approach by attributing all mapping units to NLCD land cover classes 1 and 2 ([Appendix 2-3 and 2-13](#)) which closely follow these upper FGDC levels. This approach facilitates application of these mapped data to these hierarchical levels.

The initial SWReGAP target legend developed by NatureServe and the mapping teams identified approximately 110 potentially mappable ecological systems from the 140 that occur in the five-state region. Omitted ecological systems were mostly small patch (below minimum mapping unit) or peripheral to the region and lacked adequate training sites. The Terrestrial Ecological Systems Classification focuses on natural and semi-natural ecological communities. For SWReGAP, altered and disturbed land cover and land use classes were considered separately. These classes were incorporated into the SWReGAP legend using descriptions adopted from either the National Land Cover Dataset 2001 legend (e.g. Agriculture, Developed-Medium-High Intensity) (Homer et al. 2004) or were given a special “altered or disturbed” designation within the SWReGAP legend (e.g. recently burned, recently logged areas, invasive annual grassland, etc.).

## **Land Cover Mapping Methods**

### Data Sources

Seventy-nine Landsat Enhanced Thematic Mapper Plus (ETM+) scenes ([Figure 2-2](#)) provided complete coverage of the five-state region, and were acquired from the USGS National Center for Earth Resources Observation and Science (EROS) through the Multi-Resolution Land Characteristics Consortium (MRLC). Spring, summer, and fall images were provided, raising the total number of images to 237 for the region. Optimal imagery dates varied across the region and were selected for peak phenological differences as well as clarity and low cloud cover. Image acquisition dates ranged from 1999 to 2001. All ETM+ scenes were terrain-corrected and provided to Utah State University in NLAPS (National Landsat Archive Processing System) format.



**Figure 2-2. SWReGAP area showing Landsat ETM+ scenes**

Our approach involved modeling image mosaics for each mapping zone (see Figure 2-1) including a 2 kilometer buffer (i.e. a 4 kilometer overlap between mapping zones). To improve image matching, image standardization for solar angle illumination, instrument calibration, and atmospheric haze (i.e. path radiance) was necessary. We determined the most practical approach was to use an image-based method as described by Chavez (1996). Standard protocol was to use a modified COST method (Chavez 1996). We found that using Chavez' COST method over-corrected atmospheric transmittance, particularly for scenes in the arid Southwest. To address this over-correction, we used COST without  $TAU_z$  (approximate atmospheric transmittance component of the COST equation). To facilitate image standardization, web-based scripts were developed to automate the process of generating corrected images on a scene-by-scene basis.<sup>2</sup>

<sup>2</sup> Scripts for image standardization were web-enabled making it possible for each land cover team to standardize their own images (see <http://www.gis.usu.edu/docs/projects/swgap/ImageStandardization.htm>). Users upload the image header file from which the script extracts the gain and bias coefficients, the solar zenith angle, and Julian date to produce an Imagine model (.gmd) file populated with extracted values for the specified correction equation. Because dark object brightness values were sometimes unavailable, or their selection was ambiguous in some mapping zones, an alternative script was available that converted brightness values to at-sensor reflectance. A single method, either the modified COST or at-sensor reflectance, was used within any given mapping zone (i.e. the standardization method was consistent within mapping zone mosaics).

Spatial data layer preparation included both image-derived and ancillary data sets. Core image-derived data sets included individual ETM+ bands, the Normalized Difference Vegetation Index (NDVI), and brightness, greenness and wetness bands created using Landsat ETM+ coefficients from Huang et al. (2002). Ancillary data sets were derived from 30 meter digital elevation models (DEM) obtained from the USGS National Elevation Dataset. Digital elevation model-derived data sets were created for each mapping zone and included elevation, slope (in degrees), a 9-class aspect data set, and a 10-class landform data set (Manis et al. 2001). Other ancillary data sets prepared for the region, but not used, included a “stitch map” of 1:500,000 scale state geology digital maps, a soil data set (STATSGO), and 1 kilometer resolution meteorological data (DAYMET). These data sets were not used because their scale was determined to be incompatible with the core Landsat ETM+ and 30 meter DEM-derived data sets.

“Ground truth” data were collected primarily through ground-based field work. Field samples were collected by traversing navigable roads in a mapping zone and opportunistically selecting plots that met criteria of appropriate size (1-hectare minimum) and composition (stand homogeneity).<sup>3</sup> Plot data were collected using ocular estimates of biotic and abiotic land cover elements, including percent cover of dominant species by life form (i.e. trees, shrubs, grasses, and forbs) and physical data such as elevation, slope, aspect and landform. Laptop computers using ArcView® software, Landsat imagery, digital orthophoto quads, and other ancillary information were also used for navigation and plot identification whenever possible. Each plot was identified with a paired UTM coordinate using a GPS and a visually interpreted polygon representing the survey plot.<sup>4</sup> Generally two digital photos were taken at each plot. Field data were recorded onto hardcopy field forms and subsequently entered into a database. Sufficient data were collected to assign a NVC alliance (Grossman et al. 1998) and/or ecological system (Comer et al. 2003) label to each plot. Of an approximate total of 93,000 samples obtained for the project, roughly 45,000 were collected via ground surveys during the course of the two field seasons ([Appendix 2-1](#)).

In addition to the SWReGAP ground-truthed samples as described above, these data were supplemented with sample plot data obtained from other projects roughly contemporary with the time period of our imagery (1999-2001), and via visual interpretation of aerial photography, digital orthophoto quads, or other remotely sensed imagery. Samples obtained from visual interpretation of remotely sensed imagery were given only a label identifying the land cover class. [Appendix 2-1](#) presents the distribution of samples used in the land cover modeling process.

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<sup>3</sup> The ability to traverse all navigable roads varied by state and subsequently Colorado relied heavily on obtaining sample data from existing databases and visual image interpretation. In Arizona, navigable roads were sampled using a distance criteria coupled with assessment of vegetation homogeneity.

<sup>4</sup> Arizona collected field samples as point features (GPS x/y location) with an estimate of the radius of vegetation type, which were subsequently polygonized using an appropriately sized buffer for each sample plot.

### Land Cover Modeling Using Decision Tree Classifiers

At the onset of the project Utah State University investigated several avenues for image classification. In particular, we experimented with methods similar to those used in previous large landscape mapping efforts such as the 1995 Utah GAP land cover project (Homer et al. 1997) and the WISCLAND project (Reese et al. 2002). Supervised-unsupervised hybrid approaches, such as those used in the Utah Gap Analysis Project and WISCLAND Project have proven effective for the groups that have used them. However, an important consideration for our project was the need to develop a common methodology that could be applied by five separate land cover teams to create a regionally consistent product.

Classification and regression trees (CART) were developed by Breiman et al. (1984) and were quickly recognized as a valuable tool for discriminating complex relationships among environmental variables (Verbyla 1987). Early spatial applications of decision trees for remote sensing-based land cover classification focused on continental and global scale mapping using coarse resolution imagery (Hansen et al. 1996, Friedl and Brodley 1997, DeFries et al. 1998, Friedl et al. 1999, Hansen et al. 2000, Friedl et al. 2002). More recently, decision tree classifiers have produced repeatable, accurate results in meso-scale mapping with Landsat Thematic Mapper imagery (Lawrence and Wright 2001, Brown de Colstoun et al. 2003, Pal and Mather 2003, Lawrence et al. 2004).

Decision tree classifiers are well suited for land cover mapping. First, as a non-parametric classifier, decision trees require no prior assumptions of normally distributed training data, which is useful as many land cover classes do not exhibit a normal distribution in spectral feature space. Second, while incorporating ancillary data sets can improve land cover class discrimination (Hutchingson 1982, Homer et al. 1997, Ricchetti 2000, Treitz and Howarth 2000), traditional parametric classifiers have difficulty dealing with differences in spectral and ancillary measurement scales. Decision trees readily accept a variety of measurement scales in addition to categorical variables. Decision tree classifiers have demonstrated improved accuracies over the use of traditional classifiers (Hansen et al. 1996, Pal and Mather 2003). Finally, decision tree software is readily available, computationally efficient, and by using a hierarchical approach to define decision rules, is intuitive to a variety of users.

Decision tree classifiers are considered an exploratory technique used to uncover structure in data (Breiman et al. 1984, Clark and Pregibon 1992). Decision trees use a binary partitioning algorithm to successively split a multidimensional “cloud” of explanatory data into increasingly homogenous subsets. Each binary split is considered a single rule in a chain of rules defining the characteristics of the response variable. Chains of rules can also be thought of as branches, with the final decision represented by a “leaf” or terminal node. For land cover mapping, explanatory variables are the spectral and ancillary data sets and the response variable is the land cover classes. Typically, decision trees recursively split the explanatory data set until no further splits are possible. Over-fitting the decision tree model in this manner usually requires “pruning” the tree, otherwise rules are generated for individual plots rather than groups of plots representing

land cover classes. The challenge with pruning is to establish optimal criteria so the final decision tree is neither too precise nor so general as to be meaningless.

As an alternative to pruning, “ensemble techniques” can be used to produce optimal trees. Ensemble techniques involve generating multiple trees to improve model accuracy and include “bagging” and “boosting” methods. With bagging, multiple trees are generated from randomly selected subsets of the data, where the final tree is produced from a majority “vote” by all the trees. Boosting similarly subsets the data, but generates multiple trees in succession focusing on branches of the tree that are most difficult to classify (based on misclassification rates). In this sense, boosting provides a way for an optimal tree to be generated by “learning” from previous tree models. This is an important benefit considering each split in a single, non-boosted decision tree determines all subsequent splits in the branch, some of which may be sub-optimal. Boosting, rather than bagging, has been more often employed for land cover mapping applications and has produced improved accuracies relative to non-boosted approaches (Pal and Mather 2003, Brown de Colstoun 2003, Lawrence et al. 2004).

A significant technical challenge with using decision trees for land cover mapping lies in the need to spatially apply the decision tree rules within a geographic information system. To successfully implement a boosted decision tree approach for such a large area among five separate teams, an effective tool for applying the decision trees in a spatially explicit context was imperative. Concurrent with our project, the USGS National Center for Earth Resources Observation and Science (EROS) began developing a land cover mapping tool capable of integrating the decision tree software See5/C5.0 (Quinlan 1993) with ERDAS Imagine. The tool, developed for the National Land cover Dataset 2001 (Homer et al. 2004) project (hereafter “NLCD mapping tool”) provided the ideal solution to our need for an efficient integration of the decision tree software within a spatially explicit modeling environment.

### SWReGAP Mapping Process

Land cover modeling was performed on a mapping zone by mapping zone basis with each mapping zone overlapping its adjacent mapping zone(s) with a 2 kilometer buffer (4 km overlap). The project’s primary objective was to produce the most accurate and complete map possible. To accomplish this, our mapping procedures required steps we determined made best use of all available training samples. In general, this meant two things:

First, we would rely on the decision tree classifier to discriminate the bulk of the land cover classes. However, recognizing that the classifier had difficulty discriminating certain classes adequately, other methods were employed to map these classes. Natural land cover classes such as lava flows and sand dunes, which are relatively rare and/or isolated on the landscape, were typically not modeled with the decision tree, nor were



anthropogenic classes such as recently chained areas, agriculture, or developed land uses.<sup>5</sup>

Second, we conducted our assessment of map quality on an intermediate land cover map generated with a subset of samples rather than the final land cover map which was generated from 100 percent of the samples. We refer to this approach as an internal validation, which should not be confused with an accuracy assessment of the final map. The internal validation involved randomly selecting 20 percent of available samples stratified by land cover class, and withholding them from the decision tree model generation. The intermediate map (generated with 80 percent of the available samples) was assessed with the 20 percent withheld dataset, producing an error matrix and kappa statistic. The land cover modeling process concluded with the generation of the final map using 100 percent of the available data. Validation results therefore represent an assessment of land cover maps created using 80 percent of the training data. No assessment of the final map produced from 100 percent of the data was made. Details of our validation approach are presented in the validation section of this chapter.

The following steps correspond with [Figure 2-3](#) and describe the general mapping process in greater detail.<sup>6</sup>

- 1) **Delineate non-modeled classes:** Delineate land cover classes anticipated to not be modeled with the decision tree classifier. These may include agriculture, developed, water, recently logged, chained, mined, etc. If GIS data exist, particularly for agriculture and developed classes, these may be used. Alternative methods for mapping these classes include screen digitizing and unsupervised clustering.
- 2) **Prepare explanatory data sets:** Explanatory data sets may be a combination of image- and DEM-derived data sets (see Data Sources). The choice of explanatory data sets may vary by mapping zone and is determined by the land cover analyst.
- 3) **Prepare sample data:** Sample data may be obtained from a number of sources (see Data Sources). All sample polygons are randomly divided into a training data set (80%) and validation data set (20%) using ArcView. The NLCD mapping tool requires individual pixels for sample observations. While each sample polygon is recognized as an independent observation, we use sub-samples (i.e. cluster sampling) within each polygon to account for spectral and environmental variability within the sample polygon. Sub-samples are randomly selected from each polygon with a maximum of 20 sub-samples per sample polygon using the Randpts extension (Jenness Enterprises 2005) in ArcView.
- 4) **Model land cover classes with decision tree classifier using 80% of sample data:** Using the NLCD mapping tool, explanatory variables are queried by the response variable data set to produce input files required by See5/C5.0. The decision tree model is created using the boosting option with 10 iterations in See5/C5.0. Output files from See5/C5.0 are spatially

<sup>5</sup> The adequacy of the decision tree classifier for mapping any given land cover class was driven primarily by availability of sample data. Our field data collection protocol focused on natural and semi-natural classes with the assumption that many anthropogenic classes could be mapped from existing GIS data, or could be more easily delineated via screen digitizing. Given the abundance of anthropogenic classes in eastern Colorado, the Colorado team used the decision tree to discriminate developed and agriculture land cover classes using a substantial amount of image interpreted sample plots.

<sup>6</sup> Steps 1-10 outline the general mapping process as established by the regional land cover lab. Steps taken by state mapping teams may have diverted slightly from this general process.

applied in Imagine using the NLCD mapping tool. Modeling is an iterative process. After model evaluation (see step 5 below) a different combination of explanatory data sets, or additional samples may be tried to improve the model. At this time the analyst decides which land cover classes are “mappable” given the availability of training data and the discriminating capabilities of the model. When model improvement reaches a point of diminishing returns, proceed to step 6.

- 5) **Internal validation of intermediate land cover map using 20% withheld sample data:** Model validation is only for those land cover classes being modeled with the decision tree. Using the 20% withheld sample polygons, use the ArcView Kappa extension (Garrard 2003) to create an error matrix and calculate the kappa statistic (Congalton 1991). The Kappa extension intersects the validation sample polygons through the completed map. When the mode (i.e. most frequent) value of pixels in the land cover map agree with the validation polygon label, the reference site is considered correctly mapped.
- 6) **Create final decision tree model and map using 100% of sample data:** This procedure is the same as step 4 with the exception that 100% of the sample data are used to generate the decision tree.
- 7) **Map refinement:** The land cover map produced in step 6 is carefully examined to determine where errors exist through a combination of visual examination and evaluation of the error matrix. The decision tree classifier may not have produced good decision rules for a number of possible reasons, such as not having an adequate number of samples for a given land cover class, not having sufficient samples in a given geographic region, or limitations of the explanatory data (spectral and/or ancillary) to discriminate between land cover classes. Known geographic errors can be fixed using Imagine’s Recode utility and an \*.aoi file. Known environmental errors (e.g. mapping on incorrect slope, elevation or aspect) can be fixed using a conditional statement in a post-classification model (e.g. Imagine \*.gmd file). If possible additional sample plots for a geographic area or land cover class are added and the preceding steps repeated.

At this step, it is also possible to correct errors associated with clouds. For example, where clouds exist in one date of imagery but not in others, separate models can be run (see step 4) to correctly classify the land cover classes in the cloud covered areas. Using a conditional post-classification model replace the cloud covered pixels in the final map with those from an alternate decision tree model/map that was not as good overall, but was not impaired by cloud cover (e.g. model using imagery from one season rather than two).

- 8) **Overlay non-modeled classes onto final land cover map:** Non-modeled classes retained from step 1 are converted to an Imagine file format, given the proper integer value, and combined (i.e. overlaid) with the map from step 7. This can be done with a conditional statement in an Imagine \*.gmd model.
- 9) **Convert to minimum mapping unit:** Use Imagine’s Clump and Eliminate functions to generalize the image to the minimum mapping unit (i.e. 1 acre). Parameters are set to use 4 connected neighbors for Clump and a minimum of 1 acre for Eliminate. When used together these steps eliminate clumps of 3 pixels or less, where the eliminated pixels assume the majority value of adjacent pixels.
- 10) **Edge-match to adjacent mapping zones:** Edge-matching requires that the integer values for land cover classes be standardized in accordance with SWReGAP Handbook guidelines (e.g. S001 has value 1, S112 has value 112, D05 has value 305, etc.). Once standardized, adjacent images are mosaiced using Imagine’s Mosaic tool with outline and overlap functions. Outlines can be drawn as needed within the 4 km overlap area using an \*.aoi file.

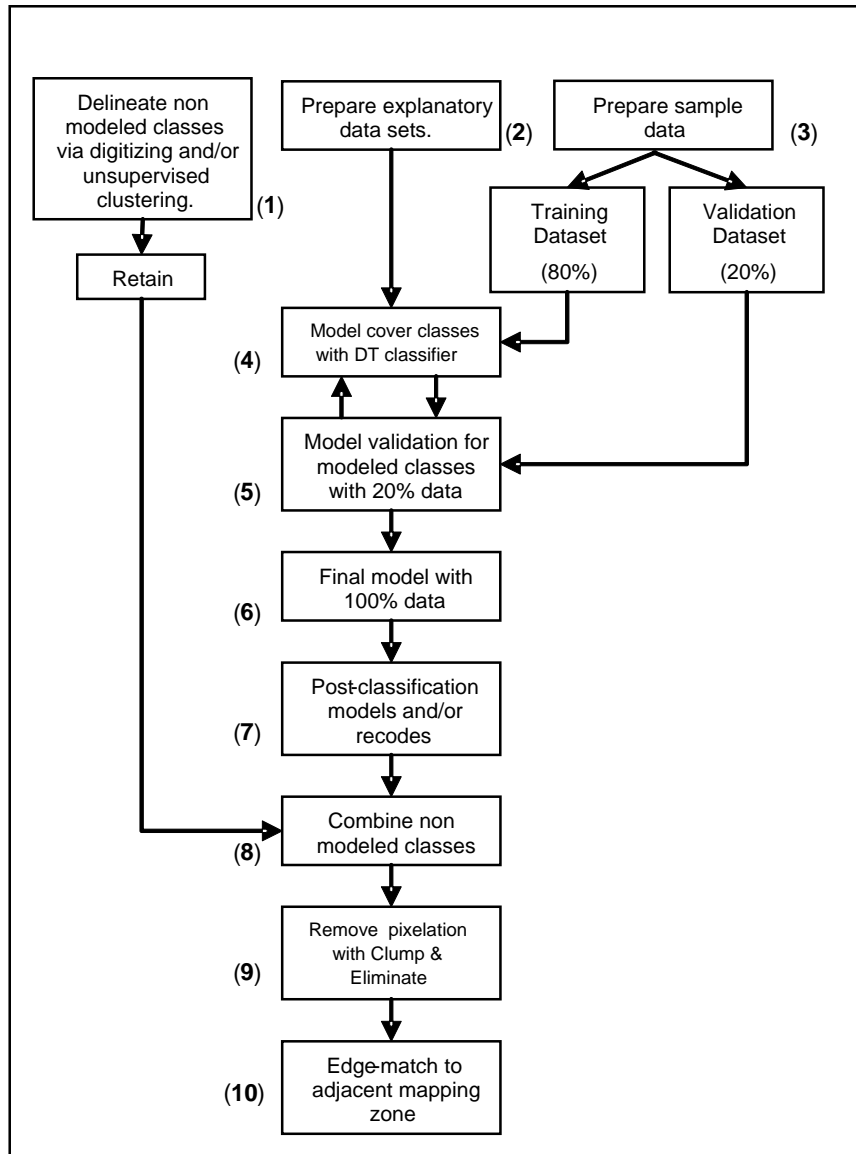
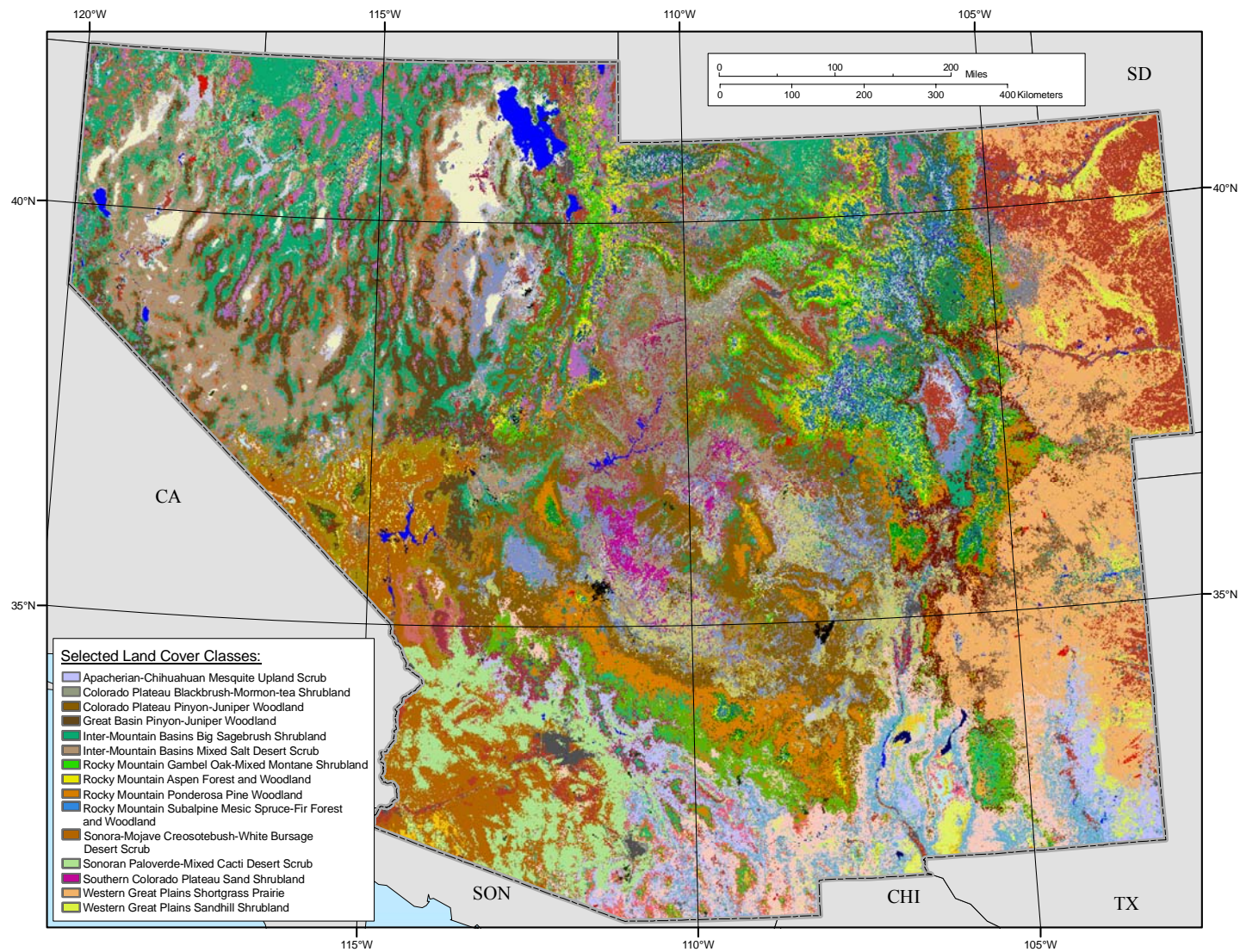


Figure 2-3. Overview of the SWReGAP Mapping Process

## Land Cover Map Results

State land cover mapping teams were responsible for all steps in the mapping process and edge-matched adjacent mapping zones within their responsibility area. Utah State University assembled the state mosaics to create the final regional mosaic. The final map product (Figure 2-4) contains 125 land cover classes, 109 of which are ecological systems. The data set retains the 30 meter pixel resolution of the core data sets with a minimum mapping unit of 1 acre (0.40 hectares). The representative fraction scale of the data set is considered to be 1:100,000. Appendix 2-2 provides a table showing land cover classes mapped for the 5-state region, their mapped area in individual states, and their total area in the region. The final land cover map is presented in Figure 2-4.



**Figure 2-4. Final land cover map showing a subset of land cover classes in the legend.**

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# LAND COVER MAP VALIDATION

## Introduction

Assessing land cover map quality is an important concern for land cover mapping projects. Map quality assessment provides useful information to map users about the reliability of the map product. Various approaches to map quality assessment are recognized (Foody 2002), however, making the assessment helpful to the map user should be of primary importance (Smits et al. 1999). Typically the quality of land cover maps are assessed using a probability based sampling design (Stehman and Czaplewski 1998) with relatively large sample sizes per class (Congalton and Green 1999). These probability based approaches utilize data collected specifically for map quality assessment, and are commonly referred to as “map accuracy assessments.”

We consider our approach an internal validation; “validation” in the sense that our purpose is to validate the quality of the map, and “internal” because we use data collected for, and used within, the modeling process (Shtatland et al. 2004). The approach may be viewed as a “split sample” or “hold out” method. This type of validation is not as accurate as a k-fold cross-validation (Goutte 1997) or as robust as an external validation (Shtatland et al. 2004). However, given the size and scope of our project, we determined it to be the most feasible approach providing a useful quantitative measure of map quality.

## Land Cover Map Validation Methods

Quantitative validation methods were described briefly in the previous section dealing with the mapping process. Here we provide a more detailed explanation about the quantitative validation process used by SWReGAP, focusing on our use of fuzzy set analysis. We also describe our approach to performing a qualitative assessment of the map product.

### Quantitative Assessment using Fuzzy Sets

The Gap Analysis Handbook recommends the use of “fuzzy set” analysis as a means of providing map users additional information about the quality of the map product (Crist and Deitner 2000). Our approach to fuzzy set assessment is based on the work of Gopal and Woodcock (1994) and described by Congalton and Green (1999). Using fuzzy set analysis for map quality assessment has proven useful in various land cover mapping efforts (Falzarano and Thomas 2004, Laba et al. 2002, Woodcock and Gopal 1992, Reiners et al. 2000). The premise behind fuzzy set theory for thematic map assessment is that thematic mapping involves placing a continuum of land cover into (somewhat artificially) discrete land cover classes. This continuum suggests that there can be different magnitudes of error between/among classes. The objective of using fuzzy sets for thematic map assessment is to provide map users with information about the frequency *and* magnitude of map error. In other words, a reference site may have been

mapped incorrectly, but how incorrect was it? An answer to this question can be provided by re-evaluating the error matrix within the context of recognized similarities among land cover classes.

The essence of fuzzy set assessment lies in the construction of a “linguistic measurement scale” to assign degrees of correctness to misclassification errors. Gopal and Woodcock (1994) suggest five levels of linguistic values ranging from “absolutely wrong” to “absolutely right” which experts use when evaluating a map product relative to the reference sample plots. Determining the appropriate linguistic class, or error type, for any given reference plot is subject to the judgment of the error assessment “expert.” Establishing objective criteria for assigning the level of error, therefore, is an important component to a fuzzy set assessment. Criteria for error assignment type may be based on seriousness of the error for its intended application (Reiners et al. 2000) or on some aspect of similarity among land cover classes.

Establishing criteria for defining error assessment types was particularly important for a collaborative project such as SWReGAP. For our project, each land cover team acted as the “expert” responsible for error type assignment. For the fuzzy assessment to be as regionally consistent as possible, establishing a regional framework for error assessment was critical. Our approach focused on criteria based on “ecological similarity.” Fuzzy assessments were created for each mapping zone independent of other mapping zones rather than the region as a whole. Typically, fuzzy assessments are conducted as part of an accuracy assessment after map completion. Our approach however used the error matrices produced from the internal validation (see *SWReGAP Mapping Process*). [Figure 2-5](#) provides an overview of the process describing the steps in greater detail.

- 1) **Regionally recognized criteria for ecological similarity types.** Four major types of ecological similarity form the criteria from which similarity among land cover classes are recognized: physiognomic structure, dominant species, juxtaposition of ecological systems, and special substrates. [Appendix 2-3](#) presents the regionally recognized ecological similarity types.
- 2) **Evaluate original error matrix for ecological similarity types to create *ecological similarity type matrix*.** The analyst evaluates each pair of land cover classes for every off-diagonal error (misclassification) cell in the original error matrix within the context of the regionally recognized ecological similarity types. While the ecological similarity types are regionally recognized, it is incumbent upon the analyst to assign ecological similarity codes. This is done based on the analyst’s knowledge of the mapped ecological systems, and familiarity with the particular mapping zone being analyzed. An ecologist from NatureServe reviewed the state analysts’ assignment of ecological similarity codes to ensure a regionally consistent application of the ecological criteria. [Appendix 2-4](#) provides an example of the original error matrix for UT-5 and [Appendix 2-5](#) presents the resulting *ecological similarity type matrix*.

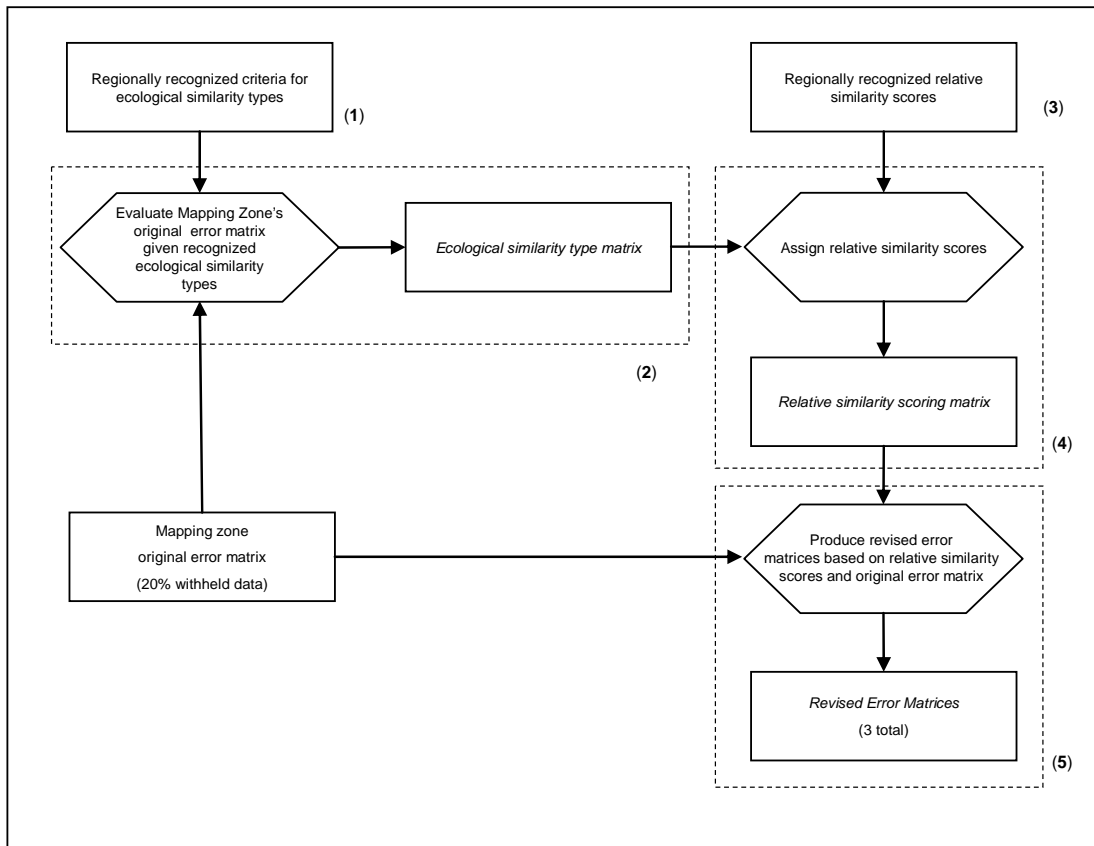


Figure 2-5. Overview of the SWReGAP fuzzy assessment process.

- 3) **Regionally recognized relative similarity scoring system based on ecological similarity types.** Based on the ecological similarity type or combination thereof, each cell that is misclassified in the original error matrix must be ranked with a numeric relative similarity score. A regionally recognized scoring system ([Appendix 2-6](#)) provides a consistent method for the numeric scoring and ranking of ecological similarities between land cover classes.
- 4) **Assign relative similarity scores (numeric) to off-diagonal cells to create *relative similarity scoring matrix*.** The analyst uses the regional similarity scoring system ([Appendix 2-6](#)) to assign a relative similarity score to each off-diagonal error cell ([Appendix 2-7](#)).
- 5) **Produce revised measure of agreement matrices:** The original error matrix ([Appendix 2-4](#)) is re-evaluated in conjunction with the matrix of relative similarity scores ([Appendix 2-7](#)) to produce revised “measure of agreement” matrices (i.e. fuzzy set assessment) for each mapping zone. Three revised error matrices are produced including: revision recognizing land cover classes that are correctly mapped, or are incorrect, but are “very similar” (scores of 4 and 5) ([Appendix 2-8](#)); revision recognizing land cover classes that are correctly mapped, or are incorrect, but “very similar” or “moderately similar” (scores of 3, 4 and 5) ([Appendix 2-9](#)); and revision recognizing land cover classes that are correctly mapped, or are incorrect, but “very similar,” “moderately similar,” or “somewhat similar” (scores of 2, 3, 4 and 5) (see [Appendix 2-10](#)). Revised error matrices ([Appendices 2-8, 2-9 and 2-10](#)) can be summarized for both errors of commission and errors of omission to show overall improvement as well as by-class improvement given the recognized ecological similarities among mapped classes. [Appendices 2-11 and 2-12](#) present summaries of fuzzy set assessments for all levels for user’s and producer’s accuracy respectively.

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### Qualitative Assessment

It is important to recall that some land cover classes were not modeled with the decision tree classifier but were instead incorporated into the map as a post-modeling step. In addition, for some classes, withholding 20% of the available samples resulted in very few reference samples. Because of these shortfalls with the quantitative assessment, and because we believe there is value in a qualitative summary, we provide qualitative assessment summaries for each land cover class by mapping zone.

Land cover qualitative summaries are brief descriptions provided by the teams involved in the mapping process for each mapping zone. They are intended to provide a qualitative evaluation from the perspective of the land cover mapping analyst of how well the land cover class appeared to be mapped, taking into consideration the number of training and reference samples available for the cover class and the team's knowledge or familiarity with the mapping area. Often, the summary provides a narrative interpretation of the error matrix, identifying in qualitative terms where a particular land cover class is being misclassified geographically and with which land cover classes it is being confused.

## **Land Cover Map Validation Results**

### Mapping Zone Assessments

Model validation as described above was performed for each mapping zone separately. While reporting kappa statistics and presenting error matrices for all 25 mapping zones is beyond the scope of this paper, these data are available to the public at <http://earth.gis.usu.edu/swgap/mapquality.html>. The website provides errors of omission, errors of commission, overall percent correctly modeled, as well as the kappa statistic for each mapping zone. Since our validation approach involved withholding 20 % of available sample plots proportionally stratified across the land cover classes, few reference plots for several rare land cover classes were available for validation. Rather than exclude the rare, or non-modeled classes (e.g. anthropogenic classes) in our final product, we chose to include them without validation.

In addition to these quantitative data on model validation, the website also provides the qualitative evaluations provided by each state's land cover mapping team for every land cover class by mapping zone. The qualitative evaluations provide brief narratives summarizing perceived strengths and weaknesses of the mapped class. These evaluations are provided for all land cover classes regardless of whether they were quantitatively validated or not.

### Regional Assessment

To provide a regional validation by land cover class, all mapping zone error matrices were combined and summarized. [Appendix 2-13](#) presents all 125 land cover classes sorted into 5 validation groups and organized hierarchically into NLCD land cover classes. The first validation group contains classes that were not assessed regionally



because of limited validation plots ( $n < 20$  for the region) or were non-natural classes and not the primary focus of our mapping effort. These 40 classes comprise approximately 9.5% of the total land area for the region, with more than half (5.5%) as agriculture.

The second validation group contains land cover classes with validation results from a user's perspective less than 30%. These three classes comprise less than 0.5% of the total land area for the region. All of the classes in this group are difficult to discriminate ecologically and spectrally (i.e. a grassland, steppe and savanna). For example, the error matrices for these classes reveal that the Chihuahuan Semi-Desert Grassland was most confused with the Apacherian-Chihuahuan Semi-Desert Grassland and Steppe class, and the Basins Big Sagebrush Steppe class was most often confused with the Basins Big Sagebrush class.

The next validation group contains classes where agreement between the validation samples and the map was between 30 and 49% from a user's perspective. These 17 classes represent approximately 9.5% of the land area. Most comprise very small portions of the region (less than 0.5%) with the exception of three classes. Two scrub/shrub classes (Apacherian-Chihuahuan Mesquite Upland Scrub, Chihuahuan Mixed Desert and Thorn Scrub) and one grassland/herbaceous class (Inter-Mountain Basins Semi-Desert Grassland) represent substantial portions of the land area, covering approximately 30,000 square kilometers each. The two desert scrub classes are confused with the Apacherian-Chihuahuan Semi-Desert Grassland and Steppe class, and with each other. The Inter-Mountain Basins Semi-Desert Grassland is mostly confused with the Intermountain Basins Semi-Desert Shrub Steppe, and the Intermountain Basins Big Sagebrush Shrubland class. The obvious trend with these poorly and very poorly mapped classes is high confusion among classes that are ecologically very similar, sparsely vegetated, or both.

The largest number of mapped classes (50) comprising the greatest proportion of land area (56.5%) are presented in the next validation group. Here agreement between the validation samples and the map was between 50 and 70%. The most notable classes for relative abundance on the landscape are the Colorado Plateau Pinyon-Juniper Woodland (7% land area) and Inter-Mountain Basins Big Basin Sagebrush Shrubland (8% land area) classes, with user validation rates of 69% and 59% respectively (producer's rates of 81% and 77%).

Fifteen classes were validated with results greater than 70% agreement between the validation samples and the map. These 15 classes represent approximately 24% of the total land area. The 85 classes that were validated represent 91% of the total land area. Overall correct classification for these 85 classes was 61% (KHAT statistic = 0.60;  $n = 17,030$ ).

The overall figure of 61% provides a summary measurement for the region of the decision tree classifier's performance relative to the reference samples used for validation. It is important to recognize that validation results vary by land cover class ([Appendix 2-13](#)) and by mapping zone. For example, matrix-forming land cover classes

(i.e. “extensive and contiguous...with wide ecological tolerances typically ranging in size from 2,000 to 100,000 ha” (Comer 2003)) such as certain forests, shrublands and grasslands typically represent a larger portion of the landscape and typically had a larger number of training and validation samples. These classes typically had better validation results than small or linear patch types with relatively few training and reference samples. Land cover classes on the fringe of their geographic range in some mapping zones may be more poorly mapped than elsewhere because the size and distribution of samples (both for training and validation) was limited. Lastly, it is important to note that the validation results are based on the intermediate land cover map using the 20% withheld dataset. Since the final map was produced using the withheld samples, we assume that the final map is an improvement over the intermediate map that was validated.

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# DISCUSSION

## Land Cover Mapping Methods

A primary objective of our land cover mapping process was to develop a methodology that was repeatable and could be consistently applied by multiple land cover mapping teams. In this regard we believe the decision tree classifier method was successful. The intuitive nature of the decision tree classifier and the easy-to-use software met this objective very well. Compared to hybrid supervised-unsupervised image classification approaches used in large land cover mapping efforts (Homer et al. 1997, Reese et al. 2002, Ma et al. 2001) we found the decision tree classifier considerably more time-efficient. Whether decision tree classifiers are a more effective tool for discriminating land cover classes was not specifically researched by our project. However Hansen et al. (1996) and Pal and Mather (2003) observed a measure of superiority over traditional parametric image classification techniques.

The use of spectro-physiographic mapping zones appeared to be a successful strategy for dividing the region into manageable working units and an effective means of constraining spectrally and environmentally similar land cover classes to logical geographic boundaries. Production of multi-scene mosaics for each mapping zone appeared successful as well. While image standardization did not result in seamless mosaics, satellite scene boundaries that were apparent generally were not problematic.<sup>7</sup> This may be due to the slight effects of atmospheric attenuation in the arid southwest, and may be of greater concern in other environments.

Identifying the optimal combination of predictor data sets for the decision tree classifier was a major focus in our efforts to develop a regional mapping methodology. Initially, we considered establishing a regional set of standard predictor data sets for all mapping zones in the region. Our concern was that adjacent land cover maps would not edge-match adequately if different sets of predictors were used for model development. Eventually, it was decided that each land cover analyst would choose the predictor data sets they determined worked best for a given mapping zone. As expected, the availability of multiseason imagery did improve image classification in most areas. However, use of imagery from a single season occasionally produced better results. The suite of core predictor data sets to choose from was consistent throughout the region, namely three seasons of ETM+ imagery with the analyst's choice of image transformations, and any combination of DEM derivatives (slope, aspect, landform, etc.). Concerns about edge-matching adjacent land cover maps proved negligible in most instances. In fact, successful matching of adjacent land cover maps could indicate accurate land cover mapping since completely different models converged upon similar predictions of vegetation distribution (see [Figure 2-6](#)). Good edge-matching was also facilitated by frequent communication and coordination between the land cover mapping teams and the

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<sup>7</sup> Given highly seasonal spectral variability in Colorado, it seemed that scene boundaries needed to be accounted for. Therefore, scene boundaries were included as a predictor layer in Colorado.

NatureServe ecologist who assisted in decision-making in order to maintain regionally consistent application of the ecological systems concepts across the project.

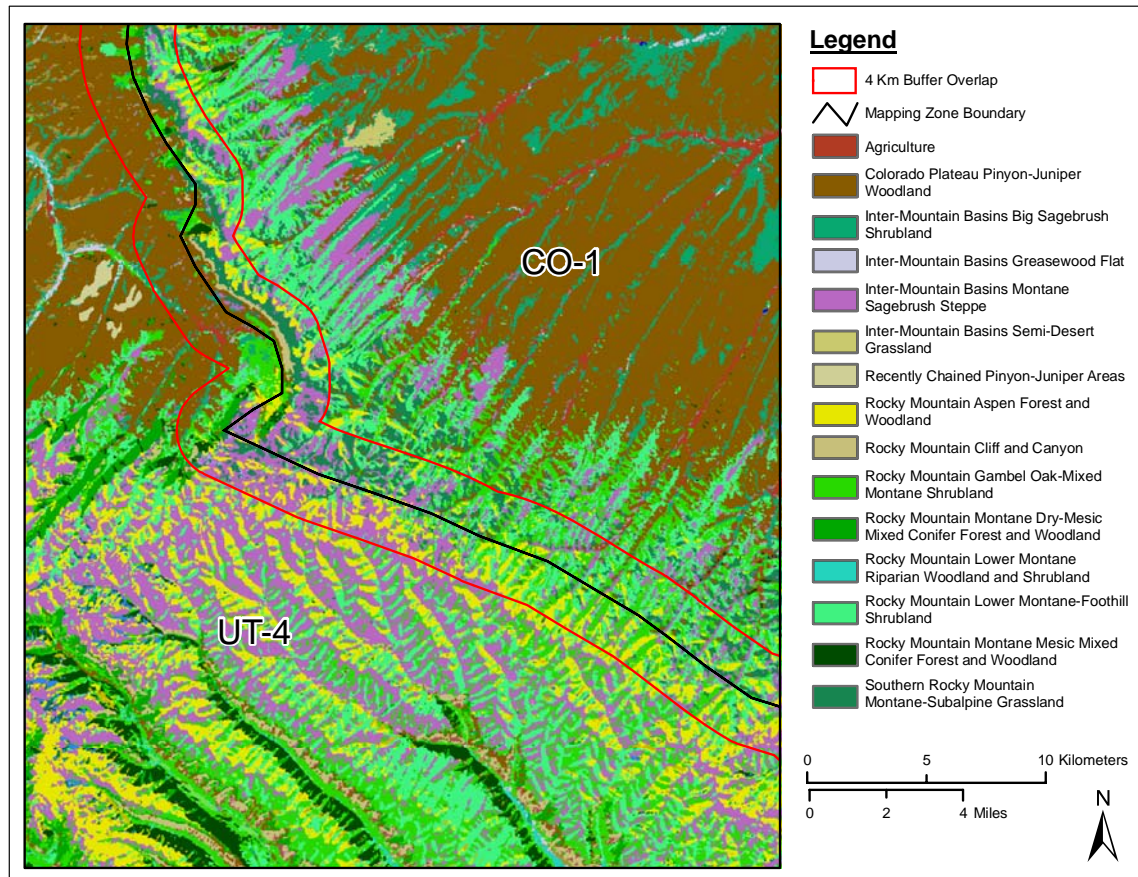


Figure 2-6. Example of edge-matching between UT-4 and CO-1

With the exception of work by Pal and Mather (2003), we found little published literature testing the training data requirements of decision tree classifiers for land cover mapping. Pal and Mather (2003) tested increasing training dataset size and found that classification accuracy increased linearly with size until reaching approximately 300 samples per class, whereupon additional training samples added little benefit. While not tested specifically, it is reasonable to assume that this is a general guideline and that the optimal number of samples for a given land cover class will vary with the spectral and environmental distinctiveness of each class, as well as the rarity of the class on the landscape. Identifying the optimal number of training samples per land cover class per mapping zone remained an elusive objective throughout the project and is certainly fertile ground for further study. We did discover, however, that sampling proportionally to the expected spatial abundance of land cover classes on the landscape produced superior results over using a roughly equal number of samples per class, which tended to over-map spatially rare classes. These findings are similar to those of McIver and Friedl (2002).

Given the importance of proportional sampling, the role of an adequate stratification strategy presents itself as another area where improvements could be made. As mentioned, our ground-truth collection strategy aimed primarily at obtaining as many samples as possible across the landscape via the road network. Some attempts were made to collect data in proportion to expected spatial abundance of land cover, and a minority of samples was collected via remote sources (e.g. aerial photography and digital orthophoto quads). While we were pleased with the number of samples collected for the region (approximately 93,000), in hindsight we recognize that more samples, more adequately stratified across the landscape within each mapping zone, could have been obtained using a more formal sampling design strategy combining ground based collection with a stronger effort at collecting remotely obtained samples.

## **Map Validation**

Throughout the course of the project we recognized the importance of providing a measure of map quality to users of the land cover map. While limitations of time, money and logistics prohibited a formal accuracy assessment (i.e. external validation with probability-based sample design), we believe the methods we employed provide useful information to map users. Our regional framework establishing criteria for fuzzy assessment helped standardize the process among the five mapping teams. However, in hindsight the criteria for the ‘moderate’ and ‘somewhat’ similar categories may be more liberal than advisable, and as such validation results at these levels of the fuzzy assessment are more optimistic than is warranted. The ‘very similar’ category we feel provides a reasonable assessment of map quality given the assumptions and rationale of fuzzy set theory for map quality assessment. We recognize that not all land cover classes were quantitatively assessed throughout the region, but are satisfied that our assessment provided some measure of quantitative assessment for 85 of the 125 classes representing 91 percent of the land area.

## **Project Coordination**

Project coordination relied heavily on frequent communication between the regional land cover lab, the five land cover mapping teams, and the NatureServe ecologist who were familiar with the ecological systems for the project area. Correspondence via email—especially a project listserve—was critical for dissemination of information related to mapping methodologies and protocols. Also invaluable to project coordination were monthly teleconferences involving all land cover mapping personnel and the NatureServe ecologist. Face-to-face meetings (yearly) and hands-on workshops (three over five years) throughout the course of the project were essential not only for conveying important methodological techniques, but also as a means of fostering interpersonal relationships among team members. While the focus of this paper has been primarily on technical and methodological aspects of the land cover mapping effort, the importance of interpersonal relationships in a project of this nature should not be underestimated. Differing opinions regarding methodological and philosophical approaches to the effort were not uncommon. However, there was also a spirit of dedication to the work, and ultimately an understanding that in order to successfully complete the project, teamwork was essential.

From a project coordination standpoint, an important consideration was the recurring theme of how much autonomy each state would have in making decisions independent of group consensus. Perhaps the most difficult decision land cover analysts faced was deciding if a given land cover class should be mapped. Decisions to model a given land cover class were primarily driven by adequate representation within the training samples of a particular land cover class for a given mapping zone. Thus, the adequacy of the sample training set was a critical deciding factor for the land cover analyst. State analysts decided which classes to map based on their knowledge of the landscape or the perceived importance of the land cover class in the mapping zone. For example, riparian areas and invasive annual grasses, though difficult to map, may have been included if the analyst felt they were important features on the landscape. Also, when compiling the regional map some classes that were determined to be mappable in one state were aggregated or eliminated in the regional product to maintain regional consistency.<sup>8</sup>

In hindsight, more objective procedures could have been established to determine land cover class mappability. The ecological system classification as a regional target legend was developed by NatureServe during the course of the project, and must be recognized as a “working classification” (Comer et al. 2003). As such, the mappability of many classes using meso scale satellite imagery and ancillary data is not fully known. Developing better methods to determine land cover class mappability over large geographic areas is another area ripe for future research. Lastly, other regional, national and local projects such as LANDFIRE, SAGEMAP, several NPS Vegetation Mapping Program and USFWS refuge mapping projects are already benefiting from the great amount of effort that was involved on behalf of the SWReGAP and NatureServe in developing a stable legend suitable for a project of this scope.

## CONCLUSION

The goal of this project was to produce a land cover map that would not only be used for gap analysis, but would also be a useful product for individuals, agencies, and organizations. The methods outlined in this paper aimed at developing a land cover map using objective and replicable methods. We found the spatial and radiometric characteristics of the Landsat ETM+ sensor effective for mapping the vegetation of the Southwest into ecologically meaningful classes with reasonable accuracy. The decision tree classifier offered considerable benefits to the mapping process, and allowed us to map many land cover classes to our satisfaction. However, in addition to the sophistication of decision tree classifiers, the adequacy of training data, the establishment of objective criteria, and regional standards for consistency, we must recognize the importance of human reason in the mapping process.

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<sup>8</sup> For example not all states distinguished irrigated and non-irrigated agriculture and in the regional product these were combined into a single agriculture class. Also, Colorado mapped several land cover classes at the alliance level and mapped Conservation Reserve Program lands as a separate class. These have relevance for Colorado but were not included in the regional product.

One may ask whether we met our objectives of producing a map that improves upon the state-based, first generation GAP land cover maps for the region. A rigorous comparison between the SWReGAP map and previous maps would be time consuming but might prove useful. Another approach would be to design a statistically rigorous accuracy assessment of our product. One measure of the quality of this map relative to first generation state-based land cover maps, worth noting, is that more than ten times the number of training samples were used for the SWReGAP map than the previous maps combined. Furthermore, an important accomplishment of our effort is that instead of five different legends, there is now one to represent the region seamlessly. Ultimately, the value of the map will be determined by how frequently and how well the map is used. For that, only time will tell.



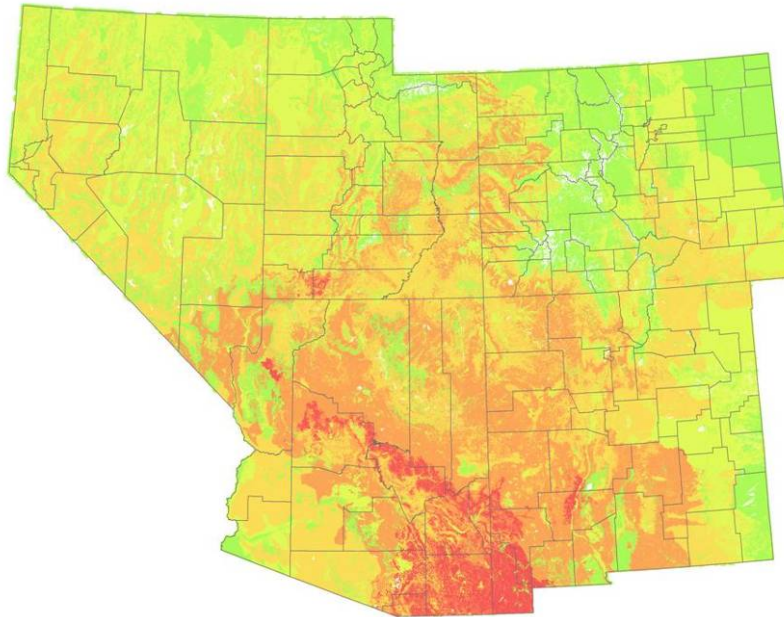
Photo from SWReGAP Training Site Image Library

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# CHAPTER 3

## PREDICTED ANIMAL HABITAT DISTRIBUTIONS AND SPECIES RICHNESS

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# INTRODUCTION

All species range maps are predictions about the occurrence of those species within a particular area (Csuti 1994). Traditionally, the predicted occurrences of most species begin with samples from collections made at individual point locations. Most species range maps are small-scale (e.g., >1:10,000,000) and derived primarily from point data to construct field guides which are suitable, at best, for approximating distribution at the regional level or counties for example. The purpose of the GAP vertebrate species maps is to provide more precise information about the current predicted distribution of individual native species' habitats according to actual habitat characteristics within their general ranges and to allow calculation of predicted area of distributions and associations to specific habitat characteristics.

GAP maps are produced at a nominal scale of 1:100,000 and are intended for applications at the landscape or "gamma" scale (heterogeneous areas generally covering 1,000 to 1,000,000 hectares and made up of more than one kind of natural community). Applications of these data to site- or stand-level analyses (site--a microhabitat, generally 10 to 100 square meters; stand--a single habitat type, generally 0.1 to 1,000 ha; Whittaker 1977, see also Stoms and Estes 1993) will likely reveal the limitations of this process to incorporate differences in habitat quality (e.g., understory condition) or necessary microhabitat features such as standing dead trees.

Gap analysis uses the predicted distributions of animal species habitat to evaluate their conservation status relative to existing land management (Scott et al. 1993). However, the maps of species distributions may be used to answer a wide variety of management, planning, and research questions relating to individual species or groups of species. In addition to the maps, great utility may be found in the literature that is assembled into databases used to produce the maps. Perhaps most importantly, as a first effort in developing such detailed distributions, they should be viewed as testable hypotheses to be confirmed or refuted in the field. We encourage biologists and naturalists to conduct such tests and report their findings in the appropriate literature and to the Gap Analysis Program such that new data may improve future iterations.

Previous to this regional effort there were five individual state-based projects in the Southwestern U.S., describing the likely present-day distribution of species by habitat type across their ranges. Ordinary species (i.e., those not threatened with extinction or not managed as game animals) are generally not given sufficient consideration in land-use decisions in the context of large geographic regions or in relation to their actual habitats. Their decline, because of incremental habitat loss can, and does, result in one threatened or endangered species "surprise" after another. The distribution and habitat information that exists for most of these species is also frequently truncated by state boundaries. Effective management of such wide ranging species requires a regional approach. Simply creating a consistent spatial framework for storing, retrieving, manipulating, analyzing, and updating the totality of our knowledge about the status of each animal species is one

of the most necessary and basic elements for preventing further erosion of biological resources.

Spatial models are an important tool for understanding wildlife-habitat relationships and for guiding natural resource management decisions (Stoms et al 1992, Pearce and Ferrier 2000, Penhollow and Stauffer 2000, Brugnach et al. 2003). For predictive models to be useful tools in the decision making process, they must be accurate, general, and easy to apply (Van Horne and Weins 1991). Bolger et al. (1997) have suggested modeling wildlife-habitat relationships at the landscape scale because management decisions are often best applied at this coarse level, and the Gap Analysis Program takes this approach to conservation.

The animal habitat modeling component of SWReGAP provides this kind of regional perspective on the distribution of vertebrate species in the Southwest. Prior to this effort, Arizona, Colorado, New Mexico, Nevada, and Utah all had existing GAP vertebrate habitat distribution models, but these earlier state-based projects used varied modeling approaches, different model datasets, and different methods (Edwards et al. 1995, Homer and Edwards 1996, Thompson et al. 1996, Schrupp et al. 2000, Halvorson et al. 2002). In addition, no effort was made to extrapolate range or habitat information across state boundaries. The data and documentation from these original efforts were not equally available and not all terrestrial vertebrate species were modeled by all states. Significant advancements in knowledge of species ecology and computer modeling technology have taken place since completion of these earlier efforts. Species habitat modeling for this project was directed at providing regional habitat models that spanned the five southwestern states. Our objective was to provide end users with a dynamic mapping solution that met Gap Analysis objectives, as well as uses and objectives suggested by potential end users (Deitner et al. 1999). We recognized the importance of documenting model attributes, and providing the capability to modify models so they could be updated as better information became available. We addressed these objectives for a list of over 800 terrestrial vertebrate species ([Appendix 3-1](#)).

This chapter is divided into five sections. The first section details the methods used to create animal habitat distribution models and to evaluate their completeness and accuracy. In the second section, we present results of the modeling process. The third section presents summary information on species richness, based on the animal-habitat distribution models. In the fourth section, we evaluate the accuracy of the models using standard GAP protocols. Finally we discuss the overall process, strengths and weaknesses of the models, potential uses of the models and associated data, and recommendations for further work.

## METHODS

Project staff for the animal-habitat distribution modeling component of the SWReGAP project represented a broad range of expertise and were drawn from a variety of State, Federal, and university sources for each of the five states in the project area (Table 3-1). Personnel from the five states helped design the modeling approach, gathered literature sources, reviewed and synthesized habitat information, and developed and reviewed the corresponding models. The workload for the project was divided among the five states, with New Mexico also serving in a coordination role as the regional laboratory. Each state was allocated a list of species for which they had lead responsibility for creating, reviewing, and modifying models. To support the collaborative effort, we held four workshops, had regional breakout sessions at National GAP meetings, conducted monthly conference calls, and communicated through email and a listserv.

**Table 3-1. Project staff involved in development of animal-habitat distribution models for the SWReGAP program, and their affiliations.**

|                                      | <b>Name</b>          | <b>Affiliation</b>            |
|--------------------------------------|----------------------|-------------------------------|
| <b>Arizona</b>                       | Charles Drost        | USGS SBSC                     |
|                                      | Trevor Persons       | USGS SBSC                     |
|                                      | Jut Wynne            | USGS SBSC                     |
| <b>Colorado</b>                      | Tammy Hamer          | NREL/CSU                      |
|                                      | Chris Mettenbrink    | NREL/CSU                      |
|                                      | Lee O'Brien          | NREL/CSU                      |
|                                      | Katy Oakes           | NREL/CSU                      |
|                                      | Don Schrupp          | Colorado Division of Wildlife |
| <b>Nevada</b>                        | David Bradford       | EPA                           |
|                                      | Chad Cross           | EPA                           |
|                                      | Bruce Jones          | EPA                           |
|                                      | Melanie Luna         | EPA                           |
| <b>New Mexico<br/>(Regional Lab)</b> | Ken Boykin           | NMCFWRU/NMSU                  |
|                                      | Bob Deitner          | NMCFWRU/NMSU                  |
|                                      | Thomas Kamienski     | NMCFWRU/NMSU                  |
|                                      | Cindy King           | NMCFWRU/NMSU                  |
|                                      | Suzanne Propeck-Gray | NMCFWRU/NMSU                  |
|                                      | Jennifer Puttere     | NMCFWRU/NMSU                  |
|                                      | Zachary Schwenke     | NMCFWRU/NMSU                  |
| <b>Utah</b>                          | Wendy Rieth          | USU                           |

The regional laboratory, with State inputs, created a habitat modeling protocol and databases (<http://fws-nmcfwru.nmsu.edu/SWReGAP>) to ensure regional consistency. GIS datasets to be used in regional modeling were identified by the entire project team, and were obtained or created by the regional lab. Model iterations were run at the regional

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and Colorado lab and provided through a website and through remote networking to lead states. States focused on literature review, species model creation, preliminary model review, and model modification. The draft models and associated data (report, range, and model) were submitted to expert review, and were revised as needed, based on the reviews.

We explored a variety of cartographic modeling techniques to represent habitat relationships in SWReGAP. These included the standard overlay method employed by Gap Analysis projects and three variations (index overlay, Bayesian methods and fuzzy sets) that incorporate uncertainty into the habitat representations. Index overlay offers a subjective consideration of the relative value of habitat variables, Bayesian methods can incorporate the uncertainty of knowledge-based habitat associations and base layer inaccuracies into the models (O'Brien 2005), and fuzzy sets allows for the inclusion of ambiguity at the habitat boundaries (Bonham-Carter 1994, Burrough and McDonnell 1998, Hill and Binford 2002). For simplicity, we produced the standard GAP binary representations (suitable or not suitable) with embedded range information (see range coding below), but still see the utility of producing non-binary representations incorporating uncertainty.

We defined Wildlife-Habitat Relationships (WHR) as a statement describing resources and conditions present in areas where a species persists and reproduces or otherwise occurs. Relationships can be modeled to predict habitat composition, and if the relationships are represented in a cartographic plane they can predict the presence of habitat spatially. A more detailed definition is:

A wildlife-habitat relationship (WHR) is a statement, mathematical or textual, about a demonstrated or inferred association of an animal with observable and describable physical or biotic features on the horizontal and vertical landscape. The relationship need not be directly cause-effect; it can involve a correlative association of the direct habitat component with a feature that is more readily observed or detected.

A WHR model is a textual, mathematical, graphical, or combination statement that predicts abstractly or directly what conditions are considered necessary for a taxon's habitat to exist and where it likely exists on a landscape. All models are inherently inaccurate to lesser or greater degrees depending on background knowledge of the taxon and the resolution of constituent spatial data used in the model. To be usable in a WHR model that predicts a mappable distribution of habitat for a taxon, an association must be able to be stated or measured in terms of an information metric (directly or remotely sensed) that can be defined in a coordinate system.

The following sections describe the major steps in developing a species list for the five-state area, gathering and synthesizing habitat information, developing WHR models, and translating these into GIS models.

## Taxa Inclusion Decision Rules

A preliminary species list for the five-state area was prepared by combining species lists from each state (based on the state GAP projects, plus other state and regional references). This list was then reviewed for errors and taxonomic changes. Taxonomy and scientific and common names were updated and standardized following the Integrated Taxonomic Information System (ITIS, <http://www.itis.usda.gov>). Familiar synonyms and common names were retained to avoid confusion and improve the usefulness of the resulting information.

We then developed “taxa inclusion decision rules” to identify the final list of species for modeling ([Appendix 3-2](#)). These rules are effectively “exclusion” rules, insofar as they identify circumstances under which we elected not to develop models. In summary, species-level taxa were excluded from consideration for modeling when any of the following were true:

- Taxa with only incidental, accidental, or vagrant occurrence in the five-state area;
- Taxa for which authoritative taxonomic sources have eliminated species standing;
- Taxa that have been extirpated from the Southwest for 20 years or over five demographic generations (whichever is a greater time span). Taxa extirpated from one or more states, but still present elsewhere in the region were modeled across the region.
- Taxa representing unsuccessful introductions or re-establishment in the area subject to distribution modeling;
- Exotic (non-native), primarily urban-dwelling taxa;
- Exotic taxa with restricted occurrence, associated with specialized or ephemeral landscapes or only under human manipulation such that the taxon cannot be modeled effectively.

We initially identified a total of 849 species-level taxa for modeling. Individual states reviewed this list and made further suggestions regarding additions and deletions. As species modeling progressed, 30 species were excluded from the final modeling list, based on the taxa inclusion rules. This resulted in a total of 819 species for which we developed distribution models

## Taxa Allocation Decision Rules

We developed taxa allocation decision rules to distribute the lead modeling responsibilities among all projects ([Table 3-2](#)). The decision rules focused on the overall distribution of the species, and also attempted to capitalize on previous modeling experience, and expertise within the modeling team on different taxonomic groups ([Appendix 3-2](#)). All projects had opportunity for input on the modeling approach and results for all taxa, regardless of the lead assignment. The taxa allocation decision rules were as follows:

- Occurring in 1 state only: assigned to that state project;

- Occurring in 2 states: assigned to the state that accounts for the majority of the species range;
- Occurring in 3 or 4 states: assigned to the state that accounts for the greatest part of the species range OR to New Mexico if widely distributed across all of the states;
- Occurring in all 5 states = assigned to New Mexico.

**Table 3-2. Number of taxa allocated to individual projects for lead responsibility for the Southwestern Regional Gap Analysis Project. There were 30 species removed from final modeling due to decision rules.**

| <b>Project</b> | <b>Number of Species</b> |
|----------------|--------------------------|
| Arizona        | 188                      |
| Colorado       | 158                      |
| New Mexico     | 389                      |
| Nevada         | 73                       |
| Utah           | 41                       |
| Total          | 849                      |

## Mapping Standards and Data Sources

The minimum mapping unit (MMU) of the habitat models is 0.4 hectares (1 –acre) because this is the minimum for land cover mapping (see [Land Cover Mapping Chapter](#)). We used a set of core data layers that were addressed for each wildlife habitat relationship model. These core data layers included land cover (SWReGAP land cover map), elevation, aspect, slope, hydrology (distance to hydrologic features), and soils (soil texture, depth, and percent rock outcrop; see [Table 3-3](#)). Other layers specifically addressed in the habitat-modeling protocol were mountain ranges, temperature (mean annual minimum and maximum), precipitation, and landform (Manis et al. 2001).

GIS coverages for surface waters are from the National Hydrography Dataset (NHD). Each type of water (lakes, perennial streams, etc.) is selected from the USGS NHD and a grid is created where each pixel is defined as the (integer) Euclidean distance (in meters) to nearest water type. Pixels are selected if they are less than the specified distance.

All soils coverages were derived from the STATSGO database (State Soil Geographic database, available from the USDA Natural Resources Conservation Service, <http://www.ncgc.nrcs.usda.gov/products/datasets/statsgo/>). Soils coverages include soil depth, texture (clay, loam, silt, cobble, etc.), and rock outcrops. Each MUID (STATSGO polygon ID) was reclassified to SWReGAP soil attributes (see [Table 3-3](#)).

Through the process of compiling habitat information, several other datasets were identified as potentially useful (e.g. mines/caves), but because of a lack of regional datasets or completeness we did not use these. For range delineation we used the 8-digit hydrologic units (See Range Delineation). We also used two mountain range coverages.

**Table 3-3. GIS coverages used in the animal species modeling process. Refer to the metadata accompanying the digital data for more complete descriptions.**

| Name             | Source                         | Description   |
|------------------|--------------------------------|---|
| usgswatersheds8  | NHD                            | 8 digit Hydrologic Unit Codes (HUCs)  |
| regional_dem     | National Elevation Dataset     | Elevation   |
| disttolake       | NHD                            | Distance (in m) to lakes without Great Salt Lake  |
| disttolakeGSL    | NHD                            | Distance to lakes (in m) with Great Salt Lake   |
| Disttoperrflow   | NHD                            | Distance (in m) to perennial streams  |
| disttosprings    | NHD                            | Distance (in m) to Springs  |
| disttowetlands   | NHD                            | Distance (in m) to Wetlands   |
| distTointerFlow  | NHD                            | Distance (in m) to Intermittent Springs   |
| disttointerstill | NHD                            | Distance (in m) to intermittent lakes, playas, etc.   |
| swlandcover      | this project                   | The SWReGAP land cover map  |
| swregapstatsgo   | STATSGO                        | Soils polygons containing greater than 50% of clay.   |
|                  | STATSGO                        | Soils polygons containing greater than 50% of loam.   |
|                  | STATSGO                        | Soils polygons containing greater than 50% of stone.  |
|                  | STATSGO                        | Soils polygons containing greater than 50% of silt.   |
|                  | STATSGO                        | Soils polygons containing greater than 50% of gravel.   |
|                  | STATSGO                        | Soils polygons containing greater than 50% of boulder.  |
|                  | STATSGO                        | Soils polygons containing greater than 50% of sand.   |
|                  | STATSGO                        | Soils polygons containing greater than 50% of cobble.   |
|                  | STATSGO                        | Soils polygons containing greater than 50% of rocky.  |
|                  | STATSGO                        | Soils polygons containing greater than 50% of shallow.  |
|                  | STATSGO                        | Soils polygons containing greater than 50% of pan soils.  |
|                  | STATSGO                        | Soils polygons containing greater than 50% of deep soils.   |
|                  | STATSGO                        | Soils polygons with rock outcrop up to 15%.   |
|                  | STATSGO                        | Soils polygons with rock outcrop 16-30%.  |
|                  | STATSGO                        | Soils polygons with rock outcrop 31-65%.  |
|                  | STATSGO                        | Soils polygons with rock outcrop greater then 65%.  |
| landform         | this project                   | Same as used by SW GAP land cover (Manis et al. 2001)   |
| gapmtn           | Regional DEM                   | Mountain range data set created by using a roughness coefficient algorithm on DEM                     |
| StateBoundary    | USGS DLG                       | For display   |
| MajorRoads       | USGS DLG                       | For display   |
| Rivers           | USGS DLG                       | For display   |
| aspect           | Regional DEM                   | Derived from regional DEM. Aspect (in degrees) was reclassified to SWReGAP categories (See Handbook). |
| slope            | Regional DEM                   | Derived from regional DEM. Value is (integer) slope in degrees.                                       |
| Mountains        | Regional DEM<br>GAP land cover | Screen digitized mountain ranges based on DEM and previous Gap Analysis land cover dataset.           |

One coverage was derived using a roughness coefficient based on the DEM and the other was a screen-digitized layer based on elevation and previous land cover maps. The default for modeling was the roughness coefficient, but the screen digitized dataset was used in specific models.

To facilitate modeling, all datasets were converted to ERDAS Imagine .img files (See Distribution Modeling). For modeling purposes two sets of data were created: 1) 240 m resolution for model review and testing; and 2) 30 m resolution for final model production.

### **Mapping Range Extent**

We used the Sub-basin hydrological cataloguing units (8-digit HUC: USGS/Office of Water Data Coordination) to delineate ranges for each species and used a coding system to label each polygon. Species ranges can be readily described by HUCs and HUCs are tractable for GIS. The 8-digit HUCs provided polygon units to create range maps for each species.

We used a 3-character coding system to label HUCs for species ranges (Table 3-4). The coding for historic/recent distribution was known (K), potential (P), or extirpated (X). Absence is implied for all polygons not attributed. This base coding system was modified based on reproductive use (breeding, non-breeding, both) and seasonal use (migratory, wintering, summering, year-round). For example, a species that is known in the HUC, and breeds and summers in the watershed was labeled K13. We used a wide variety of sources for species range delineation, emphasizing the most recent published literature. Previous Colorado GAP and New Mexico GAP data were also incorporated, as was a dataset of element occurrence within watershed obtained from NatureServe. To ensure consistency, all states consulted and reviewed a set of regional and national references for range depiction (Table 3-5).



**Table 3-4. Definitions and coding system identified for use in range delineation for the Southwest Regional Gap Analysis Project. The code consists of three characters, corresponding to (in order) distribution, reproduction, and seasonal use (e.g. K14).**

| <b>Species Range Delineation</b> |  | <b>Code</b>                     |
|----------------------------------|--|---------------------------------|
| <b>Occurrence</b>                | <b>Description</b>   | <b>1<sup>st</sup> Character</b> |
| Known                            | Species is known or probably occurs within the watershed. Species may have been repatriated recently in a portion of the historical range. | K                               |
| Potential <sup>1</sup>           | No known locations, but species could be within the watershed based on proximity and habitat characteristics.                              | P                               |
| Extirpated                       | Species with historical occurrence that have been chosen to be modeled.  | X                               |
| <b>Reproductive Use</b>          |  | <b>2<sup>nd</sup> Character</b> |
| Breeding <sup>2</sup>            | Species is known to breed within the watershed.  | 1                               |
| Non-Breeding*                    | Species is known to occur within the watershed when non-breeding.  | 2                               |
| Both*                            | Species is known to occur within the watershed throughout the year.  | 3                               |
| <b>Seasonal Use</b>              |  | <b>3<sup>rd</sup> Character</b> |
| Migratory                        | Species is known to occur within the watershed during its regular migration in Spring and/or Fall.   | 1                               |
| Wintering                        | Species is known to winter within the watershed.   | 2                               |
| Summering                        | Species is known to summer within the watershed.   | 3                               |
| Winter and Summer                | Species uses watershed during summer and winter  | 4                               |

<sup>1</sup> Potential was identified in the model process but was largely included within the K code with the addition of “probable” in the definition.

<sup>2</sup> Breeding and non-breeding habitat may apply to bird species, bats, and some other mammal species.

**Table 3-5. List of standard references used for animal-habitat distribution models****Amphibians and Reptiles**

- Degenhardt, William G., Charles W. Painter, and Andrew H. Price. 1996. *Amphibians and Reptiles of New Mexico*. University of New Mexico Press, Albuquerque, New Mexico.
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**Birds**

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- Phillips, A.R., J. Marshall, and G. Monson. 1983. *The Birds of Arizona*. University of Arizona Press, Tucson, Arizona. 220 pp.
- Poole, A.F., P. Stettenheim, and F.B. Gill (Editors). 1992. *The Birds of North America*. The American Ornithologists' Union and the Academy of Natural Sciences of Philadelphia, Philadelphia, Pennsylvania.
- Walters, R.E., and E. Sorenson, editors. 1983. *Utah bird distribution: latilong study*. Utah Department of Natural Resources, Division of Wildlife Resources, Salt Lake City. Publication 83-10.

**Mammals**

- Cockrum, E.L. 1960. *The Recent Mammals of Arizona - Their Taxonomy and Distribution*. The University of Arizona Press, Tucson, Arizona. 276 pp.
- Durrant, S.D. 1952. *Mammals of Utah – Taxonomy and Distribution*. University of Kansas Publications, Museum of Natural History 6:1-549.
- Feldhamer, G.A., B.C. Thompson, and J.A. Chapman (Editors). 2003. *Wild Mammals of North America – Biology, Management, and Conservation*. The Johns Hopkins University Press, Baltimore, Maryland. 1216 pp.
- Findley, James S. 1987. *The Natural History of New Mexican Mammals*. University of New Mexico Press, Albuquerque, New Mexico. 164 pp.
- Findley, James S., Arthur H. Harris, Don E. Wilson, and Clyde Jones. 1975. *Mammals of New Mexico*. The University of New Mexico Press, Albuquerque, New Mexico. 360 pages
- Fitzgerald, James P., Carren A. Meaney, and David M. Armstrong. 1994. *Mammals of Colorado*. University Press of Colorado, Niwot, Colorado. 467 pp.
- Hall, E.R. 1981. *The Mammals of North America*, 2<sup>nd</sup> ed. Wiley Interscience, New York, N.Y.
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- Hoffmeister, D.F. 1986. *Mammals of Arizona*. University of Arizona Press and the Arizona Game and Fish Department, Tucson. 602 pp.
- Wilson, D.E., and D.M. Reeder, editors. 1993. *Mammal Species of the World: a Taxonomic and Geographic Reference*. Smithsonian Institution Press, Washington, D.C.
- Wassink, Jan L. 1993. *Mammals of the Central Rockies*. Mountain Press Publishing Company, Missoula, Montana. 161 pp.

## Wildlife Habitat Relationships

WHRs were developed from a variety of sources including previous GAP efforts in the 5-state region (Edwards et al. 1995, Thompson et al. 1996, Schrupp et al. 2000). Where possible, we used “legacy” information from the past state-based GAP modeling efforts. However, most of this information was more than 10 years old, and differences in land cover legends necessitated comparing the original information and current information to associate species with the SWReGAP land cover legend. Because of differences in methods and datasets, much of this information could not be used. Project personnel identified a set of standard state and regional references to use as a starting point for the modeling effort (Table 3-5). We began by reviewing this information, along with online databases including the NatureServe Explorer database (<http://www.natureserve.org/explorer/>), Biota Information System of New Mexico (<http://fwie.fw.vt.edu/states/nm.htm>), Colorado GAP Analysis (<http://ndis1.nrel.colostate.edu/cogap/gapframe.html>), and internal database such as the Colorado Wildlife Species Database. These sources were considered the minimum for habitat information, and habitat modelers used a variety of sources to search for additional habitat references as time allowed.

WHRs were constructed following a standard protocol (Appendix 3-3). The protocol provides a user interface / template, automated tools, and associated reference information for defining range limits and compiling habitat associations for each species. The template could also be printed for use as a hard copy form for recording habitat association information (Appendix 3-4). Appendix 3-3 lists the main habitat components included in the WHR database and protocol, and provides a link to the full protocol.

Regional vegetation alliances were one of the primary components of the WHR models. We modified vegetation alliance data to fit with the final SWReGAP legend of 125 ecological systems, national land cover dataset classes, and disturbed classes. Modelers selected vegetation / land cover classes that were most similar to habitat descriptions in published accounts for each species. This process was aided by a cross-walk of familiar habitat classes frequently used in habitat descriptions (e.g. Merriam’s life zones) to the GAP vegetation classes (see Land Cover chapter). Many references list one or more individual plant species (e.g. creosote bush or juniper) in describing species habitats. In these cases, we attempted to match the plant species to the corresponding vegetation class (or classes), or ecological system. Alliances were subsequently cross-walked into the appropriate ecological systems.

We identified elevation attribute parameters based on regional elevation ranges. In some cases state elevation limits were combined to get a range for the entire SWReGAP area, and in other cases we had to extract elevation data from sources that covered a broader area. In these latter cases, we frequently had to trim the elevation range to values that reflect the five-state Southwest project area (e.g. by eliminating low-elevation records for a species, when those low elevations are from the species’ range in Mexico). Species experts and field location points were also queried when data were available. Separate models were created if elevation extremes for one or two states were very different from the rest, for example, greater short-horned lizard (*Phrynosoma hernandesi*).

We did not use slope for the majority of the species habitat models. This attribute was selected only if a species account indicated it was important. Aspect was also not included for the majority of the species habitat models. This was due to lack of information for these parameters for most species in published accounts.

Proximity to hydrological features was an important modeling component. We created different data layers for perennial streams, perennial lakes, intermittent streams, intermittent lakes, wetlands, and springs/seeps. In many cases the perennial stream coverage provided a surrogate for riparian vegetation that is often difficult to map with TM imagery (See [land cover chapter](#)). We used distance categories for modeling (0-50m, 0-100m, 0m-500m, 0-1000m, or if >1000m the explicit number). If explicit data were available we used that information. For species that have a hydrologic association but do not occur within the hydrologic feature itself we modified the model to exclude the water body (e.g. many species occur near lakes but not in the lake itself).

For soil identification we used the STATSGO dataset and identified 3 modeling components of soil texture, soil depth class, and percent rock outcrop (Thompson et al. 1996). Because of the scale of the STATSGO dataset (1:250,000) this layer was considered a constraining layer. Soil polygons were identified in STATSGO as possessing that soil texture if the polygon contained >50% of that soil type. Rock outcrops were identified based on the percentage of outcrop within the polygon (see [Table 3-3](#)).

Mountains were included in a model only if the species was limited to mountainous areas. Once the species' overall range limits had been delineated, it was constrained to all mountains within the selected watersheds, using as a mask the regional mountain range coverage based on roughness coefficient. Some species are known (based on literature and/or museum records) to occur only in specific mountain ranges. In these cases, we used a separate polygonal coverage to limit the model to those specific mountain ranges.

We compiled bibliographic references for each model to document model attributes used ([Appendix 3-5](#)). We did not limit references by a specific time frame and inclusion of information was based on current applicability to each species modeled and was at the judgment of the teams compiling the WHRs.

We were not able to model some species using the above WHRM procedure. Several species required multiple models because of differences in habitat over the range of the species or variation in elevational range due to latitudinal differences over the study area. For these species, two models were created. Several species models (Amargosa toad, *Bufo nelsoni*; Jemez Mountains Salamander, *Plethodon neomexicanus*) had to be modified and run after creation of the model file to fit specific life history or distribution traits of the species.

## State Modeling Methods

The availability of distribution and habitat data for vertebrate species varied among states. This included both published material (e.g. Nevada has a dearth of recent published compilations on vertebrate species in the state) and also information from previous modeling efforts. For this reason, details of the modeling work varied somewhat among the five state teams. These differences are described below.

### *Arizona*

Arizona completed models for 170 species. Habitat and distributional range narratives for each species were developed from exhaustive literature reviews. The approach of the Arizona team was as follows: first, five on-line abstract services (Science Direct, Cambridge Scientific Abstracts Internet Database Service, Kluwer Online, Springer Online, and Blackwell Publishing Synergy Online) were searched for each species. Then, the literature cited section of each published and unpublished report that was obtained was reviewed for additional relevant literature sources. Also, all literature cited within a given literature source was verified. For example, if Strong and Bock (1990) stated “acorn woodpeckers select for cottonwood granary trees (Phillips et al. 1964),” this statement was confirmed within Phillips et al. (1964). For each species, a literature-cited summary and an assessment of the literature used was written. Arizona used a set of decision rules for model parameterization.

### *Colorado*

Colorado completed models for 153 species. Colorado produced two models for the two subspecies of sharp-tailed grouse, and also produced two separate models for brown-capped rosy-finch and sandhill crane, for a total of 155 models. Colorado used the habitat affinity data from the Colorado Wildlife Species Database (CWSD) along with other state databases (breeding bird atlas, amphibian surveys, etc.) to derive habitat relationships for the original Colorado Gap Analysis Project (COGAP). This COGAP database was used as the starting point for compiling habitat relationships for the SWReGAP project. Colorado cross-walked the Anderson Level II land cover types used in COGAP to the National Vegetation Classification System (NVCS) types used in SWReGAP. These land cover associations were combined with other parameters from CWSD (hydrology, elevation, soils, etc.) to pre-populate the SWReGAP WHR database. Literature and database searches were then conducted to incorporate more recent information and to extend the models beyond Colorado's borders. Much of the information gathered was from recent taxa accounts, local studies, and on-line databases such as the Cumulative Index for Mammalian Species and NatureServe. CWSD is a thoroughly referenced database created by species experts citing original studies and literature. When habitat association information was gleaned from this data source, “CWSD” was cited as the source instead of citing the original references. Land cover assignments were made by cross-walking habitat relationship data from other classification systems or by interpreting descriptions in species accounts in the literature. Most references used dominant plant species to describe habitat type, but in a few cases, there were direct matches to community descriptions to NVCS Ecological Systems. All relevant land cover associations were included, anticipating that range, elevation, and

other limits would effectively trim the modeled habitats. New references were captured during the species expert review workshops if they supported substantial modifications to the current modeling variables.

### *Nevada*

Nevada completed models for 69 species. The Nevada group produced two models for the greater short-horned lizard, so the state produced a total of 70 models. Nevada used literature that was pertinent to the data layers available to build models. First, general sources were reviewed that likely had habitat information for a species (e.g., field guides, and state and regional references on taxonomic groups), and sources that compiled information from original sources (NatureServe Explorer, Mammalian Species Accounts, Catalog of American Amphibians and Reptiles, state wildlife databases). From these and other sources, additional references were identified that were likely to provide information particularly pertinent to the available model parameters, such as studies on habitat conducted within the 5-state area. The Nevada team did not do an extensive search of the primary literature and cited only literature that was sufficient to justify the parameters selected for the model.

### *New Mexico*

New Mexico completed models for 387 species. New Mexico produced two models for Virginia rail, so the state produced a total of 388 models. As the regional laboratory, New Mexico modeled those species that occurred throughout the region. NM-GAP (1996) data were used as the initial starting point to identify habitat associations and references. Other online data sources such as NatureServe Explorer and Biotic Information System of New Mexico (BISON-M) were also used. From this starting point, combined with standard state and regional references, further literature was sought through reference search engines including SciSEARCH, BIOSYS, and Wildlife Worldwide. Every attempt was made to obtain original citations to ensure proper synthesis. Literature cited within the models was focused on those sources either directly related to the model parameters or those that identified potential future modeling modifications.

### *Utah*

Utah completed habitat models for 39 species. Utah produced two models for the black rosy-finch, so the state produced a total of 40 models. First, a variety of databases were searched for primary literature on species' habitat and range, including Biological and Agricultural Abstracts, BIOSIS Previews, Cambridge Scientific Abstracts, CABDirect, Geobase, and Wildlife Worldwide. If there were many publications available for a particular species, as with many game and sensitive species, only those studies that were from or near the SWReGAP region were reviewed. Government documents and the Utah State University library database were also searched for potentially relevant books and theses. The state and regional references identified by the project were always consulted and cited if a species occurred in the particular state (e.g., Mammals of Utah by Durrant) and these were typically the best sources for initial generalizations and range delineations by state. Tertiary sources and internet databases (including Utah-GAP, CA-WHR, CWSD, BISON-M, and NatureServe Explorer) were used to check for missed references

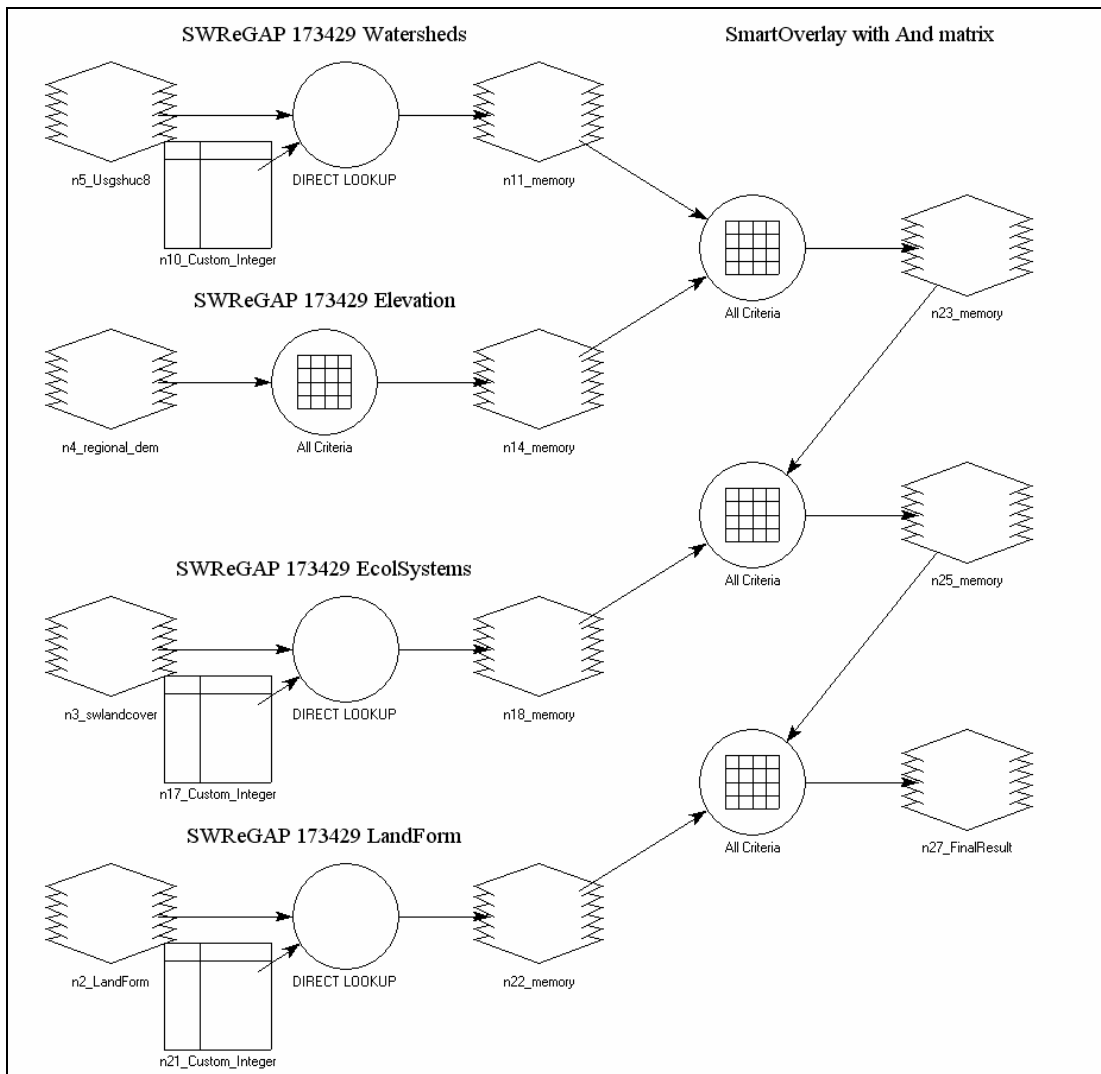
but Utah avoided citing these sources in most cases. The primary literature provided the most detailed and rigorous information on habitat, particularly when the study specifically addressed habitat issues or was conducted in the SWReGAP region. In addition, primary literature was important in gathering the most up-to-date information, given that some of the state references are decades old and even the internet databases were at least a few years out of date. Once literature was collected, notes were compiled and summaries were written for each species to assess the state of knowledge about a species range and habitat, as well as to aid in generating an overall concept of a species' habitat. Utah originally composed lengthy species accounts but these were later edited to fit within the 500 word limit imposed by the database, and to include only relevant information that would justify the range map and selection of model attributes.

## Distribution Modeling

To facilitate habitat modeling we created a set of Microsoft Access™ databases based on the recommendations of Deitner et al. (1999). The intent was to create a database that could be used to manage information and construct each species' wildlife habitat relationships model. The resulting databases are a tool for modeling and for end-users. Included within the database is a user-friendly method to define range limits using the 8-digit HUCs (drainage sub-basins). The FrontEndArc9 database provides a series of forms or wizards that guide the modeler through the habitat model. Data are stored in the WHRDataStore database. This structure allows more than one user to access and work on any given model. All previously discussed model attributes were available for use in modeling including DEM derived datasets (slope, aspect, elevation, landform), hydrology datasets (distance to streams, lakes, wetlands, intermittent streams, and intermittent lakes), mountain ranges, and soil (see [Table 3-3](#)). WHRDataStore stores the data in clauses defining model attributes for each species.

The FrontEndArc9 database gives modelers the ability to select model attributes in plain text, to provide references to document the model development, and to update model background information,. The database also allows the modeler to compile an ERDAS Imagine script to facilitate modeling ([Figure 3-1](#)). The script can either be run immediately or sent to a queue that can batch process the models. Scripts are then queued in a third database (GISEngine.mdb) that manages the Imagine Graphical model Files (.gmd) and runs the models in batch mode. [Figure 3-1](#) shows a sample model equation for Couch's spadefoot with the database code defined as:

```
SmartOverlay($[And matrix], $[SWReGAP 173429 Watersheds], $[SWReGAP 173429
Elevation], $[SWReGAP 173429 EcolSystems], $[SWReGAP 173429 LandForm])
```



**Figure 3-1. Example Wildlife Habitat Relationship Graphical Model for Couch's spadefoot (*Scaphiopus couchii*) ITIS # 173429 for Southwest Regional Gap Analysis Project. The model depicts (from top down) the watershed relationship, the elevation association, the ecological system associations, and the landform associations. End-users can modify these as needed.**

We created two regional datasets for use in the modeling. A 240 m resolution dataset was used to test models and provide models quickly to experts for review. A 30 m resolution dataset was created for the final model. Because of the size of the region and physical size of the model datasets, the 240m models took 2-5 minutes to complete, while the 30m resolution models could take 1 - 3 hours.

We created a fourth database to help in model development and internal and external review (SWReGAP-VSA.mdb). This database was linked to ArcGIS and provided habitat modelers a real time visual sensitivity analysis (VSA). Though not a quantifiable process like Gonzales-Rebeles et al. (2002), this tool gave habitat modelers the ability to add layers to the model in sequence to observe the sensitivity of the model to each data set. This process also allowed verification of models created through scripting.



After draft models were completed for all species, the models were reviewed (See Model Review). Comments from the reviews were provided to the lead state for each species to make adjustments to the models. Model modification was an iterative process, as modelers reviewed and incorporated expert information. Once modified models were reviewed we compiled and ran the final models.

There was some variation in development of models among the different taxonomic groups, due to differences in life history and the habitat components that were generally most important. Some examples of these differences are noted below.

### Mammals

Modification of distance to water for mammals occurring near lakes but not in lakes was done post model file (.gmd) creation. This was particularly useful in rodent species that are riparian obligates but not aquatic species. For some species (e.g. bats), large distance-to-water associations were used with an “and” statement of land cover. Bats were modeled with varying range codes to account for their seasonal life history (e.g. migratory species with distinct summer and winter ranges).

### Birds

We modeled all bird habitats including breeding, migratory, and wintering. There is increasing recognition of the importance of managing and protecting habitat used throughout a species’ life cycle. This is true for birds, in particular, which may have critical needs for migratory stopover habitats and winter habitats, in addition to their breeding habitats. Habitat modelers had the ability to separate breeding, migration, and winter habitat by land cover type or by range. For most species (those whose breeding and winter distributions do not overlap), range was sufficient to distinguish between these categories.

### Reptiles

Soils attributes were used for many reptiles, from the STATSGO soils dataset. Soil characteristics are frequently important for reptiles, particularly burrowing species, however the coarse scale of this dataset limited its usefulness. Many reptile models had to be modified to allow the distance to water dataset to model species near lakes but not in lakes. This was completed after creation of the model gmd file.

### Amphibians

Most amphibian models were based on our hydrology datasets to a greater or lesser extent. We had to modify our model procedures to create maps for species such as the Amargosa toad (*Bufo nelsoni*), which has such a limited range that we had to create a polygon specifically to limit the model extent to the species’ small known range. We recognized the need to separate lakes by size for modeling some amphibians, but did not include this step in our current effort because of dataset complexity.

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## Model Review

Each state reviewed all of the models for the species for which they were responsible. We conducted an additional internal review by having each state review the models created by other states. Finally, we had an external review that used outside experts to review the range information, habitat data, and resulting models for the species included in the SWReGAP area. Consistency in modeling effort was a considerable task given the number of habitat modelers ([Table 3-1](#)), the number of species, and the broad spectrum of data available for each species. Our internal review was intended primarily to ensure an adequate degree of consistency across all species included in the modeling effort. The purpose of the external review was to evaluate model correctness. The internal review included dividing species by taxonomic groups and reviewing the basic modeling attributes of the models (e.g. use of vegetation types vs. hydrology vs. soils or other habitat characteristics). We also reviewed the extent of literature available for each species, how that literature was used to select habitat parameters, and which habitat parameters went in to each species model.

The external review process was undertaken once the internal review was completed. External reviews were solicited from individuals and groups who had expertise with particular species or taxonomic groups. Reviewers included staff from Federal and State agencies (such as State wildlife and natural resources agencies), university scientists, and private individuals and groups familiar with species occurrence and natural history in the Southwest (e.g. the Great Basin Bird Observatory in Nevada)([Appendix 3-6](#)). We provided the external reviewers with a standard briefing about the GAP animal-habitat distribution models, along with an explanation of the type of critique and comments we were looking for in the model review. Workshops for purposes of external review were held in Colorado, Nevada, New Mexico, and Utah. These workshops discussed the process of modeling, the limitations of the process, and the intent of the habitat models. We asked reviewers to look at three review documents including the species report, range, and model (Examples in [Appendix 3-7](#)). The report contained all the information that was used in the model in plain text. The range map depicted the range limits of the species including our range coding scheme. The habitat distribution model was the spatial depiction (including overall range and habitat) of our final model. All were provided via the web or through paper copy. We asked reviewers to identify their level of confidence in the overall model, the range limits, and the report content, and also the individual datasets used in modeling ([Appendix 3-8](#)). We also provided areas for the reviewer to include comments and suggest additions to the map and/or model. We asked that they provide references when possible; otherwise comments were cited as personal communication.

In Colorado, three centralized introductory workshops were held in February 2005, and follow-on workshops in Grand Junction in March 2005. Some expert review meetings were design to leverage work being done for development of Colorado's Comprehensive Wildlife Conservation Strategy. Subsequent workshops were held on an individual basis with taxa experts as necessary. In Nevada, the external review consisted of two workshops held in Las Vegas in April 2005. The Great Basin Bird Observatory was

contracted to complete reviews for all bird species. In Utah, one workshop was held in March 2005 and a subsequent workshop was held in July 2005. In New Mexico, we began working with the New Mexico Department of Game and Fish (NMDGF) in August 2004. In conjunction with the Comprehensive Wildlife Conservation Strategy we worked with NMDGF biologists identifying suitable habitat for each species of greatest conservation concern (SGCN). Several subsequent workshops were held with other experts specifically for bats and small mammals. In Arizona, the external review consisted of online document reviews. Experts were contacted by phone and briefed on the process for the review.

## **Final Models**

Model reviews generated wide interest throughout the region. We received more than 1000 external reviews covering most of the species that were modeled. Comments and suggestions from both the internal and external reviews were directed to the modeling team responsible for each species. The lead team then reviewed and evaluated the comments. Although all comments were recorded, not all were incorporated into the models. Recommended changes that were not supported by references or verifiable data, for example, were not included in the final models. Model modification was an iterative process as modelers reviewed and incorporated expert information, as it was received. Although models were frequently modified based on information from species experts, any errors in modeling remain the responsibility of the SWReGAP team. Habitat modelers made final judgments regarding model attributes.

Once model review and modification was completed, all model information was submitted to the regional lab in New Mexico. The New Mexico lab, in turn, compiled and ran the final models with assistance from the Colorado Team.

## **Accuracy Assessment**

Assessing the accuracy of the predicted animal-habitat distributions is subject to many of the same problems as assessing land cover maps, as well as a host of more serious challenges related to variability in habitat use over extensive ranges, year-to-year variations in abundance, and the difficulty of detecting many species at low numbers. These are described further in the Background section of the [Vertebrate Distribution Assessment](#) chapter of the GAP Handbook available from “Conducting a Gap Analysis” page at the website <http://gapanalysis.nbi.gov>. It is useful to provide some measure of confidence in the results of the gap analysis for species collectively, if not individually or by taxonomic group (comparison to stewardship and management status), and to allow users to judge the suitability of the distribution maps for their own uses. We feel it is important to provide users with a statement about the accuracy of GAP-predicted animal-habitat distributions but were limited by available resources and practicalities of such an endeavor. We acknowledge that habitat distribution maps are never finished products but are continually updated as new information is gathered. This reflects not only an improvement over the modeling process, but also the opportunity to map true changes in species habitat distributions over time. Assessing the accuracy of the current maps would be useful to potential users.

Our goal was to produce maps that predict distribution of terrestrial vertebrate habitats and from that, derive total species richness and species habitat extent with an accuracy of 80% or higher. There is an effort in the GAP process, however, to err on the side of commission. In other words, to attribute species as possibly present when they are not. There are two primary reasons for doing so: first, few species have systematic, unbiased known ranges and we believe science is best served by identifying a greater potential for sampling and investigation than a conservative approach that may miss such opportunities; second, in conducting the analysis of conservation representation (see the [Analysis Chapter](#)), we believe it most appropriate to identify a species that may need additional conservation attention that is then refuted by further investigation rather than identifying a species as sufficiently protected that is discovered not to be by its subsequent loss.

The standard Gap Analysis assessment is a measure of agreement to describe the degree of concurrence between habitat model predictions, and species occurrences as documented by inventory studies. We obtained 14 species lists from the National Park Service (NPS) Inventory and Monitoring (I&M) program for the Northern Colorado Plateau network and have identified data from the southern Colorado Plateau Parks (including northern Arizona and Northern New Mexico), and the Sonoran Desert network of National Parks (including southern Arizona and southern New Mexico). These species lists are contemporary with the SWReGAP land cover mapping and animal-habitat modeling effort. Each dataset identifies species that occur or probably occur within the park. We conducted an initial assessment on species lists for the Northern Colorado Plateau NPS network. This assessment, however, identified a bias in the outcome because accidental, rare, and occasional species were included with the species lists. Our protocol for identifying species and mapping habitat eliminated these species based on these factors. Thus, omission error is significantly increased by using this data. We have omitted that analysis from this report in an effort to further refine the assessment and provide more accurate analysis. Further research is warranted to understand the nature of the omission and commission errors. GAP prefers to err on the side of commission errors and these types of errors may be due to error in selecting model parameters, error in model input datasets, or the detectability of the species in the field. Omission errors may be the result of model parameters, model datasets, or may be related to listing species that probably occur within the park but actually do not or listing species with accidental or transitory occurrence. Our models excluded ranges where the species was identified as transitory or accidental.

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## RESULTS

We reviewed information on a total of 849 species listed as occurring in the five-state SWReGAP region. Of these, 30 were not modeled, primarily because they were vagrants, or had very few records of occurrence in the SWReGAP region. Out of the total of 849 species on our preliminary list, then, we developed models for a total of 819 species. This included 215 species of mammals, 437 species of birds, 130 species of reptiles, and 37 species of amphibians. We were also able to map seasonal distribution of bird habitat and some mammal habitat when data were available.

In addition, we developed two different models for five species that had disjunct ranges, or otherwise had range characteristics that warranted splitting the range into separate models. These species were the greater short-horned lizard, Virginia rail, sandhill crane, black rosy-finch, and brown-capped rosy-finch. Also, we produced two models for the sharp-tailed grouse, for the two subspecies that occur in the study region (the Columbian sharp-tailed grouse and the plains sharp-tailed grouse; *Tympanuchus phasianellus columbianus* and *T. p. jamesi*, respectively). Hence, considering the extra models produced for these six species, we developed a total of 825 different models.

Land cover and elevation were the most used habitat associations. The detail of the land cover map provided ecoregional differences needed to differentiate between species habitat use throughout the range. The use of landform proved to be useful in some instances but was not as widely applicable as we initially anticipated. Soil characteristics are an important aspect of habitat for many species, but the soils datasets are not of sufficient detail to be used in most models. When SSURGO data (Soil Survey Geographic database, being developed by the USDA Natural Resources Conservation Service) become available for the 5-state area, the finer scale of those data may allow significant enhancement for habitat models using soil characteristics.



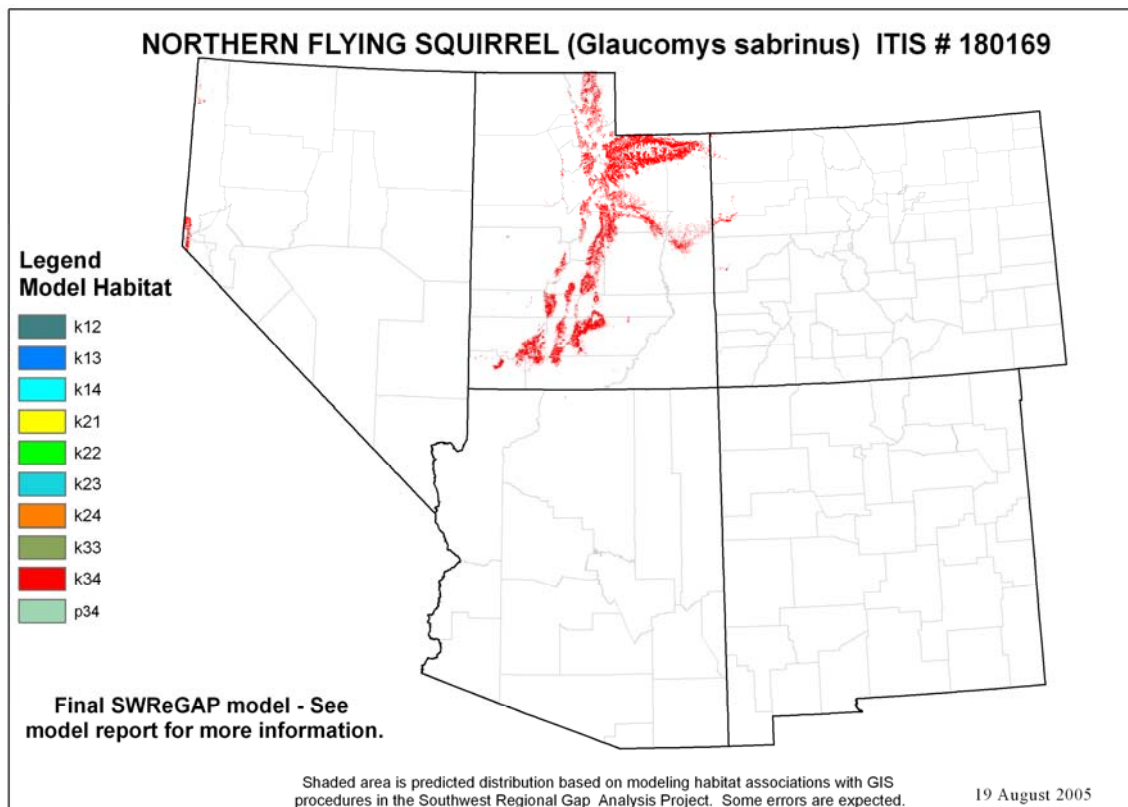
Least Chipmunk (*Tamias minimus*)

Photographer: John J. Mosesso, NBII Digital Image Library

## Mammals

We mapped habitat for 215 mammal species in the five-state region of SWReGAP (e.g. [Figure 3-2](#)). An additional six species were initially included on the list but were not modeled, either because they have very marginal occurrence in the five-state area (e.g. ocelot, *Leopardus pardalis*), or because of taxonomic changes that resulted in a species that was originally on our list being excluded from the area (e.g. Townsend's ground squirrel, *Spermophilus townsendii*, was originally on our list; this group has recently been split, and the species now bearing the name *S. townsendii* is restricted to southern Washington state). Bats were difficult to model because of the relative lack of information on foraging habitat, and the relatively poor understanding of the life history of the group. Much sampling for bats is focused around water and thus biases available habitat information. As with many of our bird models, we included seasonal range within bat models when appropriate.

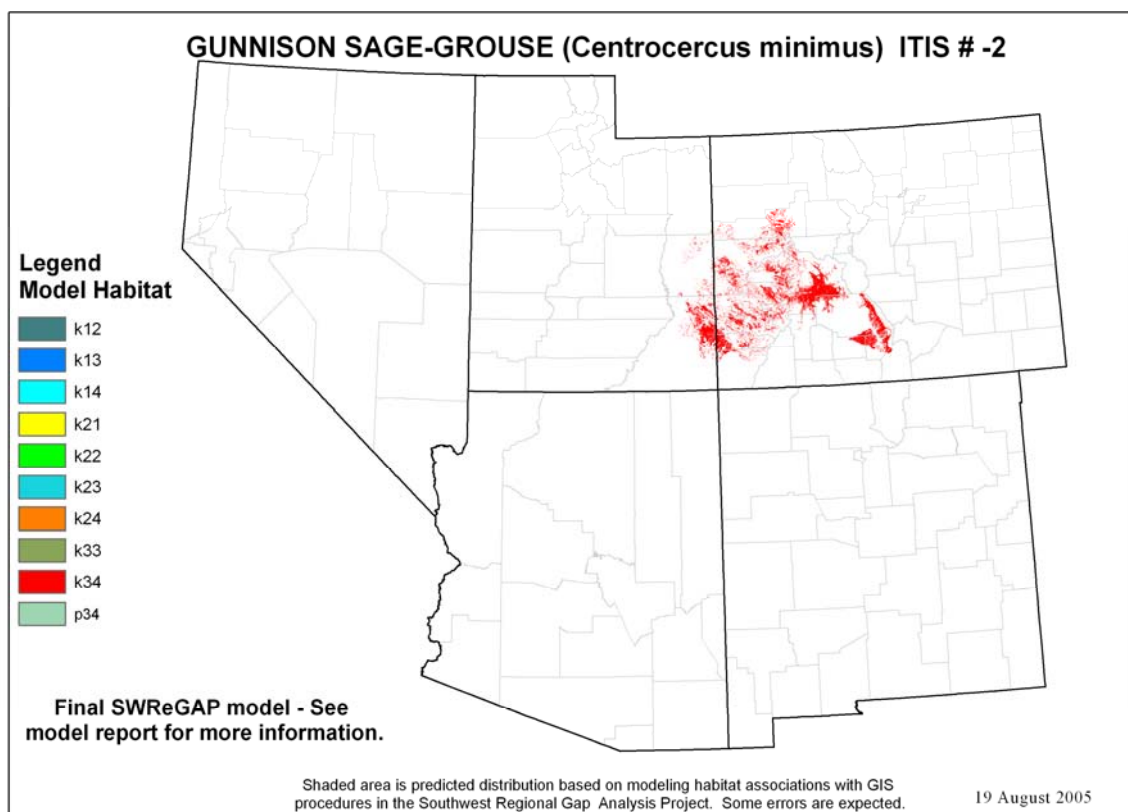
Some rodent species (e.g. chipmunks and squirrels) presented a challenge in modeling because of their requirements for microhabitat features that are not mappable on a regional scale, and also because of the paucity of habitat information for other species. Many of these models could use further modification.



**Figure 3-2. Potential Habitat Model for Northern Flying Squirrel (*Glaucomys sabrinus*).**

## Birds

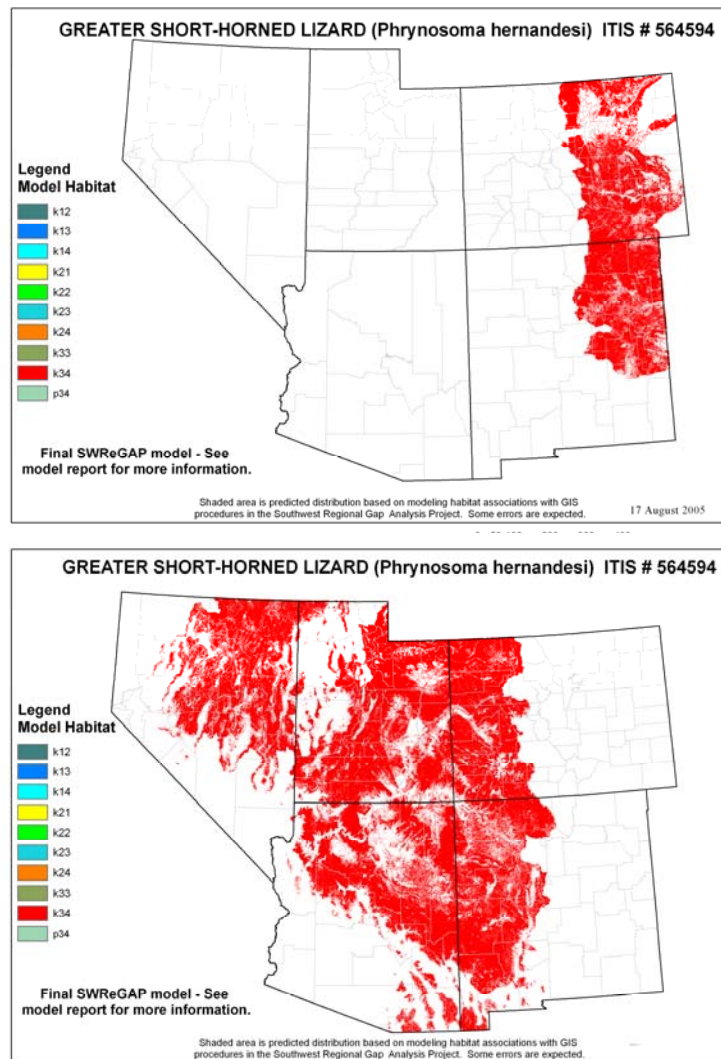
We created 437 bird species habitat models for the SWReGAP region (e.g. [Figure 3-3](#)). We initially included an additional 17 species on our working list, but did not produce models for them. Almost all of these species had very limited occurrence within the five-state project area (most of these were eastern vagrants, or Mexican species that rarely stray north into southern Arizona and New Mexico). We were able to model most species' habitat with just one model, based on varying range and land cover associations. Four species had to have two models created to separate breeding and non-breeding habitat (Virginia Rail, Sandhill Crane, Black Rosy-finch, and Brown-capped Rosy-finch).



**Figure 3-3. Potential habitat model for Gunnison sage-grouse (*Centrocercus minimus*)**

## Reptiles

We mapped habitat for 130 reptile species in the five state region. Five additional species originally on our working list were not modeled because they were introduced species restricted to a few urban areas (Mediterranean house gecko, *Hemidactylus turcicus*, and black spiny-tailed iguana, *Ctenosaura hemilopha*), or because they were modeled as part of another species due to taxonomic changes (variable skink, *Eumeces gaigeae*, Big Bend patch-nosed snake, *Salvadora deserticola* – modeled as part of *S. hexalepis*, and *Tantilla planiceps* – split from what is now called the southwestern black-headed snake, *T. hobartsmithi* in our area). One species (*Phrynosoma hernandesi*) was modeled using two models based on differing elevations (Figure 3-4). Soil type was often used for this taxonomic group. The availability of finer scaled soils data (SSURGO) would likely enhance models.

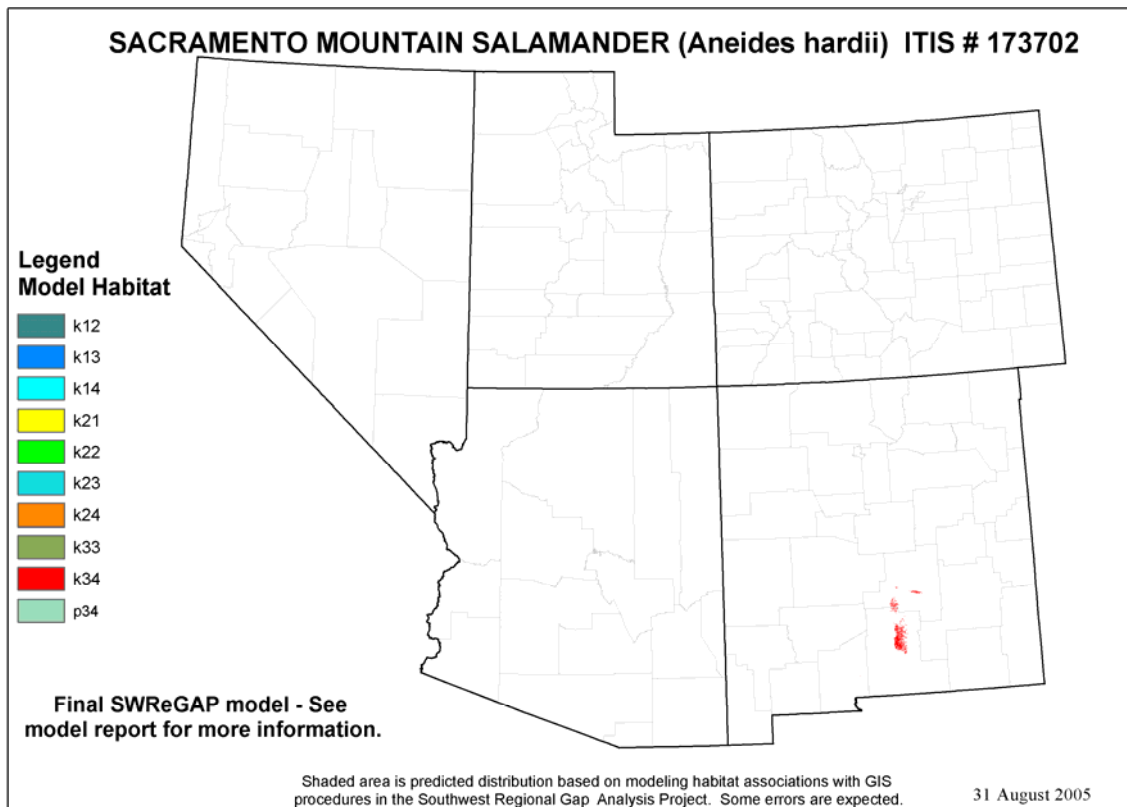


**Figure 3-4. Eastern (top) and western (bottom) habitat models for greater short-horned lizard (*Phrynosoma hernandesi*). Two models were created to reflect an elevation break between the two geographic areas.**



## Amphibians

We mapped habitat for 37 amphibian species within the five states (Figure 3-5). An additional five species were researched but were not modeled because of taxonomic changes, loss of the species from our area, or because of marginal occurrence. The western chorus frog, *Pseudacris triseriata*, and spotted frog, *Rana pretiosa*, are no longer considered to occur in our area; we modeled the boreal chorus frog, *P. maculata*, and the Columbia spotted frog, *R. luteiventris*, instead. The Ramsey Canyon leopard frog, *Rana subaquavocalis*, is now considered conspecific with the Chiricahua leopard frog, *R. chiricahuensis*. The Tarahumara frog, *R. tarahumarae*, has been extirpated from its limited U.S. range for over 20 years (though a reintroduction program is underway). The African clawed frog, *Xenopus laevis* is an introduced species limited to a few artificial ponds in the Tucson area. Hydrology was an important component in modeling amphibians. The models for most frog species incorporated hydrology or riparian land cover types. Toads were modeled over broader expanses because of their ability to use intermittent ponds that are often not adequately included within hydrography data sets.



**Figure 3-5. Habitat model for Sacramento mountain salamander (*Aneides hardii*) produced in the Southwest Regional Gap Analysis Project.**

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## SPECIES RICHNESS

GAP has often been associated with the mapping of species-rich areas or "hotspots." Richness maps identify where the same numbers of elements co-occur in the same geographic locations. (In the case of our data, the total numbers of animal species per drainage area or smaller geographic unit, across the five-state Southwest area.) These are color coded or shaded in intensity from the highest numbers of known or possible co-occurrence (richness) to the lowest. Richness is only one of many pattern metrics that may be derived using the data. Richest areas may or may not indicate best conservation opportunities. They may occur in already protected areas or may represent mostly already protected species or those not at risk. Still, they are often a useful starting point to examine conservation opportunities in combination with other analyses described in this report's Introduction and in the Analysis section. We also feel they may be useful for other rewarding applications such as identifying places of interest for wildlife observation and study.

We believe the individual species models are of greater value than just the richness summaries. Having distribution models for all species allows more detailed analysis of species habitat overlap by looking at the complementarity of different species' ranges. Aggregating individual models offers the opportunity to evaluate the spatial assemblages of species and to compare and contrast habitat values across the landscape. We present species richness maps for selected taxonomic groups to illustrate potential use of the data. Because of the dataset size, we did not complete an evaluation of richness for all species. [Figure 3-6](#) displays species richness of bats throughout the five-state region, and [Figure 3-7](#) shows species richness of rattlesnakes in the genus *Crotalus* in the region.

The individual species models contributing to richness metrics should be considered in the different spatial locales that have similar richness values, in that those locales may support predominantly different assemblages of species.

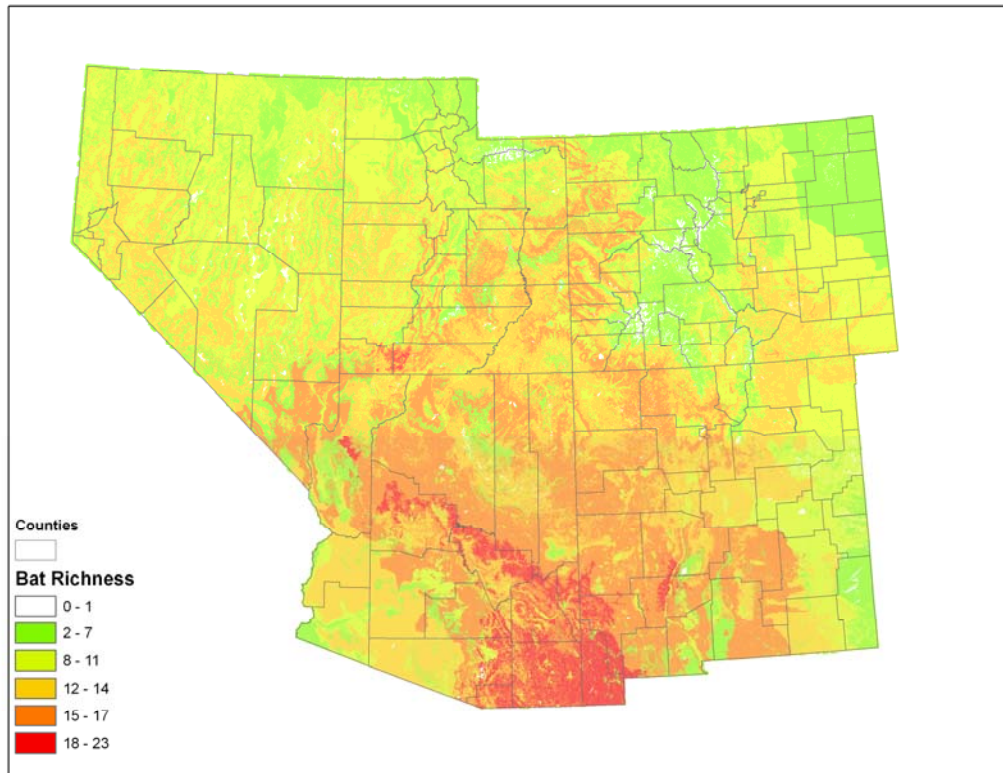


Figure 3-6. Bat species richness for the entire Southwest Regional Gap Analysis Project study area.

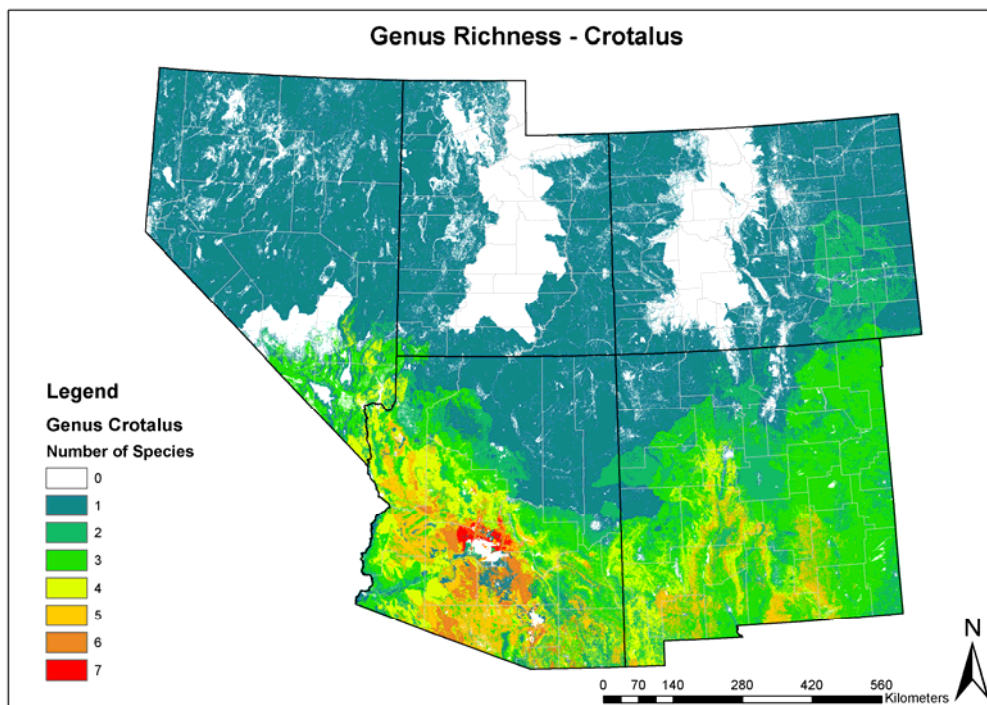
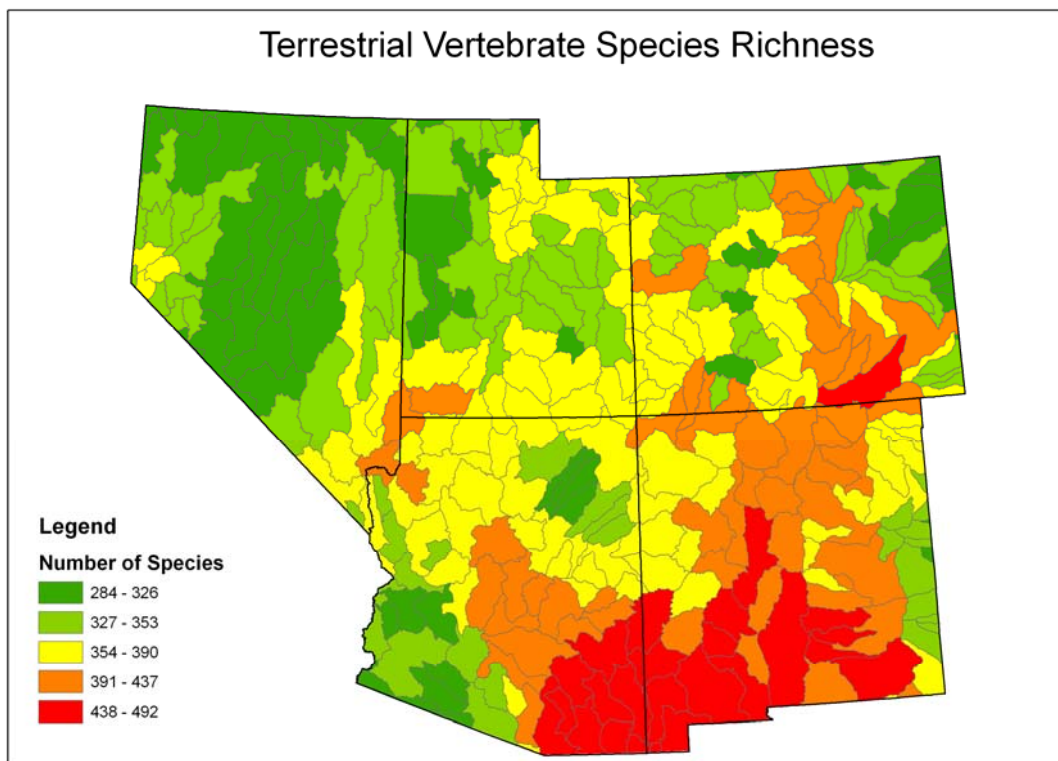


Figure 3-7. Species richness for rattlesnakes (genus *Crotalus*) for the Southwest Regional Gap Analysis Project study area.

Richness is depicted for all mapped taxa (Figure 3-8), and by taxonomic groups (Figures 3-9 to 3-13). Richness is presented by HUC and by 1-km grid cell with ramped colors from cool (low richness) to hot (high richness). Natural breaks within the data are used to provide classification within these maps. Seasonality and reproductive use are not included.

Total species richness is highest in southwestern New Mexico and southeastern Arizona (Figure 3-8). This area includes the Madrean Archipelago and is influenced by species ranging north from Mexico. Species richness in southern New Mexico is also augmented by Chihuahuan desert species. In New Mexico, relatively high richness (391-437 species) occurs throughout the Rio Grande Valley. The Front Range of the Rocky Mountains in Colorado is identified as having relatively high species richness. This is due in part to the presence of Great Plains species and Rocky Mountains species. The Colorado River including the Lake Mead area is also relatively high in species richness. It is important to note that overall richness is weighted heavily by the number of bird species within the project area and both spatial depictions are similar (cf. Figure 3-10).

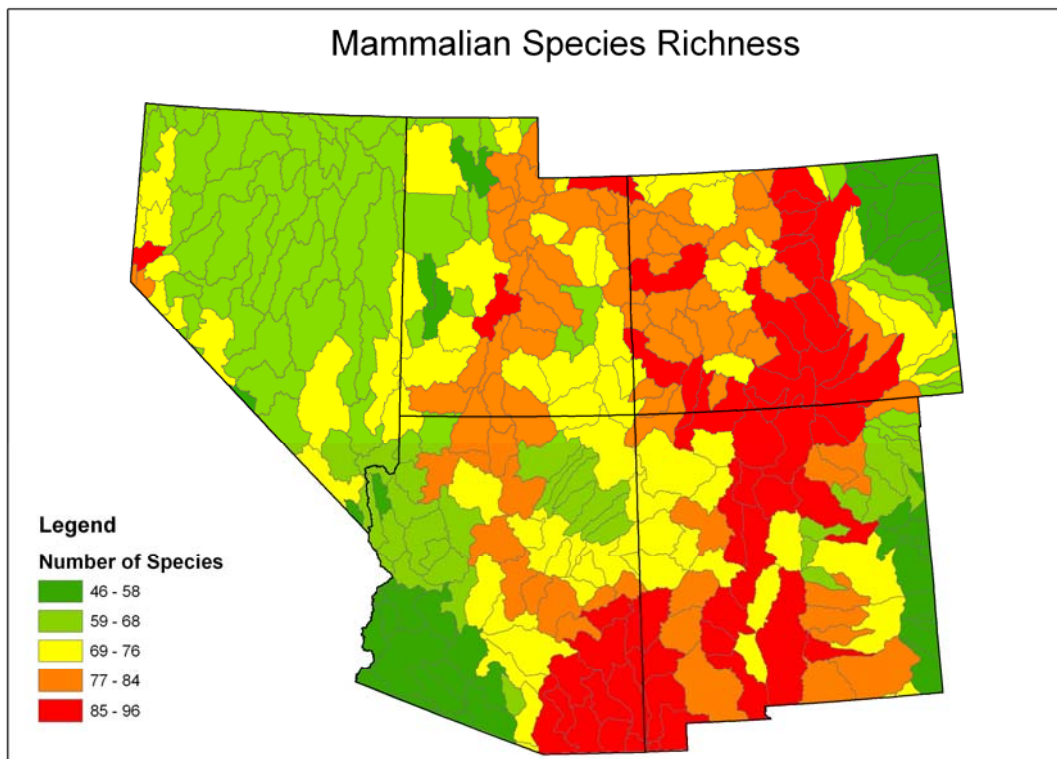


**Figure 3-8. Species Richness by 8-Digit Hydrologic Unit for 819 species in the Southwest Regional Gap Analysis Project.**

## Mammal Richness

Species richness within the mammals exhibited an east west pattern following many of the mountainous areas of the region. (Figure 3-9). Southwestern New Mexico and southeastern Arizona are high in species richness (85-96 species). The Rio Grande Valley is also an area of higher richness as are the mountainous regions of northern New Mexico, Colorado, and Utah. Richness is also high along the Mogollon Rim in Central Arizona.

Areas in Utah and Nevada with high mammalian species richness are associated with mountains such as the Wasatch in Utah and the Sierra Nevada in western Nevada. In southern Utah, the richness is associated with several desert ecosystems occurring within a transition zone from the Great Basin desert. The area of high richness in southwestern New Mexico and southeastern Arizona comprises the Madrean Archipelago and is influenced by species extending north from Mexico.

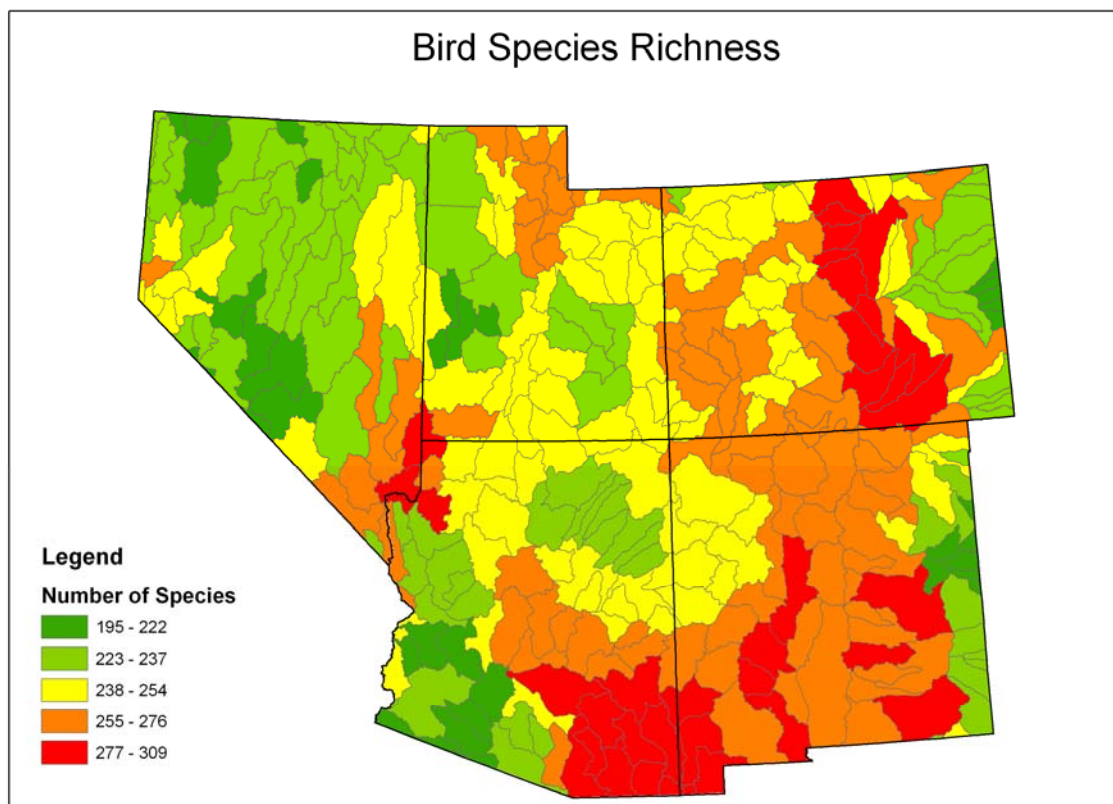


**Figure 3-9. Species Richness by 8-Digit Hydrologic Unit for 215 modeled mammal species in the Southwest Regional Gap Analysis Project.**

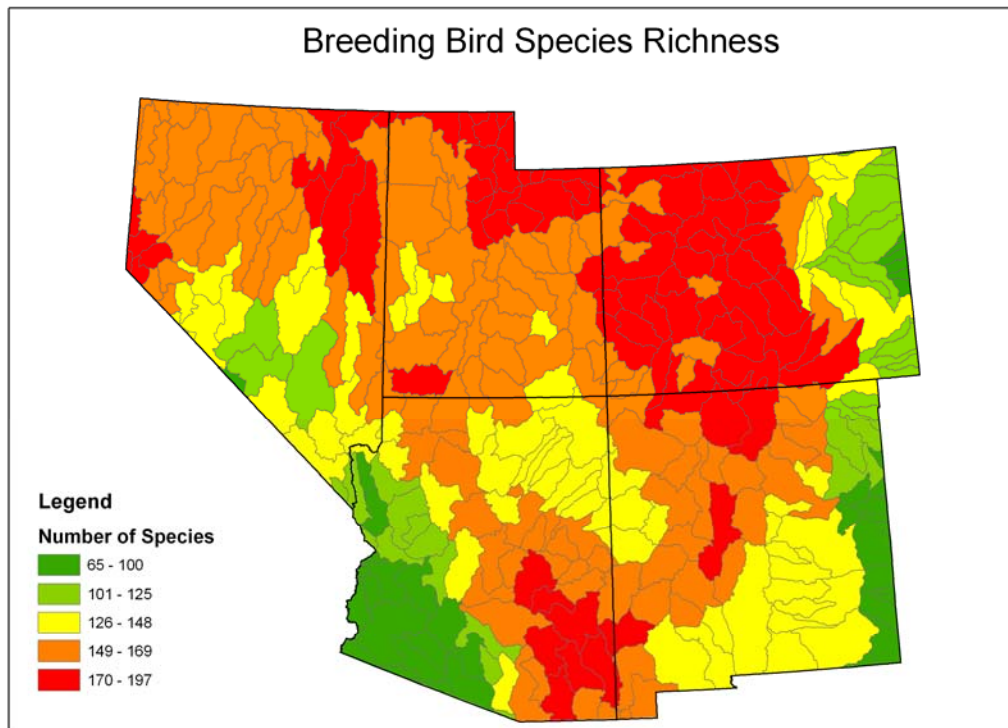
## Bird Richness

Bird species richness follows a roughly similar pattern to that shown by mammals, with the Madrean ecosystem highest in species richness (Figure 3-10). The Rio Grande corridor is also an area of high bird species richness as is the Front Range of the Rocky Mountains in Colorado. Areas of lowest species diversity are desert areas within Nevada, Arizona, and Utah and some of the Great Plains grasslands of Colorado and New Mexico.

Breeding bird richness (Figure 3-11) shows a decidedly different pattern from year-round richness. The number of species by HUCs transitions into a broader pattern with large portions of Colorado, Nevada, and Utah identified as having high species numbers, along with southeastern and central Arizona, and southwestern, central, and northern New Mexico. The deserts of southwestern Arizona, the plains of eastern Colorado, and the eastern New Mexico border area have relatively low numbers of breeding species.



**Figure 3-10. Species Richness by 8-Digit Hydrologic Unit for 437 modeled bird species in the Southwest Regional Gap Analysis Project.**



**Figure 3-11. Species Richness by 8-Digit Hydrologic Unit for modeled breeding bird species in the Southwest Regional Gap Analysis Project. Breeding Birds data includes hydrologic units with specific breeding and year round residents.**

## Reptile Richness

The greatest reptile richness occurs in the southern part of the SWReGAP project area (Figure 3-12) in New Mexico and Arizona. Similar to amphibian richness, this may be due to the confluence of the Madrean, Chihuahuan, Rocky Mountains and Great Plains ecoregions. Additional ecoregion influences are the Sonoran and Mojave deserts. The lowest richness is found primarily in the mountainous regions of Utah and Colorado (3-17 species). Reptile species richness shows a pronounced north to south cline in increasing species numbers. This pattern is obviously modified by elevation, particularly in the Rocky Mountains and the mountains of north-central Utah.

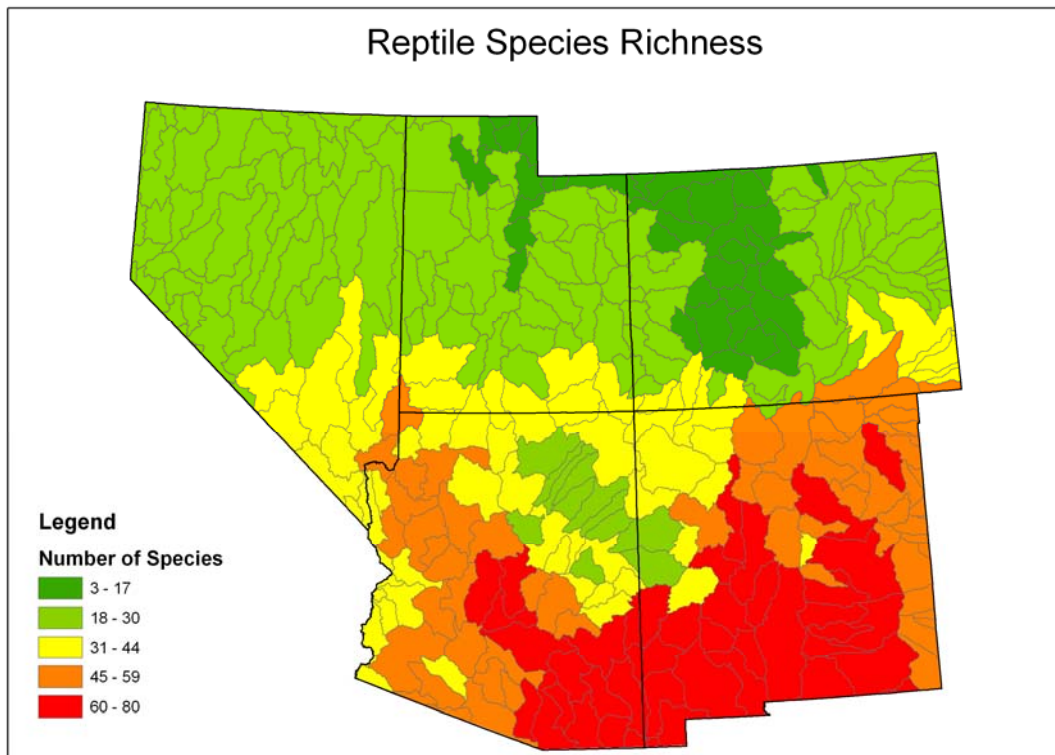


Figure 3-12. Species Richness by 8-Digit Hydrologic Unit for 130 modeled reptiles in the Southwest Regional Gap Analysis Project.



## Amphibian Richness

Amphibian richness is highest in the south and southeastern portions of the SWReGAP study area (Figure 3-13). This includes a large portion of New Mexico and southeastern Arizona. This is likely a factor of many ecoregions combining in these areas including the Great Plains, Madrean, Rocky Mountains and Chihuahuan Desert. The majority of Nevada and the western deserts of Utah have relatively few amphibians, as do most of the higher Rocky Mountain HUCs (2-5 species).

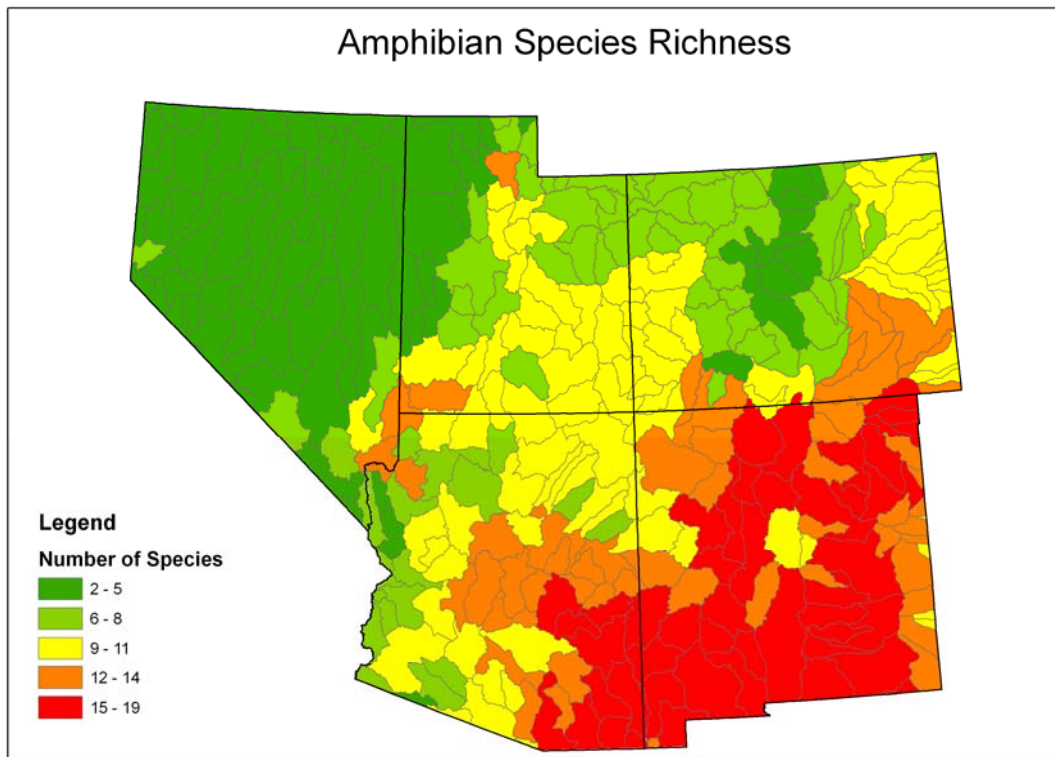


Figure 3-13. Species Richness by 8-Digit Hydrologic Unit for 37 amphibian species in the Southwest Regional Gap Analysis Project.

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# DISCUSSION

## Modeling Process

We modeled 819 species with varying degrees of confidence. We focused our efforts at the species level except for one species, the sage-grouse. Sage-grouse populations in the region show distinct habitat differences, and the species is of special conservation concern in the areas where it occurs. The models were based on detailed literature review to develop Wildlife Habitat Relationships. Literature information included data for delineating species ranges and categorical and classification variable requirements for animal-habitat modeling. The WHR protocol and related MS Access database user interface served as a general guideline for model development, but we recognized that each species was different and could not always be modeled the same way.

The resulting models predict habitat for vertebrates of the Southwest within the known distribution range of each species. Regional habitat modeling is subject to several assumptions:

1. The models are based on suitable habitat for each species;
2. The models do not depict different degrees of habitat quality;
3. The models do not attempt to project species abundance; and
4. The models show habitat where the species may occur at some point in its life history.

Range limits depicted in the SWReGAP habitat models are defined in terms of watershed units (HUCs). Defining range limits in this way tends to overpredict species ranges to a greater or lesser extent. Finer scale HUCs (14-digit) or topologically derived watersheds may provide a truer range delineation but difficulty in delineation may be significantly increased. These finer scale partitions would better approximate distributions. Ranges for species varied and because of the regionalization we may have over-generalized these ranges. We suggest end-users take our models as a baseline and modify them based on the needs of the region in which they are working.

Vegetation structure is an important component in habitat selection. The land cover map provided partial structure given the ecological system definition (woodland, forest, etc.), however smaller structure changes and successional states are not available. Microhabitat features are also important particularly to the smaller and less vagile species. These features are difficult to model at local scales much less at the regional level.

Our modeling effort did not take into account a number of potentially important factors affecting habitat suitability, including prey sources, competition with other species, or predation. Competitive exclusion was mentioned by reviewers in several workshops and further research regarding this may be useful. Similarly, we initially considered temperature and precipitation as potential habitat components within the models, but ended up excluding these data also because of the general lack of information available for each species and the scale of the dataset.

Biogeographical factors such as patch size, distance to habitat patches and habitat edge were also not included in the modeling effort. In general, it was not possible to include these factors because of limitations on our knowledge of species ecology, or because we lacked adequate capabilities for depicting these factors within GIS models of this scale. We did include patch size (the size of habitat area needed for a species to successfully persist over time) in our review of habitat modeling literature. However, we found little specific data to model patch size for any species in the region. This is an important species specific modeling consideration and one in that would help elucidate meta-population dynamics. We considered using home range size to estimate patch size, but home-range size is not necessarily directly related to patch size. Information on maximum distance between occupied patches would also be needed to successfully model patch size effects. Patch size was not included in the final models, but information is available within the database to post-process the final SWReGAP models.

## **Expert Review**

Review of draft models by state and regional experts was an important part of the modeling process for SWReGAP. Experts ranged from personnel with state and Federal wildlife agencies, to university biologists, NGOs, and biological consultants. Overall, more than 80 reviewers took part in the review, evaluating the model information and range depictions for 680 of the 819 species that were modeled. There were a total of 1023 reviews, including species that were reviewed more than once. Our original goal was to have each model reviewed by an expert in each state inhabited by the species. However this was not possible given limited time and available reviewers. Instead, we modified our approach to attempt to have each species reviewed at least once.

Reviews ranged from corroboration of species range to reviews of the entire model. These reviews helped to identify errors within models and provided additional references and data to enhance models. The overall impressions of reviewers concerning draft models ranged from good to poor. With some models, the experts were more pleased with the models than were our habitat modelers. The review identified several concerns with literature derived modeling efforts. Our literature review was necessarily brief given the scale and scope of the project. Reviewers were able to provide more detailed specific information and provided specific references that were not identified in our initial data-gathering.

## **Accuracy Assessment**

Assessment of accuracy is useful but should be an iterative process. Withholding data that may improve a model may not provide an assessment as much as ensure a model will suffer from either omission or commission errors. Further assessment of the habitat models is warranted and we encourage these efforts. There are species occurrence datasets from the National Park Service, U.S. Forest Service, NatureServe, natural heritage programs, and others that can be used in that endeavor. These datasets would provide another metric for measuring agreement with habitat models. As good inventory data becomes available, this data should also be used to analyze the distribution models

throughout the region. We encourage land managers to assess these models and provide feedback.

## Limitations of the Models

Several limitations were noted through the modeling process. The first limitation is limited available habitat information for many species – a limitation that has been consistently identified in past GAP efforts. We had a broad array of species to deal with and extreme variability in the data available for use in the modeling. Another limitation was the size of the region that we modeled. We may have very precise information in one area of the range but very limited knowledge in other parts of the range. Another limitation was the lack of structural data that we could incorporate into the modeling aspect. Habitat information may be specific to a seral stage or age class of dominant plant species but the land cover map did not provide that depth of detail. This is not a new problem with deductive modeling as the limitations of modeling microhabitat at large landscape scales is well documented (Van Horne and Wiens 1991, Gonzales-Rebeles et al. 2002).

Depicting detailed species distribution models over a large biogeographic region was one of the main motivations for the SWReGAP project, but the regional aspect of the project was limited in many cases by the lack of availability (or poor quality) of regional datasets. For example, a comprehensive GIS layer showing mines and caves would be useful in modeling bat habitat, but regional datasets were considered incomplete. Because many important reference sources are based on state boundaries, there were other inconsistencies exhibited at a state level. There were also some major regional features that required special treatment. For example, the Great Salt Lake provided a major issue in modeling. We created two data layers, one to remove the Great Salt Lake from fresh water lakes, and one including the Great Salt Lake with all other lakes. Prior to this, we identified errors in habitat models such as the Boreal Toad (*Bufo boreas*) and Beaver (*Castor canadensis*).

There were also limitations in terms of available literature to develop models. State based references range from detailed, authoritative compilations to very general works, and the usefulness of these references for our purposes was correspondingly quite variable. For example, published reptile and amphibian data sources are available for New Mexico (Degenhardt et al. 1996) and Colorado (Hammerson 1999), but are lacking or are outdated in the other 3 project states. These provided excellent resources and this effort would have benefited by similar works in the other states. Similarly, references for mammals (Fitzgerald et al. 1994) and birds (Andrews and Righter 1992) were also dated except for the recent work for Colorado.

Different states also took a more or less extensive approach to reviewing species / habitat literature. A few states conducted a relatively exhaustive review of available literature, while others focused on the major references that pertained to particular species and their state or region. The expert review process did identify references we were unaware of and in some cases substantially added to the models. We encourage identification of

other references that may enhance these models. Habitat studies have become more popular and published more often. The SWReGAP models should be viewed as dynamic, and should be modified to reflect changing knowledge as it becomes available.

We took an approach that put state modelers in the lead for developing individual models. This created a focus of habitat modelers on “their” species and inadvertently resulted in less communication among states than would have been desirable for wide-ranging species. We did include a step after draft models were produced, in which each state reviewed models from other states of all species that occurred within that state (we referred to this as “internal review;” e.g. Arizona reviewed and commented on all models of species occurring in Arizona, regardless of which state produced the model). This step improved the quality and regional consistency of the final models. Local datasets and knowledge could be incorporated in this way, and the step would also facilitate expert review.

The completeness of the hydrography dataset was questionable but did prove useful on a regional basis. Modification of this dataset has been occurring on a state by state basis and further updates would improve our models. We used the medium resolution data (1:100,000), and our modeling effort would likely be enhanced by using the finer scale (1:24,000) dataset, if appropriately attributed.

In a project such as this, timing can also play a limiting role. Our database was a work in progress through much of the project. The final product is a useful and efficient tool to collect and maintain wildlife habitat relationship data, but our habitat modelers and database programmer learned an extensive amount as we progressed to the current stage. Insofar as possible, a better approach would be to have the database created prior to initiating the habitat modeling phase.

Over the course of the SWReGAP project, our modelers came up with some novel approaches to modeling species. However, the need for regional consistency and to complete the project on time sometimes took precedence over this creative thinking. We had to choose between what was best for the regional product versus what would make 1 or 2 species models better. We endeavored to capture this information in the database so that it might be used in the future. We did model several species with specific, non-standard modifications, including the Amargosa toad, Jemez Mountains salamander, and the spotted bat. Amargosa toad and Jemez Mountains salamander both used individual range limits. The spotted bat model incorporated a distance to cliffs dataset created toward the end of the project specifically for this species.

## **Suggestions for Future Work**

Our SWReGAP models are based on a deductive modeling approach and should be useful in providing the sampling frame for field efforts and conservation planning. Deductive modeling approaches such as we used for the regional animal habitat distribution models provide a variety of useful information to land managers and conservation planning. We provide species habitat models for 819 terrestrial vertebrate species at a coarse scale. In general, models are useful when they provide more

information then previously available (Johnson 2001). However, there are alternatives to the approach we used, and there are many additions and improvements that can be made in future efforts.

Peterson (2005) compares and contrasts GAP methods to the Genetic Approach to Rule-based Production (GARP) approach. The arguments made by Peterson do highlight the differences between a deductive modeling approach such as GAP and an inductive modeling approach such as GARP. The SWReGAP process allows end users to modify models to be either more specific to their area of interest or to include newer information or correct information in the existing model. This is something that an inductive approach may have a more difficult time doing. If adequate field observations are available for some species, classification-tree based models should be developed. For example, we explored the use of datasets such as precipitation and temperature data in our modeling approaches, but these are more suited for an inductive modeling approach such as GARP or Maximum Entropy (Phillips et al. 2006). Inductive modeling techniques provide a way to get past the lack of information within the literature to include these types of datasets.

Modeling approaches such as those used in SWReGAP provide general habitat suitability models in a binary fashion (though this binary model has been extended for some State GAP efforts). Regional maps show areas as either suitable or unsuitable for a given species, and it would obviously be more useful to have models with more information that show varying degrees of habitat quality. Such models represent a further step up in complexity, particularly given our limited knowledge of many species, and the computing power required to produce models at large scales like the Southwest region. Although quantitative models may not always be possible on such a large scale for so many species, models focusing on habitat quality may be possible at least on a number of the species within the region. O'Brien (2005) provides a description of such a quantitative deductive modeling approach.

Other suggestions for future habitat modeling efforts include incorporation of additional regional datasets such as the Level IV Ecoregions. HUCs provide a range constraint as do mountain ranges, but the inclusion of this dataset may provide additional constraining power to those models predicting habitat on the edges. To help in land cover review, it would be useful to develop a list of land cover types by hydrologic unit. This would allow reviewers and modelers to ensure land cover within the range of the species was not omitted. Our review process allowed commission errors to be identified, but not necessarily omission error.

The Visual Sensitivity Analysis provides for the use of gradient or weighted information within the modeling process. During the creation and modification of individual models, we used visual sensitivity analysis to evaluate the contribution of the STATSGO soils dataset as a modeling layer. This on-the-fly pseudo-modeling effort would also be useful in an expert workshop effort to identify optimum or marginal habitat. O'Brien's (2005) Bayesian methodologies provide another rationale for weighted models.

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# CONCLUSIONS

To our knowledge these models represent the first regional habitat models for vertebrate species at this resolution for the American Southwest. We anticipate that as these models are used, errors will be identified. Our database and the production of graphical models provides the foundation for these model modifications. The intent of the dataset and associated GIS tools is to provide end-users functionality and the ability for model modification. We hope some provision is made for maintaining and evolving these into the future.

The maps of species habitat distributions may be used to answer a wide variety of management, planning, and research questions on individual species or groups of species. In addition to the maps, great utility may be found in the literature references that are assembled into databases used to produce the maps.

Habitat distribution maps are never finished products but should be continually updated as new information is gathered. This reflects not only improvements in the modeling process, but also the opportunity to map true changes in species habitat distributions over time. Perhaps most importantly, as a first effort in developing such detailed distributions, they should be viewed as testable hypotheses to be confirmed or refuted in the field. We encourage biologists and naturalists to conduct such tests and report their findings in the appropriate literature and to the Gap Analysis Program such that new data may improve future versions of these models. Ultimately, the validation of these models will come from those that use them.

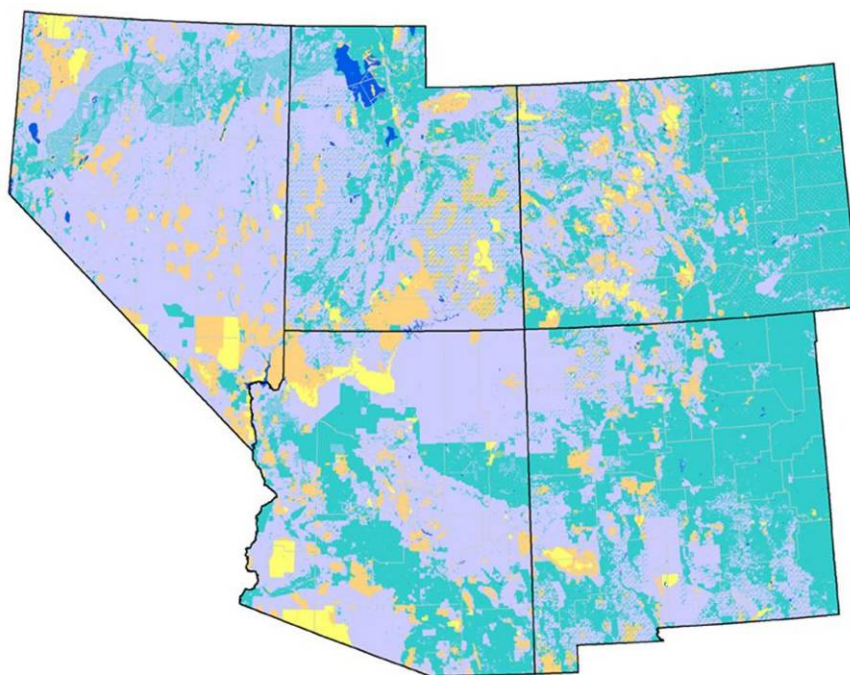


Photo from SWReGAP Training Site Image Library

# CHAPTER 4

## LAND STEWARDSHIP

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# INTRODUCTION

The analytical mission of GAP is to compare the mapped distribution of biota with their representation in different categories of stewardship. These comparisons do not measure viability, but are a start to assessing the likelihood of future threats to biota through habitat conversion--the primary cause of biodiversity decline. We have utilized "stewardship" to describe the quality of land management that is collectively the land ownership of a parcel and the legal and administrative mandates that guide the management of the parcel as it effects the long-term maintenance of biodiversity. Legal ownership does not necessarily equate to the entity charged with management of the resource; hence we refer to 'land stewards' as those entities that are actually charged with management of biotic resources. The mix of owners and managers is a complex and rapidly changing condition. A single land owner, such as a national forest, may be subject to several different legal and/or administrative mandates for management of land cover and vertebrate species.

The purpose of comparing natural land cover and vertebrate distributions with stewardship is to allow land stewards to assess their relative contribution to the overall management of the distribution of a vertebrate or plant community and identify other stewards sharing that responsibility. This information can reveal opportunities for cooperative management that directly supports the primary mission of GAP to provide objective, scientific information to decision makers and managers to make informed decisions regarding biodiversity. It also is not unlikely that a steward that has previously borne the major responsibility for managing a species may, through such analyses, identify a more equitable distribution of that responsibility. We emphasize, however, that GAP only identifies private land as a single category and does not differentiate individual tracts or owners, unless the information was provided voluntarily to recognize a long-term commitment to biodiversity maintenance.

After comparison to stewardship, it is also necessary to compare biotic distributions to biodiversity management status categories. This comparison can identify species or plant communities that are underrepresented in lands managed for biodiversity maintenance. GAP currently uses a scale of 1 to 4 to denote relative degree of maintenance of biodiversity for each tract. A status of "1" denotes the highest, most permanent level of maintenance, and "4" represents the lowest level of biodiversity management, or unknown status where information is not available to assign a potentially higher rating. We recognize a variety of limitations in our approach, although we maintain certain principles in assigning the status level. Our first principle is that land stewardship is not the primary determinant in assigning status. The second principle is that the legal and administrative mandates informing management of a parcel also reflect management intent. In other words, if a land steward institutes a program backed by legal and institutional arrangements that are intended for permanent biodiversity maintenance, we use that as the guide for assigning status.

The characteristics used to determine status are as follows:

- Permanence of legal or administrative protection from conversion of natural land cover to unnatural (human-induced barren, exotic-dominated, arrested succession).
- Relative amount of the tract managed for natural cover.
- Inclusiveness of the management, i.e., single feature such as a historical, geological, or archeological site or a single species versus all biota.
- Type of management and degree that it is mandated through legal and institutional arrangements.

The four status categories are defined by GAP as follows (after Scott et al. 1993, Edwards et al. 1995, Crist et al. 1996):

Status 1: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events (of natural type, frequency, and intensity) are allowed to proceed without interference or are mimicked through management.

Status 2: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but which may receive use or management practices that degrade the quality of existing natural communities.

Status 3: An area having permanent protection from conversion of natural land cover for the majority of the area, but subject to extractive uses of either a broad, low-intensity type or localized intense type. It also confers protection to federally listed endangered and threatened species throughout the area.

Status 4: Lack of irrevocable easement or mandate to prevent conversion of natural habitat types to anthropogenic habitat types. Allows for intensive anthropogenic use throughout the tract, including those tracts for which the existence of such restrictions or sufficient information to establish a higher status is unknown.

## METHODS

Land stewardship data was developed in two phases: (1) documentation of land ownership; and (2) assignment of biodiversity management status codes.

### **Land Stewardship**

We began by collecting existing digital ownership datasets to provide a baseline of ownership boundaries for each state in the region. These data distinguished general

administrative land ownership by private, state, and federal categories. In most cases, federal and state lands were then further divided by managing entity such as Bureau of Land Management (BLM), National Park Service (NPS), or State Trust Lands. Special management areas, such as wilderness, and other internal management units were often not delineated in these baseline datasets.

Sources of base ownership data for each state include the following:

**Arizona** –The Arizona State Land Department (ASLD) and Arizona Land Resource Information System (ALRIS) publish the state-wide surface ownership coverage. Three agencies update this dataset: federal boundaries are updated by BLM, Indian reservation boundaries are updated by Bureau of Indian Affairs, and State Land boundaries are updated by ASLD. The data used included the last full BLM update from 1994 with partial updates in January 2001, the BIA update from 1997, and the ASLD lands which are updated on a weekly basis.

**Colorado** – The Colorado Ownership, Management, and Protection (COMaP) project at the Natural Resource Ecology Lab (NREL) of Colorado State University began mapping status and trends of Colorado’s protected areas to build a statewide protected areas map (Wilcox et al. 2006). NREL and the SWReGAP stewardship lab coordinated the acquisition of base information to be used for the SWReGAP and COMaP products. Data represented in COMaP v2-SWReGAP were last updated August 2004.

**Nevada** – The Mapping Sciences Division of the Nevada State Office of BLM updates and manages the polygon layer representing and identifying land ownership status and boundaries of BLM, private, and other public land throughout Nevada. The polygon layer was updated in September 2003 using BLM field office data.

**New Mexico** - The New Mexico State Office of BLM coordinated ownership data collection from various BLM field offices and the New Mexico State Land Office. Surface ownership data was generally digitized from 1:24,000 USGS quads or on-screen digitized using the BLM's Master Title Plats as the original data source. The version used by SWReGAP reflected the latest updates contained in the 64 100k ownership tiles for New Mexico from June 2004.

**Utah** – BLM produced and maintains the Utah Land Status/Administrative Ownership Data Layer in collaboration with regional partners. The information for federal ownership is derived from a number of sources, but primarily from the BLM’s Master Title Plats maintained by the Utah BLM Lands and Realty program and from the BLM’s LR2000 database. Information is also incorporated from the State and Institutional Trust Lands agency (SITLA), the Bureau of Indian Affairs (BIA), counties, and other government agencies. The data layer used was version 1.2, last updated April 2005.

Base data layers acquired for each state were then converted to a common projection system and loaded into the SWReGAP geographic database (geodatabase). The geodatabase, a more modern GIS data model, was structured to meet GAP Standards and included domains described by the GAP Management Coding System (see [Appendix 4-1](#)). Additional attributes such as the GAP biodiversity management code, individual parcel name, alternative name, and source of the digital data were added to the geodatabase attribute table (see [Figure 4-1](#)).

|                       |   |
|-----------------------|---|
| <b>GAP_Status</b>     | 1,2,3,or 4                                      |
| <b>Class_Desc</b>     | Federal Lands, State Lands, Tribal Lands, etc.  |
| <b>Owner_Desc</b>     | BLM, USFS, BOR, TNC, State Wildlife Reserve     |
| <b>Manager_Desc</b>   | ACEC, RNA, Wilderness Area, Recreation Area     |
| <b>Division</b>       | BLM Field Office, Regional Offices              |
| <b>Parcel_Name</b>    | Gunnison Gorge NCA, Dinosaur NM                 |
| <b>Alt_Name</b>       | Important Bird Area, Name of Management Area    |
| <b>Source_SWReGAP</b> | Colorado State BLM Office, Gila National Forest |

**Figure 4-1. Example of the attribute domains based on GAP Management Coding System. On the left are the geodatabase domain and attribute titles and on the right are possible, but not all inclusive, attributes for a parcel delineated in the SWReGAP dataset.**

The next step in stewardship mapping involved separating source data for individual land ownership categories (e.g., Nevada BLM lands) from the larger state-wide dataset. Each individual land ownership category was then attributed according to the standard GAP Management Coding System. Additional boundary information for special management units or other internal boundaries was also collected via the internet or from agency GIS personnel. For example, the statewide data layer depicting Areas of Critical Environmental Concern (ACEC) was received from individual state BLM offices. These datasets were also individually loaded into the geodatabase and attributed with the GAP Management Coding System and additional geodatabase attributes. Other individual digital data sources included The Nature Conservancy (TNC) preserves and easement boundaries collected from state TNC offices, National Forest GIS and ownership data collected from each individual forest, and other agencies such as State Wildlife Agencies, Division of State Parks, and several county and city GIS programs. In addition, throughout the region over 100 local land trusts were contacted for potential data acquisition.

Once all boundary files for a major ownership category (e.g., BLM) were imported into the geodatabase and appropriately attributed, the dataset was merged into one, continuous feature dataset. Spatial integrity between the datasets was built and maintained by using geodatabase topology. Topologies contain rules about how features share geometry. The rules SWReGAP used to define the behavior of the features were ‘must not have gaps’ and ‘must not have overlaps.’ The process of validation was then used to show areas where the dataset broke the topology rules. Edits to the line work geometry were then executed to features that share common polygon boundaries. Once validation and errors in the topology were addressed for a particular ownership category, new internal

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management data layers were combined in the same manner until the entire individual state dataset was complete. Water boundaries extracted from the National Hydrography Dataset (Medium Resolution) were the last dataset to be attributed and merged.

## **Biodiversity Management Status Categorization**

To reduce conflicting information about management of a particular parcel every attempt was made to collect the most current management plan describing management actions for each land tract. These management plans provide the overall guiding principal for management of the land tract. Federal resource management plans are usually developed for compliance with federal laws such as the National Forest Management Act, the Federal Land Policy and Management Act, or the National Environmental Policy Act (NEPA) and usually span a 10-15 year management timeframe. Collection of management plans included National Park Service General Management Plans or Statements of Management, BLM Field Office Resource Management Plans with corresponding Records of Decisions, Forest Service Forest Plans and Amendments, Bureau of Reclamation Management Plans, and Fish and Wildlife Service Comprehensive Conservation Plans.

In previous GAP efforts, land management units were added to the stewardship map if the land unit was likely to be categorized in a GAP management status higher than the status of surrounding land. For example, most multiple use land receives a management status of 3, with internal units having a potential to receive a status 2 or higher. Although SWReGAP attempted to create a detailed map including all parcels regardless of management status, we used this general rule of thumb when delineating management status. For example, if general information indicated that a parcel might receive a higher status code (i.e. a status 1 instead of a status 4) more effort was made to obtain management information. The goal was to make a seamless stewardship map for the region, not to just distinguish the management status 1 or 2 lands. When management plans were received they were individually reviewed to evaluate the potential management status on a site by site basis. In other words, parcels of the same management type were not given a blanket status code and status coding was evaluated on an individual parcel by parcel basis. For example, there are instances of Pristine or Primitive management techniques within the same wilderness. These different management techniques may receive different management status codes. Another example, BLM Areas of Critical Environmental Concern may be managed differently between field offices and/or among different states, and thus needed to be evaluated independently.

Not all land parcels had management plans available to be used for management status categorization. For example, most parcels not under federal jurisdiction do not have existing written management plans. State Lands are not required by law to have a management plan supported by written documentation. Therefore, in certain cases, the guiding management document is the state constitution or master plans. When plans were not available, an Internet search often provided information that could lead to an appropriate assignment of a biodiversity management status category to a land parcel. In other cases, telephone interviews were conducted with agency personnel to determine

management practices. A standardized questionnaire was used in conducting these interviews (see [Appendix 4-2](#)). Lands tracts such as state parks or private lands received a uniform management status category. Non-governmental lands status assignments were based on telephone interviews and information obtained from the Internet. TNC preserves were one example of a land parcel where adequate information was obtained via the Internet to make the determination of management category for most preserves.

To minimize variability in the categorization of any one land tract GAP developed a dichotomous key (see [Figure 4-2](#)) to ensure consistent assignment of management categories (Crist et al. 1995). This key was applied throughout the assignment of biodiversity management status categories for SWReGAP. To further remove variability all biodiversity management status codes for biodiversity were assigned by one person, the regional stewardship coordinator. The decisions made were documented and saved in Excel spreadsheets and were indexed to the dichotomous key.

|      |  |
|------|--|
| A-1: | If the management intent can be determined through agency or institutional documentation GO TO A-2, if not, GO TO A-5  |
| A-2: | If the land unit is subject to statutory or legally enforceable protection from conversion to anthropogenic use of all or selected biological features by state or federal legislation, regulation, private deed restriction, or conservation easement intended for permanent status, GO TO B-1; if not, GO TO A-3 |
| A-3: | If ecological protection is not legally enforceable, temporary, or lacking but managed by a plan intended for permanent status, GO TO A-4; if not, GO TO A-5   |
| A-4: | Management to benefit biological diversity is provided by a written plan in place or in process under an institutional policy requiring such management - <b>Status 3</b>  |
| A-5: | Not subject to an adopted management plan or regulation that promotes biological diversity, or management intent is unknown - <b>Status 4</b>  |
| B-1: | If the total system in the land unit is conserved for natural ecological function with no more than 5% of the land unit in anthropogenic use, GO TO B-4; if conservation provisions apply only to selected features or species, GO TO B-2  |
| B-2: | If management emphasizes natural processes including allowing or mimicking natural ecological disturbance events, but also allows low anthropogenic disturbance, renewable resource use, or high levels of human visitation on more than 5% of the land unit - <b>Status 2</b> ; if not, GO TO B-3                 |
| B-3: | Management allows intensive, anthropogenic disturbance such as resource extraction, military exercises, or developed or motorized recreation on more than 5% of the land unit, but includes ecological management for select features - <b>Status 3</b>  |
| B-4: | If management strives for natural processes including allowing or mimicking natural ecological disturbance events - <b>Status 1</b> ; if not, GO TO B-5  |
| B-5: | Managed for natural processes, but some or all disturbance events are suppressed or modified - <b>Status 2</b>   |

Figure 4-2. A dichotomous key for categorization of biodiversity management status of land units. In using the terms "permanent" and "legally enforceable" we recognize that all conditions are subject to change, even in wilderness and national parks, but the intent is for the condition to be long term extending over 10 years time.

## **External Review**

Because the processes described above are interpretive in both editing of source boundary information and the assigning of biodiversity management status codes, a variety of end users were asked to review and quality check the preliminary stewardship products. To do so, each state project coordinator helped host, organize, and facilitate a one-day conservation review meeting.

These review meetings consisted of a presentation by the state project coordinator offering an overview of SWReGAP methods, products, and project objectives. This was followed by a more detailed presentation focused specifically on the stewardship aspect of GAP. These meetings were held in one or two key locations in each state and a variety of agency experts were invited to attend. During these meetings questions and concerns were addressed and copies of the state draft stewardship maps were provided. After the initial meeting attendees had one month to examine the draft maps and provide their overall review, comments, and suggestions for data quality and improvements. Occasionally new boundary files were provided and incorporated into the overall dataset. Status codes were changed if sufficient documentation was provided by the land steward for a parcel of land. The stewardship product greatly benefited from this examination by providing a variety of agencies with differing management strategies the ability to review and comment on the stewardship dataset as part of the development process.

## **Regionalization**

Changes to the draft maps were incorporated based on comments provided during the external review. Once complete, each state dataset was imported into the final regional stewardship geodatabase. Parcel boundaries that extended across state boundaries were sometimes moved to ensure alignment across state lines. An additional topological rule of “must be covered by” was used to expand or contract parcels along the edge of the state. This rule was used to precisely fit the stewardship map into the pre-existing state boundaries. Some information in the attribute table was updated or changed for regional consistency.



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# RESULTS

The stewardship geodatabase, consisting of records and fields, is described in the accompanying metadata for this data set. We extracted summary statistics from the stewardship database to develop a summary of land stewardship and biodiversity management conservation status by region and by each state. We also developed cross tabulation statistics of stewardship and management conservation status (Tables 4-1 through 4-6), again by region and for each state. When read by row, these tables show the area and proportion of each biodiversity management status category for each stewardship type. When read by columns, the tables show the area and proportion of stewardship types comprising each of the four management status categories. Tables 4-7 through 4-11 present a summary of documentation and management plans that specifically provided sufficient information to assign a management status category of 1 for land tracts in each state. Appendices 4-3 thru 4-7 summarize documentation and management plans that provided information for Status 2 lands.

## Land Stewards

In the region, federal agencies account for the largest land steward category managing over 51% of the landscape (Figure 4-3). BLM is the largest federal land steward accounting for over 30% of the total land area. The U.S. Forest Service (USFS) is the second largest federal land steward accounting for 14% of the area. Private lands are the second largest land steward category in the region comprising 30% of the region's lands. Tribal lands and State managed lands account for 9% and 8% respectively. Regional and local government lands, non-governmental organization lands, and water bodies comprise the smallest proportion of land stewards each contributing less than 1% to the overall area.

Federal land stewards manage 42% of Arizona (Figure 4-3) with the BLM and USFS managing 17% and 15% respectively. Arizona contains a higher percentage of tribal lands than any other state in the region with approximately 28% of the state in this category. Private lands and State-managed lands account for 17% and 13% respectively. Regional and local government lands, non-governmental organization lands, and water bodies comprise less than 1% of the state.

Colorado has the largest proportion of private lands in the region with over 57% under private stewardship (Figure 4-3). Federal land stewards manage 36% of the state, with the USFS being the largest land management agency, managing over 21% and the BLM managing over 12% of the state. State-managed lands comprise 5% of the state, and Tribal lands, regional and local government lands, non-governmental lands, and water represent slightly more than 2% of the area in Colorado.

Within the region, Nevada has the highest proportion of land area under federal stewardship with 85% (Figure 4-3). The majority, or 67%, of these lands are managed by BLM. Other federal stewards include USFS and Department of Defense/Department of Energy managing 8% and 5% respectively. Private land comprises 13% of Nevada.

Tribal lands, regional and local government lands, State-managed lands, non-governmental organizations, and water bodies make up less than 3% of Nevada lands combined.

New Mexico has 43% of the area under private land stewardship (Figure 4-3). Federal lands are the second largest land steward managing 34% with BLM managing 17% as the largest federal land steward in the state, and USFS the second largest federal land steward with 12%. State-managed lands including State Land Board lands, State Parks, and State Wildlife Areas, make up 12% of New Mexico. Tribal lands comprise 10% of the state, with regional and local government lands, non-governmental organization lands, and water bodies combined accounting for less than 1%.

Federal land stewards manage 64% of Utah lands (Figure 4-3). BLM manages 42% of those federal lands while USFS manages 15%. Private lands in Utah comprise 21% of the state. State-managed lands and Tribal lands account for 8% and 5% respectively. Other lands such as regional and local government lands, non-governmental organization lands, and water bodies are less than 4% of the state combined.

### **Biodiversity Management Status**

Status 4 lands comprise 38% of the region (Figure 4-4). Private land stewards manage over 80% of these lands, with State Land Board lands managing 17%. Status 4 lands account for 31% of Arizona, 58% of Colorado, 13% of Nevada, 57% of New Mexico, and 28% of Utah.

Status 3 lands comprise 50% of the region. BLM manages 51% of these lands, USFS manages 23%, and Native Americans manage 17%. Status 3 lands comprise 55% of Arizona, 32% of Colorado, 72% of Nevada, 37% of New Mexico, and 56% of Utah.

Status 2 lands comprise 9% of the region. The largest land steward in this category is the BLM which manages 57% of these lands. Other land stewards include 26% managed by USFS, 5% managed by U.S. Fish and Wildlife Service, and 4% managed by state wildlife agencies. Status 2 lands include 9% of Arizona, 8% of Colorado, 12% of Nevada, 6% of New Mexico, and 12% of Utah.

Status 1 lands comprise 3% of the region. Stewards managing these lands include 40% managed by National Park Service, 33% managed by U.S. Fish and Wildlife Service, 21% by USFS, and 7% by BLM. State lands and non-governmental organizations account for less than 1% of these lands. Status 1 lands include 5% of Arizona, 3% of both Colorado and Nevada, 2% of Utah, and less than 1% of New Mexico. The majority of the Status 1 lands are small, isolated tracts.

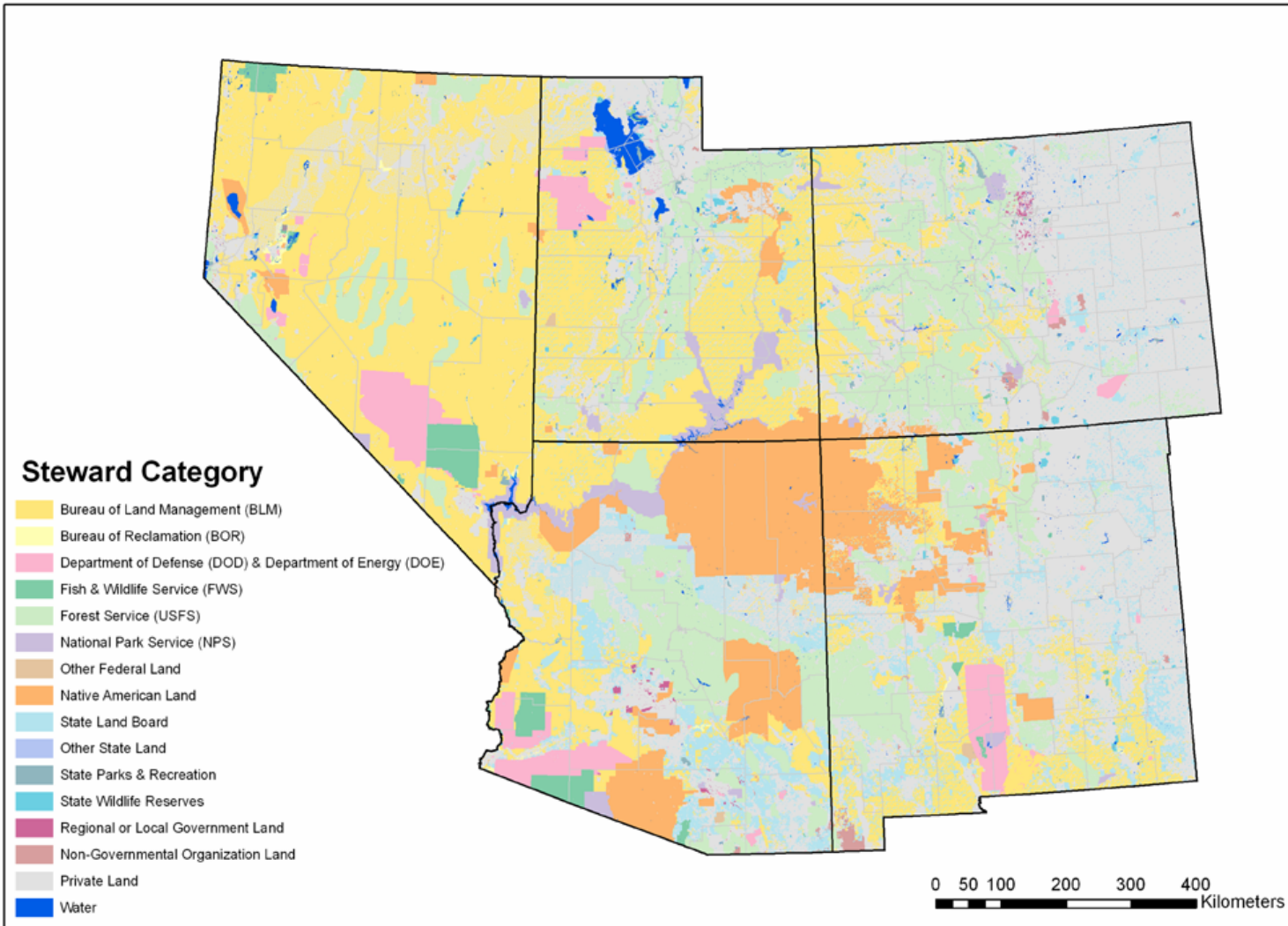


Figure 4-3. Final stewardship map for the Southwestern U.S.

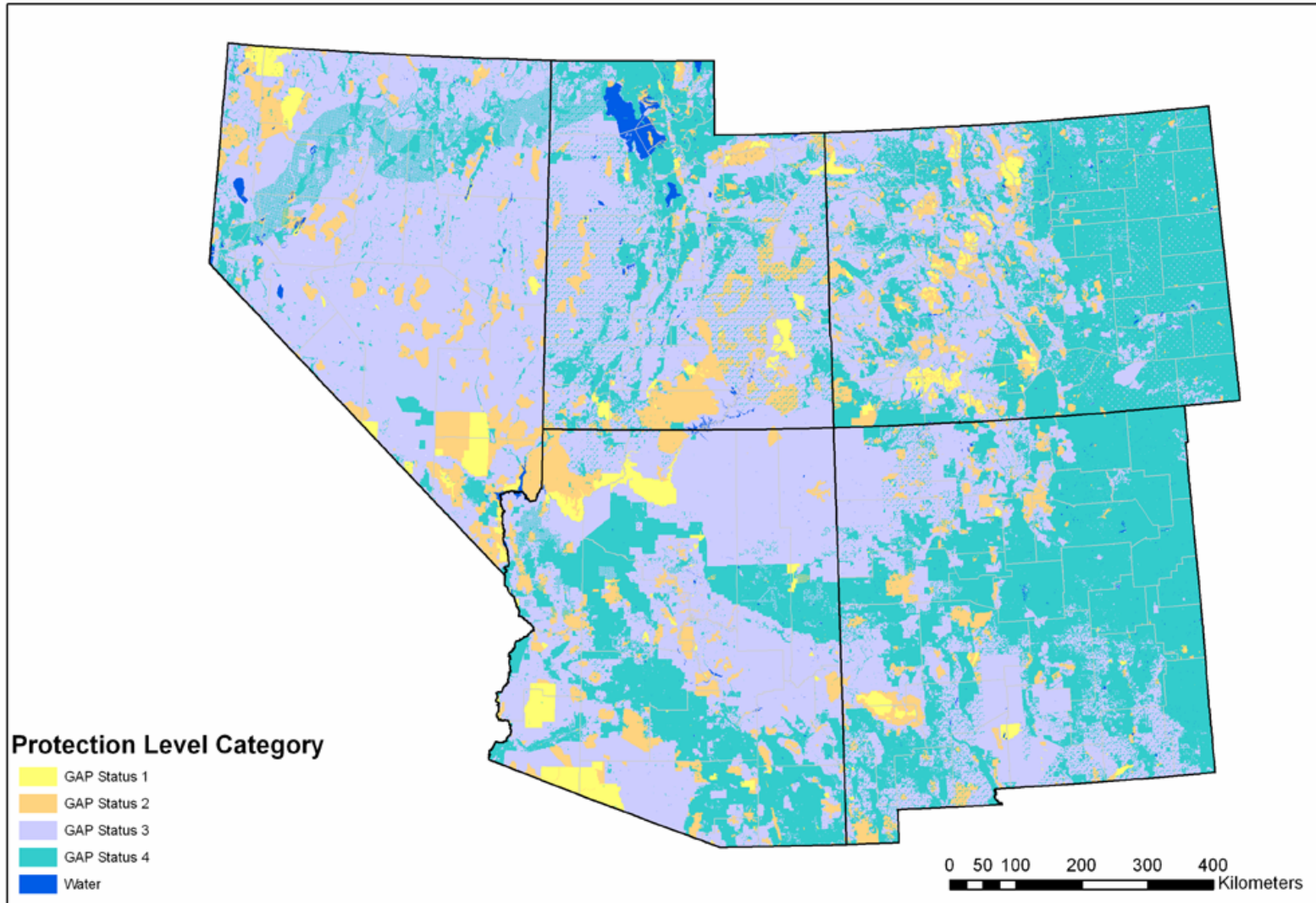


Figure 4-4. Final GAP management status map for the Southwestern U.S.

**Table 4-1. Total Area by Land Steward and Protection Level Category for the Region.**

| Steward Category  | Total Land Area         |               | Status 1                |               | Status 2                |               | Status 3                |               | Status 4                |               |
|---|-------------------------|---------------|-------------------------|---------------|-------------------------|---------------|-------------------------|---------------|-------------------------|---------------|
|   | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             |
| Bureau of Land Management   | 423,009                 | 30.52         | 2,541                   | 6.93          | 70,381                  | 56.99         | 350,087                 | 50.82         | —                       | —             |
| Bureau of Reclamation   | 1,767                   | 0.13          | —                       | —             | 375                     | 0.30          | 943                     | 0.14          | 448                     | 0.09          |
| U.S. Fish & Wildlife Service  | 18,363                  | 1.32          | 11,912                  | 32.47         | 6,133                   | 4.97          | 318                     | 0.05          | —                       | —             |
| U.S. Forest Service   | 197,519                 | 14.25         | 7,568                   | 20.63         | 31,788                  | 25.74         | 158,163                 | 22.96         | —                       | —             |
| Department of Defense &/or<br>Department of Energy                    | 44,413                  | 3.20          | —                       | —             | 1,244                   | 1.01          | 41,433                  | 6.02          | 1,736                   | 0.33          |
| National Park Service   | 24,181                  | 1.74          | 14,573                  | 39.72         | 3,391                   | 2.75          | 6,217                   | 0.90          | —                       | —             |
| Agricultural Research Service   | 952                     | 0.07          | —                       | —             | 293                     | 0.24          | 659                     | 0.10          | —                       | —             |
| Department of Commerce  | 7                       | 0.00          | —                       | —             | —                       | —             | —                       | —             | 7                       | 0.00          |
| Tribal Land   | 131,047                 | 9.45          | —                       | —             | 1,038                   | 0.84          | 116,416                 | 16.90         | 13,593                  | 2.58          |
| State Parks & Recreation  | 2,223                   | 0.16          | —                       | —             | 172                     | 0.14          | 2,051                   | 0.30          | 0                       | 0.00          |
| State Land Board  | 98,045                  | 7.07          | —                       | —             | 1,538                   | 1.25          | 9,831                   | 1.43          | 86,676                  | 16.47         |
| State Wildlife Reserves   | 5,216                   | 0.38          | 2                       | 0.01          | 5,169                   | 4.19          | 39                      | 0.01          | 6                       | 0.00          |
| Other State Land  | 529                     | 0.04          | —                       | —             | 5                       | 0.00          | 518                     | 0.08          | 6                       | 0.00          |
| Regional Government Land  | 534                     | 0.04          | —                       | —             | —                       | —             | —                       | —             | 534                     | 0.10          |
| City Land   | 509                     | 0.04          | —                       | —             | —                       | —             | —                       | —             | 509                     | 0.10          |
| County Land   | 655                     | 0.05          | —                       | —             | —                       | —             | 55                      | 0.01          | 600                     | 0.11          |
| Audubon Society   | 5                       | 0.00          | 4                       | 0.01          | 0                       | 0.00          | 334                     | 0.05          | —                       | —             |
| Local Land Trust<br>Preserve/Easement                                 | 1,268                   | 0.09          | —                       | —             | 934                     | 0.76          | —                       | —             | —                       | —             |
| The Nature Conservancy  | 2,306                   | 0.17          | 89                      | 0.24          | 1,032                   | 0.84          | 1,185                   | 0.17          | —                       | —             |
| Private Conservation<br>Easement/ Conservation Deed<br>Restriction    | —                       | —             | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| Private Institution Managed for<br>Biodiversity                       | 4,604                   | 0.33          | —                       | —             | —                       | —             | —                       | —             | 4,604                   | 0.87          |
| Private Land Unrestricted for<br>Development/ No Known<br>Restriction | 418,213                 | 30.17         | —                       | —             | —                       | —             | 567                     | 0.08          | 417,647                 | 79.35         |
| Water*  | 10,707                  | 0.77          | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| <b>TOTAL</b>  | <b>1,386,072</b>        | <b>100.00</b> | <b>36,690</b>           | <b>100.00</b> | <b>123,493</b>          | <b>100.00</b> | <b>688,816</b>          | <b>100.00</b> | <b>526,366</b>          | <b>100.00</b> |

\*The complexity of ownership, water rights, managing entities, and protection level categories of water resources are addressed in the aquatic component of GAP.

**Table 4-2. Total Area by Land Steward and Protection Level Category for Arizona.**

| Steward Category  | Total Land Area         |               | Status 1                |               | Status 2                |               | Status 3                |               | Status 4                |               |
|---|-------------------------|---------------|-------------------------|---------------|-------------------------|---------------|-------------------------|---------------|-------------------------|---------------|
|   | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             |
| Bureau of Land Management   | 50,251                  | 17.01         | 156                     | 1.11          | 14,928                  | 58.49         | 35,167                  | 21.60         | —                       | —             |
| Bureau of Reclamation   | 432                     | 0.15          | —                       | —             | —                       | —             | —                       | —             | 432                     | 0.47          |
| U.S. Fish & Wildlife Service  | 6,865                   | 2.32          | 6,106                   | 43.20         | 759                     | 2.97          | —                       | —             | —                       | —             |
| U.S. Forest Service   | 45,068                  | 15.26         | 706                     | 5.00          | 6,990                   | 27.38         | 37,372                  | 22.95         | —                       | —             |
| Department of Defense &/or<br>Department of Energy                    | 11,151                  | 3.78          | —                       | —             | 1,244                   | 4.87          | 9,907                   | 6.08          | —                       | —             |
| National Park Service   | 9,336                   | 3.16          | 7,153                   | 50.60         | 409                     | 1.60          | 1,774                   | 1.09          | —                       | —             |
| Agricultural Research Service   | 217                     | 0.07          | —                       | —             | —                       | —             | 217                     | 0.13          | —                       | —             |
| Department of Commerce  | —                       | —             | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| Tribal Land   | 81,298                  | 27.53         | —                       | —             | 353                     | 1.38          | 77,613                  | 47.66         | 3,333                   | 3.62          |
| State Parks & Recreation  | 289                     | 0.10          | —                       | —             | 28                      | 0.11          | 261                     | 0.16          | —                       | —             |
| State Land Board  | 37,265                  | 12.62         | —                       | —             | 544                     | 2.13          | 100                     | 0.06          | 36,622                  | 39.74         |
| State Wildlife Reserves   | 211                     | 0.07          | —                       | —             | 189                     | 0.74          | 16                      | 0.01          | 5                       | 0.01          |
| Other State Land  | —                       | —             | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| Regional Government Land  | 488                     | 0.17          | —                       | —             | —                       | —             | —                       | —             | 488                     | 0.53          |
| City Land   | 191                     | 0.06          | —                       | —             | —                       | —             | —                       | —             | 191                     | 0.21          |
| County Land   | 202                     | 0.07          | —                       | —             | —                       | —             | 2                       | 0.00          | 200                     | 0.22          |
| Audubon Society   | 4                       | 0.00          | 4                       | 0.03          | —                       | —             | —                       | —             | —                       | —             |
| Local Land Trust<br>Preserve/Easement                                 | 154                     | 0.05          | —                       | —             | 3                       | 0.01          | 151                     | 0.09          | —                       | —             |
| The Nature Conservancy  | 337                     | 0.11          | 9                       | 0.06          | 78                      | 0.30          | 250                     | 0.15          | —                       | —             |
| Private Conservation<br>Easement/ Conservation Deed<br>Restriction    | —                       | —             | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| Private Institution Managed for<br>Biodiversity                       | —                       | —             | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| Private Land Unrestricted for<br>Development/ No Known<br>Restriction | 50,892                  | 17.23         | —                       | —             | —                       | —             | —                       | —             | 50,892                  | 55.22         |
| Water*  | 695                     | 0.24          | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| <b>TOTAL</b>  | <b>295,349</b>          | <b>100.00</b> | <b>14,135</b>           | <b>100.00</b> | <b>25,524</b>           | <b>100.00</b> | <b>162,830</b>          | <b>100.00</b> | <b>92,164</b>           | <b>100.00</b> |

\*The complexity of ownership, water rights, managing entities, and protection level categories of water resources are addressed in the aquatic component of GAP.

**Table 4-3. Total Area by Land Steward and Protection Level Category for Colorado.**

| Steward Category  | Total Land Area         |               | Status 1                |               | Status 2                |               | Status 3                |               | Status 4                |               |
|---|-------------------------|---------------|-------------------------|---------------|-------------------------|---------------|-------------------------|---------------|-------------------------|---------------|
|   | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             |
| Bureau of Land Management   | 33,786                  | 12.53         | 40                      | 0.59          | 5,654                   | 27.32         | 28,092                  | 32.99         | —                       | —             |
| Bureau of Reclamation   | 5                       | 0.00          | —                       | —             | —                       | —             | —                       | —             | 5                       | 0.00          |
| U.S. Fish & Wildlife Service  | 353                     | 0.13          | 118                     | 1.72          | 142                     | 0.69          | 93                      | 0.11          | —                       | —             |
| U.S. Forest Service   | 58,482                  | 21.68         | 4,299                   | 62.87         | 10,156                  | 49.08         | 44,027                  | 51.71         | —                       | —             |
| Department of Defense &/or<br>Department of Energy                    | 1,771                   | 0.66          | —                       | —             | —                       | —             | 1,623                   | 1.91          | 148                     | 0.09          |
| National Park Service   | 2,787                   | 1.03          | 2,358                   | 34.49         | 236                     | 1.14          | 193                     | 0.23          | —                       | —             |
| Agricultural Research Service   | 68                      | 0.03          | —                       | —             | 68                      | 0.33          | —                       | —             | —                       | —             |
| Department of Commerce  | 7                       | 0.00          | —                       | —             | —                       | —             | —                       | —             | 7                       | 0.00          |
| Tribal Land   | 3,093                   | 1.15          | —                       | —             | 643                     | 3.11          | —                       | —             | 2,450                   | 1.57          |
| State Parks & Recreation  | 784                     | 0.29          | —                       | —             | 15                      | 0.07          | 769                     | 0.90          | —                       | —             |
| State Land Board  | 10,722                  | 3.97          | —                       | —             | 990                     | 4.78          | 9,732                   | 11.43         | —                       | —             |
| State Wildlife Reserves   | 2,111                   | 0.78          | —                       | —             | 2,106                   | 10.18         | 5                       | 0.01          | —                       | —             |
| Other State Land  | 5                       | 0.00          | —                       | —             | —                       | —             | 5                       | 0.01          | —                       | —             |
| Regional Government Land  | 36                      | 0.01          | —                       | —             | —                       | —             | —                       | —             | 36                      | 0.02          |
| City Land   | 286                     | 0.11          | —                       | —             | —                       | —             | —                       | —             | 286                     | 0.18          |
| County Land   | 344                     | 0.13          | —                       | —             | —                       | —             | 2                       | 0.00          | 342                     | 0.22          |
| Audubon Society   | —                       | —             | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| Local Land Trust<br>Preserve/Easement                                 | 5                       | 0.00          | —                       | —             | —                       | —             | 5                       | 0.01          | —                       | —             |
| The Nature Conservancy  | 1,304                   | 0.48          | 23                      | 0.33          | 682                     | 3.30          | 599                     | 0.70          | —                       | —             |
| Private Conservation<br>Easement/ Conservation Deed<br>Restriction    | —                       | —             | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| Private Institution Managed for<br>Biodiversity                       | 140                     | 0.05          | —                       | —             | —                       | —             | —                       | —             | 140                     | 0.09          |
| Private Land Unrestricted for<br>Development/ No Known<br>Restriction | 152,675                 | 56.60         | —                       | —             | —                       | —             | —                       | —             | 152,675                 | 97.81         |
| Water*  | 975                     | 0.36          | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| <b>TOTAL</b>  | <b>269,738</b>          | <b>100.00</b> | <b>6,838</b>            | <b>100.00</b> | <b>20,692</b>           | <b>100.00</b> | <b>85,145</b>           | <b>100.00</b> | <b>156,089</b>          | <b>100.00</b> |

\*The complexity of ownership, water rights, managing entities, and protection level categories of water resources are addressed in the aquatic component of GAP.

**Table 4-4. Total Area by Land Steward and Protection Level Category for Nevada.**

| Steward Category  | Total Land Area         |               | Status 1                |               | Status 2                |               | Status 3                |               | Status 4                |               |
|---|-------------------------|---------------|-------------------------|---------------|-------------------------|---------------|-------------------------|---------------|-------------------------|---------------|
|   | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             |
| Bureau of Land Management   | 192,438                 | 67.22         | 1,516                   | 17.08         | 23,514                  | 70.53         | 167,407                 | 82.04         | —                       | —             |
| Bureau of Reclamation   | 1,040                   | 0.36          | —                       | —             | 375                     | 1.13          | 665                     | 0.33          | —                       | —             |
| U.S. Fish & Wildlife Service  | 9,367                   | 3.27          | 5,461                   | 61.52         | 3,685                   | 11.05         | 222                     | 0.11          | —                       | —             |
| U.S. Forest Service   | 23,600                  | 8.24          | 387                     | 4.36          | 4,374                   | 13.12         | 18,840                  | 9.23          | —                       | —             |
| Department of Defense &/or<br>Department of Energy                    | 13,846                  | 4.84          | —                       | —             | —                       | —             | 12,480                  | 6.12          | 1,366                   | 3.58          |
| National Park Service   | 2,592                   | 0.91          | 1,508                   | 16.99         | 1,085                   | 3.25          | —                       | —             | —                       | —             |
| Agricultural Research Service   | —                       | —             | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| Department of Commerce  | —                       | —             | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| Tribal Land   | 4,149                   | 1.45          | —                       | —             | —                       | —             | 3,959                   | 1.94          | 191                     | 0.50          |
| State Parks & Recreation  | 389                     | 0.14          | —                       | —             | —                       | —             | 389                     | 0.19          | —                       | —             |
| State Land Board  | 32                      | 0.01          | —                       | —             | —                       | —             | —                       | —             | 32                      | 0.08          |
| State Wildlife Reserves   | 303                     | 0.11          | —                       | —             | 303                     | 0.91          | —                       | —             | —                       | —             |
| Other State Land  | 17                      | 0.01          | —                       | —             | —                       | —             | 11                      | 0.01          | 6                       | 0.02          |
| Regional Government Land  | 10                      | 0.00          | —                       | —             | —                       | —             | —                       | —             | 10                      | 0.03          |
| City Land   | 12                      | 0.00          | —                       | —             | —                       | —             | —                       | —             | 12                      | 0.03          |
| County Land   | 91                      | 0.03          | —                       | —             | —                       | —             | 51                      | 0.03          | 40                      | 0.10          |
| Audubon Society   | —                       | —             | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| Local Land Trust<br>Preserve/Easement                                 | —                       | —             | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| The Nature Conservancy  | 22                      | 0.01          | 5                       | 0.05          | 6                       | 0.02          | 11                      | 0.01          | —                       | —             |
| Private Conservation<br>Easement/ Conservation Deed<br>Restriction    | —                       | —             | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| Private Institution Managed for<br>Biodiversity                       | —                       | —             | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| Private Land Unrestricted for<br>Development/ No Known<br>Restriction | 36,476                  | 12.74         | —                       | —             | —                       | —             | 11                      | 0.01          | 36,465                  | 95.66         |
| Water*  | 1,900                   | 0.66          | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| <b>TOTAL</b>  | <b>286,284</b>          | <b>100.00</b> | <b>8,876</b>            | <b>100.00</b> | <b>33,341</b>           | <b>100.00</b> | <b>204,046</b>          | <b>100.00</b> | <b>38,121</b>           | <b>100.00</b> |

\*The complexity of ownership, water rights, managing entities, and protection level categories of water resources are addressed in the aquatic component of GAP.



**Table 4-5. Total Area by Land Steward and Protection Level Category for New Mexico.**

| Steward Category  | Total Land Area         |               | Status 1                |               | Status 2                |               | Status 3                |               | Status 4                |               |
|---|-------------------------|---------------|-------------------------|---------------|-------------------------|---------------|-------------------------|---------------|-------------------------|---------------|
|   | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             |
| Bureau of Land Management   | 54,453                  | 17.29         | 206                     | 7.70          | 6,596                   | 38.29         | 47,650                  | 41.54         | —                       | —             |
| Bureau of Reclamation   | 290                     | 0.09          | —                       | —             | —                       | —             | 278                     | 0.24          | 11                      | 0.01          |
| U.S. Fish & Wildlife Service  | 1,532                   | 0.49          | 169                     | 6.31          | 1,360                   | 7.90          | 3                       | 0.00          | —                       | —             |
| U.S. Forest Service   | 37,703                  | 11.97         | 1,363                   | 50.92         | 6,752                   | 39.19         | 29,588                  | 25.79         | —                       | —             |
| Department of Defense &/or<br>Department of Energy                    | 10,373                  | 3.29          | —                       | —             | —                       | —             | 10,332                  | 9.01          | 41                      | 0.02          |
| National Park Service   | 1,563                   | 0.50          | 896                     | 33.46         | 664                     | 3.85          | 3                       | 0.00          | —                       | —             |
| Agricultural Research Service   | 442                     | 0.14          | —                       | —             | —                       | —             | 442                     | 0.39          | —                       | —             |
| Department of Commerce  | —                       | —             | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| Tribal Land   | 32,618                  | 10.36         | —                       | —             | —                       | —             | 25,195                  | 21.97         | 7,423                   | 4.13          |
| State Parks & Recreation  | 336                     | 0.11          | —                       | —             | 25                      | 0.14          | 311                     | 0.27          | —                       | —             |
| State Land Board  | 36,024                  | 11.44         | —                       | —             | —                       | —             | —                       | —             | 36,024                  | 20.06         |
| State Wildlife Reserves   | 676                     | 0.21          | —                       | —             | 670                     | 3.89          | 6                       | 0.01          | —                       | —             |
| Other State Land  | —                       | —             | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| Regional Government Land  | —                       | —             | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| City Land   | 12                      | 0.00          | —                       | —             | —                       | —             | —                       | —             | 12                      | 0.01          |
| County Land   | 1                       | 0.00          | —                       | —             | —                       | —             | —                       | —             | 1                       | 0.00          |
| Audubon Society   | 0                       | 0.00          | —                       | —             | 0                       | 0.00          | —                       | —             | —                       | —             |
| Local Land Trust<br>Preserve/Easement                                 | 1,108                   | 0.35          | —                       | —             | 930                     | 5.40          | 177                     | 0.15          | —                       | —             |
| The Nature Conservancy  | 438                     | 0.14          | 43                      | 1.61          | 230                     | 1.33          | 165                     | 0.14          | —                       | —             |
| Private Conservation<br>Easement/ Conservation Deed<br>Restriction    | —                       | —             | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| Private Institution Managed for<br>Biodiversity                       | 4,465                   | 1.42          | —                       | —             | —                       | —             | —                       | —             | 4,465                   | 2.49          |
| Private Land Unrestricted for<br>Development/ No Known<br>Restriction | 132,118                 | 41.96         | —                       | —             | —                       | —             | 556                     | 0.48          | 131,562                 | 73.28         |
| Water*  | 721                     | 0.23          | —                       | —             | —                       | —             | —                       | —             | —                       | —             |
| <b>TOTAL</b>  | <b>314,873</b>          | <b>100.00</b> | <b>2,678</b>            | <b>100.00</b> | <b>17,228</b>           | <b>100.00</b> | <b>114,707</b>          | <b>100.00</b> | <b>179,539</b>          | <b>100.00</b> |

\*The complexity of ownership, water rights, managing entities, and protection level categories of water resources are addressed in the aquatic component of GAP.

**Table 4-6. Total Area by Land Steward and Protection Level Category for Utah.**

| Steward Category  | Total Land Area         |               | Status 1                |               | Status 2                |               | Status 3                |               | Status 4                |               |
|---|-------------------------|---------------|-------------------------|---------------|-------------------------|---------------|-------------------------|---------------|-------------------------|---------------|
|   | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             | Area (km <sup>2</sup> ) | %             |
| Bureau of Land Management   | 92,081                  | 41.89         | 623                     | 14.95         | 19,689                  | 73.72         | 71,770                  | 58.78         | ---                     | ---           |
| Bureau of Reclamation   | ---                     | ---           | ---                     | ---           | ---                     | ---           | ---                     | ---           | ---                     | ---           |
| U.S. Fish & Wildlife Service  | 246                     | 0.11          | 58                      | 1.40          | 187                     | 0.70          | 1                       | 0.00          | ---                     | ---           |
| U.S. Forest Service   | 32,666                  | 14.86         | 813                     | 19.53         | 3,517                   | 13.17         | 28,336                  | 23.21         | ---                     | ---           |
| Department of Defense &/or<br>Department of Energy                    | 7,272                   | 3.31          | ---                     | ---           | ---                     | ---           | 7,091                   | 5.81          | 181                     | 0.30          |
| National Park Service   | 7,904                   | 3.60          | 2,659                   | 63.85         | 997                     | 3.73          | 4,247                   | 3.48          | ---                     | ---           |
| Agricultural Research Service   | 225                     | 0.10          | ---                     | ---           | 225                     | 0.84          | ---                     | ---           | ---                     | ---           |
| Department of Commerce  | ---                     | ---           | ---                     | ---           | ---                     | ---           | ---                     | ---           | ---                     | ---           |
| Tribal Land   | 9,888                   | 4.50          | ---                     | ---           | 42                      | 0.16          | 9,649                   | 7.90          | 197                     | 0.33          |
| State Parks & Recreation  | 425                     | 0.19          | ---                     | ---           | 104                     | 0.39          | 321                     | 0.26          | 0                       | 0.00          |
| State Land Board  | 14,002                  | 6.37          | ---                     | ---           | 5                       | 0.02          | ---                     | ---           | 13,998                  | 23.15         |
| State Wildlife Reserves   | 1,916                   | 0.87          | 2                       | 0.05          | 1,902                   | 7.12          | 11                      | 0.01          | 0                       | 0.00          |
| Other State Land  | 507                     | 0.23          | ---                     | ---           | 5                       | 0.02          | 502                     | 0.41          | ---                     | ---           |
| Regional Government Land  | 0                       | 0.00          | ---                     | ---           | ---                     | ---           | ---                     | ---           | 0                       | 0.00          |
| City Land   | 8                       | 0.00          | ---                     | ---           | ---                     | ---           | ---                     | ---           | 8                       | 0.01          |
| County Land   | 18                      | 0.01          | ---                     | ---           | ---                     | ---           | ---                     | ---           | 18                      | 0.03          |
| Audubon Society   | ---                     | ---           | ---                     | ---           | ---                     | ---           | ---                     | ---           | ---                     | ---           |
| Local Land Trust<br>Preserve/Easement                                 | ---                     | ---           | ---                     | ---           | ---                     | ---           | ---                     | ---           | ---                     | ---           |
| The Nature Conservancy  | 207                     | 0.09          | 9                       | 0.22          | 36                      | 0.14          | 161                     | 0.13          | ---                     | ---           |
| Private Conservation<br>Easement/ Conservation Deed<br>Restriction    | ---                     | ---           | ---                     | ---           | ---                     | ---           | ---                     | ---           | ---                     | ---           |
| Private Institution Managed for<br>Biodiversity                       | ---                     | ---           | ---                     | ---           | ---                     | ---           | ---                     | ---           | ---                     | ---           |
| Private Land Unrestricted for<br>Development/ No Known<br>Restriction | 46,052                  | 20.95         | ---                     | ---           | ---                     | ---           | ---                     | ---           | 46,052                  | 76.18         |
| Water*  | 6,415                   | 2.92          | ---                     | ---           | ---                     | ---           | ---                     | ---           | ---                     | ---           |
| <b>TOTAL</b>  | <b>219,831</b>          | <b>100.00</b> | <b>4,165</b>            | <b>100.00</b> | <b>26,708</b>           | <b>100.00</b> | <b>122,090</b>          | <b>100.00</b> | <b>60,453</b>           | <b>100.00</b> |

\*The complexity of ownership, water rights, managing entities, and protection level categories of water resources are addressed in the aquatic component of GAP.

**Table 4-7. Documentation of Biodiversity Management Status 1 lands in Arizona.**

| <b>Land Steward</b>          | <b>Name of Status 1 Area in Arizona</b>  | <b>Source of Management Plan</b>   |
|------------------------------|--|--|
| Bureau of Land Management    | <i>Desert Grasslands ACEC/RNA; San Pedro River ACEC/RNA; Swamp Springs-Hot Springs Watershed ACEC</i>            | Final Safford District Resource Management Plan and Environmental Impact Statement 08/1991   |
| Bureau of Land Management    | <i>East Cactus Plain Wilderness</i>  | East Cactus Plain Wilderness Management Plan, Environmental Assessment, and Decision Record 09/1994  |
| Bureau of Land Management    | <i>Larry Canyon ACEC</i>   | Draft Phoenix Resource Management Plan and Environmental Impact Statement 12/1987  |
| Bureau of Land Management    | <i>Clay Hills ACEC/RNA</i>   | Record of Decision for the Approval of the Kingman Resource Area Resource Management Plan 03/1995; Kingman Resource Area Resource Management Plan and Final Environmental Impact Statement 01/1992 |
| Bureau of Land Management    | <i>Appleton-Whittell ACEC</i>  | Approved Las Cienegas Resource Management Plan and Record of Decision 07/2003  |
| U.S. Fish & Wildlife Service | <i>Bill Williams River NWR; Cibola NWR, Havasu NWR &amp; Wilderness Area; Imperial NWR &amp; Wilderness Area</i> | Final Lower Colorado River National Wildlife Refuges Comprehensive Management Plan 1994-2014   |
| U.S. Fish & Wildlife Service | <i>Kofa NWR &amp; Wilderness Area</i>  | Kofa National Wildlife Refuge & Wilderness and New Water Mountains Wilderness Interagency Management Plan and Environmental Assessment 10/1996   |
| U.S. Fish & Wildlife Service | <i>Leslie Canyon NWR; San Bernardino NWR</i>   | San Bernardino and Leslie Canyon National Wildlife Refuges Comprehensive Management Plan 1995-2015   |
| U.S. Fish & Wildlife Service | <i>Cabeza Prieta Wilderness</i>  | URL:<br><a href="http://www.fws.gov/southwest/refuges/arizona/cabeza.html">http://www.fws.gov/southwest/refuges/arizona/cabeza.html</a>  |
| U.S. Forest Service          | <i>Bear Wallow Wilderness; Escudilla Mountain RNA; Mount Baldy Wilderness; Thomas Creek RNA</i>                  | Apache-Sitgreaves National Forest Plan 1987; Amendment No. 6. 07/1996  |

| <b>Land Steward</b>   | <b>Name of Status 1 Area in Arizona</b>   | <b>Source of Management Plan</b>   |
|-----------------------|---|--|
| U.S. Forest Service   | <i>Casner Canyon RNA; Fern Mountain Botanical Area; Fossil Springs Botanical Area; Mogollon Rim Botanical Area; Rocky Gulch Proposed RNA; Strawberry Crater Wilderness; Verde Valley Botanical Area</i> | Coconino National Forest Plan 08/1987; Amendment No. 17. 12/2002   |
| U.S. Forest Service   | <i>Butterfly Peak RNA; Elgin RNA; Goodding RNA; Goudy Canyon RNA; Pole Bridge RNA; Santa Catalina RNA</i>   | Coronado National Forest Plan 1986; Forest Plan Change Notice No. 3 06/1999  |
| U.S. Forest Service   | <i>Garland Prairie RNA; Kanab Creek Wilderness</i>  | Kaibab National Forest Land Management Plan 04/1988; Amendment No. 5. 02/2003  |
| U.S. Forest Service   | <i>Apache Creek Wilderness; Castle Creek Wilderness; Cedar Bench Wilderness; Juniper Mesa Wilderness; Woodchute Wilderness</i>  | Prescott National Forest Plan 11/1986; Amendment No. 11. 03/2000   |
| U.S. Forest Service   | <i>Buckhorn Mountain RNA; Bush Highway RNA; Hauffer Wash RNA; Mazatzal Wilderness; Picket Post Mountain RNA; Upper Forks Parker Creek RNA</i>   | Tonto National Forest Plan 10/1985; Amendment No. 22. 06/1996  |
| National Park Service | <i>Chiricahua NM Wilderness Area</i>  | Draft Environmental Impact Statement General Management Plan Chiricahua National Monument 1999                                     |
| National Park Service | <i>Grand Canyon NP</i>  | General Management Plan Grand Canyon National Park 08/1995   |
| National Park Service | <i>Hohokam Pima NM</i>  | URL:<br><a href="http://www.nps.gov/pima/">http://www.nps.gov/pima/</a> ; c/o Casa Grande Ruins National Monument                  |
| National Park Service | <i>Organ Pipe Cactus NM &amp; Wilderness Area</i>   | Final General Management Plan Development Concept Plans Environmental Impact Statement Organ Pipe Cactus National Monument 07/1997 |
| National Park Service | <i>Petrified Forest NP &amp; Wilderness Area</i>  | Final General Management Plan Development Concept Plans Environmental Impact Statement Petrified Forest National Park 1992         |
| National Park Service | <i>Saguaro NP &amp; Wilderness Area</i>   | Statement for Management Saguaro National Park 12/1991   |
| National Park Service | <i>Sunset Crater Volcano NM</i>   | General Management Plan Final Environmental Impact Statement Sunset Crater Volcano National Monument 11/2002                       |

| <b>Land Steward</b>    | <b>Name of Status 1 Area in Arizona</b>   | <b>Source of Management Plan</b>  |
|------------------------|---|---|
| National Park Service  | <i>Tonto NM</i>   | Final Environmental Impact Statement General Management Plan Tonto National Monument 12/2003  |
| National Park Service  | <i>Walnut Canyon NM</i>   | Draft Environmental Impact Statement Draft General Management Plan Walnut Canyon National Monument 09/2001  |
| National Park Service  | <i>Wupatki NM</i>   | Final Environmental Impact Statement General Management Plan Wupatki National Monument 11/2002  |
| Audubon Society        | <i>Appleton-Whittell Research Ranch</i>   | Appleton-Whittell Research Ranch National Audubon Society Santa Cruz County Elgin, AZ 85611   |
| The Nature Conservancy | <i>Chiricahua Cave Creek; Hassayampa River Preserve; Patagonia-Sonoita Creek Preserve; Ramsey Canyon Preserve</i> | URL:<br><a href="http://www.nature.org/wherewework/northamerica/states/arizona/preserves/">http://www.nature.org/wherewework/northamerica/states/arizona/preserves/</a> |

**Table 4-8. Documentation of Status 1 lands in Colorado.**

| <b>Land Steward</b>          | <b>Name of Status 1 Area in Colorado</b>  | <b>Source of Management Plan</b>   |
|------------------------------|---|--|
| Bureau of Land Management    | <i>Thompson Creek ACEC/NEA</i>  | Record of Decision and Resource Management Plan Glenwood Springs Resource Area (Revised 1988)  |
| Bureau of Land Management    | <i>Fruita Paleontological Site ACEC/RNA; Pyramid Rock ACEC/RNA; Rabbit Valley Paleontological Site ACEC/RNA</i>   | Grand Junction Resource Area Resource Management Plan and Record of Decision 01/1987   |
| Bureau of Land Management    | <i>Fairview ACEC/RNA</i>  | Gunnison Gorge NCA Approved Resource Management Plan and Final Environmental Impact Statement 01/2004  |
| Bureau of Land Management    | <i>Ammonite Site ACEC/RNA; North Park Phaceila Site ACEC/RNA</i>  | Kremmling Resource Area Resource Management Plan Record of Decision 01/1984  |
| Bureau of Land Management    | <i>Mosquito Pass ACEC</i>   | Royal Gorge Resource Area Record of Decision and Approved Resource Management Plan 05/1996   |
| U.S. Fish & Wildlife Service | <i>Alamosa NWR; Monte Vista NWR</i>   | Alamosa-Monte Vista National Wildlife Refuge Complex Comprehensive Conservation Plan 09/2003   |
| U.S. Fish & Wildlife Service | <i>Baca NWR</i>   | Interviewed Refuge Manager: Mike Blenden - 07/26/04  |
| U.S. Forest Service          | <i>Boston Peak Fen RNA; Daves Draw RNA; Indian Caves RNA; Keota RNA; Little Owl Creek RNA; Lone Pine RNA; Mount Goliath RNA; Sheep Creek RNA</i>                      | 1997 Revision of the Land and Resource Management Plan Arapaho and Roosevelt National Forests and Pawnee National Grassland                      |
| U.S. Forest Service          | <i>Escalante Creek RNA; Gothic RNA; La Garita Wilderness; Powderhorn Wilderness; Unknown; West Elk Wilderness</i>   | Amended Land and Resource Management Plan Grand Mesa, Uncompahgre, and Gunnison National Forests 1991  |
| U.S. Forest Service          | <i>Campo RNA; Hurricane Canyon RNA; Saddle Mountain RNA</i>   | Land and Resource Management Plan Pike and San Isabel National Forest; Comanche and Cimarron National Grasslands 1984; Amendment No. 24. 04/1992 |
| U.S. Forest Service          | <i>Deadman Creek RNA; Finger Mesa RNA; Hot Creek RNA; Mill Creek RNA; North Zapata RNA; Sangre de Cristo Wilderness; South San Juan Wilderness; Spring Branch RNA</i> | Revised Land and Resource Management Plan Rio Grande National Forest 11/1996   |
| U.S. Forest Service          | <i>Kettle Lakes RNA; Mad Creek RNA; Mount Zirkel Wilderness; Never Summer Wilderness; Sarvis Creek Wilderness; Silver Creek RNA</i>                                   | Revised Forest Plan and Final Environmental Impact Statement for the Routt National Forest 2001  |
| U.S. Forest Service          | <i>Lizard Head Wilderness; Narraguinnep RNA; Piedra Area; Weminuche Wilderness; Williams Creek RNA</i>  | Amended Land and Resource Management Plan San Juan National Forest 04/1992; Amendment No. 20 08/1998   |

|                        |   |   |
|------------------------|---|---|
| U.S. Forest Service    | <i>Assignment Creek RNA; Collegiate Peaks Wilderness; Eagles Nest Wilderness; East Lake and West Cross Creeks RNA; Flat Tops Wilderness; Gift and Kline Creeks RNA; Holy Cross Wilderness; Hoosier Ridge NRA; Hunter-Fryingpan Wilderness; Lower Battlement Mesa RNA; Main Elk Creek RNA; Maroon Bells-Snowmass Wilderness; Ptarmigan Peak Wilderness; Raggeds Wilderness</i> | 2002 Revision for Land and Resource Management Plan<br>White River National Forest  |
| National Park Service  | <i>Black Canyon of the Gunnison Wilderness</i>  | General Management Plan<br>Black Canyon of the Gunnison National Monument and Curecanti National Recreation Area 09/1996  |
| National Park Service  | <i>Colorado NM</i>  | Draft General Management Plan<br>Environmental Impact Statement<br>Colorado National Monument<br>01/2004  |
| National Park Service  | <i>Dinosaur NM</i>  | General Management Plan<br>Development Concept Plans Land Protection Plan Environmental Assessment<br>Dinosaur National Monument<br>07/1988; Amended 04/1991              |
| National Park Service  | <i>Florissant Fossil Beds NM</i>  | Final General Management Plan and Development Concept Plan<br>Florissant Fossil Beds National Monument 09/1985  |
| National Park Service  | <i>Great Sand Dunes NP &amp; Wilderness Area</i>  | Statement for Management<br>Great Sand Dunes National Monument 02/1988  |
| National Park Service  | <i>Hovenweep NM</i>   | Statement for Management<br>Hovenweep National Monument<br>04/1992  |
| National Park Service  | <i>Mesa Verde NP &amp; Wilderness Area; Park Mesa RNA</i>   | Statement for Management<br>Mesa Verde National Park<br>10/1986   |
| National Park Service  | <i>Rocky Mountain NP; Indian Peaks Wilderness; Paradise Park RNA; Specimen Mountain RNA; West Creek RNA</i>   | Statement for Management<br>Rocky Mountain National Park<br>09/1988   |
| National Park Service  | <i>Yucca House NM</i>   | Statement for Management<br>Yucca House National Monument<br>06/1987  |
| The Nature Conservancy | <i>High Creek Fen Preserve; Mexican Cut Preserve; Mishak Lakes Preserve; Yampa River Preserve</i>   | URL:<br><a href="http://www.nature.org/wherewework/northamerica/states/colorado/preserves/">http://www.nature.org/wherewework/northamerica/states/colorado/preserves/</a> |

**Table 4-9. Documentation of Status 1 lands in Nevada.**

| <b>Land Steward</b>          | <b>Name of Status 1 Area in Nevada</b>   | <b>Source of Management Plan</b>  |
|------------------------------|--|---|
| Bureau of Land Management    | <i>Ash Meadows ACEC; Pine Creek RNA</i>  | Record of Decision for the Approved Las Vegas Resource Management Plan and Final Environmental Impact Statement 10/1998   |
| Bureau of Land Management    | <i>Black Rock Desert Wilderness</i>  | Resource Management Plan and Final Environmental Impact Statement for the Black Rock Desert-High Rock Canyon Emigrant Trails National Conservation Area (NCA) and Associated Wilderness, and Other Contiguous Lands in Nevada 09/2003 |
| Bureau of Land Management    | <i>Stewart Valley Fossil Site ACEC</i>   | Carson City Field Office Consolidated Resource Management Plan 05/2001  |
| U.S. Fish & Wildlife Service | <i>Anaho Island NWR; Stillwater NWR</i>  | Stillwater National Wildlife Refuge Complex Comprehensive Conservation Plan 06/2003   |
| U.S. Fish & Wildlife Service | <i>Ash Meadows NWR; Desert National Wildlife Range; Moapa Valley NWR; Pahranaagat NWR</i>  | URL:<br><a href="http://www.fws.gov/desertcomplex/">http://www.fws.gov/desertcomplex/</a>   |
| U.S. Fish & Wildlife Service | <i>Charles Sheldon NWR</i>   | Interviewed Deputy Project Leader of Hart-Sheldon Complex: Dave Johnson - 10/2004   |
| U.S. Fish & Wildlife Service | <i>Ruby Lake NWR</i>   | Interviewed Refuge Manager: Martha Collins -10/04   |
| U.S. Forest Service          | <i>Fall Creek RNA; Hole-in-the-Mountain RNA; Mount Moriah Table RNA; North-South Schell Peaks RNA; Pearl Peak RNA; Seitz Canyon/Echo Lake RNA; Troy Peak RNA; White Pine Peak RNA</i>  | Humboldt National Forest Land and Resource Management Plan 1996   |
| U.S. Forest Service          | <i>Bald Mountain Wash RNA; Jacks Spring Pinyon RNA; Mount Jefferson RNA</i>  | Land and Resource Management Plan Toiyabe National Forest 1987  |
| U.S. Forest Service          | <i>Carpenter Canyon RNA; La Madre Mountain Wilderness; Mount Charleston Wilderness; Rainbow Mountain Wilderness</i>  | General Management Plan for the Spring Mountains National Recreation Area: An Amendment to the Land and Resource Management Plan Toiyabe National Forest 1996   |
| National Park Service        | <i>Black Canyon Wilderness; Bridge Canyon Wilderness; Eldorado Wilderness; Iretaba Peaks Wilderness; Jimbilnan Wilderness; Muddy Mountains Wilderness; Nellis Wash Wilderness; Pinto Valley Wilderness; Spirit Mountain Wilderness</i> | Revised Draft Environmental Statement Preliminary Wilderness Proposal Lake Mead National Recreation Area & Interagency Wilderness Strategic Plan (1995)   |
| National Park Service        | <i>Death Valley NP &amp; Wilderness Area</i>   | General Management Plan Death Valley National Park 04/2002  |



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| <b>Land Steward</b>    | <b>Name of Status 1 Area in Nevada</b>   | <b>Source of Management Plan</b>  |
|------------------------|--|---|
| National Park Service  | <i>Great Basin NP</i>  | Final General Management Plan<br>Development Concept Plans<br>Environmental Impact Statement<br>Great Basin National Park<br>09/1992                                      |
| The Nature Conservancy | <i>Alamo; Anderson; Bugbee; Elbow/NLRC; Ferretto; Henrie; Nye County; Parker; Shelton; Shirley Perkins; Torrance</i> | URL:<br><a href="http://www.nature.org/wherewework/northamerica/states/nevada/prereserves/">http://www.nature.org/wherewework/northamerica/states/nevada/prereserves/</a> |

**Table 4-10. Documentation of Status 1 lands in New Mexico.**

| <b>Land Steward</b>          | <b>Name of Status 1 Area in New Mexico</b>  | <b>Source of Management Plan</b>  |
|------------------------------|---|---|
| Bureau of Land Management    | <i>Aden Lava Flow RNA; Antelope Pass RNA; Bear Creek ACEC; Gila Middle Box ACEC; Lordsburg Playa RNA; Paleozoic Trackways RNA</i>   | Las Cruces District Office-Mimbres Resource Area - Mimbres Resource Management Plan 12/1993   |
| Bureau of Land Management    | <i>Ah-shi-sle-pah Road ACEC; Albert Mesa ACEC; Andrews Ranch ACEC; Bee Burrow ACEC; Bis sa'ani ACEC; Casamero Community ACEC; Church Rock Outlier ACEC; Cottonwood Divide ACEC; Dogie Canyon School ACEC; East Side Rincon ACEC; Farmer's Arroyo ACEC; Fossil Forest RNA; Four Ye'i ACEC; Gonzalez Canyon-Senon S. Vigil Homestead ACEC; Halfway House ACEC; Haynes Trading Post ACEC; Headcut Prehistoric Community; Holmes Group ACEC; Indian Creek ACEC; Jacques Chacoan Community ACEC; Kin Nizhoni ACEC; Margarita Martinez Homestead ACEC; Martin Apodaco Homestead ACEC; Morris 41 ACEC; Pierre's Site ACEC; Reese Canyon RNA; Rock House-Nestor Martin Homestead ACEC; Simon Ruin ACEC; Toh-la-kai ACEC; Twin Angels ACEC; Upper Kin Klizhin ACEC</i> | Record of Decision Farmington Proposed Resource Management Plan and Final Environmental Impact Statement 09/2003  |
| Bureau of Land Management    | <i>Little McKittrick Draw Habitat Management RNA; South Texas Hill Canyon RNA; Yeso Hills RNA; Pecos River/Canyons Complex RNA</i>  | Approved Carlsbad Resource Management Plan 09/1988  |
| Bureau of Land Management    | <i>Mathers RNA/ISA</i>  | Special Status Species Resource Management Plan Amendment Analysis of Management Situation 01/2005  |
| Bureau of Land Management    | <i>McGregor Black Grama Grassland ACEC</i>  | Draft McGregor Range Resource Management Plan Amendment and Environmental Impact Statement 01/2005; Resource Management Plan Amendment McGregor Range 09/1990 |
| Bureau of Land Management    | <i>Roswell Cave Complex ACEC</i>  | Record of Decision Proposed Roswell Resource Management Plan 10/1997  |
| U.S. Fish & Wildlife Service | <i>Bosque del Apache Wilderness</i>   | URL:<br><a href="http://www.fws.gov/southwest/refuges/newmex/bosque/">http://www.fws.gov/southwest/refuges/newmex/bosque/</a>                                 |
| U.S. Fish & Wildlife Service | <i>Salt Creek Wilderness</i>  | Bitter Lake National Wildlife Refuge Comprehensive Conservation Plan 09/1998  |

| <b>Land Steward</b>    | <b>Name of Status 1 Area in New Mexico</b>   | <b>Source of Management Plan</b>  |
|------------------------|--|---|
| U.S. Forest Service    | <i>Aldo Leopold Wilderness; Gila River RNA; Gila Wilderness</i>  | Gila National Forest Plan 09/1986; Amendment No. 9 11/2002  |
| U.S. Forest Service    | <i>Bernalillo RNA</i>  | Cibola National Forest Land and Resource Management Plan 07/1985; Amendment No. 8. 11/1996  |
| U.S. Forest Service    | <i>Canada Bonito RNA; Mesita de las Ladrones RNA; Monument Canyon RNA</i>  | Santa Fe National Forest Plan 07/1987; Amendment Change Notice No. 1. 09/1994   |
| U.S. Forest Service    | <i>Haynes Canyon RNA; Upper McKittrick RNA; William G. Telfer RNA</i>  | Lincoln National Forest Plan 1986; Amendment No. 9. 06/1996   |
| National Park Service  | <i>Bandelier NM &amp; Wilderness Area</i>  | Resources Management Plan Bandelier National Monument 01/1995   |
| National Park Service  | <i>Capulin Volcano NM</i>  | Statement for Management Capulin Volcano National Monument 10/1989  |
| National Park Service  | <i>Carlsbad Caverns NP &amp; Wilderness Area</i>   | General Management Plan Carlsbad Caverns National Park 10/1996  |
| National Park Service  | <i>Gila Cliff Dwellings NM</i>   | Interviewed Gila Cliff Dwellings National Monument Superintendent: Steve Riley - 06/04  |
| National Park Service  | <i>White Sands NM</i>  | Final Master Plan in Conjunction with the Resource Management Plan for White Sands National Monument 01/1995  |
| The Nature Conservancy | <i>Gila Riparian Preserve; Gila River Farm; Lama Canyon Preserve; Milnesand Prairie Preserve; Mimbres River Preserve; Rattlesnake Spring Preserve; Rio Nutria Preserve; Santa Fe Canyon Preserve</i> | URL:<br><a href="http://www.nature.org/wherework/northamerica/states/newmexico/preserves/">http://www.nature.org/wherework/northamerica/states/newmexico/preserves/</a> |

**Table 4-11. Documentation of Status 1 lands in Utah.**

| <b>Land Steward</b>          | <b>Name of Status 1 Area in Utah</b>  | <b>Source of Management Plan</b>  |
|------------------------------|---|---|
| Bureau of Land Management    | <i>Beaver Wash Canyon ACEC; North Caineville Mesa ACEC; South Caineville Mesa ACEC</i>  | Henry Mountain Parker Mountain and Mountain Valley Management Framework Plans Approved Amendments and Record of Decision 1982 |
| Bureau of Land Management    | <i>Big Flat Tops ACEC; Bowknot Bend ACEC; Pictographs ACEC; San Rafael Reef North ACEC</i>  | San Rafael Final Resource Management Plan and Rangeland Program Summary 05/1991   |
| Bureau of Land Management    | <i>Dark Canyon ACEC; Lavender Mesa ACEC</i>   | San Juan/San Miguel Planning Area Resource Management Plan 09/1985  |
| Bureau of Land Management    | <i>Lears Canyon ACEC</i>  | Diamond Mountain Resource Area Resource Management Plan and Record of Decision Fall 1994                                      |
| Bureau of Land Management    | <i>Water Canyon/South Fork Indian Canyon ACEC</i>   | Vermillion Management Framework Plan 12/1986  |
| Bureau of Land Management    | <i>Dance Hall Rock Historic Site; Devils Garden ISA; Escalante Canyons ONA; No Mans Mesa RNA; North Escalante Canyon ONA; The Gulch ONA; Phipps-Death Hollow ISA; Wolverine Petrified Wood Natural Area</i> | Grand Staircase-Escalante National Monument Management Plan 02/2000   |
| Bureau of Land Management    | <i>Wah Wah Mountains RNA</i>  | Warm Springs Resource Area Management Plan, Record of Decision and Rangeland Program Summary 1987                             |
| Bureau of Land Management    | <i>Bridger Jack Mesa WSA/ACEC</i>   | Resource Management Plan Record of Decision and Rangeland Program Summary for the San Juan Resource Area 03/1991              |
| U.S. Fish & Wildlife Service | <i>Fish Springs NWR</i>   | Fish Springs National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Assessment 07/2004              |
| U.S. Forest Service          | <i>Gunsight Peak RNA</i>  | Caribou Revised Forest Plan Caribou-Targhee National Forest 2003  |
| U.S. Forest Service          | <i>Browse RNA; Red Canyon RNA; Table Cliff RNA; Timbered Cinder Cone RNA; Upper Sand Creek RNA</i>  | Land and Resource Management Plan for the Dixie National Forest 09/1986   |
| U.S. Forest Service          | <i>Bullion Canyon RNA; Partridge Mountain RNA; Upper Fish Creek RNA</i>   | Land and Resource Management Plan Fishlake National Forest 1986   |

| <b>Land Steward</b>   | <b>Name of Status 1 Area in Utah</b>   | <b>Source of Management Plan</b>  |
|-----------------------|--|---|
| U.S. Forest Service   | <i>Gates of Birch Creek RNA; Pollen Lake RNA; Sims Peak Potholes RNA; Timber-Cow Ridge RNA; Uinta Shale Creek RNA; Lance Canyon RNA; Ashley Gorge RNA</i>  | Land and Resource Management Plan for Ashley National Forest 10/1986  |
| U.S. Forest Service   | <i>Cliff Dwellers Pasture RNA; Elk Knoll RNA; Great Basin Experimental Range; Hammond Canyon; Hideout Mesa RNA; Mill Creek Gorge RNA; Mount Peale RNA; Nelson Mountain RNA; Pinhook Battleground Historical Site; Scad Valley Botanical Area; The Grove of Aspen Giants Area; World Record Pinyon Pine</i> | Land and Resource Management Plan for Manti-La Sal National Forest; Amendment No. 2. 09/1990  |
| U.S. Forest Service   | <i>Jumpoff RNA</i>   | 2003 Land and Resource Management Plan Revision Unita National Forest 05/2003   |
| U.S. Forest Service   | <i>Deseret Peak Wilderness; High Uintas Wilderness; Lone Peak Wilderness; Mollens Hollow RNA; Morris Creek RNA; Mount Naomi Wilderness; Mount Olympus Wilderness; Red Butte Canyon RNA; Twin Peaks Wilderness; Wellsville Mountain Wilderness</i>  | Revised Forest Plan Wasatch-Cache National Forest 02/2003   |
| National Park Service | <i>Arches NP</i>   | General Management Plan Development Concept Plan Environmental Assessment Arches National Park 07/1989  |
| National Park Service | <i>Bryce Canyon NP</i>   | Statement for Management Bryce Canyon National Park 02/1993   |
| National Park Service | <i>Canyonlands NP</i>  | Statement for Management Canyonlands National Park 07/1988  |
| National Park Service | <i>Cedar Breaks NM</i>   | Environmental Assessment, General Management Plan, and Development Concept Plan for Cedar Breaks National Monument 09/1983                          |
| National Park Service | <i>Dinosaur NM</i>   | General Management Plan Development Concept Plans Land Protection Plan Environmental Assessment Dinosaur National Monument 07/1988; Amended 04/1991 |
| National Park Service | <i>Hovenweep NM</i>  | Statement for Management Hovenweep National Monument 04/1992  |

| Land Steward           | Name of Status 1 Area in Utah  | Source of Management Plan   |
|------------------------|--|---|
| National Park Service  | <i>Natural Bridges NM</i>  | General Management Plan<br>Final Environmental Impact Statement Development<br>Concept Plan Natural Bridges National Monument 02/1997                       |
| National Park Service  | <i>Zion National Park; Crazy Quilt Mesa RNA; Goose Creek RNA; Hanging Garden RNA; Isolated Mesa Tops RNA; Kolob Mesas RNA; Parunuweap RNA; Shunes Creek RNA; Slickrock RNA; Southeast Pinyon Juniper RNA</i> | General Management Plan<br>Zion National Park 08/2001   |
| The Nature Conservancy | <i>Autumn Buttercup Preserve; Clay Phacalia Preserve; Dwarf Bear Claw Poppy Preserve; Great Salt Lake Shorelands; Mayberry Preserve; Red Cliffs Desert Preserve; Scott M. Matheson Preserve</i>              | URL:<br><a href="http://www.nature.org/wherever/northamerica/states/utah/preserves/">http://www.nature.org/wherever/northamerica/states/utah/preserves/</a> |

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## LIMITATIONS AND DISCUSSION

The SWReGAP stewardship dataset reflects a compilation of datasets provided by a variety of data stewards that are individually responsible for the accuracy of their own datasets. No single source could provide a map of all managed areas within a state or for the region. Numerous difficulties arose when combining information from a large number of data sources and compiling the disparate data into a single comprehensive dataset. Some of these difficulties were caused by digital sources using different map projections, different scales, different production quality, and varying dates of production. In addition, some sources only had paper versions of the map and therefore, boundaries were on-screen digitized at the SWReGAP stewardship laboratory, introducing the possibility of additional errors. Due to the wide range and variety of source data sets, existing boundary discrepancies between two contributed datasets frequently occurred. In order to compile the region-wide dataset, the errors in boundaries were adjusted, usually to the more detailed or larger scale dataset, but on occasion without knowing which source of data was correct. Because of this uncertainty, boundaries represented in the stewardship dataset should not be considered cadastral, meaning they are not an official register to the division of land parcels for surveying, taxation or administrative purposes. Although some parcel-level data was used to produce the stewardship dataset, the SWReGAP geodatabase does not, and should not be considered to, provide legal representation of land ownership boundaries.

The regional stewardship mapping laboratory attempted to maintain consistency when compiling the dataset, however, absolute mapping standards were difficult to establish and many decisions were made on a case by case basis. Some simple rules were maintained throughout the dataset during topology editing. These rules usually related to size of the particular parcels. For example, if an ACEC was smaller than a wilderness area the ACEC was usually embedded on top of the wilderness area. Many parcels have dual designations, which complicates the task of creating a standard parcel editing methodology. When this occurred, the regional stewardship coordinator attempted to attribute the parcel to the more legally binding land management descriptor.

Other considerations pertain to the lack of detailed geospatial data that correspond with the written management plans. For example, individual parcels such as National Parks are usually not under one management mandate; some parks have recreation zones, development zones, and natural zones. Often the park management plan describes various management zones but no digital data representing the various zones in the park exist. For the most part, the available digital data only represented the proclamation (outer and generalized) boundary of the park. Because of this some parcels had an oversimplification of management levels because the entire parcel (a park in this example) was assigned the same biodiversity management status code. This approach could cause estimates of the area actually being managed in each management status code to be over or under estimated. This lack of internal management boundary detail most commonly occurred in National Park Service lands, some U.S. Fish and Wildlife Service lands and most of the Tribal Lands.

The stewardship data is a dynamic GAP product. Lands are regularly changing ownership and new management directions are continually being applied. This creates an on-going need to add or revise parcel information. At this time there is no organization tasked with the continual upkeep and maintenance of the stewardship dataset especially at a regional or national scale. Tasking an organization with the maintenance and upkeep of this type of regionally consistent data could prove to be very beneficial in the development of multi-state, landscape scale perspectives of biodiversity management. These considerations could help identify new or additional opportunities for biodiversity planning across political boundaries from local visions to national efforts. Continual updates to these data would also provide a unique visual representation for individual land stewards to identify other land stewards in different geographic regions who share similar biodiversity management responsibilities.

Another important aspect related to maintenance and development of this dataset is an expanded geodatabase system. Beardsley and Stoms (1993) suggested three improvements pertaining to: delineation of sections within managed areas, encoding of additional attributes, and multi-scale representations of parcels. An enhanced system should facilitate revising and tracking ownership and protection modifications to the dataset. For the most part, improvements and updates should include both the coding and spatial representation of dually designated parcels. Other modifications could allow for non-spatial information to be dynamically linked to the parcel such as sources of management plans or alternative coding systems. By establishing a more formal data steward and a system for maintenance and upkeep of the stewardship dataset, the stewardship information produced by GAP could become an even more valuable data resource for natural resource managers throughout the Southwest United States.



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## CHAPTER 5

# ANALYSIS BASED ON STEWARDSHIP AND MANAGEMENT STATUS

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Photo from SWReGAP Training Site Image Library

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# INTRODUCTION

This chapter describes the methods and results of the gap analysis as conducted by the Gap Analysis Program. As described in the general introduction to this report, the primary objective of GAP is to provide information on the distribution and status of several elements of biological diversity. Here, we present gap analysis results for land cover and terrestrial vertebrate species for the southwestern region. Other components of biodiversity, such as aquatic organisms or selected groups of invertebrates may be incorporated into GAP distributional data sets, however they were not the focus of SWReGAP's mapping effort.

Although GAP "seeks to identify habitat types and species not adequately represented in the current network of biodiversity management areas" (GAP 2000), it is unrealistic to create a standard definition of "adequate representation" for either land cover types or individual species (Noss et al. 1995). A practical solution to this problem is to report both percentages and absolute area of each element in biodiversity management areas and allow the user to determine which types are adequately represented in natural areas. There are many other factors that should be considered in such determinations including:

- historic loss or gain in distribution;
- nature of the spatial distribution;
- immediate versus long term risk; and
- degree of local adaptation among populations of the biotic elements that are worthy of individual conservation consideration.

Such analyses are beyond the scope of this project, but we encourage their application coupled with field confirmation of the mapped distributions.

Where appropriate, GAP data may also be analyzed to identify the location of a set of areas in which most or all land cover types or animal species are predicted to be represented. The use of "complementarity" analysis, that is, an approach that additively identifies a selection of locations that may represent biodiversity rather than "hot spots of species richness" may prove most effective for guiding biodiversity maintenance efforts. Several quantitative techniques have been developed that facilitate this process (see Pressey et al. 1993, Williams et al. 1996, Csuti et al. 1997, for details). These areas become candidates for field validation and may be incorporated into a system of areas managed for the long-term maintenance of biological diversity.

State wildlife agencies maintain records on vertebrate species inventories. The network of Conservation Data Centers (CDCs) and Natural Heritage Programs (NHPs) established cooperatively by The Nature Conservancy and various state agencies maintain detailed databases on the locations of rare elements of biodiversity. GAP cooperatively uses these data to develop predicted distributions of potentially suitable habitat for these elements. These data may also be valuable for identifying additional research needs and preliminary considerations for restoration or reintroduction. Conservation of rare elements, however, is best accomplished through the fine-filter approach of the above organizations as

described in the general introduction. It is not the role of GAP to duplicate or disseminate state wildlife agency data or Natural Heritage Program or CDC Element Occurrence Records. Users interested in more specific information about the location, status, and ecology of populations of rare species are directed to their state wildlife agencies and state Heritage Program or CDC.

## METHODS

We conducted the gap analysis using ESRI® ArcGIS Desktop 9 software and the Spatial Analyst extension. Gap analysis is accomplished by first producing maps of land cover ([Chapter 2](#)), predicted animal-habitat distributions ([Chapter 3](#)), land stewardship ([Chapter 4](#)), and GAP management status ([Chapter 5](#)). To facilitate the analysis, each data set was converted to grid format for use within ArcGIS' Model Builder. In Model Builder, a graphical model was designed to run a series of cross-tabulations employing the "Tabulate Area" tool. By intersecting the land stewardship and management status maps with the land cover and animal-habitat species distribution maps, estimates were produced of the total area and percent of the mapped distributions for every land cover class and animal species within each land stewardship and management status category. Calculations were generated for the entire 5-state region as well as for each state individually. We highlight the results of these analyses in the sections below and present detailed summaries in a series of appendices at the end of this chapter. Management implications of the results are provided in [Chapter 6](#).

## RESULTS

Results from the gap analysis are provided in a series of appendices, tables, and figures that allow users to carry out inquiries about the representation of each element in different land stewardship and management status categories as appropriate to their own management objectives. This forms the basis of Gap's mission to provide land owners and managers with the information necessary to conduct informed policy development, planning, and management for biodiversity maintenance.

Recall from [Chapter 4 \(Land Stewardship\)](#), that each biodiversity management category recognized by GAP provides increasing levels of conservation based on the management objectives of the land steward. Lands managed according to GAP Status 1 and 2 criteria are assumed to have the highest amount of protection. As a coarse indicator of the conservation status of the elements, we identify for every land cover type and animal species, the proportion of its distribution that falls within Status 1 and 2 lands according to five levels of representation: 0-<1%, 1-<10%, 10-<20%, 20-<50%, and >=50%. The <1% level indicates elements with essentially none of their distribution in a protected status while levels of 10%, 20%, and 50% have been recommended in the literature as necessary amounts of conservation (Noss and Cooperrider 1994, Odum and Odum 1972, Specht et al. 1974, Ride 1975, Miller 1984).

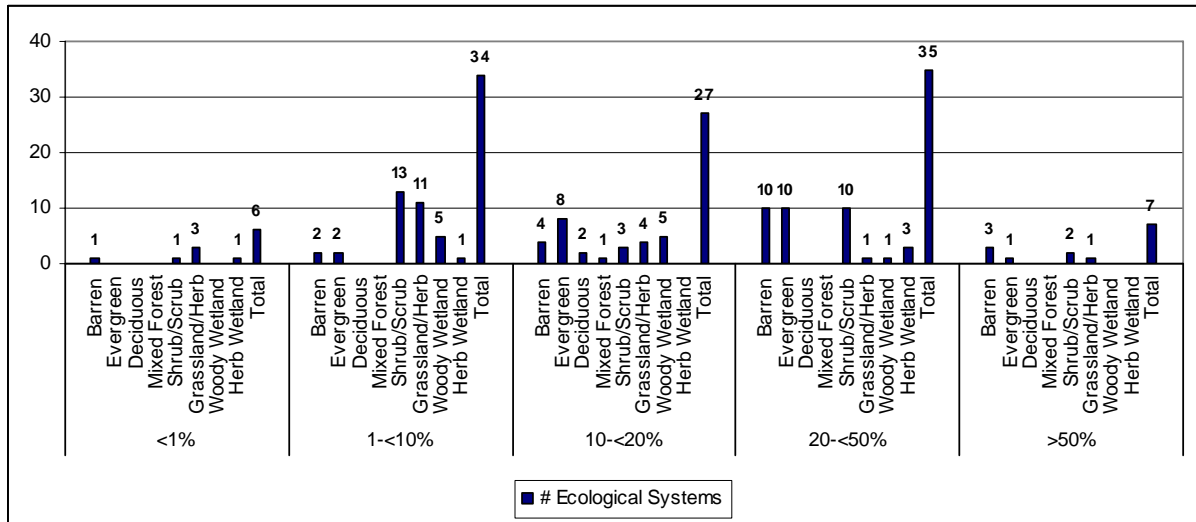
## Land Cover - Regional Analysis

A total of 125 land cover types are mapped within the SWReGAP area; of which 109 are natural or semi-natural ecological systems. The five most abundant land cover types in the region are: *Western Great Plains Shortgrass Prairie* (S088) (comprising 8.2% of the region), *Inter-Mountain Basins Big Sagebrush Shrubland* (S054) (7.8% of the region), *Colorado Plateau Pinyon-Juniper Woodland* (S039) (7.1%), *Inter-Mountain Basins Mixed Salt Desert Scrub* (S065) (5.7%), and *Agriculture* (N80) (5.5%). *Great Basin Pinyon-Juniper Woodland* (S040) and *Southern Rocky Mountain Ponderosa Pine Woodland* (S036) are also quite extensive as well as several varieties of desert scrub, grassland, and shrub-steppe systems.

The proportional distribution (as a percent) for each land cover type by land steward in the 5-state region is provided in [Appendix 5-1](#). The distribution of each land cover type by GAP Management Status is presented in [Appendix 5-2](#). For example, from these appendices we note that *Inter-Mountain Basins Mixed Salt Desert Scrub* (S065), a land cover type that occurs in all 5 states, is managed predominantly by the U.S. Bureau of Land Management (65.1%) ([Appendix 5-1](#)) and for the most part, falls within GAP Management Status 3 ([Appendix 5-2](#)).

[Figure 5-2](#) presents a summary of ecological systems within GAP Management Status 1 and 2 for each of the five threshold categories of conservation. Ecological systems have been aggregated into National Land Cover Database (NLCD) classes to aid in presenting these data. For instance, from [Figure 5-1](#) we note there are six ecological systems with less than 1% (0-<1% threshold category) of their distribution within Status 1 or 2 lands for the 5-state region. These include: one barren type, one shrub/scrub type, one emergent herbaceous wetland system, and three grassland/herbaceous systems. [Table 5-1](#) presents similar, but more detailed information about the distribution of land cover types in Status 1 and 2 lands for the 5-state region.

Approximately 11.5% (160,183 km<sup>2</sup>) of the 5-state region falls within GAP Status 1 or 2 ([Appendix 5-2](#)). In general, land cover classes at higher elevations are more likely to have a larger proportion of their total distribution within GAP Management Status 1 and 2 than lower elevation land cover classes, because much of the higher elevation land is under government stewardship with a mandate to protect biodiversity (e.g. Wilderness Areas). On the other hand, examining land cover types that exhibit low proportions (e.g. thresholds of 0-<1%, and 1%-<10%) of their distribution in GAP Management Status 1 and 2 is useful as it provides a measure of potentially threatened biodiversity (e.g. using a coarse filter approach), and may help prioritize land cover types in need of conservation action.



**Figure 5-1. Total number of ecological systems (Y-axis) aggregated into NLCD classes (X-axis) and summarized by conservation thresholds (<1%, 1-<10%, 10-<20%, 20-<50%, and >50%) of Status 1 and 2 lands in the SWReGAP project area.**

**Table 5-1. Representation of each land cover type in the SWReGAP project area within Status 1 & 2 Lands, summarized by conservation thresholds of 0-<1%, 1-<10%, 10-<20%, and 20-<50%; >=50%.**

| Code | Land Cover Type  | Area in region  |                 | Area in Status 1&2 |            |             |             |           |
|------|--|-----------------|-----------------|--------------------|------------|-------------|-------------|-----------|
|      |  | km <sup>2</sup> | km <sup>2</sup> | <1<br>%            | 1-<10<br>% | 10-<20<br>% | 20-<50<br>% | >=50<br>% |
| S109 | Chihuahuan-Sonoran Desert Bottomland and Swale Grassland               | <1              | n/a             | 0.0                |            |             |             |           |
| S008 | Western Great Plains Cliff and Outcrop                                 | 315             | 3               | 0.9                |            |             |             |           |
| S138 | Western Great Plains Mesquite Woodland and Shrubland                   | 1,898           | 3               | 0.2                |            |             |             |           |
| S108 | Western Great Plains Saline Depression Wetland                         | 41              | <1              | 0.5                |            |             |             |           |
| S089 | Western Great Plains Sand Prairie                                      | 18              | n/a             | 0.0                |            |             |             |           |
| S088 | Western Great Plains Shortgrass Prairie                                | 114,340         | 774             | 0.7                |            |             |             |           |
| S058 | Apacherian-Chihuahuan Mesquite Upland Scrub                            | 32,060          | 1,671           |                    | 5.2        |             |             |           |
| S077 | Apacherian-Chihuahuan Semi-Desert Grassland and Steppe                 | 46,038          | 3,289           |                    | 7.1        |             |             |           |
| S087 | Central Mixedgrass Prairie   | 123             | 3               |                    | 2.7        |             |             |           |
| S062 | Chihuahuan Mixed Desert and Thorn Scrub                                | 27,891          | 1,359           |                    | 4.9        |             |             |           |
| S116 | Chihuahuan Mixed Salt Desert Scrub                                     | 4,448           | 306             |                    | 6.9        |             |             |           |
| S113 | Chihuahuan Sandy Plains Semi-Desert Grassland                          | 1,050           | 44              |                    | 4.2        |             |             |           |
| S068 | Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub                 | 5,891           | 138             |                    | 2.3        |             |             |           |
| S061 | Chihuahuan Succulent Desert Scrub                                      | 189             | 13              |                    | 6.8        |             |             |           |
| S056 | Colorado Plateau Mixed Low Sagebrush Shrubland                         | 2,401           | 158             |                    | 6.6        |             |             |           |
| S118 | Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland | 1,387           | 99              |                    | 7.1        |             |             |           |
| S054 | Inter-Mountain Basins Big Sagebrush Shrubland                          | 109,699         | 7,553           |                    | 6.9        |             |             |           |
| S078 | Inter-Mountain Basins Big Sagebrush Steppe                             | 1,851           | 45              |                    | 2.4        |             |             |           |
| S096 | Inter-Mountain Basins Greasewood Flat                                  | 23,842          | 1,728           |                    | 7.2        |             |             |           |
| S075 | Inter-Mountain Basins Juniper Savanna                                  | 5,615           | 147             |                    | 2.6        |             |             |           |
| S045 | Inter-Mountain Basins Mat Saltbush Shrubland                           | 4,155           | 271             |                    | 6.5        |             |             |           |
| S065 | Inter-Mountain Basins Mixed Salt Desert Scrub                          | 79,498          | 4,589           |                    | 5.8        |             |             |           |
| S071 | Inter-Mountain Basins Montane Sagebrush Steppe                         | 41,190          | 3,831           |                    | 9.3        |             |             |           |
| S090 | Inter-Mountain Basins Semi-Desert Grassland                            | 33,693          | 1,519           |                    | 4.5        |             |             |           |
| S079 | Inter-Mountain Basins Semi-Desert Shrub-Steppe                         | 47,668          | 3,453           |                    | 7.2        |             |             |           |
| S014 | Inter-Mountain Basins Wash   | 46              | 2               |                    | 4.4        |             |             |           |
| S115 | Madrean Juniper Savanna  | 995             | 54              |                    | 5.5        |             |             |           |
| S098 | North American Warm Desert Riparian Mesquite Bosque                    | 847             | 79              |                    | 9.3        |             |             |           |
| S125 | Rocky Mountain Foothill Limber Pine-Juniper Woodland                   | 6               | <1              |                    | 3.1        |             |             |           |
| S046 | Rocky Mountain Gambel Oak-Mixed Montane Shrubland                      | 18,960          | 1,402           |                    | 7.4        |             |             |           |
| S047 | Rocky Mountain Lower Montane-Foothill Shrubland                        | 2,872           | 199             |                    | 6.9        |             |             |           |
| S007 | Sierra Nevada Cliff and Canyon   | 134             | 6               |                    | 4.5        |             |             |           |
| S136 | Southern Colorado Plateau Sand Shrubland                               | 7,021           | 244             |                    | 3.5        |             |             |           |
| S074 | Southern Rocky Mountain Juniper Woodland and Savanna                   | 11,968          | 179             |                    | 1.5        |             |             |           |
| S038 | Southern Rocky Mountain Pinyon-Juniper Woodland                        | 15,311          | 1,040           |                    | 6.8        |             |             |           |
| S103 | Temperate Pacific Subalpine-Montane Wet Meadow                         | 3               | <1              |                    | 1.7        |             |             |           |
| S120 | Western Great Plains Floodplain  | 842             | 31              |                    | 3.7        |             |             |           |
| S086 | Western Great Plains Foothill and Piedmont Grassland                   | 5,096           | 121             |                    | 2.4        |             |             |           |
| S095 | Western Great Plains Riparian Woodland and Shrubland                   | 1,720           | 140             |                    | 8.1        |             |             |           |
| S048 | Western Great Plains Sandhill Shrubland                                | 14,088          | 368             |                    | 2.6        |             |             |           |
| S080 | Chihuahuan Gypsophilous Grassland and Steppe                           | 805             | 154             |                    |            | 19.1        |             |           |
| S039 | Colorado Plateau Pinyon-Juniper Woodland                               | 97,894          | 13,618          |                    |            | 13.9        |             |           |
| S055 | Great Basin Xeric Mixed Sagebrush Shrubland                            | 35,631          | 4,030           |                    |            | 11.3        |             |           |
| S012 | Inter-Mountain Basins Active and Stabilized Dune                       | 3,103           | 383             |                    |            | 12.3        |             |           |
| S042 | Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland          | 3,445           | 390             |                    |            | 11.3        |             |           |
| S015 | Inter-Mountain Basins Playa  | 17,586          | 1,891           |                    |            | 10.8        |             |           |
| S011 | Inter-Mountain Basins Shale Badland                                    | 3,301           | 390             |                    |            | 11.8        |             |           |
| S051 | Madrean Encinal  | 4,406           | 695             |                    |            | 15.8        |             |           |
| S035 | Madrean Pine-Oak Forest and Woodland                                   | 5,737           | 959             |                    |            | 16.7        |             |           |
| S112 | Madrean Pinyon-Juniper Woodland  | 21,930          | 2,547           |                    |            | 11.6        |             |           |
| S123 | Mediterranean California Ponderosa-Jeffrey Pine Forest and Woodland    | 236             | 24              |                    |            | 10.1        |             |           |
| S057 | Mogollon Chaparral   | 11,518          | 2,153           |                    |            | 18.7        |             |           |

| Code | Land Cover Type  | Area in         | Area                | <1 | 1-<10 | 10-<br><20 | 20-<br><50 | >50 |
|------|--|-----------------|---------------------|----|-------|------------|------------|-----|
|      |  | region          | in<br>Status<br>1&2 |    |       |            |            |     |
|      |  | km <sup>2</sup> | km <sup>2</sup>     | %  | %     | %          | %          | %   |
| S018 | North American Warm Desert Active and Stabilized Dune                    | 2,845           | 526                 |    |       | 18.5       |            |     |
| S094 | North American Warm Desert Lower Montane Riparian Woodland and Shrubland | 427             | 75                  |    |       | 17.7       |            |     |
| S097 | North American Warm Desert Riparian Woodland and Shrubland               | 461             | 84                  |    |       | 18.2       |            |     |
| S020 | North American Warm Desert Wash  | 657             | 95                  |    |       | 14.4       |            |     |
| S134 | North Pacific Montane Grassland  | 32              | 4                   |    |       | 11.4       |            |     |
| S023 | Rocky Mountain Aspen Forest and Woodland                                 | 21,050          | 2,675               |    |       | 12.7       |            |     |
| S024 | Rocky Mountain Bigtooth Maple Ravine Woodland                            | 898             | 103                 |    |       | 11.4       |            |     |
| S031 | Rocky Mountain Lodgepole Pine Forest                                     | 8,876           | 1,649               |    |       | 18.6       |            |     |
| S093 | Rocky Mountain Lower Montane Riparian Woodland and Shrubland             | 2,236           | 223                 |    |       | 10.0       |            |     |
| S083 | Rocky Mountain Subalpine Mesic Meadow                                    | 2,178           | 392                 |    |       | 18.0       |            |     |
| S092 | Rocky Mountain Subalpine-Montane Riparian Woodland                       | 294             | 51                  |    |       | 17.5       |            |     |
| S122 | Sierra Nevada Subalpine Lodgepole Pine Forest and Woodland               | 21              | 4                   |    |       | 19.1       |            |     |
| S070 | Sonora-Mojave Mixed Salt Desert Scrub                                    | 2,571           | 499                 |    |       | 19.4       |            |     |
| S085 | Southern Rocky Mountain Montane-Subalpine Grassland                      | 10,346          | 1,181               |    |       | 11.4       |            |     |
| S036 | Southern Rocky Mountain Ponderosa Pine Woodland                          | 50,241          | 5,683               |    |       | 11.3       |            |     |
| S117 | Coahuilan Chaparral  | 96              | 39                  |    |       |            | 40.7       |     |
| S059 | Colorado Plateau Blackbrush-Mormon-tea Shrubland                         | 13,310          | 2,669               |    |       |            | 20.1       |     |
| S010 | Colorado Plateau Mixed Bedrock Canyon and Tableland                      | 24,321          | 7,416               |    |       |            | 30.5       |     |
| S052 | Colorado Plateau Pinyon-Juniper Shrubland                                | 11,536          | 4,179               |    |       |            | 36.2       |     |
| S040 | Great Basin Pinyon-Juniper Woodland                                      | 51,234          | 10,351              |    |       |            | 20.2       |     |
| S053 | Great Basin Semi-Desert Chaparral  | 169             | 57                  |    |       |            | 33.7       |     |
| S009 | Inter-Mountain Basins Cliff and Canyon                                   | 2,889           | 759                 |    |       |            | 26.3       |     |
| S050 | Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland           | 2,569           | 726                 |    |       |            | 28.3       |     |
| S013 | Inter-Mountain Basins Volcanic Rock and Cinder Land                      | 1,360           | 519                 |    |       |            | 38.2       |     |
| S111 | Madrean Upper Montane Conifer-Oak Forest and Woodland                    | 811             | 163                 |    |       |            | 20.1       |     |
| S003 | Mediterranean California Alpine Bedrock and Scree                        | 39              | 17                  |    |       |            | 42.3       |     |
| S033 | Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland     | 2               | 1                   |    |       |            | 32.0       |     |
| S121 | Mediterranean California Red Fir Forest and Woodland                     | 114             | 24                  |    |       |            | 20.6       |     |
| S105 | Mediterranean California Subalpine-Montane Fen                           | 2               | 1                   |    |       |            | 45.8       |     |
| S060 | Mojave Mid-Elevation Mixed Desert Scrub                                  | 16,864          | 7,220               |    |       |            | 42.8       |     |
| S100 | North American Arid West Emergent Marsh                                  | 1,074           | 248                 |    |       |            | 23.1       |     |
| S017 | North American Warm Desert Badland                                       | 113             | 53                  |    |       |            | 46.7       |     |
| S016 | North American Warm Desert Bedrock Cliff and Outcrop                     | 3,635           | 1,645               |    |       |            | 45.3       |     |
| S021 | North American Warm Desert Pavement                                      | 399             | 99                  |    |       |            | 24.8       |     |
| S022 | North American Warm Desert Playa   | 1,146           | 352                 |    |       |            | 30.7       |     |
| S019 | North American Warm Desert Volcanic Rockland                             | 995             | 347                 |    |       |            | 34.9       |     |
| S029 | Northern Pacific Mesic Subalpine Parkland                                | 53              | 25                  |    |       |            | 47.0       |     |
| S102 | Rocky Mountain Alpine-Montane Wet Meadow                                 | 1,962           | 622                 |    |       |            | 31.7       |     |
| S006 | Rocky Mountain Cliff, Canyon and Massive Bedrock                         | 2,971           | 774                 |    |       |            | 26.1       |     |
| S032 | Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland       | 8,970           | 2,073               |    |       |            | 23.1       |     |
| S034 | Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland           | 7,297           | 1,462               |    |       |            | 20.0       |     |
| S028 | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland        | 14,846          | 4,941               |    |       |            | 33.3       |     |
| S030 | Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland            | 10,365          | 3,375               |    |       |            | 32.6       |     |
| S025 | Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland        | 802             | 207                 |    |       |            | 25.8       |     |
| S091 | Rocky Mountain Subalpine-Montane Riparian Shrubland                      | 3,240           | 1,124               |    |       |            | 34.7       |     |
| S069 | Sonora-Mojave Creosotebush-White Bursage Desert Scrub                    | 59,616          | 16,190              |    |       |            | 27.2       |     |
| S129 | Sonoran Mid-Elevation Desert Scrub                                       | 5,395           | 1,240               |    |       |            | 23.0       |     |
| S063 | Sonoran Paloverde-Mixed Cacti Desert Scrub                               | 40,079          | 8,778               |    |       |            | 21.9       |     |

| Code | Land Cover Type  | Area in         | Area            | <1  | 1-<10 | 10-<20 | 20-<50 | >50  |
|------|--|-----------------|-----------------|-----|-------|--------|--------|------|
|      |  | region          | in              |     |       |        |        |      |
|      |  | km <sup>2</sup> | Status          | %   | %     | %      | %      | %    |
|      |  |                 | 1&2             |     |       |        |        |      |
|      |  | km <sup>2</sup> | km <sup>2</sup> | %   | %     | %      | %      | %    |
| S132 | Western Great Plains Tallgrass Prairie                           | 1               | <1              |     |       |        | 25.8   |      |
| S128 | Wyoming Basins Low Sagebrush Shrubland                           | 54              | 13              |     |       |        | 23.7   |      |
| S026 | Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland | 670             | 430             |     |       |        |        | 64.2 |
| S001 | North American Alpine Ice Field                                  | 23              | 22              |     |       |        |        | 92.8 |
| S002 | Rocky Mountain Alpine Bedrock and Scree                          | 3,863           | 2,392           |     |       |        |        | 61.9 |
| S043 | Rocky Mountain Alpine Dwarf-Shrubland                            | 109             | 88              |     |       |        |        | 80.2 |
| S004 | Rocky Mountain Alpine Fell-Field                                 | 761             | 474             |     |       |        |        | 62.3 |
| S081 | Rocky Mountain Dry Tundra  | 2,779           | 1,447           |     |       |        |        | 52.1 |
| S114 | Sonora-Mojave Semi-Desert Chaparral                              | 89              | 85              |     |       |        |        | 95.6 |
| N80  | Agriculture  | 77,813          | 639             | 0.8 |       |        |        |      |
| N22  | Developed, Medium - High Intensity                               | 7,600           | 38              | 0.5 |       |        |        |      |
| N21  | Developed, Open Space - Low Intensity                            | 7,463           | 19              | 0.3 |       |        |        |      |
| D03  | Recently Mined or Quarried                                       | 1,240           | 7               | 0.5 |       |        |        |      |
| N31  | Barren Lands, Non-specific                                       | 1,437           | 65              |     | 4.5   |        |        |      |
| D01  | Disturbed, Non-specific  | 93              | 6               |     | 6.4   |        |        |      |
| D14  | Disturbed, Oil Well  | 52              | 1               |     | 1.7   |        |        |      |
| D09  | Invasive Annual and Biennial Forbland                            | 2,649           | 86              |     | 3.2   |        |        |      |
| D08  | Invasive Annual Grassland  | 8,347           | 274             |     | 3.3   |        |        |      |
| D06  | Invasive Perennial Grassland                                     | 2,869           | 49              |     | 1.7   |        |        |      |
| N11  | Open Water   | 11,220          | 322             |     | 2.9   |        |        |      |
| D11  | Recently Chained Pinyon-Juniper Areas                            | 689             | 68              |     | 9.9   |        |        |      |
| D10  | Recently Logged Areas  | 855             | 55              |     | 6.4   |        |        |      |
| D04  | Invasive Southwest Riparian Woodland and Shrubland               | 1,666           | 267             |     |       | 16.0   |        |      |
| D02  | Recently Burned  | 2,033           | 305             |     |       | 15.0   |        |      |
| D07  | Invasive Perennial Forbland                                      | 1               | <1              |     |       |        | 31.0   |      |

***Land cover classes with <1% of mapped distribution in Status 1 or 2:***

Six ecological systems in the 5-state region have between 0 and <1% of their distribution in Gap Management Status 1 or 2 (Table 5-1). With one exception (*Western Great Plains Shortgrass Prairie* (S088)) they are mostly rare, small patch types or peripheral types that occur on the edge of their range within the SWReGAP project area. More research is needed to focus on conservation of biodiversity in these small patch types, and because the peripheral types mostly occur in adjacent regions, analysis needs to be expanded by mapping a fuller extent of the range-wide occurrence of the ecological system (i.e. beyond the SWReGAP study area).



***Land cover classes with 1-<10% of mapped distribution in Status 1 or 2:***

Thirty-four ecological systems have between 1 and <10% of their distribution within Status 1 or 2 (Table 5-1). Twenty-one ecological systems are relatively uncommon (<10,000 km<sup>2</sup> mapped in the region) and all but one (*Inter-Mountain Basins Wash* (S014)) of the 6 rarest types (<200 km<sup>2</sup> mapped), are peripheral to the region. The widespread *Inter-Mountain Basins Wash* (S014) often occurs as narrow, linear bands below the minimum mapping unit and with only 46 km<sup>2</sup> having been mapped. However, this system as well as all the other lower elevation riparian and wetland types have between 1 and <10% for their distributions within Status 1 or 2 lands. This is a concern because of the importance of riparian and wetland cover types for many upland wildlife species, and further supports their need to be targeted for biodiversity conservation and restoration.

There are several widespread ecological systems that are characteristic of the region, and some endemic or near-endemic types that are largely restricted to the 5-state study area. Protection is likely warranted for some of these widespread land cover types to conserve biodiversity within the southwestern U.S., and additional research might be needed to assess conservation status of these cover types in Mexico and neighboring U.S. states. These systems are: *Apacherian-Chihuahuan Semi-Desert Grassland and Steppe* (S077), *Chihuahuan Mixed Desert Scrub* (S116), *Inter-Mountain Basins Montane Sagebrush Steppe* (S071), *Inter-Mountain Basins Big Sagebrush Shrubland* (S054), and *Inter-Mountain Basins Semi-Desert Grassland* (S090).

Endemic or near-endemic ecological systems with between 1 and <10% of their distribution in Status 1 or 2 are: *Colorado Plateau Mixed Low Sagebrush Shrubland* (S056), *Southern Colorado Plateau Sand Shrubland* (S136), *Southern Rocky Mountain Juniper Woodland and Savanna* (S074), *Western Great Plains Sandhill Shrubland* (S048), *Southern Rocky Mountain Pinyon-Juniper Woodland* (S038), and *Rocky Mountain Gambel Oak-Mixed Montane Shrubland* (S046).

The remaining land cover types with between 1 and <10% of their distribution in Status 1 or 2 include several peripheral types that would require information from outside the SWReGAP project area to evaluate their range-wide protection status.

***Land cover classes with 10-<20% of mapped distribution in Status 1 or 2:***

Twenty-seven ecological systems have between 10 and <20% of their distribution in Status 1 or 2 lands (Table 5-1). These ecological systems occur in a wide variety of environmental settings, from areas of high elevation with subalpine forests and wetlands to playas and salt desert scrub. Types of ecological systems include: 4 riparian systems, 1 aspen and 1 aspen-mixed conifer system, 2 montane grassland systems, 2 dune systems, and 1 badland system. Four systems in this distribution category occur only marginally within the 5-state region.

***Land cover classes with 20-<50% of mapped distribution in Status 1 or 2:***

There are 35 ecological systems with between 20 and <50% of their distribution in Status 1 and 2 lands (Table 5-1). Many of these ecological systems include lower- to mid-elevation forests and rock outcrops (e.g. barren lands).

***Land cover classes with >50% of mapped distribution in Status 1 or 2:***

Seven ecological systems have greater than 50% of their distribution in Status 1 and 2 lands. With the exception of one somewhat rare system (*Sonora-Mojave Semi-Desert Chaparral* (S114)), all occur in higher elevation (alpine and subalpine) zones.

In addition to the data provided in Appendices 5-1 and 5-2, Appendix 5-3 presents for each land cover type, a cross-tabulation of land stewardship by GAP Management Status. This effectively allows users of this report to assess relative biodiversity protection using thresholds other than those used by the Gap Analysis Program (i.e. 0-<1%, 1-<10%, 10-<20%, 20-<50%, and >50%).

**Land Cover - State-based Analyses**Arizona

Seventy-seven land cover types are mapped in Arizona; 70 of these are natural or semi-natural ecological systems and constitute 95.4% of all land cover in the state (Appendix 5-4). Over half (54%) of the state consists of six ecological systems. Three of these ecological systems (*Sonoran Paloverde-Mixed Cacti Desert Scrub* (S063), *Sonora-Mojave Creosotebush-White Bursage Desert Scrub* (S069), and *Colorado Plateau Pinyon-Juniper Woodland* (S039)) cover more than 10% of the state and together comprise 37.7% of the state. Three other ecological systems *Apacherian-Chihuahuan Mesquite Upland Scrub* (S058); *Southern Rocky Mountain Ponderosa Pine Woodland* (S036); and *Inter-Mountain Basins Semi-Desert Shrub-Steppe* (S079) occur with greater than 5% cover (and < 10% cover) and make up an additional 16.3% of the state land cover. Sixteen ecological systems have greater than 1% cover (and < 5%) and make up 36% of the total state land cover. Forty-eight ecological systems are limited in their distribution with less than 1% cover and form 5.3% of the state cover.

A summary of the percent distribution of each land cover type by land steward for Arizona is provided in Appendix 5-4. For example, in Arizona, tribal lands are responsible for approximately 27% of the land stewardship within the state (Appendix 5-4). Several ecological systems have greater than 80% of their total distribution within these areas, including 3 barren land types, 1 shrubland, 1 grassland, 2 woody wetlands, and 1 emergent herbaceous wetland. Appendix 5-5 summarizes the percent distribution of each land cover type represented within the four GAP Management Status categories. Ecological systems such as *Southern Colorado Plateau Sand Shrubland* (S136) where 89% of its distribution occurs on tribal lands has nearly the same proportion of its distribution within Status 3 lands (Appendix 5-5).

Approximately 13.5% (39,659 km<sup>2</sup>) of Arizona lands are currently managed according to GAP Management Status 1 or 2 criteria. We summarize below the representation of ecological systems within these lands. Representation is categorized by the percent of the

aerial coverage of the ecological system occurring in Status 1 and 2 lands: <1%, 1 to < 10%, 10 to < 20%, 20 to < 50% and greater than 50%. [Figure 5-2](#) presents an overview of the number of ecological systems by NLCD class with representation in Status 1 and 2 lands broken down by conservation threshold for the state of Arizona. [Table 5-2](#) presents a more detailed version of this information by identifying the representation of individual land cover types in Status 1 and 2 lands.

***Land cover classes with <1% of mapped distribution in Status 1 or 2:***

Seven ecological systems ([Table 5-2](#)) receive the least amount of protection, with less than 1% of their respective distributions within Status 1 or 2 lands. These ecological systems are: *Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub* (S068), *Inter-Mountain Basins Mat Saltbush Shrubland* (S045), *Inter-Mountain Basins Playa* (S015), *North American Warm Desert Playa* (S022), *Rocky Mountain Alpine-Montane Wet Meadow* (S102), *Rocky Mountain Subalpine Mesic Meadow* (S083), and *Rocky Mountain Subalpine-Montane Riparian Shrubland* (S091). Each of these has limited distribution within Arizona (4% or less of the regional distribution) and collectively the seven contribute 0.2% to the state's total land cover.

***Land cover classes with 1-<10% of mapped distribution in Status 1 or 2:***

Twenty-five ecological systems ([Table 5-2](#)) have between 1 and <10% of their respective areas within Status 1 and 2 lands in Arizona. Four of the most extensive ecological systems, *Southern Rocky Mountain Ponderosa Pine Woodland* (S036), *Colorado Plateau Pinyon-Juniper Woodland* (S039), *Apacherian-Chihuahuan Mesquite Upland Scrub* (S058) and *Inter-Mountain Basins Semi-Desert Shrub-Steppe* (S079) are included in this group of 25. Collectively the 25 ecological systems contribute 46% to the state's total land cover.

***Land cover classes with 10-<20% of mapped distribution in Status 1 or 2:***

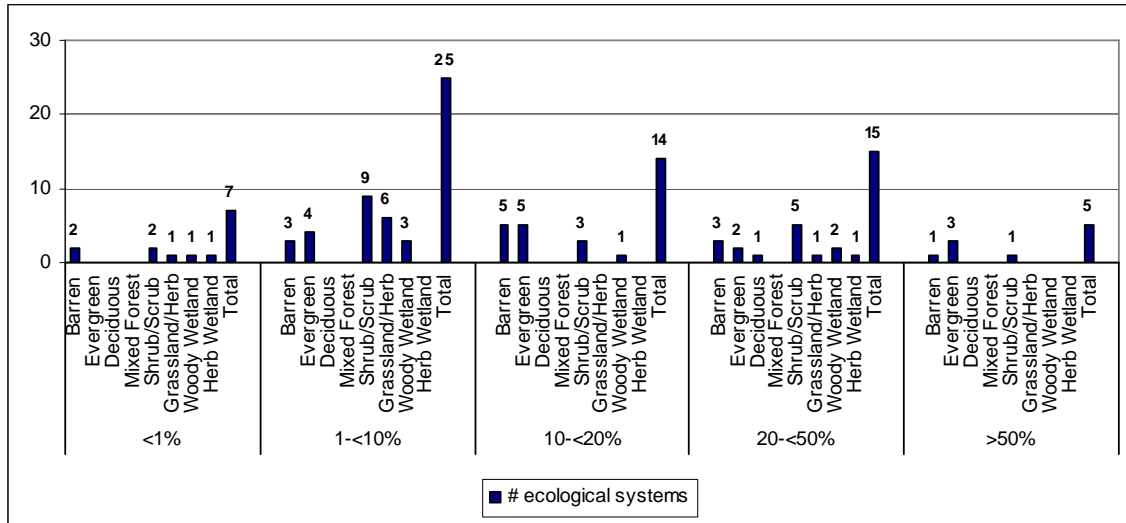
There are 14 ecological systems with distributions between 10 and <20% within Status 1 and 2 lands in Arizona ([Table 5-2](#)). These types collectively comprise 14.2% of the land cover in Arizona.

***Land cover classes with 20-<50% of mapped distribution in Status 1 or 2:***

Fifteen ecological systems have 20 to <50% of their distribution in conservation lands; they collectively contribute 33.7% to the state's total land cover.

***Land cover classes with >50% of mapped distribution in Status 1 or 2:***

Five ecological systems have distributions greater than 50% within Status 1 and 2 lands in Arizona: *Great Basin Semi-Desert Chaparral* (S053), *Great Basin Pinyon-Juniper Woodland* (S040), *Madrean Upper Montane Conifer-Oak Forest and Woodland* (S111), *Rocky Mountain Alpine Bedrock and Scree* (S002), and *Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland* (S025). The *Great Basin Pinyon-Juniper Woodland* covers 1.15% of Arizona land cover, while the other four ecological systems .04% or less land cover. The *Rocky Mountain Alpine Bedrock and Scree* and *Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland* occur at the highest elevations in Arizona.



**Figure 5-2. Total number of ecological systems (Y-axis) aggregated into NLCD classes (X-axis) summarized by conservation thresholds (<1%, 1-<10%, 10-<20%, 20-<50%, and >50%) of Status 1 and 2 lands in the state of Arizona.**

**Table 5-2. Percent distribution of each land cover type represented within Status 1 & 2 lands, summarized by conservation thresholds of 0-<1%, 1-<10%, 10-<20%, 20-<50%, and >=50% in the state of Arizona.**

| Code | Land Cover Type  | Area            | Area            | <1  | 1-  | 10-  | 20- | >50 |
|------|--|-----------------|-----------------|-----|-----|------|-----|-----|
|      |  | in AZ           | in              |     | <10 | <20  | <50 |     |
|      |  | km <sup>2</sup> | km <sup>2</sup> | %   | %   | %    | %   | %   |
| S068 | Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub       | 187             | 2               | 0.9 |     |      |     |     |
| S045 | Inter-Mountain Basins Mat Saltbush Shrubland                 | 75              | <1              | 0.1 |     |      |     |     |
| S015 | Inter-Mountain Basins Playa                                  | 7               | n/a             | 0.0 |     |      |     |     |
| S022 | North American Warm Desert Playa                             | 48              | <1              | 0.3 |     |      |     |     |
| S102 | Rocky Mountain Alpine-Montane Wet Meadow                     | <1              | n/a             | 0.0 |     |      |     |     |
| S083 | Rocky Mountain Subalpine Mesic Meadow                        | <1              | n/a             | 0.0 |     |      |     |     |
| S091 | Rocky Mountain Subalpine-Montane Riparian Shrubland          | <1              | n/a             | 0.0 |     |      |     |     |
| S058 | Apacherian-Chihuahuan Mesquite Upland Scrub                  | 16,539          | 1,369           |     | 8.3 |      |     |     |
| S077 | Apacherian-Chihuahuan Semi-Desert Grassland and Steppe       | 11,346          | 596             |     | 5.3 |      |     |     |
| S062 | Chihuahuan Mixed Desert and Thorn Scrub                      | 6,318           | 215             |     | 3.4 |      |     |     |
| S116 | Chihuahuan Mixed Salt Desert Scrub                           | 2,814           | 153             |     | 5.4 |      |     |     |
| S113 | Chihuahuan Sandy Plains Semi-Desert Grassland                | 16              | <1              |     | 2.7 |      |     |     |
| S061 | Chihuahuan Succulent Desert Scrub                            | 109             | 6               |     | 5.7 |      |     |     |
| S056 | Colorado Plateau Mixed Low Sagebrush Shrubland               | 489             | 5               |     | 1.1 |      |     |     |
| S052 | Colorado Plateau Pinyon-Juniper Shrubland                    | 353             | 23              |     | 6.4 |      |     |     |
| S039 | Colorado Plateau Pinyon-Juniper Woodland                     | 32,482          | 2,724           |     | 8.4 |      |     |     |
| S012 | Inter-Mountain Basins Active and Stabilized Dune             | 350             | 19              |     | 5.6 |      |     |     |
| S096 | Inter-Mountain Basins Greasewood Flat                        | 1,235           | 13              |     | 1.0 |      |     |     |
| S075 | Inter-Mountain Basins Juniper Savanna                        | 3,998           | 57              |     | 1.4 |      |     |     |
| S065 | Inter-Mountain Basins Mixed Salt Desert Scrub                | 6,995           | 169             |     | 2.4 |      |     |     |
| S090 | Inter-Mountain Basins Semi-Desert Grassland                  | 11,245          | 298             |     | 2.7 |      |     |     |
| S079 | Inter-Mountain Basins Semi-Desert Shrub-Steppe               | 15,465          | 560             |     | 3.6 |      |     |     |
| S011 | Inter-Mountain Basins Shale Badland                          | 729             | 42              |     | 5.7 |      |     |     |
| S115 | Madrean Juniper Savanna                                      | 336             | 23              |     | 6.8 |      |     |     |
| S098 | North American Warm Desert Riparian Mesquite Bosque          | 795             | 69              |     | 8.6 |      |     |     |
| S006 | Rocky Mountain Cliff, Canyon and Massive Bedrock             | 91              | 5               |     | 5.1 |      |     |     |
| S093 | Rocky Mountain Lower Montane Riparian Woodland and Shrubland | 24              | <1              |     | 2.0 |      |     |     |
| S070 | Sonora-Mojave Mixed Salt Desert Scrub                        | 1,011           | 31              |     | 3.1 |      |     |     |
| S136 | Southern Colorado Plateau Sand Shrubland                     | 6,073           | 188             |     | 3.1 |      |     |     |
| S085 | Southern Rocky Mountain Montane-Subalpine Grassland          | 563             | 22              |     | 3.9 |      |     |     |
| S038 | Southern Rocky Mountain Pinyon-Juniper Woodland              | 1               | <1              |     | 4.3 |      |     |     |
| S036 | Southern Rocky Mountain Ponderosa Pine Woodland              | 16,233          | 1,328           |     | 8.2 |      |     |     |
| S059 | Colorado Plateau Blackbrush-Mormon Tea Shrubland             | 4,033           | 583             |     |     | 14.4 |     |     |
| S054 | Inter-Mountain Basins Big Sagebrush Shrubland                | 5,199           | 568             |     |     | 10.9 |     |     |
| S013 | Inter-Mountain Basins Volcanic Rock and Cinder Land          | 573             | 98              |     |     | 17.2 |     |     |

| Code | Land Cover Type  | Area            | Area            | <1  | 1-<br><10 | 10-<br><20 | 20-<br><50 | >50   |
|------|--|-----------------|-----------------|-----|-----------|------------|------------|-------|
|      |  | in AZ           | in Status 1&2   |     |           |            |            |       |
|      |  | km <sup>2</sup> | km <sup>2</sup> | %   | %         | %          | %          | %     |
| S014 | Inter-Mountain Basins Wash   | 4               | 1               |     |           | 14.9       |            |       |
| S051 | Madrean Encinal  | 3,008           | 357             |     |           | 11.9       |            |       |
| S035 | Madrean Pine-Oak Forest and Woodland                                     | 4,008           | 796             |     |           | 19.9       |            |       |
| S112 | Madrean Pinyon-Juniper Woodland  | 13,161          | 1,842           |     |           | 14.0       |            |       |
| S057 | Mogollon Chaparral   | 9,636           | 1,683           |     |           | 17.5       |            |       |
| S017 | North American Warm Desert Badland                                       | 34              | 4               |     |           | 12.5       |            |       |
| S094 | North American Warm Desert Lower Montane Riparian Woodland and Shrubland | 180             | 33              |     |           | 18.3       |            |       |
| S021 | North American Warm Desert Pavement                                      | 45              | 5               |     |           | 12.1       |            |       |
| S019 | North American Warm Desert Volcanic Rockland                             | 205             | 32              |     |           | 15.5       |            |       |
| S034 | Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland           | 439             | 74              |     |           | 16.8       |            |       |
| S030 | Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland            | 120             | 23              |     |           | 19.2       |            |       |
| S010 | Colorado Plateau Mixed Bedrock Canyon and Tableland                      | 6,965           | 1,459           |     |           |            | 20.9       |       |
| S071 | Inter-Mountain Basins Montane Sagebrush Steppe                           | 1               | <1              |     |           |            | 26.9       |       |
| S060 | Mojave Mid-Elevation Mixed Desert Scrub                                  | 5,416           | 2,179           |     |           |            | 40.2       |       |
| S100 | North American Arid West Emergent Marsh                                  | 24              | 8               |     |           |            | 31.6       |       |
| S018 | North American Warm Desert Active and Stabilized Dune                    | 1,017           | 406             |     |           |            | 40.0       |       |
| S016 | North American Warm Desert Bedrock Cliff and Outcrop                     | 760             | 301             |     |           |            | 39.6       |       |
| S097 | North American Warm Desert Riparian Woodland and Shrubland               | 269             | 62              |     |           |            | 23.1       |       |
| S020 | North American Warm Desert Wash  | 152             | 31              |     |           |            | 20.5       |       |
| S023 | Rocky Mountain Aspen Forest and Woodland                                 | 442             | 93              |     |           |            | 21.1       |       |
| S032 | Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland       | 1,029           | 225             |     |           |            | 21.8       |       |
| S046 | Rocky Mountain Gambel Oak-Mixed Montane Shrubland                        | 128             | 30              |     |           |            | 23.6       |       |
| S028 | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland        | 223             | 56              |     |           |            | 24.9       |       |
| S069 | Sonora-Mojave Creosotebush-White Bursage Desert Scrub                    | 38,909          | 7,935           |     |           |            | 20.4       |       |
| S129 | Sonoran Mid-Elevation Desert Scrub                                       | 5,390           | 1,239           |     |           |            | 23.0       |       |
| S063 | Sonoran Paloverde-Mixed Cacti Desert Scrub                               | 39,773          | 8,778           |     |           |            | 22.1       |       |
| S040 | Great Basin Pinyon-Juniper Woodland                                      | 3,414           | 2,414           |     |           |            |            | 70.7  |
| S053 | Great Basin Semi-Desert Chaparral  | <1              | <1              |     |           |            |            | 100.0 |
| S111 | Madrean Upper Montane Conifer-Oak Forest and Woodland                    | 123             | 96              |     |           |            |            | 78.3  |
| S002 | Rocky Mountain Alpine Bedrock and Scree                                  | 5               | 5               |     |           |            |            | 95.9  |
| S025 | Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland        | 2               | 2               |     |           |            |            | 76.2  |
| N80  | Agriculture  | 5,629           | 21              | 0.4 |           |            |            |       |

| Code | Land Cover Type                                    | Area<br>in AZ   | Area<br>in<br>Status<br>1&2 | <1  | 1-<br><10 | 10-<br><20 | 20-<br><50 | >50  |
|------|--|-----------------|-----------------------------|-----|-----------|------------|------------|------|
|      |  | km <sup>2</sup> | km <sup>2</sup>             | %   | %         | %          | %          | %    |
| N22  | Developed, Medium - High Intensity                 | 4,046           | 12                          | 0.3 |           |            |            |      |
| N21  | Developed, Open Space - Low Intensity              | 1,710           | 3                           | 0.2 |           |            |            |      |
| D06  | Invasive Perennial Grassland                       | 13              | <1                          | 0.0 |           |            |            |      |
| D03  | Recently Mined or Quarried                         | 467             | <1                          | 0.1 |           |            |            |      |
| N31  | Barren Lands, Non-specific                         | 1,118           | 49                          |     | 4.4       |            |            |      |
| D09  | Invasive Annual and Biennial Forbland              | 127             | 10                          |     | 7.5       |            |            |      |
| D08  | Invasive Annual Grassland                          | 72              | 1                           |     | 1.7       |            |            |      |
| D04  | Invasive Southwest Riparian Woodland and Shrubland | 473             | 80                          |     |           | 16.9       |            |      |
| N11  | Open Water   | 220             | 54                          |     |           |            | 24.7       |      |
| D02  | Recently Burned                                    | 168             | 91                          |     |           |            |            | 54.5 |

## Colorado

A total of 82 land cover types are mapped in the state of Colorado, 66 of which are ecological systems ([Appendix 5-6](#)) and comprise 77% of the state's total area. With the exception of agricultural lands (N80), *Western Great Plains Shortgrass Prairie* (S088) is the most abundant land cover type, making up 16.9% of the state's area. *Colorado Plateau Pinyon-Juniper Woodland* (S039) (5.6%), *Inter-Mountain Basins Big Sagebrush Shrubland* (S054) (5.0%), *Rocky Mountain Aspen Forest and Woodland* (S023) (4.2%), and *Southern Rocky Mountain Ponderosa Pine Woodland* (S036) (4.0%) are the next most abundant land cover types.

A summary of the percent distribution of each land cover type by land steward for Colorado is provided in [Appendix 5-6](#), and the percent distribution of each land cover type by GAP Management Status is reported in [Appendix 5-7](#). For example, the U.S. Forest Service is responsible for managing a substantial portion of two forest types, *Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland* (S028) (88.4%) and *Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland* (S030) (86.4%) ([Appendix 5-6](#)). Due to multiple resource management objectives of the Forest Service, representation of these land cover types is well distributed across each GAP Management Status, including: ~12% in Status 1, ~22% in Status 2, ~60% in Status 3, and ~6% in Status 4 ([Appendix 5-7](#)).

[Figure 5-3](#) presents an overview of the number of ecological systems by NLCD class with representation in Status 1 and 2 lands broken down by conservation threshold for the state of Colorado. [Table 5-3](#) presents a more detailed version of this information by identifying the representation of individual land cover types in Status 1 and 2 lands.

A total area of 27,529 km<sup>2</sup> (10.2%) of Colorado's land cover is managed according to Status 1 and 2 criteria ([Table 5-3](#)); representing 6,837 km<sup>2</sup> Status 1 and 20,692 km<sup>2</sup> Status 2 lands, respectively. [Figure 5-3](#) provides a condensed version of the information in [Table 5-3](#) by aggregating the land cover types by NLCD class and showing the total number of ecological systems with representation in Status 1 and 2 lands according to the conservation thresholds.

### ***Land cover classes with <1% of mapped distribution in Status 1 or 2:***

Colorado has 14 land cover types that occur less than 1% in GAP Status 1 and 2 lands. Ten of these systems (*Western Great Plains Cliff and Outcrop* (S008), *North American Warm Desert Bedrock Cliff and Outcrop* (S016), *North American Warm Desert Active and Stabilized Dune* (S018), *North American Warm Desert Wash* (S020), *North American Warm Desert Playa* (S022), *Madrean Pine-Oak Forest and Woodland* (S035), *Chihuahuan Mixed Desert and Thorn Scrub* (S062), *Chihuahuan Gypsophilous Grassland and Steppe* (S080), *Madrean Pinyon-Juniper Woodland* (S112), and *Madrean Juniper Savanna* (S115)) occur minimally within the state, and four of which are 'Chihuahuan' and 'Madrean' in nature, and are unlikely to occur in Colorado. One type, *Western Great Plains Sand Prairie* (S089), is not abundant, but was mapped, where modeled in northeastern Colorado. One type, *Southern Rocky Mountain Juniper*



*Woodland and Savanna* (S074), is mapped fairly abundantly in southeastern Colorado (2149 km<sup>2</sup>), where little protected lands exist (only 6 km<sup>2</sup> of it is attributed to Status 1 and 2 lands in Colorado). The last three of the land cover types occurring less than 1% in GAP Status 1 and 2 lands (N21, N22 and N80) are not natural communities, but human dominated landscapes of low intensity developed areas, medium to high intensity developed areas, and agricultural areas.

***Land cover classes with 1-<10% of mapped distribution in Status 1 or 2:***

There are 29 land cover types that occur with 1-<10% of their distribution on GAP Status 1 and 2 lands. Of these, 22 are considered representative of natural communities, and 7 of ‘disturbed’ land cover classes. Of the 22 considered natural communities, 6 of those systems (27%) (*Inter-Mountain Basins Cliff and Canyon* (S009), *Inter-Mountain Basins Wash* (S014), *Western Great Plains Shortgrass Prairie* (S088), *Rocky Mountain Foothill Limber Pine-Juniper Woodland* (S125), *Southern Colorado Plateau Sand Shrubland* (S136), and *Western Great Plains Mesquite Woodland and Shrubland* (S138)) provided less than 150 square kilometers of habitat base across the 5-state region. Another 12 (55%) of these woodland, grassland and riparian communities (*Southern Rocky Mountain Pinyon-Juniper Woodland* (S038), *Inter-Mountain Basins Mat Saltbush Shrubland* (S045), *Rocky Mountain Lower Montane-Foothill Shrubland* (S047), *Western Great Plains Sandhill Shrubland* (S048), *Inter-Mountain Basins Montane Sagebrush Steppe* (S071), *Inter-Mountain Basins Juniper Savanna* (S075), *Southern Rocky Mountain Montane-Subalpine Grassland* (S085), *Western Great Plains Foothill and Piedmont Grassland* (S086), *Inter-Mountain Basins Semi-Desert Grassland* (S090), *Rocky Mountain Lower Montane Riparian Woodland and Shrubland* (S093), *Western Great Plains Riparian Woodland and Shrubland* (S095), and *Western Great Plains Floodplain* (S120)), provided more than 150 square kilometers, but less than 10,000 square kilometers of habitat base per type, across the 5-state region. There were 4 (18%) natural communities with greater than 10,000 square kilometers of habitat base per type (*Southern Rocky Mountain Ponderosa Pine Woodland* (S036), *Rocky Mountain Gambel Oak-Mixed Montane Shrubland* (S046), *Inter-Mountain Basins Big Sagebrush Shrubland* (S054), and *Western Great Plains Shortgrass Prairie* (S088)) with 1-<10% of their distribution on GAP Status 1 and 2 lands. The majority of these types are desert montane shrublands, pinyon-juniper woodlands, and shortgrass prairies of the eastern plains. These systems with greater areal extents for management consideration were ponderosa pine woodlands, gambel oak shrublands, big sagebrush shrublands, and shortgrass prairies. The 7 non-natural community cover types (*Recently Mined or Quarried* (D03), *Invasive Southwest Riparian Woodland and Shrubland* (D04), *Invasive Perennial Grassland* (D06), *Invasive Annual Grassland* (D08), *Invasive Annual and Biennial Forbland* (D09), *Recently Logged Areas* (D10), *Recently Chained Pinyon-Juniper Areas* (D11)) present more than 4,400 square kilometers of habitats with ‘restoration potential,’ with almost half of this amount being ‘invasive annual grasslands. The next five most available (based on areal extent) for restoration possibilities, in descending order of square kilometers of habitat modified, were cover types currently labeled as invasive annual and biennial forblands, recently logged areas, invasive southwest riparian woodlands and shrublands, invasive annual grasslands, and recently chained pinyon-

juniper areas. The logged and chained areas, may in fact represent already prescribed habitat manipulation treatments.

***Land cover classes with 10-<20% of mapped distribution in Status 1 or 2:***

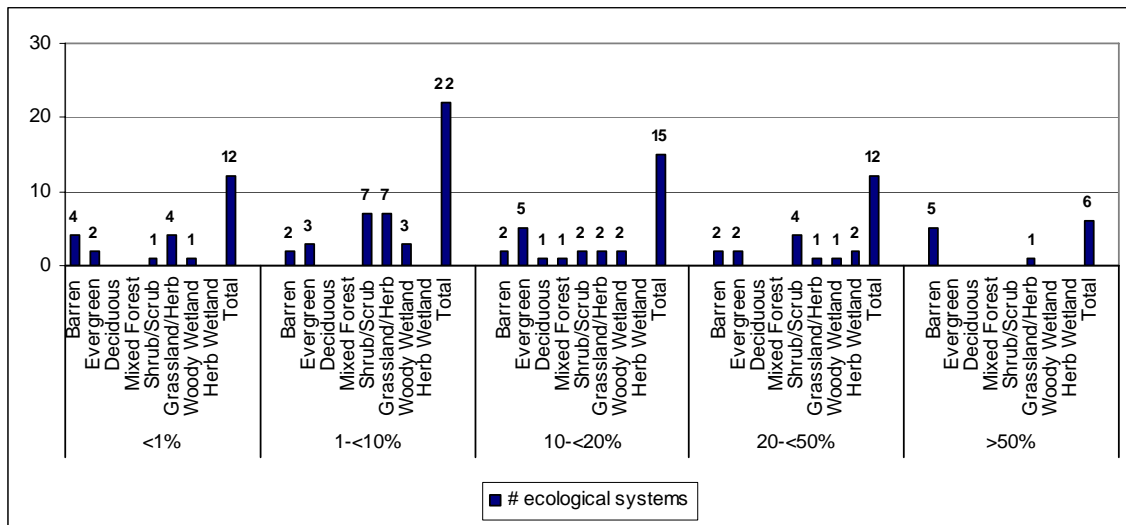
There are 16 land cover types with distributions of between 10-<20% on GAP Status 1 and 2 lands in Colorado; 15 of which are natural communities, and one ‘disturbed’ land cover class representing the ‘disturbed, oil well’ class, with less than 1 km<sup>2</sup> of this type mapped in Colorado. (This class was the focus of more mapping effort in the other four states). Of the 15 natural land cover types, *Rocky Mountain Aspen Forest and Woodland* (S023) and *Colorado Plateau Pinyon-Juniper Woodland* (S039) provide the most land base (11,432 km<sup>2</sup> and 15,134 km<sup>2</sup>, respectively, with potential for increasing the extent of protected habitat). Seven of the 15 natural land cover types (47%) represent a per type habitat base of between 1,504 km<sup>2</sup> and 6,938 km<sup>2</sup> to work with, from a management potential standpoint. The remaining 5 cover types (33%) (*Inter-Mountain Basins Shale Badland* (S011), *Inter-Mountain Basins Playa* (S015), *Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland* (S025), *Colorado Plateau Mixed Low Sagebrush Shrubland* (S056), and *Rocky Mountain Subalpine-Montane Riparian Woodland* (S092)) each afforded less than 500 km<sup>2</sup> of total base per type to work with, across the 5-stage region. These types represented mixed bedrock canyonlands, intermountain basin playas, limber/bristlecone pine woodlands, low sagebrush woodland, and sub-alpine/montane riparian woodlands.

***Land cover classes with 20-<50% of mapped distribution in Status 1 or 2:***

There are 16 land cover types with distributions of between 20-<50% on GAP Status 1 and 2 lands in Colorado. Two of these (12%) (*Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland* (S028) and *Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland* (S030)) represent high elevation conifer forest types, with >10,000 km<sup>2</sup> and >8,000 km<sup>2</sup>, respectively, of habitat base in our SWReGAP project area. Three of these 16 land cover types (*Colorado Plateau Pinyon-Juniper Shrubland* (S052), *Rocky Mountain Subalpine-Montane Riparian Shrubland* (S091), *Rocky Mountain Alpine-Montane Wet Meadow* (S102)) (19%) provide per class habitat bases of >1,700, >2,800 and >1,300 km<sup>2</sup> respectively, representing pinyon-juniper woodlands, subalpine-montane riparian shrublands, and alpine-montane wet meadows. Seven of the 16 land cover types (44%) (*Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland* (S050), *North American Arid West Emergent Marsh* (S100), *Wyoming Basins Low Sagebrush Shrubland* (S128), *Western Great Plains Tallgrass Prairie* (S132), *Barren Lands, Non-specific* (N31), *Disturbed, Non-specific* (D01), and *Recently Burned* (D02)), with distributions between 20-<50% in Status 1 and 2 lands (44%) each afford less than 500 km<sup>2</sup> of habitat base across the 5-state project area. Three of these types represent either barren lands, or disturbed/burned land cover types, for which their minimal representation might be interpreted as a good thing, *Rocky Mountain Cliff, Canyon and Massive Bedrock* (S006) and *Colorado Plateau Mixed Bedrock Canyon and Tableland* (S010) represented 981 km<sup>2</sup> and 674 km<sup>2</sup> of habitat base, for which 20-<50% was found in GAP Status 1 and 2 lands.

**Land cover classes with >50% of mapped distribution in Status 1 or 2:**

There are 5 land cover types with distributions of greater than 50% on GAP Status 1 and 2 lands in Colorado. Four of these are ‘alpine’ systems (*North American Alpine Ice Field* (S001), *Rocky Mountain Alpine Bedrock and Scree* (S002), *Rocky Mountain Alpine Fell-Field* (S004), and *Rocky Mountain Dry Tundra* (S081)), and fall within the greater than 50% GAP Status 1 and 2 lands, by virtue of the amount of these types falling within wilderness areas. The fifth type, *Inter-Mountain Basins Active and Stabilized Dune* (S012), falls into this category given the substantial amount of its cover that occurs within the Great Sand Dunes National Monument.



**Figure 5-3. Total number of ecological systems (Y-axis) aggregated into NLCD classes (X-axis) summarized by conservation thresholds (<1%, 1-<10%, 10-<20%, 20-<50%, and >50%) of Status 1 and 2 lands in the state of Colorado.**

**Table 5-3. Percent distribution of each land cover type represented within Status 1 & 2 lands, summarized by conservation thresholds of 0-<1%, 1-<10%, 10-<20%, 20-<50%, and >50% in the state of Colorado.**

| Code | Land Cover Type   | Area in         | Area in | <1  | 1-  | 10-  | 20-<50 | >50 |
|------|---|-----------------|---------|-----|-----|------|--------|-----|
|      |   | CO              | Status  | <1  | <10 | <20  | 20-<50 | >50 |
|      |   | km <sup>2</sup> | 1&2     | %   | %   | %    | %      | %   |
| S080 | Chihuahuan Gypsophilous Grassland and Steppe                  | <1              | n/a     | 0.0 |     |      |        |     |
| S062 | Chihuahuan Mixed Desert and Thorn Scrub                       | 9               | <1      | 0.1 |     |      |        |     |
| S115 | Madrean Juniper Savanna                                       | 1               | n/a     | 0.0 |     |      |        |     |
| S035 | Madrean Pine-Oak Forest and Woodland                          | <1              | n/a     | 0.0 |     |      |        |     |
| S112 | Madrean Pinyon-Juniper Woodland                               | <1              | n/a     | 0.0 |     |      |        |     |
| S018 | North American Warm Desert Active and Stabilized Dune         | <1              | n/a     | 0.0 |     |      |        |     |
| S016 | North American Warm Desert Bedrock Cliff and Outcrop          | <1              | n/a     | 0.0 |     |      |        |     |
| S022 | North American Warm Desert Playa                              | <1              | n/a     | 0.0 |     |      |        |     |
| S020 | North American Warm Desert Wash                               | 1               | <1      | 0.7 |     |      |        |     |
| S074 | Southern Rocky Mountain Juniper Woodland and Savanna          | 2,149           | 6       | 0.3 |     |      |        |     |
| S008 | Western Great Plains Cliff and Outcrop                        | 88              | 1       | 0.7 |     |      |        |     |
| S089 | Western Great Plains Sand Prairie                             | 18              | n/a     | 0.0 |     |      |        |     |
| S087 | Central Mixedgrass Prairie                                    | 120             | 3       |     | 2.7 |      |        |     |
| S054 | Inter-Mountain Basins Big Sagebrush Shrubland                 | 13,378          | 1,024   |     | 7.7 |      |        |     |
| S009 | Inter-Mountain Basins Cliff and Canyon                        | 4               | <1      |     | 8.5 |      |        |     |
| S075 | Inter-Mountain Basins Juniper Savanna                         | 281             | 7       |     | 2.3 |      |        |     |
| S045 | Inter-Mountain Basins Mat Saltbush Shrubland                  | 1,019           | 72      |     | 7.1 |      |        |     |
| S071 | Inter-Mountain Basins Montane Sagebrush Steppe                | 8,498           | 673     |     | 7.9 |      |        |     |
| S090 | Inter-Mountain Basins Semi-Desert Grassland                   | 862             | 69      |     | 8.0 |      |        |     |
| S014 | Inter-Mountain Basins Wash                                    | 20              | 1       |     | 3.9 |      |        |     |
| S125 | Rocky Mountain Foothill Limber Pine-Juniper Woodland          | 6               | <1      |     | 3.4 |      |        |     |
| S046 | Rocky Mountain Gambel Oak-Mixed Montane Shrubland             | 10,226          | 618     |     | 6.0 |      |        |     |
| S093 | Rocky Mountain Lower Montane Riparian Woodland and Shrubland  | 566             | 54      |     | 9.5 |      |        |     |
| S047 | Rocky Mountain Lower Montane-Foothill Shrubland               | 2,303           | 176     |     | 7.6 |      |        |     |
| S136 | Southern Colorado Plateau Sand Shrubland                      | 13              | <1      |     | 2.3 |      |        |     |
| S085 | Southern Rocky Mountain Montane-Subalpine Grassland           | 7,245           | 687     |     | 9.5 |      |        |     |
| S038 | Southern Rocky Mountain Pinyon-Juniper Woodland               | 4,834           | 386     |     | 8.0 |      |        |     |
| S036 | Southern Rocky Mountain Ponderosa Pine Woodland               | 10,790          | 829     |     | 7.7 |      |        |     |
| S120 | Western Great Plains Floodplain                               | 828             | 31      |     | 3.8 |      |        |     |
| S086 | Western Great Plains Foothill and Piedmont Grassland          | 4,362           | 102     |     | 2.3 |      |        |     |
| S138 | Western Great Plains Mesquite Woodland and Shrubland          | 10              | <1      |     | 2.8 |      |        |     |
| S095 | Western Great Plains Riparian Woodland and Shrubland          | 849             | 61      |     | 7.2 |      |        |     |
| S048 | Western Great Plains Sandhill Shrubland                       | 8,679           | 259     |     | 3.0 |      |        |     |
| S088 | Western Great Plains Shortgrass Prairie                       | 45,615          | 634     |     | 1.4 |      |        |     |
| S056 | Colorado Plateau Mixed Low Sagebrush Shrubland                | 66              | 8       |     |     | 11.5 |        |     |
| S039 | Colorado Plateau Pinyon-Juniper Woodland                      | 15,134          | 3,014   |     |     | 19.9 |        |     |
| S042 | Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland | 1,951           | 224     |     |     | 11.5 |        |     |
| S096 | Inter-Mountain Basins Greasewood Flat                         | 2,276           | 337     |     |     | 14.8 |        |     |
| S065 | Inter-Mountain Basins Mixed Salt Desert Scrub                 | 2,324           | 269     |     |     | 11.6 |        |     |
| S015 | Inter-Mountain Basins Playa                                   | 44              | 7       |     |     | 16.3 |        |     |

| Code | Land Cover Type  | Area in         | Area in | <1  | 1-  | 10-  | 20-<50 | >50  |
|------|--|-----------------|---------|-----|-----|------|--------|------|
|      |  | CO              | Status  | <1  | <10 | <20  | 20-<50 | >50  |
|      |  | km <sup>2</sup> | 1&2     | %   | %   | %    | %      | %    |
| S079 | Inter-Mountain Basins Semi-Desert Shrub-Steppe                     | 3,350           | 540     |     |     | 16.1 |        |      |
| S011 | Inter-Mountain Basins Shale Badland                                | 258             | 33      |     |     | 12.9 |        |      |
| S023 | Rocky Mountain Aspen Forest and Woodland                           | 11,432          | 1,337   |     |     | 11.7 |        |      |
| S032 | Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland | 3,150           | 425     |     |     | 13.5 |        |      |
| S031 | Rocky Mountain Lodgepole Pine Forest                               | 6,939           | 1,302   |     |     | 18.8 |        |      |
| S034 | Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland     | 3,603           | 475     |     |     | 13.2 |        |      |
| S083 | Rocky Mountain Subalpine Mesic Meadow                              | 1,504           | 251     |     |     | 16.7 |        |      |
| S025 | Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland  | 369             | 56      |     |     | 15.2 |        |      |
| S092 | Rocky Mountain Subalpine-Montane Riparian Woodland                 | 215             | 24      |     |     | 11.4 |        |      |
| S059 | Colorado Plateau Blackbrush-Mormon-tea Shrubland                   | 97              | 36      |     |     |      | 37.0   |      |
| S010 | Colorado Plateau Mixed Bedrock Canyon and Tableland                | 674             | 253     |     |     |      | 37.6   |      |
| S052 | Colorado Plateau Pinyon-Juniper Shrubland                          | 1,764           | 549     |     |     |      | 31.1   |      |
| S050 | Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland     | 1               | <1      |     |     |      | 24.4   |      |
| S100 | North American Arid West Emergent Marsh                            | 44              | 19      |     |     |      | 44.5   |      |
| S102 | Rocky Mountain Alpine-Montane Wet Meadow                           | 1,327           | 488     |     |     |      | 36.8   |      |
| S006 | Rocky Mountain Cliff, Canyon and Massive Bedrock                   | 981             | 298     |     |     |      | 30.3   |      |
| S028 | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland  | 10,179          | 3,563   |     |     |      | 35.0   |      |
| S030 | Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland      | 8,150           | 2,789   |     |     |      | 34.2   |      |
| S091 | Rocky Mountain Subalpine-Montane Riparian Shrubland                | 2,812           | 1,073   |     |     |      | 38.1   |      |
| S132 | Western Great Plains Tallgrass Prairie                             | 1               | <1      |     |     |      | 27.7   |      |
| S128 | Wyoming Basins Low Sagebrush Shrubland                             | 43              | 11      |     |     |      | 26.4   |      |
| S012 | Inter-Mountain Basins Active and Stabilized Dune                   | 129             | 111     |     |     |      |        | 85.5 |
| S001 | North American Alpine Ice Field                                    | 2               | 2       |     |     |      |        | 78.8 |
| S002 | Rocky Mountain Alpine Bedrock and Scree                            | 2,878           | 1,734   |     |     |      |        | 60.3 |
| S004 | Rocky Mountain Alpine Fell-Field                                   | 584             | 354     |     |     |      |        | 60.7 |
| S081 | Rocky Mountain Dry Tundra  | 2,446           | 1,328   |     |     |      |        | 54.3 |
| N21  | Developed, Open Space - Low Intensity                              | 2,010           | 3       | 0.1 |     |      |        |      |
| N22  | Developed, Medium - High Intensity                                 | 1,068           | 8       | 0.8 |     |      |        |      |
| N80  | Agriculture  | 52,820          | 518     |     | 1.0 |      |        |      |
| D09  | Invasive Annual and Biennial Forbland                              | 633             | 20      |     | 3.2 |      |        |      |
| D08  | Invasive Annual Grassland  | 372             | 21      |     | 5.7 |      |        |      |
| D06  | Invasive Perennial Grassland                                       | 2,079           | 25      |     | 1.2 |      |        |      |
| D04  | Invasive Southwest Riparian Woodland and Shrubland                 | 486             | 27      |     | 5.5 |      |        |      |
| D11  | Recently Chained Pinyon-Juniper Areas                              | 231             | 19      |     | 8.4 |      |        |      |
| D10  | Recently Logged Areas  | 540             | 52      |     | 9.6 |      |        |      |
| D03  | Recently Mined or Quarried   | 87              | 4       |     | 4.7 |      |        |      |
| D14  | Disturbed, Oil Well  | <1              | <1      |     |     | 14.8 |        |      |
| N11  | Open Water   | 607             | 82      |     |     | 13.5 |        |      |
| N31  | Barren Lands, Non-specific   | 10              | 2       |     |     |      | 21.5   |      |
| D07  | Invasive Perennial Forbland  | 1               | <1      |     |     |      | 31.0   |      |
| D02  | Recently Burned  | 313             | 139     |     |     |      | 44.5   |      |
| D01  | Disturbed, Non-specific  | 2               | 1       |     |     |      |        | 50.4 |

## New Mexico

There are 89 land cover types mapped in New Mexico, 79 of which are natural or semi-natural ecological systems ([Appendix 5-8](#)). Of the 89 land cover types, there are eight (9%) that were mapped most abundantly. These are: *Western Great Plains Shortgrass Prairie* (S088), *Apacherian-Chihuahuan Semi-Desert Grassland and Steppe* (S077), *Colorado Plateau Pinyon-Juniper Woodland* (S039), *Southern Rocky Mountain Ponderosa Pine Woodland* (S036), *Chihuahuan Mixed Desert and Thorn Scrub* (S062), *Inter-Mountain Basins Semi-Desert Grassland* (S090), *Apacherian-Chihuahuan Mesquite Upland Scrub* (S058), and *Inter-Mountain Basins Semi-Desert Shrub-Steppe* (S079). These eight land cover types account for 228,258 square kilometers (73%) of New Mexico and each represent 5% or greater of the state. An additional six land cover types account for 1-4% each of the state's total area including: *Southern Rocky Mountain Pinyon-Juniper Woodland* (S038), *Southern Rocky Mountain Juniper Woodland and Savanna* (S074), *Madrean Pinyon-Juniper Woodland* (S112), *Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub* (S068), *Western Great Plains Sandhill Shrubland* (S048), *Inter-Mountain Basins Big Sagebrush Shrubland* (S054), and *Inter-Mountain Basins Mixed Salt Desert Scrub* (S065).

A summary of the percent distribution of each land cover type by land steward for New Mexico is provided in [Appendix 5-8](#), and the percent distribution of each land cover type by GAP Management Status is reported in [Appendix 5-9](#). For instance, the distribution of a relatively sparse but localized (<1 km<sup>2</sup>) ecological system, *Chihuahuan-Sonoran Desert Bottomland and Swale Grassland* (S109), falls almost entirely within private lands (98%) with the other 2% in State School Trust lands ([Appendix 5-8](#)), where 100% of its total distribution is managed according to Status 4 criteria ([Appendix 5-9](#)).

[Figure 5-4](#) presents an overview of the number of ecological systems by NLCD class with representation in Status 1 and 2 lands broken down by conservation threshold for the state of New Mexico. [Table 5-4](#) presents a more detailed version of this information by identifying the representation of individual land cover types in Status 1 and 2 lands.

Approximately 6.3% (19,908 km<sup>2</sup>) of New Mexico lands are currently managed according to GAP Management Status 1 or 2 criteria ([Appendix 5-9](#)). There are 36 land cover types (40%) that do not occur on Status 1 lands (10 of which are altered or disturbed). Fourteen (16%) of these land cover types do not occur on Status 2 lands either (four of which are altered or disturbed).

### ***Land cover classes with <1% of mapped distribution in Status 1 or 2:***

Of the 89 land cover types, eight (9%) occur with less than 1% of their distribution on GAP Status 1 and 2 lands. Two types (*Western Great Plains Shortgrass Prairie* (S088), *Western Great Plains Mesquite Woodland and Shrubland* (S138)) were mapped on the eastern part of New Mexico, an area primarily under private ownership. *Western Great Plains Shortgrass Prairie* was the dominant mapped system within New Mexico and accounts for greater than 20% of the mapped land cover type within the state. The other type (*Western Great Plains Mesquite Woodland and Shrubland*) was mapped in the

northeastern part of the state, but still largely occurring on private lands. There are four systems (*Rocky Mountain Alpine Bedrock and Scree* (S002), *Rocky Mountain Alpine Fell-Field* (S004), *Rocky Mountain Dry Tundra* (S081), *Chihuahuan-Sonoran Desert Bottomland and Swale Grassland* (S109)) that occur sparsely within the state and Inter-Mountain Basins Playa (S015) that was mapped only slightly more extensively in the state. One type (*Sonora-Mojave Creosotebush-White Bursage Desert Scrub* (S069)) was mapped very sparsely and would not likely occur within the state as it is a type associated with the Sonoran and Mojave deserts.

***Land cover classes with 1-<10% of mapped distribution in Status 1 or 2:***

There are 39 land cover types that occur with 1-<10% of their distribution on GAP Status 1 and 2 lands. The majority of these types are desert scrub, pinyon-juniper woodlands, and riparian types. The areas in which these land cover types occur are where the majority of private lands or multiple use lands (Status 3) occur. Historically, areas near to and surrounding riparian zones were settled first, and thus, are likely to be privately owned. Consequently, there are several riparian land cover types each with minimal protection of their distribution within Status 1 and 2 lands, including: *North American Arid West Emergent Marsh* (S100), *North American Warm Desert Wash* (S020), *Inter-Mountain Basins Greasewood Flat* (S096), *Inter-Mountain Basins Wash* (S014), *Rocky Mountain Alpine-Montane Wet Meadow* (S102), *Rocky Mountain Lower Montane Riparian Woodland and Shrubland* (S093), *Western Great Plains Riparian Woodland and Shrubland* (S095), and *Western Great Plains Saline Depression Wetland* (S108).

***Land cover classes with 10-<20% of mapped distribution in Status 1 or 2:***

There are 15 land cover types with distributions of between 10-<20% on GAP Status 1 and 2 lands in New Mexico. Many of the land cover types within this category are riparian areas and thus subject to management discussed above. These include: *North American Warm Desert Lower Montane Riparian Woodland and Shrubland* (S094), *North American Warm Desert Riparian Woodland and Shrubland* (S097), *Rocky Mountain Subalpine Mesic Meadow* (S083), *Rocky Mountain Subalpine-Montane Riparian Shrubland* (S091), and *Rocky Mountain Subalpine-Montane Riparian Woodland* (S092). Also included within this category is *Southern Rocky Mountain Ponderosa Pine Woodland* (S036) which is a dominant land cover type on forested Status 3 lands. One grassland type, *Chihuahuan Gypsophilous Grassland and Steppe* (S080), one forest type, *Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland* (S042), and one shrubland type, *Mogollon Chaparral* (S057) are also included within this threshold. There are two shrublands which include: *Colorado Plateau Mixed Low Sagebrush Shrubland* (S056) and *Sonoran Mid-Elevation Desert Scrub* (S129). Four barren or sparse land cover types include: *Inter-Mountain Basins Active and Stabilized Dune* (S012), *Inter-Mountain Basins Shale Badland*, (S011) *North American Warm Desert Pavement* (S021), and *Rocky Mountain Cliff, Canyon and Massive Bedrock* (S006).

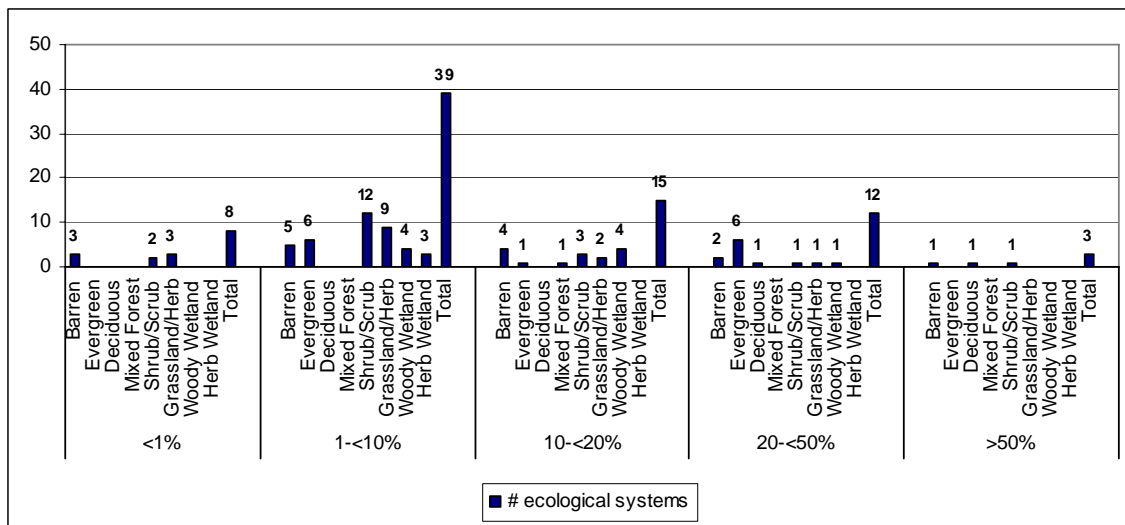
***Land cover classes with 20-<50% of mapped distribution in Status 1 or 2:***

There are 12 land cover types with distributions of between 20-<50% on GAP Status 1 and 2 lands in New Mexico. Many of the land cover types within this category are high

elevation conifer and aspen forest types that occur within wildernesses in New Mexico. The high elevation land cover types include: *Rocky Mountain Aspen Forest and Woodland* (S023), *Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland* (S032), *Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland* (S034), *Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland* (S028), *Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland* (S030), *Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland* (S025), and *Southern Rocky Mountain Montane-Subalpine Grassland* (S085). Lower elevation land cover types include *Coahuilan Chaparral* (S117), *Madrean Encinal* (S051), *North American Warm Desert Playa* (S022), *North American Warm Desert Riparian Mesquite Bosque* (S098), and *North American Warm Desert Volcanic Rockland* (S019).

**Land cover classes with >50% of mapped distribution in Status 1 or 2:**

There are 3 land cover types with distributions of greater than 50% on GAP Status 1 and 2 lands in New Mexico. These include: *Inter-Mountain Basins Volcanic Rock and Cinder Land* (S013), *Rocky Mountain Bigtooth Maple Ravine Woodland* (S024), and *Sonoran Paloverde-Mixed Cacti Desert Scrub* (S063). The volcanic lands are largely within El Malpais National Park in central New Mexico. *Rocky Mountain Bigtooth Maple Ravine Woodland* (S024) was mapped sparsely within the southeastern part of the state within the Lincoln National Forest. *Sonoran Paloverde-Mixed Cacti Desert Scrub* (S063) was mapped very sparsely in southwestern New Mexico. Although it is considered a Sonoran Desert land cover type, where it occurs in New Mexico, the actual vegetation is probably more closely associated with the Chihuahuan Desert.



**Figure 5-4. Total number of ecological systems (Y-axis) aggregated into NLCD classes (X-axis) summarized by conservation thresholds (<1%, 1-<10%, 10-<20%, 20-<50%, and >50%) of Status 1 and 2 lands in the state of New Mexico.**



**Table 5-4. Percent distribution of each land cover type represented within Status 1 & 2 lands, summarized by conservation thresholds of 0-<1%, 1-<10%, 10-<20%, 20-<50%, and >50% in the state of New Mexico.**

| Code | Land Cover Type  | Area            | Area   | <1  | 1-<10 | 10-<20 | 20-<50 | >50 |
|------|--|-----------------|--------|-----|-------|--------|--------|-----|
|      |  | in NM           | in     |     |       |        |        |     |
|      |  | km <sup>2</sup> | Status | %   | %     | %      | %      | %   |
|      |  |                 | 1&2    |     |       |        |        |     |
| S109 | Chihuahuan-Sonoran Desert Bottomland and Swale Grassland     | <1              | n/a    | 0.0 |       |        |        |     |
| S015 | Inter-Mountain Basins Playa                                  | 2               | n/a    | 0.0 |       |        |        |     |
| S002 | Rocky Mountain Alpine Bedrock and Scree                      | 7               | n/a    | 0.0 |       |        |        |     |
| S004 | Rocky Mountain Alpine Fell-Field                             | <1              | n/a    | 0.0 |       |        |        |     |
| S081 | Rocky Mountain Dry Tundra                                    | 19              | n/a    | 0.0 |       |        |        |     |
| S069 | Sonora-Mojave Creosotebush-White Bursage Desert Scrub        | <1              | n/a    | 0.0 |       |        |        |     |
| S138 | Western Great Plains Mesquite Woodland and Shrubland         | 1,787           | 3      | 0.2 |       |        |        |     |
| S088 | Western Great Plains Shortgrass Prairie                      | 67,399          | 140    | 0.2 |       |        |        |     |
| S058 | Apacherian-Chihuahuan Mesquite Upland Scrub                  | 15,120          | 302    |     | 2.0   |        |        |     |
| S077 | Apacherian-Chihuahuan Semi-Desert Grassland and Steppe       | 34,343          | 2,694  |     | 7.8   |        |        |     |
| S062 | Chihuahuan Mixed Desert and Thorn Scrub                      | 21,066          | 1,144  |     | 5.4   |        |        |     |
| S116 | Chihuahuan Mixed Salt Desert Scrub                           | 1,590           | 153    |     | 9.6   |        |        |     |
| S113 | Chihuahuan Sandy Plains Semi-Desert Grassland                | 969             | 44     |     | 4.5   |        |        |     |
| S068 | Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub       | 5,537           | 136    |     | 2.5   |        |        |     |
| S061 | Chihuahuan Succulent Desert Scrub                            | 78              | 7      |     | 8.5   |        |        |     |
| S059 | Colorado Plateau Blackbrush-Mormon-tea Shrubland             | 141             | 5      |     | 3.8   |        |        |     |
| S010 | Colorado Plateau Mixed Bedrock Canyon and Tableland          | 2,465           | 225    |     | 9.1   |        |        |     |
| S039 | Colorado Plateau Pinyon-Juniper Woodland                     | 27,849          | 2,351  |     | 8.4   |        |        |     |
| S054 | Inter-Mountain Basins Big Sagebrush Shrubland                | 3,929           | 118    |     | 3.0   |        |        |     |
| S096 | Inter-Mountain Basins Greasewood Flat                        | 2,264           | 97     |     | 4.3   |        |        |     |
| S075 | Inter-Mountain Basins Juniper Savanna                        | 1,297           | 82     |     | 6.3   |        |        |     |
| S065 | Inter-Mountain Basins Mixed Salt Desert Scrub                | 3,777           | 161    |     | 4.3   |        |        |     |
| S071 | Inter-Mountain Basins Montane Sagebrush Steppe               | 282             | 24     |     | 8.6   |        |        |     |
| S090 | Inter-Mountain Basins Semi-Desert Grassland                  | 16,390          | 663    |     | 4.0   |        |        |     |
| S079 | Inter-Mountain Basins Semi-Desert Shrub-Steppe               | 14,466          | 574    |     | 4.0   |        |        |     |
| S014 | Inter-Mountain Basins Wash                                   | 3               | <1     |     | 1.1   |        |        |     |
| S115 | Madrean Juniper Savanna                                      | 657             | 32     |     | 4.8   |        |        |     |
| S035 | Madrean Pine-Oak Forest and Woodland                         | 1,725           | 163    |     | 9.5   |        |        |     |
| S112 | Madrean Pinyon-Juniper Woodland                              | 8,754           | 705    |     | 8.1   |        |        |     |
| S111 | Madrean Upper Montane Conifer-Oak Forest and Woodland        | 672             | 66     |     | 9.9   |        |        |     |
| S100 | North American Arid West Emergent Marsh                      | 85              | 3      |     | 3.8   |        |        |     |
| S018 | North American Warm Desert Active and Stabilized Dune        | 1,695           | 113    |     | 6.7   |        |        |     |
| S016 | North American Warm Desert Bedrock Cliff and Outcrop         | 838             | 61     |     | 7.3   |        |        |     |
| S020 | North American Warm Desert Wash                              | 197             | 10     |     | 5.1   |        |        |     |
| S102 | Rocky Mountain Alpine-Montane Wet Meadow                     | 136             | 11     |     | 7.8   |        |        |     |
| S046 | Rocky Mountain Gambel Oak-Mixed Montane Shrubland            | 1,888           | 147    |     | 7.8   |        |        |     |
| S031 | Rocky Mountain Lodgepole Pine Forest                         | 7               | 1      |     | 8.2   |        |        |     |
| S093 | Rocky Mountain Lower Montane Riparian Woodland and Shrubland | 783             | 43     |     | 5.5   |        |        |     |
| S047 | Rocky Mountain Lower Montane-Foothill Shrubland              | 266             | 4      |     | 1.7   |        |        |     |
| S136 | Southern Colorado Plateau Sand Shrubland                     | 79              | 1      |     | 1.2   |        |        |     |

| Code | Land Cover Type  | Area            | Area            | <1  | 1-<10 | 10-<20 | 20-<50 | >50  |
|------|--|-----------------|-----------------|-----|-------|--------|--------|------|
|      |  | in NM           | in Status 1&2   |     |       |        |        |      |
|      |  | km <sup>2</sup> | km <sup>2</sup> | %   | %     | %      | %      | %    |
| S074 | Southern Rocky Mountain Juniper Woodland and Savanna                     | 9,803           | 173             |     | 1.8   |        |        |      |
| S038 | Southern Rocky Mountain Pinyon-Juniper Woodland                          | 10,465          | 654             |     | 6.2   |        |        |      |
| S008 | Western Great Plains Cliff and Outcrop                                   | 221             | 2               |     | 1.0   |        |        |      |
| S086 | Western Great Plains Foothill and Piedmont Grassland                     | 701             | 18              |     | 2.6   |        |        |      |
| S095 | Western Great Plains Riparian Woodland and Shrubland                     | 851             | 78              |     | 9.2   |        |        |      |
| S108 | Western Great Plains Saline Depression Wetland                           | 20              | <1              |     | 1.0   |        |        |      |
| S048 | Western Great Plains Sandhill Shrubland                                  | 5,208           | 109             |     | 2.1   |        |        |      |
| S080 | Chihuahuan Gypsophilous Grassland and Steppe                             | 803             | 154             |     |       | 19.1   |        |      |
| S056 | Colorado Plateau Mixed Low Sagebrush Shrubland                           | 329             | 42              |     |       | 12.8   |        |      |
| S012 | Inter-Mountain Basins Active and Stabilized Dune                         | 735             | 89              |     |       | 12.1   |        |      |
| S042 | Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland            | 182             | 33              |     |       | 18.1   |        |      |
| S011 | Inter-Mountain Basins Shale Badland                                      | 481             | 79              |     |       | 16.5   |        |      |
| S057 | Mogollon Chaparral   | 870             | 150             |     |       | 17.2   |        |      |
| S094 | North American Warm Desert Lower Montane Riparian Woodland and Shrubland | 191             | 31              |     |       | 16.1   |        |      |
| S021 | North American Warm Desert Pavement                                      | 173             | 32              |     |       | 18.2   |        |      |
| S097 | North American Warm Desert Riparian Woodland and Shrubland               | 122             | 21              |     |       | 16.8   |        |      |
| S006 | Rocky Mountain Cliff, Canyon and Massive Bedrock                         | 417             | 77              |     |       | 18.4   |        |      |
| S083 | Rocky Mountain Subalpine Mesic Meadow                                    | 147             | 27              |     |       | 18.3   |        |      |
| S091 | Rocky Mountain Subalpine-Montane Riparian Shrubland                      | 103             | 15              |     |       | 14.9   |        |      |
| S092 | Rocky Mountain Subalpine-Montane Riparian Woodland                       | 5               | 1               |     |       | 10.0   |        |      |
| S129 | Sonoran Mid-Elevation Desert Scrub                                       | 2               | <1              |     |       | 10.7   |        |      |
| S036 | Southern Rocky Mountain Ponderosa Pine Woodland                          | 21,160          | 3,297           |     |       | 15.6   |        |      |
| S117 | Coahuilan Chaparral  | 93              | 39              |     |       |        | 41.7   |      |
| S051 | Madrean Encinal  | 1,350           | 339             |     |       |        | 25.1   |      |
| S022 | North American Warm Desert Playa   | 515             | 171             |     |       |        | 33.2   |      |
| S098 | North American Warm Desert Riparian Mesquite Bosque                      | 3               | 1               |     |       |        | 20.9   |      |
| S019 | North American Warm Desert Volcanic Rockland                             | 700             | 264             |     |       |        | 37.6   |      |
| S023 | Rocky Mountain Aspen Forest and Woodland                                 | 1,483           | 522             |     |       |        | 35.2   |      |
| S032 | Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland       | 2,864           | 967             |     |       |        | 33.8   |      |
| S034 | Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland           | 1,610           | 514             |     |       |        | 31.9   |      |
| S028 | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland        | 982             | 359             |     |       |        | 36.6   |      |
| S030 | Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland            | 640             | 275             |     |       |        | 43.0   |      |
| S025 | Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland        | 376             | 129             |     |       |        | 34.4   |      |
| S085 | Southern Rocky Mountain Montane-Subalpine Grassland                      | 1,855           | 430             |     |       |        | 23.2   |      |
| S013 | Inter-Mountain Basins Volcanic Rock and Cinder Land                      | 470             | 414             |     |       |        |        | 88.1 |
| S024 | Rocky Mountain Bigtooth Maple Ravine Woodland                            | <1              | <1              |     |       |        |        | 62.6 |
| S063 | Sonoran Paloverde-Mixed Cacti Desert Scrub                               | <1              | <1              |     |       |        |        | 66.3 |
| N80  | Agriculture  | 6,026           | 25              | 0.4 |       |        |        |      |
| N22  | Developed, Medium - High Intensity                                       | 1,107           | 3               | 0.3 |       |        |        |      |
| N21  | Developed, Open Space - Low Intensity                                    | 975             | 3               | 0.3 |       |        |        |      |

| Code | Land Cover Type                                    | Area            | Area            | <1  | 1-<10 | 10-<20 | 20-<50 | >50 |
|------|--|-----------------|-----------------|-----|-------|--------|--------|-----|
|      |  | in NM           | in Status 1&2   |     |       |        |        |     |
|      |  | km <sup>2</sup> | km <sup>2</sup> | %   | %     | %      | %      | %   |
| D06  | Invasive Perennial Grassland                       | 29              | <1              | 0.1 |       |        |        |     |
| D11  | Recently Chained Pinyon-Juniper Areas              | <1              | n/a             | 0.0 |       |        |        |     |
| D03  | Recently Mined or Quarried                         | 177             | n/a             | 0.0 |       |        |        |     |
| N31  | Barren Lands, Non-specific                         | 54              | 1               |     | 1.5   |        |        |     |
| D09  | Invasive Annual and Biennial Forbland              | 48              | 3               |     | 6.5   |        |        |     |
| D04  | Invasive Southwest Riparian Woodland and Shrubland | 27              | 1               |     | 3.4   |        |        |     |
| N11  | Open Water   | 438             | 36              |     | 8.3   |        |        |     |
| D02  | Recently Burned                                    | 806             | 45              |     | 5.6   |        |        |     |
| D10  | Recently Logged Areas                              | 8               | <1              |     | 2.6   |        |        |     |

## Nevada

Seventy-four of the 125 land cover classes mapped within the 5-state region occur in Nevada. Of this total, nine cover classes are either altered and disturbed (e.g., invasive species, mineral extraction, or recently burned) or developed and agriculture, where the remainder are naturally occurring ecological systems ([Appendix 5-10](#)). Nearly 78% of the state is dominated by six land cover types: *Inter-mountain Basins Big Sagebrush Shrubland* (S054), *Inter-mountain Basins Mixed Salt Desert Scrub* (S065), *Great Basin Pinyon-Juniper Woodland* (S040), *Great Basin Xeric Mixed Sagebrush Shrubland* (S055), *Sonora-Mojave Creosotebush-White Bursage Desert Scrub* (S069), and *Inter-mountain Basins Montane Sagebrush Steppe* (S071).

Remarkably, 62 mapped cover types in Nevada are limited in their distribution with less than 1% cover each and form less than 8% of the total state cover. Invasive species, such as *Invasive Annual and Biennial Forbland* (D09), *Invasive Annual Grassland* (D08), *Invasive Perennial Grassland* (D06), and *Invasive Southwest Riparian Woodland and Shrubland* (D04) represent slightly more than 2% of the total land cover for Nevada. Collectively, developed and agricultural land cover types in Nevada represent 2,914 km<sup>2</sup> or approximately only 1% of the areal extent of the state.

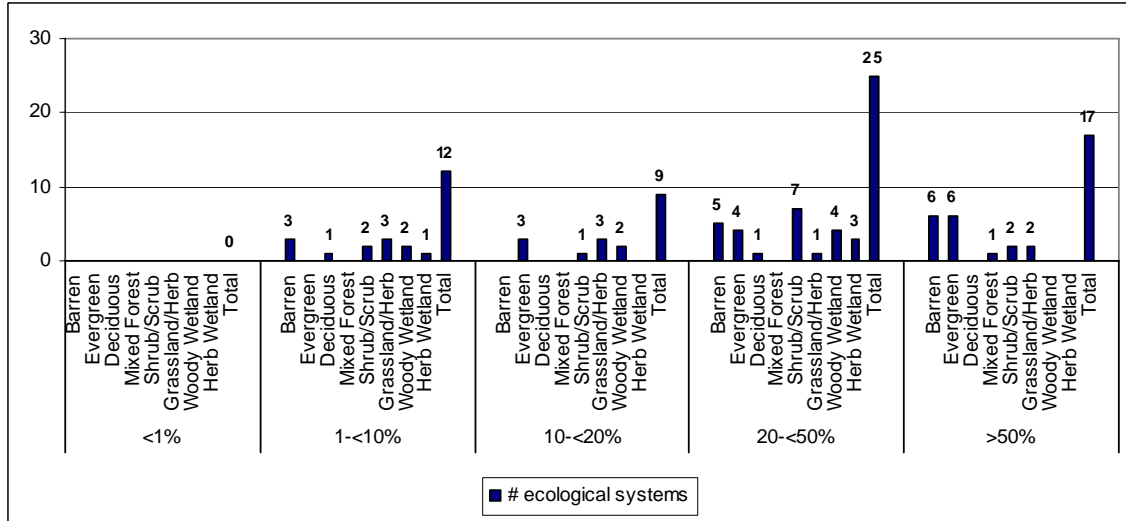
A summary of the percent distribution of each land cover type by land steward for Nevada is provided in [Appendix 5-10](#). As an example, the U.S. Bureau of Land Management is responsible for 67% of the surface land management for the state of Nevada ([Appendix 5-10](#)). Consequently, it manages the majority of pinyon-juniper woodlands (~64%), basin big sagebrush and black sagebrush shrublands (76% and 78%, respectively) that occur throughout the state. [Appendix 5-11](#) summarizes the percent distribution of each land cover type represented within the four levels of GAP Management Status, where it can be seen that these three land cover types fall mostly within Status 3 lands (75%, 78.1%, and 79.5%, respectively).

[Figure 5-5](#) presents an overview of the number of ecological systems by NLCD class with representation in Status 1 and 2 lands broken down by conservation threshold for the state of Nevada. [Table 5-5](#) presents a more detailed version of this information by identifying the representation of individual land cover types in Status 1 and 2 lands.

Approximately 14.8% (42,218 km<sup>2</sup>) of Nevada lands are currently managed according to GAP Management Status 1 or 2 criteria ([Appendix 5-11](#)); they represent 8,876 km<sup>2</sup> Status 1 and 33,342 km<sup>2</sup> Status 2 lands, respectively. The ecological systems receiving the least amount of protection in Nevada, i.e., where less than 10 % of their respective distributions occur within Status 1 or 2 lands, include the following: *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* (S118), *Inter-mountain Basins Active and Stabilized Dune* (S012), *Inter-mountain Basins Big Sagebrush Shrubland* (S054), *Inter-mountain Basins Big Sagebrush Steppe* (S078), *Inter-mountain Basins Greasewood Flat* (S096), *Inter-mountain Basins Mixed Salt Desert Scrub* (S065), *Inter-mountain Basins Semi-Desert Grassland* (S090), *Inter-Mountain Basins Wash* (S014), *Rocky Mountain Bigtooth Maple Ravine Woodland* (S024), *Sierra Nevada Cliff and*

*Canyon* (S007), *Southern Rocky Mountain Montane-Subalpine Grassland* (S085), and *Temperate Pacific Subalpine-Montane Wet Meadow* (S103). Some of these ecological types, however, present the most opportunity to provide conservation measures. Many of the rarest Status 1 and 2 ecological systems predominantly occur in Status 3 areas such as U.S. Bureau of Land Management and U.S. Forest Service lands where the land is under permanent federal control and where public laws apply to conservation management. Status 3 lands in Nevada represent 71.8% of the aerial extent of the state or 204,049 km<sup>2</sup> ([Appendix 5-11](#)). Forty-one of the 74 land cover types in Nevada have greater than 50% of their areal extents classified as within the GAP Management Status 3 category ([Appendix 5-11](#)). Among the 12 ecological systems identified with low protection (less than 10% aerial extent in Status 1 or 2), all but three have >50 % of their areal extent in Nevada in Status 3 (*Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* -S118, *Inter-mountain Basins Semi-Desert Grassland* -S090, and *Rocky Mountain Bigtooth Maple Ravine Woodland* -S024), and thus represent the greatest opportunity for future protective actions.

Lastly, under the Status 4 GAP management category there are no known public or private institutional mandates or legally recognized easements or deed restrictions to prevent conversion of natural habitat types to anthropogenic cover types, thus these are the least protected lands for biodiversity conservation in Nevada. Land cover types in this category are typically developed as high- or low-density urban or converted to agriculture and are held in private ownership. The total Status 4 lands in Nevada represent 13.4% of the areal extent of the state or 38,120 km<sup>2</sup> ([Appendix 5-11](#)). Nevertheless, eight natural ecological systems are well represented within Status 4 category lands in that they represent 35 - 89% of the areal extent for the ecological system as it is represented in Nevada. They include 1 deciduous forest type, 2 grassland /herbaceous types, 3 woody wetland types, and 2 emergent herbaceous wetland types. Specifically they include: *Rocky Mountain Bigtooth Maple Ravine Woodland* (S024), *Inter-mountain Basins Big Sagebrush Steppe* (S078), *Inter-mountain Basins Semi-Desert Grassland* (S090), *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* (S118), *North American Warm Desert Lower Montane Riparian Woodland and Shrubland* (S094), *North American Warm Desert Riparian Woodland and Shrubland* (S097), *North American Arid West Emergent Marsh* (S100), and *Temperate Pacific Subalpine-Montane Wet Meadow* (S103). These may represent management opportunities such as conservation easements for future consideration.



**Figure 5-5. Total number of ecological systems (Y-axis) aggregated into NLCD classes (X-axis) summarized by conservation thresholds (<1%, 1-<10%, 10-<20%, 20-<50%, and >50%) of Status 1 and 2 lands in the state of Nevada.**

**Table 5-5. Percent distribution of each land cover type represented within Status 1 & 2 lands, summarized by conservation thresholds of 0-<1%, 1-<10%, 10-<20%, 20-<50%, and >50% in the state of Nevada.**

| Code | Land Cover Type  | Area            | Area            | <1 | 1-<10 | 10-<20 | 20-<50 | >50 |
|------|--|-----------------|-----------------|----|-------|--------|--------|-----|
|      |  | in NV           | in Status 1&2   |    |       |        |        |     |
|      |  | km <sup>2</sup> | km <sup>2</sup> | %  | %     | %      | %      | %   |
| S118 | Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland   | 1,059           | 72              |    | 6.8   |        |        |     |
| S012 | Inter-Mountain Basins Active and Stabilized Dune                         | 79              | 3               |    | 4.1   |        |        |     |
| S054 | Inter-Mountain Basins Big Sagebrush Shrubland                            | 65,988          | 4,165           |    | 6.3   |        |        |     |
| S078 | Inter-Mountain Basins Big Sagebrush Steppe                               | 1,274           | 37              |    | 2.9   |        |        |     |
| S096 | Inter-Mountain Basins Greasewood Flat                                    | 10,550          | 1,011           |    | 9.6   |        |        |     |
| S065 | Inter-Mountain Basins Mixed Salt Desert Scrub                            | 50,604          | 3,090           |    | 6.1   |        |        |     |
| S090 | Inter-Mountain Basins Semi-Desert Grassland                              | 3,101           | 195             |    | 6.3   |        |        |     |
| S014 | Inter-Mountain Basins Wash   | 18              | 1               |    | 3.4   |        |        |     |
| S024 | Rocky Mountain Bigtooth Maple Ravine Woodland                            | 1               | <1              |    | 1.0   |        |        |     |
| S007 | Sierra Nevada Cliff and Canyon   | 123             | 6               |    | 4.9   |        |        |     |
| S085 | Southern Rocky Mountain Montane-Subalpine Grassland                      | 2               | <1              |    | 6.7   |        |        |     |
| S103 | Temperate Pacific Subalpine-Montane Wet Meadow                           | 2               | <1              |    | 2.4   |        |        |     |
| S040 | Great Basin Pinyon-Juniper Woodland                                      | 36,374          | 6,489           |    |       | 17.8   |        |     |
| S055 | Great Basin Xeric Mixed Sagebrush Shrubland                              | 31,792          | 3,724           |    |       | 11.7   |        |     |
| S071 | Inter-Mountain Basins Montane Sagebrush Steppe                           | 17,813          | 2,344           |    |       | 13.2   |        |     |
| S079 | Inter-Mountain Basins Semi-Desert Shrub-Steppe                           | 5,973           | 1,030           |    |       | 17.2   |        |     |
| S123 | Mediterranean California Ponderosa-Jeffrey Pine Forest and Woodland      | 209             | 24              |    |       | 11.4   |        |     |
| S097 | North American Warm Desert Riparian Woodland and Shrubland               | 5               | 1               |    |       | 18.1   |        |     |
| S020 | North American Warm Desert Wash  | 288             | 53              |    |       | 18.3   |        |     |
| S134 | North Pacific Montane Grassland  | 27              | 4               |    |       | 13.3   |        |     |
| S122 | Sierra Nevada Subalpine Lodgepole Pine Forest and Woodland               | 20              | 4               |    |       | 19.5   |        |     |
| S053 | Great Basin Semi-Desert Chaparral  | 162             | 57              |    |       |        | 34.8   |     |
| S009 | Inter-Mountain Basins Cliff and Canyon                                   | 2,486           | 642             |    |       |        | 25.8   |     |
| S075 | Inter-Mountain Basins Juniper Savanna                                    | 1               | <1              |    |       |        | 35.4   |     |
| S050 | Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland           | 1,924           | 626             |    |       |        | 32.5   |     |
| S015 | Inter-Mountain Basins Playa  | 6,082           | 1,475           |    |       |        | 24.3   |     |
| S033 | Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland     | 2               | 1               |    |       |        | 32.7   |     |
| S121 | Mediterranean California Red Fir Forest and Woodland                     | 106             | 24              |    |       |        | 22.4   |     |
| S105 | Mediterranean California Subalpine-Montane Fen                           | 2               | 1               |    |       |        | 47.4   |     |
| S057 | Mogollon Chaparral   | 425             | 133             |    |       |        | 31.3   |     |
| S060 | Mojave Mid-Elevation Mixed Desert Scrub                                  | 10,521          | 4,952           |    |       |        | 47.1   |     |
| S100 | North American Arid West Emergent Marsh                                  | 311             | 72              |    |       |        | 23.2   |     |
| S018 | North American Warm Desert Active and Stabilized Dune                    | 16              | 7               |    |       |        | 45.4   |     |
| S094 | North American Warm Desert Lower Montane Riparian Woodland and Shrubland | 30              | 8               |    |       |        | 26.9   |     |
| S021 | North American Warm Desert Pavement                                      | 168             | 62              |    |       |        | 36.9   |     |

| Code | Land Cover Type  | Area            | Area            | <1  | 1-<10 | 10-<20 | 20-<50 | >50  |
|------|--|-----------------|-----------------|-----|-------|--------|--------|------|
|      |  | in NV           | in Status 1&2   |     |       |        |        |      |
|      |  | km <sup>2</sup> | km <sup>2</sup> | %   | %     | %      | %      | %    |
| S022 | North American Warm Desert Playa                                   | 526             | 180             |     |       |        | 34.3   |      |
| S098 | North American Warm Desert Riparian Mesquite Bosque                | 25              | 9               |     |       |        | 37.6   |      |
| S102 | Rocky Mountain Alpine-Montane Wet Meadow                           | 10              | 5               |     |       |        | 47.9   |      |
| S023 | Rocky Mountain Aspen Forest and Woodland                           | 1,289           | 364             |     |       |        | 28.3   |      |
| S046 | Rocky Mountain Gambel Oak-Mixed Montane Shrubland                  | 108             | 39              |     |       |        | 35.8   |      |
| S030 | Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland      | 175             | 71              |     |       |        | 40.7   |      |
| S025 | Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland  | 14              | 6               |     |       |        | 43.3   |      |
| S091 | Rocky Mountain Subalpine-Montane Riparian Shrubland                | 3               | 1               |     |       |        | 30.2   |      |
| S092 | Rocky Mountain Subalpine-Montane Riparian Woodland                 | 67              | 25              |     |       |        | 37.3   |      |
| S069 | Sonora-Mojave Creosotebush-White Bursage Desert Scrub              | 19,013          | 8,036           |     |       |        | 42.3   |      |
| S070 | Sonora-Mojave Mixed Salt Desert Scrub                              | 1,528           | 467             |     |       |        | 30.6   |      |
| S059 | Colorado Plateau Blackbrush-Mormon-tea Shrubland                   | 4               | 3               |     |       |        |        | 89.6 |
| S010 | Colorado Plateau Mixed Bedrock Canyon and Tableland                | 2               | 2               |     |       |        |        | 96.1 |
| S042 | Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland      | 84              | 44              |     |       |        |        | 52.5 |
| S026 | Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland   | 635             | 409             |     |       |        |        | 64.5 |
| S003 | Mediterranean California Alpine Bedrock and Scree                  | 23              | 17              |     |       |        |        | 71.3 |
| S017 | North American Warm Desert Badland                                 | 78              | 48              |     |       |        |        | 62.1 |
| S016 | North American Warm Desert Bedrock Cliff and Outcrop               | 1,842           | 1,233           |     |       |        |        | 67.0 |
| S019 | North American Warm Desert Volcanic Rockland                       | 78              | 52              |     |       |        |        | 65.9 |
| S029 | Northern Pacific Mesic Subalpine Parkland                          | 42              | 25              |     |       |        |        | 59.0 |
| S002 | Rocky Mountain Alpine Bedrock and Scree                            | 148             | 97              |     |       |        |        | 65.8 |
| S081 | Rocky Mountain Dry Tundra  | 20              | 14              |     |       |        |        | 70.1 |
| S032 | Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland | 196             | 140             |     |       |        |        | 71.7 |
| S034 | Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland     | 216             | 127             |     |       |        |        | 58.8 |
| S028 | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland  | 190             | 97              |     |       |        |        | 51.0 |
| S083 | Rocky Mountain Subalpine Mesic Meadow                              | 24              | 14              |     |       |        |        | 59.2 |
| S114 | Sonora-Mojave Semi-Desert Chaparral                                | 86              | 85              |     |       |        |        | 98.8 |
| S036 | Southern Rocky Mountain Ponderosa Pine Woodland                    | 7               | 7               |     |       |        |        | 96.9 |
| N21  | Developed, Open Space - Low Intensity                              | 724             | <1              | 0.0 |       |        |        |      |
| D03  | Recently Mined or Quarried   | 319             | <1              | 0.0 |       |        |        |      |
| N80  | Agriculture  | 2,222           | 33              |     | 1.5   |        |        |      |
| N31  | Barren Lands, Non-specific   | 186             | 13              |     | 7.0   |        |        |      |
| N22  | Developed, Medium - High Intensity                                 | 210             | 5               |     | 2.5   |        |        |      |
| D09  | Invasive Annual and Biennial Forbland                              | 1,131           | 27              |     | 2.4   |        |        |      |
| D08  | Invasive Annual Grassland  | 4,610           | 118             |     | 2.6   |        |        |      |



| Code | Land Cover Type                                    | Area            | Area            | <1 | 1-<10 | 10-<20 | 20-<50 | >50 |
|------|--|-----------------|-----------------|----|-------|--------|--------|-----|
|      |  | in NV           | in Status 1&2   |    |       |        |        |     |
|      |  | km <sup>2</sup> | km <sup>2</sup> | %  | %     | %      | %      | %   |
| D06  | Invasive Perennial Grassland                       | 187             | 3               |    | 1.5   |        |        |     |
| D02  | Recently Burned                                    | 574             | 28              |    | 4.9   |        |        |     |
| N11  | Open Water   | 129             | 24              |    |       | 18.7   |        |     |
| D04  | Invasive Southwest Riparian Woodland and Shrubland | 126             | 37              |    |       |        | 29.6   |     |

## Utah

Within the state of Utah a total of 80 land cover types are mapped, 65 of which are natural or semi-natural ecological systems ([Appendix 5-12](#)). The most abundant ecological systems mapped within the state of Utah are: *Colorado Plateau Pinyon-Juniper Woodland* (S039), *Inter-Mountain Basins Big Sagebrush Shrubland* (S054), *Inter-Mountain Basins Mixed Salt Desert Scrub* (S065), *Colorado Plateau Mixed Bedrock Canyon and Tableland* (S010), *Inter-Mountain Basins Montane Sagebrush Steppe* (S071), *Inter-Mountain Basins Playa* (S015), and *Great Basin Pinyon-Juniper Woodland* (S040). Of these more abundant land cover types, each represents 5% or more of the state's total area, and when combined represent nearly half (~49%) of the state's area. There are nine ecological systems that represent between 1% and 5% of the state's area: *Colorado Plateau Pinyon-Juniper Shrubland* (S052), *Colorado Plateau Blackbrush-Mormon-tea Shrubland* (S059), *Inter-Mountain Basins Semi-Desert Shrub-Steppe* (S079), *Inter-Mountain Basins Greasewood Flat* (S096), *Rocky Mountain Gambel Oak-Mixed Montane Shrubland* (S046), *Rocky Mountain Aspen Forest and Woodland* (S023), *Great Basin Xeric Mixed Sagebrush Shrubland* (S055), *Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland* (S028), and *Inter-Mountain Basins Mat Saltbush Shrubland* (S045). Collectively these ecological systems comprise another quarter of the state's total area (~26%). There are forty-nine ecological systems that are only sparsely distributed throughout the state, each contributing proportions smaller than 1% to the state's total area. Several ecological systems occur near the periphery of the state's borders and are sparsely distributed within the state (e.g. *Sonora-Mojave Mixed Salt Desert Scrub* (S070), *Wyoming Basins Low Sagebrush Shrubland* (S128), *North American Warm Desert Riparian Mesquite Bosque* (S098), and *Sonora-Mojave Semi-Desert Chaparral* (S114)), or are naturally rare with very limited extents in Utah. Examples include: *Rocky Mountain Dry Tundra* (S081), *Rocky Mountain Alpine Dwarf-Shrubland* (S043), *Southern Rocky Mountain Ponderosa Pine Woodland* (S036), *Inter-Mountain Basins Juniper Savanna* (S075), and *Inter-Mountain Basins Semi-Desert Grassland* (S090).

A summary of the percent distribution of each land cover type by land steward for Utah is provided in [Appendix 5-12](#), and the percent distribution of each land cover type by GAP Management Status is reported in [Appendix 5-13](#). As an example, the U.S. Bureau of Land Management is responsible for 74% of the management of *Inter-Mountain Basins Shale Badland* (S011) ([Appendix 5-12](#)), and the majority of this land cover type falls within Status 3 lands (72.2%) ([Appendix 5-13](#)).

[Figure 5-6](#) presents an overview of the number of ecological systems by NLCD class with representation in Status 1 and 2 broken down by conservation threshold. [Table 5-6](#) presents a more detailed version of this information by identifying the representation of individual land cover types in Status 1 and 2 lands.

### ***Land cover classes with <1% of mapped distribution in Status 1 or 2:***

Approximately 14.5% (30,874 km<sup>2</sup>) of Utah lands are currently managed according to GAP Management Status 1 or 2 criteria ([Table 5-6](#)). Of those ecological systems

receiving the least amount of protection (0-<1% of distribution in Status 1 or 2) are the following: *Great Basin Semi-Desert Chaparral* (S053), *Inter-Mountain Basins Wash* (S014), *Inter-Mountain Basins Juniper Savanna* (S075), *North American Warm Desert Volcanic Rockland* (S019), *North American Warm Desert Riparian Mesquite Bosque* (S098), and *Sonora-Mojave Semi-Desert Chaparral* (S114). It should be noted however, that each of their distributions are also quite limited within the state of Utah.

***Land cover classes with 1%-<10% of mapped distribution in Status 1 or 2:***

Twenty-three ecological systems have between 1 and <10% of their distribution in Status 1 or 2. This ranking comprises the most diverse set of ecological systems, including at the lower elevations a variety of desert scrub types, dunes, washes, playas, lower elevation riparian, and sagebrush-dominated systems. At higher elevations, pure aspen forests and woodlands, aspen-mixed coniferous forests, several shrubland types of the lower montane and foothill regions, and montane-subalpine grasslands are within this threshold category of biodiversity projection.

***Land cover classes with 10%-<20% of mapped distribution in Status 1 or 2:***

There are 14 ecological systems with between 10 and <20% of their distribution within Status 1 or 2. Of those ecological systems, many are evergreen forest or woodland types occurring within montane and subalpine zones (e.g. *Southern Rocky Mountain Ponderosa Pine Woodland* (S036), *Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland* (S030), *Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland* (S032), *Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland* (S034), and *Rocky Mountain Lodgepole Pine Forest* (S031). In a slightly lower elevation range are the extensive *Great Basin Pinyon-Juniper Woodland* (S040), *IMB Mountain Mahogany Woodland & Shrubland* (S050), and *IMB Semi-desert Grassland* (S090). Additionally, there are three riparian types *Rocky Mountain Subalpine-Montane Riparian Shrubland* (S091), *Rocky Mountain Lower Montane Riparian Woodland and Shrubland* (S093), and *North American Warm Desert Lower Montane Riparian Woodland and Shrubland* (S094), plus *IMB Shale Badlands* (S011) and one mixed desert scrub type *Mojave Mid-Elevation Mixed Desert Scrub* (S060) within this ranking.

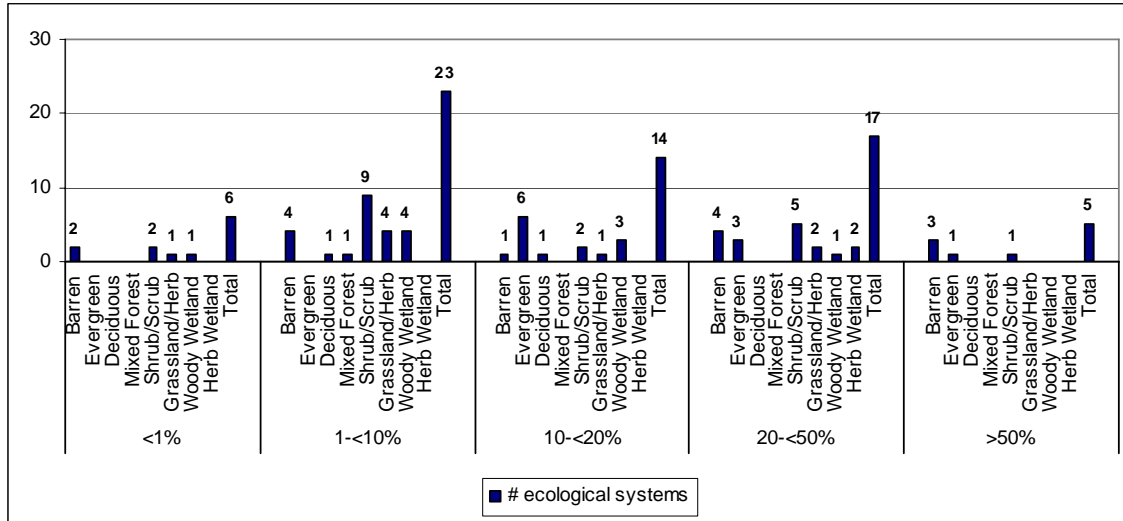
***Land cover classes with 20%-<50% of mapped distribution in Status 1 or 2:***

Seventeen ecological systems have between 20 and <50% of their total distribution within Status 1 and 2 lands in Utah. This ranking includes systems that generally occur at higher elevations such as *Rocky Mountain Alpine-Montane Wet Meadow* (S102), *Rocky Mountain Subalpine Mesic Meadow* (S083), *Rocky Mountain Dry Tundra* (S081), *Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland* (S025), and *Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland* (S028). Several of these systems are characterized by having rugged terrain such as the cliff and canyon, massive bedrock types, making them less conducive for development or agricultural endeavors. Many of these systems also tend to occur within the southern part of the state where a greater proportion of the lands have a GAP Management Status of 2 due to their inclusion within National Parks and/or National Monuments (e.g. *Colorado Plateau Pinyon-Juniper Woodland* (S039), *Colorado Plateau Pinyon-Juniper Shrubland* (S052), *Colorado Plateau Blackbrush-Mormon-tea Shrubland* (S059), *Sonora-Mojave*

*Creosotebush-White Bursage Desert Scrub (S069), North American Arid West Emergent Marsh (S100), Colorado Plateau Mixed Bedrock Canyon and Tableland (S010).*

**Land cover classes with >50% of mapped distribution in Status 1 or 2:**

There are 5 ecological systems with greater than 50% of their distribution in Status 1 and 2, all of which occur at only the highest elevations within the state: *Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland (S026), Rocky Mountain Alpine Fell-Field (S004), Rocky Mountain Alpine Bedrock and Scree (S002), Rocky Mountain Alpine Dwarf-Shrubland (S043), and North American Alpine Ice Field (S001).*



**Figure 5-6. Total number of ecological systems (Y-axis) aggregated into NLCD classes (X-axis) summarized by conservation thresholds (<1%, 1-<10%, 10-<20%, 20-<50%, and >50%) of Status 1 and 2 lands in the state of Utah.**

**Table 5-6: Percent distribution of each Land Cover type represented within Status 1 & 2 Lands, summarized by conservation thresholds of 0-<1%, 1-<10%, 10-<20%, 20-<50%, and >=50% in the state of Utah.**

| Code | Land Cover Type  | Area in UT      |                 | Area in Status 1&2 |            |             |             |          |
|------|--|-----------------|-----------------|--------------------|------------|-------------|-------------|----------|
|      |  | km <sup>2</sup> | km <sup>2</sup> | <1<br>%            | 1-<10<br>% | 10-<20<br>% | 20-<50<br>% | >50<br>% |
| S053 | Great Basin Semi-Desert Chaparral  | <1              | n/a             | 0.0                |            |             |             |          |
| S075 | Inter-Mountain Basins Juniper Savanna                                    | 9               | <1              | 0.9                |            |             |             |          |
| S014 | Inter-Mountain Basins Wash   | 1               | n/a             | 0.0                |            |             |             |          |
| S098 | North American Warm Desert Riparian Mesquite Bosque                      | 3               | <1              | 0.7                |            |             |             |          |
| S019 | North American Warm Desert Volcanic Rockland                             | 8               | n/a             | 0.0                |            |             |             |          |
| S114 | Sonora-Mojave Semi-Desert Chaparral                                      | 3               | n/a             | 0.0                |            |             |             |          |
| S056 | Colorado Plateau Mixed Low Sagebrush Shrubland                           | 1,517           | 103             |                    | 6.8        |             |             |          |
| S118 | Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland   | 283             | 27              |                    | 9.5        |             |             |          |
| S055 | Great Basin Xeric Mixed Sagebrush Shrubland                              | 3,635           | 305             |                    | 8.4        |             |             |          |
| S012 | Inter-Mountain Basins Active and Stabilized Dune                         | 1,804           | 160             |                    | 8.9        |             |             |          |
| S042 | Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland            | 1,222           | 90              |                    | 7.3        |             |             |          |
| S054 | Inter-Mountain Basins Big Sagebrush Shrubland                            | 19,935          | 1,678           |                    | 8.4        |             |             |          |
| S078 | Inter-Mountain Basins Big Sagebrush Steppe                               | 522             | 8               |                    | 1.6        |             |             |          |
| S096 | Inter-Mountain Basins Greasewood Flat                                    | 7,280           | 270             |                    | 3.7        |             |             |          |
| S045 | Inter-Mountain Basins Mat Saltbush Shrubland                             | 3,036           | 199             |                    | 6.6        |             |             |          |
| S065 | Inter-Mountain Basins Mixed Salt Desert Scrub                            | 15,499          | 901             |                    | 5.8        |             |             |          |
| S071 | Inter-Mountain Basins Montane Sagebrush Steppe                           | 14,046          | 790             |                    | 5.6        |             |             |          |
| S015 | Inter-Mountain Basins Playa  | 10,998          | 408             |                    | 3.7        |             |             |          |
| S079 | Inter-Mountain Basins Semi-Desert Shrub-Steppe                           | 8,329           | 748             |                    | 9.0        |             |             |          |
| S013 | Inter-Mountain Basins Volcanic Rock and Cinder Land                      | 316             | 7               |                    | 2.1        |             |             |          |
| S022 | North American Warm Desert Playa   | 6               | <1              |                    | 6.3        |             |             |          |
| S097 | North American Warm Desert Riparian Woodland and Shrubland               | 8               | <1              |                    | 5.9        |             |             |          |
| S020 | North American Warm Desert Wash  | 10              | 1               |                    | 8.1        |             |             |          |
| S023 | Rocky Mountain Aspen Forest and Woodland                                 | 6,334           | 359             |                    | 5.7        |             |             |          |
| S046 | Rocky Mountain Gambel Oak-Mixed Montane Shrubland                        | 6,596           | 568             |                    | 8.6        |             |             |          |
| S047 | Rocky Mountain Lower Montane-Foothill Shrubland                          | 252             | 18              |                    | 7.3        |             |             |          |
| S070 | Sonora-Mojave Mixed Salt Desert Scrub                                    | 10              | <1              |                    | 2.7        |             |             |          |
| S136 | Southern Colorado Plateau Sand Shrubland                                 | 855             | 55              |                    | 6.4        |             |             |          |
| S085 | Southern Rocky Mountain Montane-Subalpine Grassland                      | 593             | 42              |                    | 7.1        |             |             |          |
| S040 | Great Basin Pinyon-Juniper Woodland                                      | 10,986          | 1,449           |                    |            | 13.2        |             |          |
| S050 | Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland           | 626             | 100             |                    |            | 15.9        |             |          |
| S090 | Inter-Mountain Basins Semi-Desert Grassland                              | 2,011           | 294             |                    |            | 14.6        |             |          |
| S011 | Inter-Mountain Basins Shale Badland                                      | 1,827           | 235             |                    |            | 12.9        |             |          |
| S060 | Mojave Mid-Elevation Mixed Desert Scrub                                  | 826             | 88              |                    |            | 10.6        |             |          |
| S094 | North American Warm Desert Lower Montane Riparian Woodland and Shrubland | 20              | 4               |                    |            | 19.3        |             |          |
| S024 | Rocky Mountain Bigtooth Maple Ravine Woodland                            | 887             | 103             |                    |            | 11.6        |             |          |

| Code | Land Cover Type  | Area            | Area            | <1  | 1-<10 | 10-<20 | 20-<50 | >50  |
|------|--|-----------------|-----------------|-----|-------|--------|--------|------|
|      |  | in UT           | in Status 1&2   |     |       |        |        |      |
|      |  | km <sup>2</sup> | km <sup>2</sup> | %   | %     | %      | %      | %    |
| S032 | Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland | 1,710           | 316             |     |       | 18.5   |        |      |
| S031 | Rocky Mountain Lodgepole Pine Forest                               | 1,815           | 346             |     |       | 19.1   |        |      |
| S093 | Rocky Mountain Lower Montane Riparian Woodland and Shrubland       | 837             | 125             |     |       | 14.9   |        |      |
| S034 | Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland     | 1,427           | 272             |     |       | 19.1   |        |      |
| S030 | Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland      | 1,273           | 216             |     |       | 17.0   |        |      |
| S091 | Rocky Mountain Subalpine-Montane Riparian Shrubland                | 298             | 35              |     |       | 11.7   |        |      |
| S036 | Southern Rocky Mountain Ponderosa Pine Woodland                    | 2,019           | 221             |     |       | 10.9   |        |      |
| S059 | Colorado Plateau Blackbrush-Mormon-tea Shrubland                   | 9,021           | 2,042           |     |       |        | 22.6   |      |
| S010 | Colorado Plateau Mixed Bedrock Canyon and Tableland                | 14,164          | 5,476           |     |       |        | 38.7   |      |
| S052 | Colorado Plateau Pinyon-Juniper Shrubland                          | 9,414           | 3,607           |     |       |        | 38.3   |      |
| S039 | Colorado Plateau Pinyon-Juniper Woodland                           | 22,356          | 5,530           |     |       |        | 24.7   |      |
| S009 | Inter-Mountain Basins Cliff and Canyon                             | 382             | 117             |     |       |        | 30.6   |      |
| S057 | Mogollon Chaparral   | 583             | 187             |     |       |        | 32.1   |      |
| S100 | North American Arid West Emergent Marsh                            | 409             | 146             |     |       |        | 35.7   |      |
| S016 | North American Warm Desert Bedrock Cliff and Outcrop               | 127             | 51              |     |       |        | 39.9   |      |
| S102 | Rocky Mountain Alpine-Montane Wet Meadow                           | 472             | 118             |     |       |        | 25.1   |      |
| S006 | Rocky Mountain Cliff, Canyon and Massive Bedrock                   | 1,466           | 395             |     |       |        | 27.0   |      |
| S081 | Rocky Mountain Dry Tundra  | 293             | 105             |     |       |        | 35.8   |      |
| S028 | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland  | 3,224           | 867             |     |       |        | 26.9   |      |
| S083 | Rocky Mountain Subalpine Mesic Meadow                              | 499             | 101             |     |       |        | 20.2   |      |
| S025 | Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland  | 39              | 14              |     |       |        | 35.1   |      |
| S092 | Rocky Mountain Subalpine-Montane Riparian Woodland                 | 4               | 1               |     |       |        | 28.6   |      |
| S069 | Sonora-Mojave Creosotebush-White Bursage Desert Scrub              | 808             | 222             |     |       |        | 27.4   |      |
| S128 | Wyoming Basins Low Sagebrush Shrubland                             | 4               | 1               |     |       |        | 34.0   |      |
| S026 | Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland   | 32              | 21              |     |       |        |        | 65.4 |
| S001 | North American Alpine Ice Field                                    | 21              | 20              |     |       |        |        | 94.2 |
| S002 | Rocky Mountain Alpine Bedrock and Scree                            | 813             | 556             |     |       |        |        | 68.4 |
| S043 | Rocky Mountain Alpine Dwarf-Shrubland                              | 109             | 88              |     |       |        |        | 80.3 |
| S004 | Rocky Mountain Alpine Fell-Field                                   | 177             | 120             |     |       |        |        | 67.8 |
| N80  | Agriculture  | 9,183           | 42              | 0.5 |       |        |        |      |
| N31  | Barren Lands, Non-specific   | 42              | <1              | 0.1 |       |        |        |      |
| N22  | Developed, Medium - High Intensity                                 | 1,098           | 9               | 0.9 |       |        |        |      |
| N21  | Developed, Open Space - Low Intensity                              | 1,978           | 9               | 0.5 |       |        |        |      |
| D02  | Recently Burned  | 172             | <1              | 0.2 |       |        |        |      |
| D10  | Recently Logged Areas  | 287             | 2               | 0.8 |       |        |        |      |
| D01  | Disturbed, Non-specific  | 90              | 5               |     | 5.3   |        |        |      |
| D14  | Disturbed, Oil Well  | 46              | 1               |     | 1.8   |        |        |      |

| Code | Land Cover Type                                    | Area in UT      |                 | Area in Status 1&2 |            |             |             |          |
|------|--|-----------------|-----------------|--------------------|------------|-------------|-------------|----------|
|      |  | km <sup>2</sup> | km <sup>2</sup> | <1<br>%            | 1-<10<br>% | 10-<20<br>% | 20-<50<br>% | >50<br>% |
| D09  | Invasive Annual and Biennial Forbland              | 695             | 25              |                    | 3.7        |             |             |          |
| D08  | Invasive Annual Grassland                          | 3,231           | 134             |                    | 4.1        |             |             |          |
| D06  | Invasive Perennial Grassland                       | 526             | 22              |                    | 4.1        |             |             |          |
| D03  | Recently Mined or Quarried                         | 171             | 2               |                    | 1.1        |             |             |          |
| D11  | Recently Chained Pinyon-Juniper Areas              | 458             | 49              |                    |            | 10.7        |             |          |
| D04  | Invasive Southwest Riparian Woodland and Shrubland | 450             | 122             |                    |            |             | 27.2        |          |

## Predicted Animal Habitat Distributions - Regional Analysis

A summary table is not provided due to the large number of species analyzed, but some generalizations and examples of species results by the various thresholds are provided below. The complete Predicted Animal Habitat Distribution Analyses Table, found in [Appendix 5-14](#), provides the area in square kilometers (km<sup>2</sup>) of the species' mapped habitat distribution by management status and land steward, and the percent of the species' habitat total distribution in each management category. For example, Gunnison sage-grouse (*Centrocercus minimus*) has 12,526.1 km<sup>2</sup> of predicted habitat within the region and 1,212.5 km<sup>2</sup> (10%) of that area is within Status 1 and 2 lands.

There are 25 species within the region with less than 1% of their habitat on Status 1 and 2 lands. Of these 25 species, 1 is an amphibian, 18 are birds, 2 are mammals and 4 are reptiles. The amphibian, lowland burrowing treefrog (*Pterohyla fodiens*), did not have any predicted habitat on Status 1 or 2 lands. Only 2.1 km<sup>2</sup> of habitat was mapped and 1.8 km<sup>2</sup> was on status 3 lands.

Of the 19 birds, the Neotropic cormorant (*Phalacrocorax brasilianus*) and lesser prairie-chicken (*Tympanuchus pallidicinctus*) had no mapped habitat on Status 1 lands and no mapped habitat for Neotropic cormorant on Status 2 lands. Only 7 km<sup>2</sup> of habitat were mapped for the bronzed cowbird (*Molothrus aeneus*) within Status 1 and 2 lands and 49 km<sup>2</sup> for the inca dove (*Columbina inca*). Two species of mammals included the Plains pocket gopher (*Geomys bursarius*) and the swift fox (*Vulpes velox*). Only 55 km<sup>2</sup> of habitat were identified on Status 1 lands for Plains pocket gopher. Of the 4 reptiles, smooth softshell turtle (*Apalone mutica*) and Colorado Desert fringe-toed lizard (*Uma notata*) had no habitat mapped on status 1 and 2 lands. The Sand dune lizard (*Sceloporus arenicolus*) had less than 1 km<sup>2</sup> of habitat mapped on Status 1 and 2 lands. Only 1,104 km<sup>2</sup> of habitat for Plains garter snake (*Thamnophis radix*) was mapped on status 1 and 2 lands.

The majority of all taxonomic groups occur with less than 20% of the predicted habitat on Status 1 and 2 lands. There are 288 species with predicted habitat 1-<10% on Status 1 and 2 lands and 385 species that have habitat between 10 and <20% on Status 1 and 2 lands. For amphibians 33 of 37 species fall within this threshold. Of the four species that have 20-<50% of their habitat within Status 1 and 2 lands, three are endemics with little predicted habitat including the Green Frog (*Rana clamitans*), Mountain yellow-legged frog (*Rana muscosa*), and Relict leopard frog (*Rana onca*). For the fourth species, Sonoran green toad (*Bufo retiformis*), habitat is found throughout southern Arizona. For birds, 54 of the 433 species modeled occur with 20% or greater predicted habitat on Status 1 and 2 lands. These figures include habitats for the entire life history of the species and are not limited to breeding habitat. There are 144 bird species with predicted habitat 1-<10% on Status 1 and 2 lands and 219 birds species with 10-<20%. There are 28 mammals that have 20% or greater of their predicted habitat on Status 1 and 2 lands. There are 78 mammal species with predicted habitat 1-<10% on Status 1 and 2 lands and 107 mammals species with 10-<20%. For reptiles, there are 33 that have 20% or greater



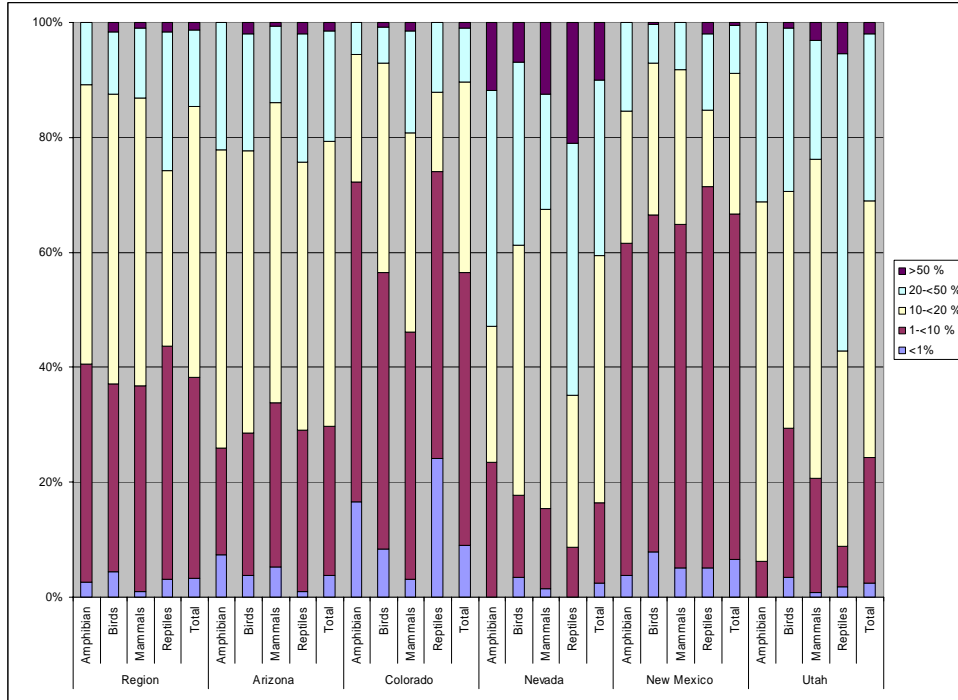
of their predicted habitat on Status 1 and 2 lands. There are 52 reptile species with predicted habitat 1-<10% on Status 1 and 2 lands and 41 reptile species with 10-<20%.

**Table 5-7. Number of species by Gap Status thresholds for each taxa group within region/state as mapped by the Southwestern Regional Gap Analysis Project.**

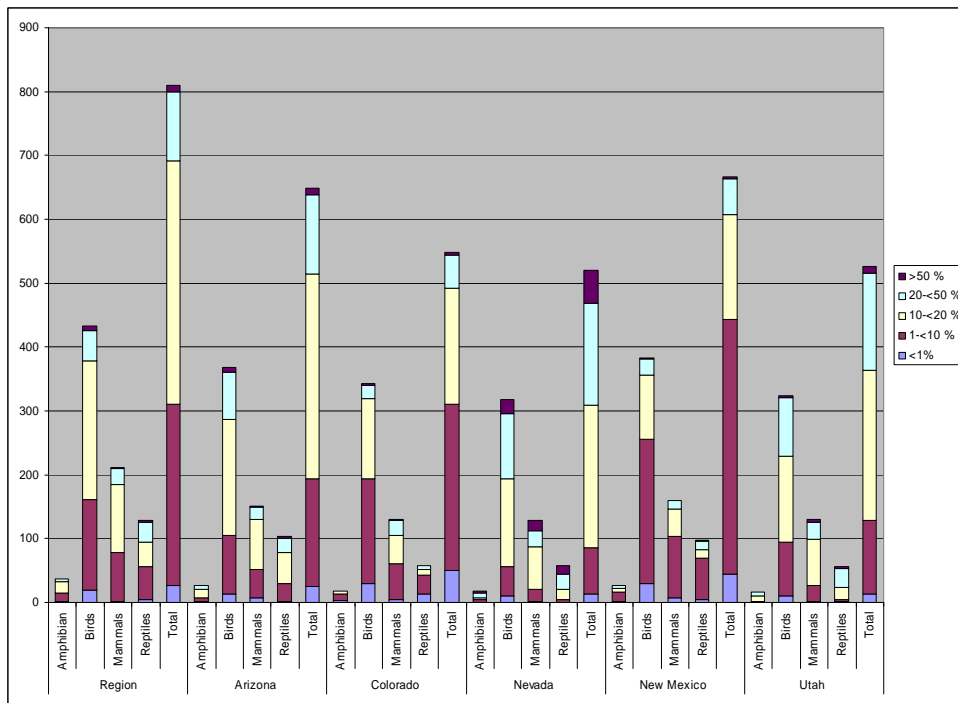
| State             | Taxon     | <1% | 1-<10 % | 10-<20 % | 20-<50 % | >50 % |
|-------------------|-----------|-----|---------|----------|----------|-------|
| <b>Region</b>     | Amphibian | 1   | 14      | 18       | 4        | 0     |
|                   | Birds     | 18  | 144     | 219      | 47       | 7     |
|                   | Mammals   | 2   | 78      | 107      | 26       | 2     |
|                   | Reptiles  | 4   | 52      | 41       | 31       | 2     |
|                   | Total     | 25  | 288     | 385      | 108      | 11    |
| <b>Arizona</b>    | Amphibian | 2   | 5       | 14       | 6        | 0     |
|                   | Birds     | 15  | 91      | 181      | 76       | 7     |
|                   | Mammals   | 8   | 45      | 80       | 20       | 1     |
|                   | Reptiles  | 1   | 31      | 48       | 23       | 2     |
|                   | Total     | 26  | 172     | 323      | 125      | 10    |
| <b>Colorado</b>   | Amphibian | 3   | 10      | 4        | 1        | 0     |
|                   | Birds     | 27  | 167     | 127      | 23       | 3     |
|                   | Mammals   | 3   | 60      | 45       | 23       | 2     |
|                   | Reptiles  | 13  | 31      | 9        | 7        | 0     |
|                   | Total     | 46  | 268     | 185      | 54       | 5     |
| <b>Nevada</b>     | Amphibian | 0   | 4       | 4        | 7        | 2     |
|                   | Birds     | 12  | 45      | 138      | 102      | 22    |
|                   | Mammals   | 2   | 17      | 69       | 27       | 16    |
|                   | Reptiles  | 0   | 5       | 15       | 25       | 12    |
|                   | Total     | 14  | 71      | 226      | 161      | 52    |
| <b>New Mexico</b> | Amphibian | 1   | 15      | 6        | 4        | 0     |
|                   | Birds     | 28  | 227     | 103      | 26       | 1     |
|                   | Mammals   | 8   | 98      | 43       | 13       | 0     |
|                   | Reptiles  | 6   | 67      | 13       | 13       | 2     |
|                   | Total     | 43  | 407     | 165      | 56       | 3     |
| <b>Utah</b>       | Amphibian | 0   | 1       | 10       | 5        | 0     |
|                   | Birds     | 11  | 85      | 135      | 92       | 3     |
|                   | Mammals   | 1   | 26      | 74       | 28       | 4     |
|                   | Reptiles  | 1   | 4       | 19       | 29       | 3     |
|                   | Total     | 13  | 116     | 238      | 154      | 10    |

Analysis of relative percentage (Figure 5-7) reveals trends regarding both the status of species within each state and the region. This figure provides the relative percent of taxon by region and by state within the five threshold categories. Colorado and New Mexico have a higher percentage of species within the 1-<10% threshold than do Arizona, Nevada, and Utah. Regionally <40% of species occur within Status 1 and 2 lands. Few species in each state and the region occur with >50% of the habitat in Status 1 and Status 2 lands. However, Nevada has a higher percentage within this category than the other four states.

Cumulative numbers by taxon by state or region (Figure 5-8) provide between and within state comparisons. As expected, protection levels vary by state and taxon. Though New Mexico and Arizona have similar total species counts, more species are in Status 1 and 2 lands in Arizona. New Mexico has more species within the thresholds of <1% and 1-<10% than Arizona. Differences manifest themselves in the 1-<10% threshold in New Mexico (407 species) and the 10-<20% threshold in Arizona. A similar pattern is observed between Colorado and Nevada. Twice as many species are in 1-<10% threshold in Colorado and Nevada has more species in the 10-<20% threshold. These differences may be more pronounced because of the discrete thresholds used for analysis.



**Figure 5-7. Percentage of species by taxon (amphibian, bird, mammal, reptile) occurring on GAP Status 1 and 2 lands within the 5 threshold categories (<1, 1-10, 10-20, 20-50, >50) for animals modeled within the Southwest Regional Gap Analysis Project.**



**Figure 5-8. Total number of species by taxon by state or region on GAP Status 1 and 2 lands for the 5 threshold categories (<1, 1-10, 10-20, 20-50, >50) for animal habitats modeled within the Southwest Regional Gap Analysis Project.**

**Table 5-8. Animal species with 0-<1% of predicted habitat distribution in GAP Management Status 1 or 2 for Region as mapped by the Southwest Regional Gap Analysis Project.**

| Taxon     | SWReGAP Common Name                | SWReGAP Scientific Name           |                         |
|-----------|------------------------------------|-----------------------------------|-------------------------|
| Amphibian | LOWLAND BURROWING TREEFROG         | <i>Pternohyla fodiens</i>         |                         |
| Bird      | UPLAND SANDPIPER                   | <i>Bartramia longicauda</i>       |                         |
|           | CHIMNEY SWIFT                      | <i>Chaetura pelagica</i>          |                         |
|           | INCA DOVE                          | <i>Columbina inca</i>             |                         |
|           | BLUE JAY                           | <i>Cyanocitta cristata</i>        |                         |
|           | GYRFALCON                          | <i>Falco rusticolus</i>           |                         |
|           | WHOOPIING CRANE                    | <i>Grus americana</i>             |                         |
|           | RED-BELLIED WOODPECKER             | <i>Melanerpes carolinus</i>       |                         |
|           | RED-HEADED WOODPECKER              | <i>Melanerpes erythrocephalus</i> |                         |
|           | BRONZED COWBIRD                    | <i>Molothrus aeneus</i>           |                         |
|           | GREAT CRESTED FLYCATCHER           | <i>Myiarchus crinitus</i>         |                         |
|           | EASTERN SCREECH-OWL                | <i>Otus asio</i>                  |                         |
|           | HOUSE SPARROW                      | <i>Passer domesticus</i>          |                         |
|           | NEOTROPIC CORMORANT                | <i>Phalacrocorax brasilianus</i>  |                         |
|           | DICKCISSEL                         | <i>Spiza americana</i>            |                         |
|           | BROWN THRASHER                     | <i>Toxostoma rufum</i>            |                         |
|           | LESSER PRAIRIE-CHICKEN             | <i>Tympanuchus pallidicinctus</i> |                         |
|           | SCISSOR-TAILED FLYCATCHER          | <i>Tyrannus forficatus</i>        |                         |
|           | TENNESSEE WARBLER                  | <i>Vermivora peregrina</i>        |                         |
|           | Mammal                             | PLAINS POCKET GOPHER              | <i>Geomys bursarius</i> |
|           |                                    | SWIFT FOX                         | <i>Vulpes velox</i>     |
| Reptile   | SMOOTH SOFTSHELL TURTLE            | <i>Apalone mutica</i>             |                         |
|           | SAND DUNE LIZARD                   | <i>Sceloporus arenicolus</i>      |                         |
|           | PLAINS GARTER SNAKE                | <i>Thamnophis radix</i>           |                         |
|           | COLORADO DESERT FRINGE-TOED LIZARD | <i>Uma notata</i>                 |                         |

***Species with <1% of predicted distribution in Status 1 or 2:***

There are 25 species (3% of those modeled) that have less than 1% of their habitat on Status 1 and 2 lands (Table 5-8). There are 18 birds species (41%), 4 reptiles (3%), 2 mammals (1%) and 1 amphibian (3%). Several of these species, such as the lesser prairie-chicken, are already the subject of conservation planning.

***Species with 1-<10% of predicted distribution in Status 1 or 2:***

There are 288 species (35% of modeled species) with predicted habitat of between 1 and less than 10% on status 1 and 2 lands within the entire region. This includes 14 amphibian species (38%), 144 bird species (33%), 78 mammal species (35%), and 52 reptile species (40%).

***Species with 10-<20% of predicted distribution in Status 1 or 2:***

385 species (47% of modeled species) have 10-<20% of their predicted habitat on status 1 and 2 lands within the entire region. This includes 18 amphibian species (49%), 219 bird species (50%), 107 mammals (49%), and 41 reptiles (30%).

***Species with 20 -<50% of predicted distribution in Status 1 or 2:***

Within the SWReGAP region, there are 108 species (13 % of those modeled) with predicted habitat occurring on status 1 and 2 lands 20-<50% of the entire distribution of habitat. These 108 species include 4 amphibian species (11%), 47 bird species (11%), 26 mammal species (12%), and 31 reptile species (24%).

***Species with at least 50% representation in GAP Status 1 and 2:***

There are 11 species (1% of those modeled) with predicted habitat occurring on status 1 and 2 lands greater than 50%. These species include 7 birds (2%), 2 mammals (1%), and 2 reptiles (1%). Birds include Clapper rail, dunlin, black tern, sedge wren, tricolored blackbird, brown-capped rosy-finch, and Mexican chickadee. Mammals include Palmer's chipmunk and mountain goat. Reptiles include Sonoran shovel-nosed snake and ridge-nosed rattlesnake.

Comparison of protection by region compared to state, using threshold numbers to define the five representative groups, is another useful way to examine differences between species protection (Table 5-9). The thresholds were defined as:

| <u>Threshold</u> | <u>Description</u>   |
|------------------|--|
| 1                | Species with <1% of predicted distribution in Status 1 or 2      |
| 2                | Species with 1-<10% of predicted distribution in Status 1 or 2   |
| 3                | Species with 10-<20% of predicted distribution in Status 1 or 2  |
| 4                | Species with 20 -<50% of predicted distribution in Status 1 or 2 |
| 5                | Species with at least 50% representation in GAP Status 1 and 2   |

In many cases the majority of species are equally well protected on the state level compared to the regional. There are differences, however, best illustrated where there is a difference of 10 or more species between state and regional protection numbers.

In Arizona, there are 4 differences (greater than 10 species) between regional protection and state protection. There are 53 species within Threshold 3 for Arizona, but within Threshold 2 for the region. There are also 52 species in Threshold 4 for Arizona, but within Threshold 3 for the region. These two groups have more predicted habitat by percentage on Status 1 and 2 lands within Arizona than the region. There are two groups with more predicted habitat by percentage on Status 1 and 2 lands within the entire region than in Arizona. This includes 36 species within Threshold 2 for Arizona, but within threshold 3 for the region. There are 14 species within Threshold 4 for the region, but within Threshold 3 for Arizona.

In Colorado, there are 4 differences. There are 27 species in Threshold 4 within Colorado, but regionally within Threshold 3. This group has more predicted habitat by percentage on Status 1 and 2 lands within Colorado than the region. There are 3 groups that have more predicted habitat by percentage on Status 1 and 2 lands in the region than in Colorado. There are 30 species in Threshold 1 in Colorado, but in Threshold 2 in the region; there are 89 species in Threshold 2 in Colorado but in Threshold 3 in the region. There are 13 species in Threshold 3 within Colorado and in Threshold 4 in the region.

In New Mexico, five groups comprise the major differences. There are 2 groups with more predicted habitat by percentage on Status 1 and 2 lands within the state than within the region. There are 17 species in Threshold 3 for the state and Threshold 2 for the region and 24 species in Threshold 4 for the state and Threshold 3 for the region. There are 3 groups with more predicted habitat by percentage on Status 1 and 2 lands within the region than the state. These include 179 species within Threshold 3 in the region and within Threshold 2 in New Mexico. There are 18 species within Threshold 1 in New Mexico and in Threshold 2 within the region and 19 species within Threshold 3 in New Mexico and Threshold 4 in the region. There are an additional 17 species within Threshold 2 in New Mexico, but within the region they are in Threshold 4.

In Nevada, there are 6 groups of species with a difference between the state and the region. Five of these groups have more predicted habitat by percentage on Status 1 and 2 lands within the state than within the region. There are 104 species within Threshold 4 of Nevada, but in Threshold 3 for the region. There are 51 species in Threshold 3 in Nevada, but in Threshold 2 in the region. 25 species are in Threshold 5 within Nevada, but Threshold 3 within the region. There are 12 species within Threshold 4 within Nevada, but in Threshold 2 for the region. There are 19 species within Threshold 5 in Nevada and within Threshold 4 in the region. There is one group with more predicted habitat by percentage on Status 1 and 2 lands within the region than the state. This group has 13 species in Threshold 2 in Nevada and Threshold 3 regionwide.

In Utah there are five differences between the state and the region. There are three groups with more predicted habitat by percentage on Status 1 and 2 lands within the state than within the region. There are 88 species within Threshold 4 in Utah, but in threshold 3 for the region. There are 16 species in Threshold 4 and 36 species in Threshold 3, but are in Threshold 2 for the region. There are two groups with more predicted habitat by percentage on Status 1 and 2 lands within the region than the state. There are 21 species in Threshold 2 for the state, but in Threshold 3 for the region. There are 15 species that are in Threshold 3 for the state, but Threshold 4 for the region.

Some of the identified differences within this comparison are likely due to using an absolute threshold value that may create more of a distinction in management than actually exists (for example, 9% vs. 12%). Each species should be reviewed individually where management decisions are to be made. Many species more protected in states than the region may be on the edges of the species range. This is particularly true for species in Nevada that are considered Sierra Nevada or California species or Great Plains species in Colorado or New Mexico.

**Table 5-9. Number of Terrestrial Vertebrate Species by threshold category for each state by threshold category for the region.**

| State | Threshold Categories | Region |     |     |    |   | Total Species |
|-------|----------------------|--------|-----|-----|----|---|---------------|
|       |                      | 1      | 2   | 3   | 4  | 5 |               |
| AZ    | 1                    | 6      | 9   | 8   | 2  |   | 25            |
| AZ    | 2                    | 1      | 125 | 36  | 5  |   | 167           |
| AZ    | 3                    |        | 53  | 255 | 14 |   | 322           |
| AZ    | 4                    |        | 6   | 52  | 67 |   | 125           |
| AZ    | 5                    |        | 3   | 1   | 1  | 5 | 10            |
| CO    | 1                    | 12     | 30  | 3   |    | 1 | 46            |
| CO    | 2                    | 6      | 164 | 89  | 3  |   | 262           |
| CO    | 3                    |        | 9   | 162 | 13 |   | 184           |
| CO    | 4                    |        | 5   | 27  | 20 |   | 52            |
| CO    | 5                    |        |     |     | 2  | 3 | 5             |
| NM    | 1                    | 17     | 18  | 4   | 2  | 1 | 42            |
| NM    | 2                    | 4      | 201 | 179 | 17 |   | 401           |
| NM    | 3                    |        | 17  | 127 | 19 | 1 | 164           |
| NM    | 4                    |        | 1   | 24  | 31 |   | 56            |
| NM    | 5                    |        | 1   |     |    | 2 | 3             |
| NV    | 1                    | 2      | 9   | 2   |    |   | 13            |
| NV    | 2                    | 1      | 53  | 13  | 3  |   | 70            |
| NV    | 3                    |        | 51  | 164 | 8  |   | 223           |
| NV    | 4                    |        | 12  | 104 | 44 | 2 | 162           |
| NV    | 5                    |        | 5   | 25  | 19 | 3 | 52            |
| UT    | 1                    | 2      | 5   | 5   | 1  |   | 13            |
| UT    | 2                    | 2      | 89  | 21  | 1  |   | 113           |
| UT    | 3                    |        | 36  | 186 | 15 |   | 237           |
| UT    | 4                    | 2      | 16  | 88  | 47 |   | 153           |
| UT    | 5                    |        | 1   | 2   | 4  | 3 | 10            |

### Analysis of State Endemics

Only two endemic species were modeled for New Mexico (Jemez Mountain Salamander and Sacramento Mountain Salamander) and one endemic species was modeled in Utah (Utah Prairie dog).

## Predicted Animal Habitat Distributions – State-based Analyses

### Arizona

We mapped 649 species within Arizona. This includes 27 amphibians (73% of amphibians modeled for region), 368 birds (84% of birds modeled for region), 151 mammals (70% of mammals modeled for region), and 103 reptiles (79% of reptiles modeled for region).

The Arizona Game and Fish Department (AGFD) identified species of conservation priority in the Arizona Comprehensive Wildlife Conservation Strategy (CWCS) (AGFD 2005a). Four categories defined in Companion Document B (AGFD 2005b) were used to evaluate a species' status: Vulnerable Species, Responsibility Species, Focal Species and/or Economic Species. Five hundred sixty nine vertebrate species are considered to be "priority," that is, classified by one or more of the four evaluation categories under the AGFD CWCS evaluation. Of these, 113 species (19.9%) have less than 10% habitat in Status 1 and 2 lands. Two hundred eighty four vertebrate species are identified as vulnerable and 62 species (21.8%) have less than 10% habitat in Status 1 and 2 lands.

#### ***Species with <1% of predicted distribution in Status 1 or 2:***

Twenty-six species (4% of all mapped species) have less than 1% of their habitat on Status 1 and 2 lands within the state of Arizona ([Table 5-10](#)). This includes 2 amphibians, 15 birds, 8 mammals, and 1 reptile. Fifteen species have less than 100 km<sup>2</sup> of habitat mapped within Arizona and 4 other species have less than 1000 km<sup>2</sup> within the state. Seven of these species were considered conservation priorities by the ADGF. Red-Eyed Vireo, American Pipit, and Thirteen-lined Ground Squirrel were identified as Vulnerable and Focal. The Pine Grosbeak was identified as Vulnerable and Economic. Calliope Hummingbird and Bronzed Cowbird were identified as Focal and Economic. The Eastern Phoebe was identified as Focal. The Bronzed Cowbird is a brood parasite and is expanding its range; this species provides an example where low representation on Status 1 and 2 lands is not necessarily a problem.

#### ***Species with 1-<10% of predicted distribution in Status 1 or 2:***

There are 172 species with 1-<10% predicted habitat within status 1 and 2 lands within the state of Arizona ([Appendix 5-15](#)). These species include 5 amphibians, 91 birds, 45 mammals, and 31 reptiles. Eight species have less than 100 km<sup>2</sup> of habitat within the state and 14 with between 100 to 1000 km<sup>2</sup> of habitat. Sixty (35%) of these species are identified as vulnerable in the Arizona CWCS.

#### ***Species with 10-<20% of predicted distribution in Status 1 or 2:***

There are 323 species with 10-<20% of their predicted habitat within Status 1 and 2 lands within Arizona ([Appendix 5-15](#)). This includes 14 amphibians, 181 birds, 80 mammals, and 48 reptiles. Seven species have less than 100 km<sup>2</sup> of habitat within the state and 16 have between 100 and 1000 km<sup>2</sup> of habitat.



**Table 5-10. Animal species with 0-<1% of predicted habitat distribution in GAP Management Status 1 or 2 for Arizona as mapped by the Southwest Regional Gap Analysis Project.**

| Taxon                 | SWReGAP Common Name                | SWReGAP Scientific Name              |
|-----------------------|------------------------------------|--------------------------------------|
| Amphibian             | BOREAL CHORUS FROG                 | <i>Pseudacris maculata</i>           |
|                       | LOWLAND BURROWING TREEFROG         | <i>Pternohyla fodiens</i>            |
| Birds                 | AMERICAN PIPIT                     | <i>Anthus rubescens</i>              |
|                       | BOHEMIAN WAXWING                   | <i>Bombycilla garrulus</i>           |
|                       | CALIFORNIA QUAIL                   | <i>Callipepla californica</i>        |
|                       | GRAY-CHEEKED THRUSH                | <i>Catharus minimus</i>              |
|                       | INCA DOVE                          | <i>Columbina inca</i>                |
|                       | PALM WARBLER                       | <i>Dendroica palmarum</i>            |
|                       | BRONZED COWBIRD                    | <i>Molothrus aeneus</i>              |
|                       | HOUSE SPARROW                      | <i>Passer domesticus</i>             |
|                       | RING-NECKED PHEASANT               | <i>Phasianus colchicus</i>           |
|                       | PINE GROSBEAK                      | <i>Pinicola enucleator</i>           |
|                       | BLACK-CAPPED CHICKADEE             | <i>Poecile atricapilla</i>           |
|                       | EASTERN PHOEBE                     | <i>Sayornis phoebe</i>               |
|                       | DICKCISSEL                         | <i>Spiza americana</i>               |
|                       | CALLIOPE HUMMINGBIRD               | <i>Stellula calliope</i>             |
| RED-EYED VIREO        | <i>Vireo olivaceus</i>             |                                      |
| Mammals               | BARBARY SHEEP                      | <i>Ammotragus lervia</i>             |
|                       | NORTHERN FLYING SQUIRREL           | <i>Glaucomys sabrinus</i>            |
|                       | MEADOW VOLE                        | <i>Microtus pennsylvanicus</i>       |
|                       | MINK                               | <i>Mustela vison</i>                 |
|                       | AMERICAN PIKA                      | <i>Ochotona princeps</i>             |
|                       | HEATHER VOLE                       | <i>Phenacomys intermedius</i>        |
|                       | THIRTEEN-LINED GROUND SQUIRREL     | <i>Spermophilus tridecemlineatus</i> |
| WESTERN JUMPING MOUSE | <i>Zapus princeps</i>              |                                      |
| Reptiles              | COLORADO DESERT FRINGE-TOED LIZARD | <i>Uma notata</i>                    |

***Species with 20 -<50% of predicted distribution in Status 1 or 2:***

Within Arizona, there are 125 species with 20-<50% of their predicted habitat occurring within Status 1 and 2 lands ([Appendix 5-15](#)). This includes 6 amphibians, 76 birds, 20 mammals, and 23 reptiles. Twenty-one species have less than 100 km<sup>2</sup> of habitat within the state and 42 between 100 and 1000 km<sup>2</sup> of habitat.

***Species with at least 50% representation in GAP Status 1 and 2:***

There are 10 species with predicted habitat occurring within Status 1 and 2 lands greater than 50% ([Appendix 5-15](#)). These species include 7 birds, 1 mammal, and 2 reptiles. Eight species have less than 100 km<sup>2</sup> of habitat within the state and one has between 100 and 1000 km<sup>2</sup> of habitat. Only the Sonoran Shovel-nosed Snake is mapped with greater than 1000 km<sup>2</sup> of habitat in Arizona.

## Colorado

We mapped 549 species within Colorado. This includes 18 amphibians (49% of amphibians modeled for region), 343 birds (78% of birds modeled for region), 130 mammals (60% of mammals modeled for region), and 58 reptiles (45% of reptiles modeled for region).

### ***Species with <1% of predicted distribution in Status 1 or 2:***

There are 46 species that have less than 1% of their habitat on Status 1 and 2 lands within the state of Colorado ([Table 5-11](#)). This includes 2 amphibians, 27 birds, 3 mammals, and 13 reptiles. Of the 46, 9 have been identified as Species of Greatest Conservation Need in Colorado (CDOW 2005).

### ***Species with 1-<10% of predicted distribution in Status 1 or 2:***

There are 268 species with 1-<10% predicted habitat within Status 1 and 2 lands within the state of Colorado. This includes 10 amphibians, 167 birds, 60 mammals, and 31 reptiles. Of the 268, 63 have been identified as Species of Greatest Conservation Need in Colorado (CDOW 2005). Representative species include northern cricket frog, plains leopard frog, sandhill crane, scaled quail, greater sage-grouse, northern bobwhite, greater prairie-chicken, lesser prairie-chicken, Columbian sharp-tailed grouse, Plains sharp-tailed grouse, sage sparrow, loggerhead shrike, golden eagle, ferruginous hawk, bald eagle, snowy plover, mountain plover, least tern, Forster's tern, northern pintail, red-headed woodpecker, Lewis's woodpecker, fringed Myotis, black-footed ferret, white-tailed prairie dog, black-tailed prairie dog, Botta's pocket gopher, northern pocket gopher, triploid checkered whiptail, and Texas horned lizard

### ***Species with 10-<20% of predicted distribution in Status 1 or 2:***

There are 185 species with 10-<20% of their predicted habitat within Status 1 and 2 lands in Colorado. This includes 4 amphibians, 127 birds, 45 mammals, and 9 reptiles. Of the 183, 49 have been identified as Species of Greatest Conservation Need in Colorado (CDOW 2005). Representative species include northern leopard frog, wood frog, northern goshawk, western grebe, black-chinned hummingbird, Gunnison sage-grouse, yellow-billed cuckoo, band-tailed pigeon, olive-sided flycatcher, black swift, Grace's warbler, willow flycatcher, peregrine falcon, black rosy-finch, flammulated owl, osprey, purple martin, broad-tailed hummingbird, rufous hummingbird, pygmy nuthatch, red-naped sapsucker, spotted owl, Townsend's big-eared bat, Gunnison's prairie dog, spotted bat, Arizona Myotis, olive-backed pocket mouse, and dwarf shrew.

**Table 5-11. Animal species with 0-<1% of predicted habitat distribution in GAP Status 1 or 2 for Colorado as mapped by the Southwest Regional Gap Analysis Project.**

| Taxon             | SWReGAP Common Name             | SWReGAP Scientific Name         |
|-------------------|---------------------------------|---------------------------------|
| Amphibian         | GREEN TOAD                      | <i>Bufo debilis</i>             |
|                   | COUCH'S SPADEFOOT               | <i>Scaphiopus couchii</i>       |
| Bird              | PLAINS SPADEFOOT                | <i>Spea bombifrons</i>          |
|                   | WOOD DUCK                       | <i>Aix sponsa</i>               |
|                   | SPRAGUE'S PIPIT                 | <i>Anthus spragueii</i>         |
|                   | UPLAND SANDPIPER                | <i>Bartramia longicauda</i>     |
|                   | CHIMNEY SWIFT                   | <i>Chaetura pelagica</i>        |
|                   | ROSS'S GOOSE                    | <i>Chen rossii</i>              |
|                   | SEDGE WREN                      | <i>Cistothorus platensis</i>    |
|                   | BLUE JAY                        | <i>Cyanocitta cristata</i>      |
|                   | GYRFALCON                       | <i>Falco rusticolus</i>         |
|                   | WHOOPING CRANE                  | <i>Grus americana</i>           |
|                   | BLUE GROSBEAK                   | <i>Guiraca caerulea</i>         |
|                   | FRANKLIN'S GULL                 | <i>Larus pipixcan</i>           |
|                   | THAYER'S GULL                   | <i>Larus thayeri</i>            |
|                   | RED-BELLIED WOODPECKER          | <i>Melanerpes carolinus</i>     |
|                   | GREAT CRESTED FLYCATCHER        | <i>Myiarchus crinitus</i>       |
|                   | WHIMBREL                        | <i>Numenius phaeopus</i>        |
|                   | EASTERN SCREECH-OWL             | <i>Otus asio</i>                |
|                   | HOUSE SPARROW                   | <i>Passer domesticus</i>        |
|                   | RING-NECKED PHEASANT            | <i>Phasianus colchicus</i>      |
|                   | GREAT-TAILED GRACKLE            | <i>Quiscalus mexicanus</i>      |
|                   | COMMON GRACKLE                  | <i>Quiscalus quiscula</i>       |
|                   | EASTERN BLUEBIRD                | <i>Sialia sialis</i>            |
|                   | FIELD SPARROW                   | <i>Spizella pusilla</i>         |
|                   | EASTERN MEADOWLARK              | <i>Sturnella magna</i>          |
|                   | CURVE-BILLED THRASHER           | <i>Toxostoma curvirostre</i>    |
|                   | BROWN THRASHER                  | <i>Toxostoma rufum</i>          |
|                   | SCISSOR-TAILED FLYCATCHER       | <i>Tyrannus forficatus</i>      |
| TENNESSEE WARBLER | <i>Vermivora peregrina</i>      |                                 |
| Mammal            | SOUTHERN PLAINS WOODRAT         | <i>Neotoma micropus</i>         |
|                   | HISPID COTTON RAT               | <i>Sigmodon hispidus</i>        |
|                   | PREBLE'S SHREW                  | <i>Sorex preblei</i>            |
| Reptile           | CHECKERED WHIPTAIL              | <i>Cnemidophorus tesselatus</i> |
|                   | WESTERN DIAMONDBACK RATTLESNAKE | <i>Crotalus atrox</i>           |
|                   | RING-NECKED SNAKE               | <i>Diadophis punctatus</i>      |
|                   | GREAT PLAINS SKINK              | <i>Eumeces obsoletus</i>        |
|                   | WESTERN HOOK-NOSED SNAKE        | <i>Gyalopion canum</i>          |
|                   | YELLOW MUD TURTLE               | <i>Kinosternon flavescens</i>   |
|                   | TEXAS BLIND SNAKE               | <i>Leptotyphlops dulcis</i>     |
|                   | PLAIN-BELLIED WATER SNAKE       | <i>Nerodia erythrogaster</i>    |
|                   | MASSASAUGA                      | <i>Sistrurus catenatus</i>      |
|                   | GROUND SNAKE                    | <i>Sonora semiannulata</i>      |
|                   | CHECKERED GARTER SNAKE          | <i>Thamnophis marcianus</i>     |
|                   | COMMON SLIDER                   | <i>Trachemys scripta</i>        |
|                   | LINED SNAKE                     | <i>Tropidoclonion lineatum</i>  |

***Species with 20 -<50% of predicted distribution in Status 1 or 2:***

Within Colorado, there are 52 species with 20-<50% of their predicted habitat occurring within Status 1 and 2 lands. This includes 1 amphibian, 21 birds, 23 mammals, and 7 reptiles. Of the 52, 12 have been identified as Species of Greatest Conservation Need in Colorado (CDOW 2005). These include: western toad, boreal owl, white-throated swift, evening grosbeak, white-tailed ptarmigan, red crossbill, wolverine, river otter, lynx, kit fox, long-nosed leopard lizard, and Southwestern black-headed snake.

***Species with at least 50% representation in GAP Status 1 and 2:***

There are 5 species with predicted habitat occurring within Status 1 and 2 lands greater than 50%. These species include 3 birds and 2 mammals. Of the 5, 2 have been identified as Species of Greatest Conservation Need in Colorado (CDOW 2005). These are black tern and brown-capped rosy-finch.

**New Mexico**

We mapped 667 species within New Mexico. We mapped 26 species of amphibians (70% of amphibians modeled for region), 383 birds species (88% of birds modeled for region), 159 mammal species (74% of mammals modeled for region), and 98 species of reptiles (75% of reptiles modeled for region).

***Species with <1% of predicted distribution in Status 1 or 2:***

There are 43 species (6%) that have less than 1% of their habitat on Status 1 and 2 lands within the state of New Mexico (Table 5-12). Of the 43, 6 have been identified as Species of Greatest Conservation Need in New Mexico (NMDGF 2005). This includes 1 amphibian (4% of mapped amphibians within the state), 28 birds (7% of mapped birds within the state), 8 mammals (5% of mapped mammals within the state), and 6 reptiles (5% of mapped reptiles within the state). Three of these species (bison, California condor, and whooping crane) are considered either extirpated or accidental within the state. Twelve of these species have a total amount of habitat mapped within the state of <100 km<sup>2</sup> and an additional 10 of these species have <1000 km<sup>2</sup> of mapped habitat within the state. A list of animal species whose predicted habitat distributions are <1% within Status 1 and 2 lands in the state of New Mexico is provided below in Table 5-12.

***Species with 1-<10% of predicted distribution in Status 1 or 2:***

There are 407 species with predicted habitat within Status 1 and 2 lands within New Mexico. Of the 407, 64 have been identified as Species of Greatest Conservation Need in New Mexico (NMDGF 2005). This includes 15 amphibians (58%), 227 birds (59%), 98 mammals (60%), and 67 reptiles (66%). There was 1 species that had little habitat mapped within the state (<100 km<sup>2</sup>) and 9 species with between 100-1000 km<sup>2</sup> of mapped habitat. Species include barking frog, Gila monster, Preble's shrew, ferruginous hawk, Gunnison's prairie dog, and sage thrasher.

**Table 5-12. Animal species with 0-<1% of predicted habitat distribution in GAP Status 1 or 2 for New Mexico as mapped by the Southwest Regional Gap Analysis Project.**

| Taxon     | SWReGAP Common Name          | SWReGAP Scientific Name            |
|-----------|------------------------------|------------------------------------|
| Amphibian | BOREAL CHORUS FROG           | <i>Pseudacris maculata</i>         |
| Bird      | CHUKAR                       | <i>Alectoris chukar</i>            |
|           | AMERICAN PIPIT               | <i>Anthus rubescens</i>            |
|           | GREATER SCAUP                | <i>Aythya marila</i>               |
|           | UPLAND SANDPIPER             | <i>Bartramia longicauda</i>        |
|           | WHITE-RUMPED SANDPIPER       | <i>Calidris fuscicollis</i>        |
|           | CALIFORNIA QUAIL             | <i>Callipepla californica</i>      |
|           | COMMON REDPOLL               | <i>Carduelis flamma</i>            |
|           | CHIMNEY SWIFT                | <i>Chaetura pelagica</i>           |
|           | SEMIPALMATED PLOVER          | <i>Charadrius semipalmatus</i>     |
|           | NORTHERN BOBWHITE            | <i>Colinus virginianus</i>         |
|           | INCA DOVE                    | <i>Columbina inca</i>              |
|           | BOBOLINK                     | <i>Dolichonyx oryzivorus</i>       |
|           | WHOOPING CRANE               | <i>Grus americana</i>              |
|           | CALIFORNIA CONDOR            | <i>Gymnogyps californianus</i>     |
|           | ORCHARD ORIOLE               | <i>Icterus spurius</i>             |
|           | BLACK RAIL                   | <i>Laterallus jamaicensis</i>      |
|           | BROWN-CAPPED ROSY-FINCH      | <i>Leucosticte australis</i>       |
|           | RED-HEADED WOODPECKER        | <i>Melanerpes erythrocephalus</i>  |
|           | BRONZED COWBIRD              | <i>Molothrus aeneus</i>            |
|           | GREAT CRESTED FLYCATCHER     | <i>Myiarchus crinitus</i>          |
|           | SNOWY OWL                    | <i>Nyctea scandiaca</i>            |
|           | HOUSE SPARROW                | <i>Passer domesticus</i>           |
|           | NEOTROPIC CORMORANT          | <i>Phalacrocorax brasilianus</i>   |
|           | RING-NECKED PHEASANT         | <i>Phasianus colchicus</i>         |
|           | EASTERN PHOEBE               | <i>Sayornis phoebe</i>             |
|           | DICKCISSEL                   | <i>Spiza americana</i>             |
|           | LESSER PRAIRIE-CHICKEN       | <i>Tympanuchus pallidicinctus</i>  |
|           | SCISSOR-TAILED FLYCATCHER    | <i>Tyrannus forficatus</i>         |
| Mammal    | BISON                        | <i>Bos bison</i>                   |
|           | LEAST SHREW                  | <i>Cryptotis parva</i>             |
|           | NINE-BANDED ARMADILLO        | <i>Dasypus novemcinctus</i>        |
|           | PLAINS POCKET GOPHER         | <i>Geomys bursarius</i>            |
|           | WYOMING GROUND SQUIRREL      | <i>Spermophilus elegans</i>        |
|           | ROUND-TAILED GROUND SQUIRREL | <i>Spermophilus tereticaudus</i>   |
|           | COLORADO CHIPMUNK            | <i>Tamias quadrivittatus</i>       |
|           | SWIFT FOX                    | <i>Vulpes velox</i>                |
| Reptile   | SMOOTH SOFTSHELL TURTLE      | <i>Apalone mutica</i>              |
|           | TRIPLOID CHECKERED WHIPTAIL  | <i>Cnemidophorus neotesselatus</i> |
|           | SIX-LINED RACERUNNER         | <i>Cnemidophorus sexlineatus</i>   |
|           | SAND DUNE LIZARD             | <i>Sceloporus arenicolus</i>       |
|           | PLAINS GARTER SNAKE          | <i>Thamnophis radix</i>            |

***Species with 10- <20% of predicted distribution in Status 1 or 2:***

There are 165 species (24%) with 10- <20% of their predicted habitat within Status 1 and 2 lands within New Mexico. Of these 165, 43 have been identified as Species of Greatest Conservation Need in New Mexico (NMDGF 2005). This includes 6 amphibians (23%), 103 birds (26%), 43 mammals (27%), and 13 reptiles (13%). There are 12 species that have little habitat mapped within the state (<100 km<sup>2</sup>) and 24 species with between 100-1000 km<sup>2</sup> of mapped habitat. Included among the species that fall within this gap status list are the Jemez Mountains Salamander, Sacramento Mountain salamander, elf owl, Baird's sparrow, and white-nosed coati.

***Species with 20 -<50% of predicted distribution in Status 1 or 2:***

Within New Mexico, there are 56 species (8%) with 20- <50% of their predicted habitat occurring within Status 1 and 2 lands. Of the 56, 26 have been identified as Species of Greatest Conservation Need in New Mexico (NMDGF 2005). This includes 4 amphibians (15%), 26 birds (7%), 13 mammals (8%), and 13 reptiles (13%). There were 4 species that had little habitat mapped within the state (<100 km<sup>2</sup>) and 8 species with between 100-1000 km<sup>2</sup> of mapped habitat. Species include Chiricahua leopard frog, Madrean alligator lizard, marten, blue grouse, and northern goshawk.

***Species with at least 50% representation in GAP Status 1 and 2:***

There are 3 species (<1%) with predicted habitat occurring within Status 1 and 2 lands greater than 50%. Of the 3, 2 have been identified as Species of Greatest Conservation Need in New Mexico (NMDGF 2005). These species include sedge wren, and 2 reptiles (canyon spotted whiptail, and ridge-nosed rattlesnake). All three species have little habitat mapped within the state (<30 km<sup>2</sup>).

**Nevada**

We mapped 520 species within Nevada including 17 amphibians (46% of amphibians modeled for region), 317 birds (73% of birds modeled for region), 129 mammals (60% of mammals modeled for region), and 57 reptiles (44% of reptiles modeled for region).

***Species with <1% of predicted distribution in Status 1 or 2:***

There are 14 species that have less than 1% of their habitat on Status 1 and 2 lands within the state of Nevada (Table 5-13). These include 12 birds and 2 mammals. Many of these species are on the periphery of their range in Nevada.

***Species with 1- <10% of predicted distribution in Status 1 or 2:***

There are 71 species with 1- <10% predicted habitat within Status 1 and 2 lands within the state of Nevada. These include 4 amphibians, 45 birds, 17 mammals, and 5 reptiles. There are 20 species identified as Species of Greatest Conservation Need (SGCN) including sage sparrow, ferruginous hawk, greater sage-grouse, Columbian sharp-tailed grouse, mountain beaver, pygmy rabbit, river otter, dark kangaroo mouse, pale kangaroo mouse, pygmy short-horned lizard, and greater short-horned lizard (NDOW 2005).

**Table 5-13. Animal species with 0-<1% of predicted habitat distribution in GAP Status 1 or 2 for Nevada as mapped by the Southwest Regional Gap Analysis Project.**

| Taxon                 | SWReGAP Common Name    | SWReGAP Scientific Name       |
|-----------------------|------------------------|-------------------------------|
| Bird                  | BOHEMIAN WAXWING       | <i>Bombycilla garrulus</i>    |
|                       | BROAD-WINGED HAWK      | <i>Buteo platypterus</i>      |
|                       | COMMON REDPOLL         | <i>Carduelis flammea</i>      |
|                       | LAWRENCE'S GOLDFINCH   | <i>Carduelis lawrencei</i>    |
|                       | VEERY                  | <i>Catharus fuscescens</i>    |
|                       | INCA DOVE              | <i>Columbina inca</i>         |
|                       | PALM WARBLER           | <i>Dendroica palmarum</i>     |
|                       | BRONZED COWBIRD        | <i>Molothrus aeneus</i>       |
|                       | BLACK-BELLIED PLOVER   | <i>Pluvialis squatarola</i>   |
|                       | EASTERN KINGBIRD       | <i>Tyrannus tyrannus</i>      |
|                       | WHITE-THROATED SPARROW | <i>Zonotrichia albicollis</i> |
|                       | HARRIS'S SPARROW       | <i>Zonotrichia querula</i>    |
|                       | Mammal                 | UTAH PRAIRIE DOG              |
| UINTA GROUND SQUIRREL |                        | <i>Spermophilus armatus</i>   |

***Species with 10-<20% of predicted distribution in Status 1 or 2:***

There are 226 species with 10-<20% of their predicted habitat within Status 1 and 2 lands within Nevada. These include 4 amphibians, 138 birds, 69 mammals, and 15 reptiles. There are 42 species that are identified as SGCNs including: desert horned lizard, American white pelican, white-faced ibis, canvasback, northern goshawk, snowy plover, rufous hummingbird, willow flycatcher, Virginia's warbler, Merriam's shrew, Inyo shrew, spotted bat, Allen's chipmunk, western jumping mouse, kit fox, Townsend's big-eared bat, and Columbia spotted frog (NDOW 2005).

***Species with 20 -<50% of predicted distribution in Status 1 or 2:***

Within Nevada, there are 161 species with 20-<50% of their predicted habitat occurring within Status 1 and 2 lands. These include 7 amphibians, 102 birds, 27 mammals, and 25 reptiles. Of these 159, 54 have been identified as Species of Greatest Conservation Need in Nevada (NDOW 2005). These include southwestern toad, desert tortoise, desert night lizard, Gila monster, common loon, eared grebe, bald eagle, peregrine falcon, black tern, yellow-billed cuckoo, Costa's hummingbird, white-headed woodpecker, black phoebe, Bendire's thrasher, grace's warbler, bell's vireo, montane shrew, hoary bat, California leaf-nosed bat, northern flying squirrel, pocket gopher, and Mojave black-collared lizard (NDOW 2005).

***Species with at least 50% representation in GAP Status 1 and 2:***

There are 52 species with predicted habitat occurring within Status 1 and 2 lands greater than 50%. These species include 2 amphibians, 22 birds, 16 mammals, and 12 reptiles. Of these 52, 14 have been identified as Species of Greatest Conservation Need in Nevada (NDOW 2005). These include: relict leopard frog, western banded gecko, western lyre snake, least bittern, spotted owl, tricolored blackbird, gray-crowned rosy-finch, cave

Myotis, big free-tailed bat, American pika, Palmer's chipmunk, marten, desert pocket mouse, and common chuckwalla (NDOW 2005).

### Utah

We mapped 526 species within Utah including 16 amphibians (43% of amphibians modeled for region), 324 birds (74% of birds modeled for region), 130 mammals (60% of mammals modeled for region), and 56 reptiles (43% of reptiles modeled for region).

#### ***Species with <1% of predicted distribution in Status 1 or 2:***

There are 13 species that have less than 1% of their habitat on Status 1 and 2 lands within the state of Utah (Table 5-14). These species include 11 birds (3% of the birds mapped within the state), 1 mammal (<1% of the mammals mapped within the state), and 1 reptile (2% of the reptiles mapped within the state). Of the total habitat mapped within Utah, seven of these species have <100 km<sup>2</sup>. Two of the species have between 100-1000 km<sup>2</sup> of habitat mapped within the state. A list of animal species whose predicted habitat distributions are <1% within Status 1 and 2 lands in the state of Utah is provided below in Table 5-14.

**Table 5-14. Animal species with 0-<1% of predicted habitat distribution in GAP Status 1 or 2 for Utah as mapped by the Southwest Regional Gap Analysis Project.**

| Taxon   | SWReGAP Common Name        | SWReGAP Scientific Name        |
|---------|----------------------------|--------------------------------|
| Bird    | RUDDY TURNSTONE            | <i>Arenaria interpres</i>      |
|         | CHESTNUT-COLLARED LONGSPUR | <i>Calcarius ornatus</i>       |
|         | LONG-TAILED DUCK           | <i>Clangula hyemalis</i>       |
|         | PALM WARBLER               | <i>Dendroica palmarum</i>      |
|         | WOOD THRUSH                | <i>Hylocichla mustelina</i>    |
|         | ACORN WOODPECKER           | <i>Melanerpes formicivorus</i> |
|         | WHITE-WINGED SCOTER        | <i>Melanitta fusca</i>         |
|         | HOUSE SPARROW              | <i>Passer domesticus</i>       |
|         | RED-NECKED GREBE           | <i>Podiceps grisegena</i>      |
|         | LEAST TERN                 | <i>Sterna antillarum</i>       |
|         | TENNESSEE WARBLER          | <i>Vermivora peregrina</i>     |
| Mammal  | BELDING'S GROUND SQUIRREL  | <i>Spermophilus beldingi</i>   |
| Reptile | PYGMY SHORT-HORNED LIZARD  | <i>Phrynosoma douglasii</i>    |

#### ***Species with 1-<10% of predicted distribution in Status 1 or 2:***

There are 116 species with 1-<10% predicted habitat within Status 1 and 2 lands within the state of Utah. These include 1 amphibian (6% of those mapped in UT), 85 birds (26% of those mapped in UT), 26 mammals (19% of those mapped in UT), and 4 reptiles (7% of those mapped in UT). Of their total mapped distributions within Utah, three of these species have <100 km<sup>2</sup>. Twelve of the species have between 100-1000 km<sup>2</sup> of habitat mapped within the state.



Twenty-five of these species are recognized as being Species of Greatest Conservation Need within the state of Utah (UDWR 2005). Included among the species within this GAP status threshold are the bobolink, Columbian sharp-tailed grouse, Gunnison sage-grouse, greater sage-grouse, relict leopard frog, olive-backed pocket mouse, pygmy rabbit, Utah prairie dog, white-tailed prairie dog, and the smooth green snake.

***Species with 10-<20% of predicted distribution in Status 1 or 2:***

There are 238 species with 10-<20% of their predicted habitat within Status 1 and 2 lands within Utah. These include 10 amphibians (63% of those mapped in UT), 135 birds (42% of those mapped in UT), 74 mammals (56% of those mapped in UT), and 19 reptiles (34% of those mapped in UT). Of their total mapped distributions within Utah, eight of these species have <100 km<sup>2</sup>. Sixteen of the species have between 100-1000 km<sup>2</sup> of habitat mapped within the state.

Fifty-five of these species are recognized as being species of greatest conservation need within the state of Utah (UDWR 2005). Included among the species within this GAP status threshold are bighorn sheep, lynx, kit fox, spotted bat, Townsend's big-eared bat, silver-haired bat, river otter, sage sparrow, willow flycatcher, yellow-billed cuckoo, northern goshawk, burrowing owl, desert tortoise, northern leopard frog, and western toad,

***Species with 20 -<50% of predicted distribution in Status 1 or 2:***

Within Utah, there are 154 species with 20-<50% of their predicted habitat occurring within Status 1 and 2 lands. These include 5 amphibians (31% of those mapped in UT), 92 birds (28% of those mapped in UT), 28 mammals (21% of those mapped in UT), and 29 reptiles (52% of those mapped in UT). Of their total mapped distributions within Utah, six of these species have <100 km<sup>2</sup>. Thirty-one of the species have between 100-1000 km<sup>2</sup> of habitat mapped within the state.

Forty-one of these species are recognized as being species of greatest conservation need within the state of Utah (UDWR 2005). Included among the species within this GAP status threshold are the black-throated gray warbler, California condor, gray vireo, spotted owl, plateau striped whiptail, big free-tailed bat, desert shrew and silky pocket mouse.

***Species with at least 50% representation in GAP Status 1 and 2:***

There are 10 species with predicted habitat occurring within Status 1 and 2 lands greater than 50%. These species include 3 birds (<1% of those mapped in UT), 4 mammals (3% of those mapped in UT), and 3 reptiles (5% of those mapped in UT). Of their total mapped distributions within Utah, one of these species has <100 km<sup>2</sup>. Six of the species have between 100-1000 km<sup>2</sup> of habitat mapped within the state.

Four of these species are recognized as being species of greatest conservation need within the state of Utah (UDWR 2005). Included among the species within this GAP status threshold are the Mogollon vole, Stephen's woodrat, desert night lizard and long-tailed brush lizard.

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# DISCUSSION

## Limitations and Discussion

When applying the results of our analyses, it is critical that the following limitations are considered: 1) the limitations described for each of the component parts (land cover mapping, animal habitat mapping, stewardship mapping) of the gap analysis, 2) the spatial and thematic map accuracy of each component, and 3) the suitability of the results for the intended application (see [Appropriate and Inappropriate Use of these data in Chapter 7](#)).

Assessing the conservation status of natural land cover is limited by certain confounding factors. One challenge is to produce a land cover map that is ecologically and spatially accurate while adequately representing the habitat requirements for terrestrial animal species. Previous GAP efforts have found the accuracy of the mapped distributions of natural land cover to be substantially lower and more variable than that of predicted animal habitat distributions. Mapping at the ecological systems level provided an appropriate scale for a project of this size, which by reducing the variability in the land cover units, improved the accuracy of the land cover map and the delineation of wildlife habitat. An important assumption behind any aggregation of biotic units (e.g. above species) is that the aggregated unit serves as a surrogate for species or lower levels of biotic organization, which may under-represent actual conservation needs (Pressey and Logan 1995). Another challenge is that we cannot distinguish the degree of natural condition or value of the mapped units due to management manipulation, exotic invasion, or spatial configuration.

In addition to the general limitations of accuracy given a project of this scale, there are several considerations that must be acknowledged in regard to the land cover data set in particular. For example, the encroachment of invasive plants such as cheatgrass or tamarisk was not captured in the land cover data set, unless it occurred as a dominant presence, in relatively homogenous, well established sites. “Disturbed” land cover types represent what was present at the time of image acquisition and ground reconnaissance. Several of these cover types incorporate to some degree human management of the vegetation. However, recently burned areas, for instance, may not be represented in the land cover map if the fire took place since the time the imagery was acquired land cover types with restricted, highly specialized niches were either under the minimum map unit for mappability (1 acre) or had low numbers of training sites, and were not mapped. Ultimately, thematic mapping involves placing a *continuum* of land cover into *discrete* land cover classes. Distinctions between certain land cover types such as grassland, shrub-steppe, and shrubland, tend to be gradual and can be difficult to detect. Therefore, some land cover types are more similar than others. For more information on land cover map validation and fuzzy accuracy assessment of individual land cover types, see Chapter 2.

With regard to the relative distribution of land cover types in Status 1 and 2 lands, we found that ecological systems that occur at higher elevations such as in the alpine and sub-alpine zones, are typically afforded greater levels of protection. This is not unexpected as much of the region's federally protected lands are at higher elevations. On the other hand, ecological systems occurring at lower elevations such as the valley bottoms and footslopes, tend to have less protection. These lower slopes and valleys tend to be more accessible, and are often considered "managed" landscapes, supporting multiple human uses.

Similar to limitations provided for land cover there are limitations to the species habitat analysis. There are no established area criteria for adequate representation for each species. This is particularly true for conservation efforts on species because of life history differences. Even within genera, there can be a wide variance of needed habitat for species survival. We focused our attention within this chapter on species and GAP Management status analysis, but stewardship data are available for further analyses ([Appendix 5-14](#)). We also focused on total habitat for the species and not on seasonal aspects of species ecology (e.g. breeding), which is also available ([Appendix 5-15](#)). As mentioned in Chapter 3, all habitat modeled within this project does not constitute occupied habitat as factors such as fragmentation, condition, and microhabitat factors play a significant role in species occurrence.

Representation between states and within the region varied by species. Some differences may be the result of species on the periphery of their range. It is important to consider that some species with little identified habitat in Status 1 and 2 lands may have their biological needs met in existing Status 3 and 4 lands. Additionally, Status 3 and 4 lands may provide better habitat because of microhabitat or other non-modelable reasons.

We compared our analysis to the recent Comprehensive Wildlife Conservation Strategy (CWCS) effort by each state. We found both similarity and dissimilarity between GAP and each state's CWCS. Species not identified by CWCS but that are identified as a "gap species" should minimally be reviewed by natural resource agencies. Species like bronzed cowbird should be excluded from conservation efforts but other, previously unidentified species may warrant review and possible inclusion into Species of Greatest Conservation Need. Providing this information to resource agencies engaged in conservation planning is one objective of GAP.

The analysis supports the need for regional projects such as SWReGAP. Species and land cover can be state protected (Status 1 and 2 lands >10%) and regionally unprotected (Status 1 and 2 lands <10%). The converse is also true. For both land cover types and animal-habitat conservation, the entirety of the range needs to be addressed. Regional efforts also allow ecoregion analyses to be completed. A separate gap analysis was recently completed for the Colorado Plateau ecoregion. A series of reports including analyses of land stewardship, land cover, and predicted animal habitat distributions are to be published in the upcoming Colorado Plateau III book.

Finally, as we stated in the introduction to this chapter, it is unrealistic to identify a standard measure constituting “adequate representation” of land cover or species distribution for biodiversity conservation. What gap analysis provides is a quantitative and systematic approach to assessing representation within a geographic framework. This framework provides data that can be used to focus attention on biota of concern within specific geographic regions. Determining which biota is of concern ultimately must be carried out by individual practitioners, agencies, and organizations with concerns about biodiversity in the region. The results in this chapter and the data provided by the SWReGAP project offer a starting point for further analysis, summary, and biological assessment.



Cactus Wren (*Camphlorhynchus brunneicapillus*)

**Photographer:** John J. Mosesso, NBII Digital Image Library

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## CHAPTER 6

# CONCLUSIONS AND MANAGEMENT IMPLICATIONS

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Photo from SWReGAP Training Site Image Library

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# INTRODUCTION

The Southwest is home to a diverse assemblage of plant and animal species largely, due to the complex topography, geology, soils, and climate patterns that occur throughout the region. The unique combination of environmental factors and natural disturbance processes inherent to the Southwest make this area one of the most biologically rich regions in the U.S. (Morin 1995, Flather et al. 1997, Flather 1998, Bender et al. 2005). Fifteen distinct ecoregions are represented within the SWReGAP area, as defined by The Nature Conservancy's (TNC) Terrestrial Global Assessment Units, Ecoregions and Major Habitat Types (TNC 2005) which include modifications to original work done by Bailey (1995). These ecologically derived landscape units are: Columbia Plateau (southern edge), Sierra Nevada (eastern edge), Great Basin, Mojave Desert, Sonoran Desert, Utah-Wyoming Rocky Mountains, Wyoming Basins (southern edge), Utah High Plateau, Colorado Plateau, Southern Rocky Mountains, Apache Highlands, Arizona-New Mexico Mountains, Chihuahuan Desert, Central Shortgrass Prairie, and Southern Shortgrass Prairie. The natural land cover of the region is largely dominated by shrub/scrub ecological systems (37% of the region), followed by grassland/herbaceous systems (23%), evergreen forests (22%), barren lands (5%), woody wetlands (3%), deciduous forest (2%), mixed forest (<1%) and emergent herbaceous wetlands (<1%). Agricultural areas compose 5.6% of the region, altered or disturbed areas (1.5%), developed areas (1.1%), and open water (0.8%).

These natural systems, however, face many threats that affect not only the biological resources within them, but the human populations that may directly or indirectly depend on their sustainability. Adverse factors include prolonged drought, invasive plant and animal species (e.g., cheatgrass, Russian thistle, tamarisk, European starling), over-utilization by livestock, altered fire regimes, increased land development and recreational demands, soil erosion, stream channelization, consumptive water use, oil and gas exploration, habitat fragmentation and conversion, over-harvesting of certain plants and animals, population isolation, and disease (e.g., bark beetles, Chronic Wasting Disease, West Nile Virus), all of which present significant management and ecological challenges encompassing range-wide to local scales. Not all of the stressors necessarily occur range-wide, and some may only affect local areas or have impacts within a specific state. Additionally, certain ecological systems and wildlife species may be more vulnerable to environmental disturbances than others. The seamless 5-state data sets created by SWReGAP provide a unique combination of information and a framework that can be used to identify some of these issues and assist with the implementation of conservation efforts at multiple scales.

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# MANAGEMENT IMPLICATIONS OF SWREGAP ANALYSIS

The goal of GAP is to identify two elements of biodiversity - land cover types and terrestrial vertebrate species - that are in need of conservation, allowing for the appropriate conservation action to take place before they become the focus of regulatory authority. The analysis is a coarse filter approach that provides a tool and framework that may identify the need for finer scale studies. Using quantitative geographic criteria, this coarse filter approach provides for the delineation of species' habitat and ecological systems for use in conservation planning. A primary assumption with gap analysis is that Status 1 and 2 lands are preferred because of the level of protection afforded these areas. However, the ecological condition of these protected areas may be such that the full range of the region's biodiversity is not fully protected. Status 3 and 4 lands may provide the conditions necessary for certain species and may provide better habitat than that which occurs on Status 1 and 2 lands. Furthermore, individual species respond differently to management practices. We recognize that protection does not always equate to conservation success; for example recent global amphibian declines have occurred both within and outside protected areas (Green 2005). Gap analysis provides a preliminary indication of the long-term maintenance of these elements of biological diversity. Further analyses of area requirements, isolation, or disturbance regimes necessary for maintaining populations, can be used to supplement the results of gap analysis.

A criticism of past gap analyses has been the lack of regional data sets and the problem of edge-matching existing GAP data sets. SWReGAP provides the first formal effort to address these concerns through a regional gap analysis. We encourage each state to consider not only the conservation status of ecological systems and species within their respective states, but also from a regional context. Likewise, it is important to consider what this 5-state region contributes to an ecological system's or terrestrial vertebrate species' management and conservation status relative to other neighboring states and Mexico, as many of the species' ranges extend beyond the SWReGAP project area. Threshold values for conservation protection were used to identify ecological systems and animal habitat distributions with low representation in Status 1 and 2 lands. Low representation in conservation lands, however, includes some elements that are restricted to and are relatively rare within the 5-state region (or state), as well as those that are peripheral to the region (or state). Conservationists and managers are encouraged to consider both, because in some cases, the protection of elements at the edge of their range may capture important components of biodiversity (Channell and Lomolino 2000, Holt and Keitt 2005, Jaeger et al. 2005).

Throughout the 5-state region, 11.5% of the total land base has been identified as providing protection for biodiversity in Status 1 and 2 lands. The majority of this (46%) is managed by BLM (largely associated with National Monuments), followed by U.S. Forest Service (25%), U.S. Fish & Wildlife Service (11%), and National Park Service

(11%). Forty ecological systems and 309 terrestrial vertebrate species have less than 10% of their regional distribution within Status 1 and 2 lands (See [Tables 6-1 and 6-2](#)). See [Chapter 5, Table 5-1](#) for the list of ecological systems and [Appendix 5-15](#) for the list of terrestrial vertebrate species. An additional 36 ecological systems and 107 terrestrial vertebrate species have greater than 10% of their distribution, but less than 500 km<sup>2</sup> total area within Status 1 and 2 lands ([Tables 6-1 and 6-2](#)). See [Table 5-1 and Appendix 5-15](#) in Chapter 5 for ecological system and terrestrial vertebrate species lists. Ecological systems and terrestrial vertebrate species that have less than 10% of their distribution or less than 500 km<sup>2</sup> absolute areal coverage in Status 1 and 2 lands may be under-represented and point to “gaps” in their conservation (Schrupp et al. 2000). Although other major land stewards in the region (e.g. private (comprising 30% of the 5-state area), tribal (9%), and state land board (7%)) may not always achieve the legal mandate for conservation management, their lands may in fact provide protection for certain species and land cover types. It is important to consider the potential that each land steward may provide as a partner in conservation, particularly at local and ecoregional scales. Cooperation and collaboration among local, state, federal, and tribal governments, non-governmental organizations, universities, and private individuals is encouraged to effectively sustain the species and ecological systems of this region.

As a separate effort, but in parallel with SWReGAP, each of the five states recently completed their State Wildlife Action Plans (SWAP) (AGFD 2005, CDOW 2005, NMDGF 2005, NDOW 2005, UDWR 2005). These strategies identify species of greatest conservation need (SGCN) and key habitats specific to each state. Also included in these reports is detailed information about the threats facing the different habitat types. The CWCS is a useful companion to SWReGAP for prioritizing ecological systems and species that require focused conservation efforts both within and between the Southwest states. The development of crosswalks between each state’s key habitats and SWReGAP’s land cover legend would be one way to maximize these two resources for future projects. It should be noted, however, that further review of the SGCNs is needed as each state identified their species using different methods.

We identified three categories of management concern to prioritize ecological systems and terrestrial vertebrate species that may require additional attention. The criteria used for these categories are the following: first priorities are ecological systems and predicted animal habitats with distributions of <1% within Status 1 and 2 lands; second priorities are those with between 1 and 10% in Status 1 or 2 lands; and third priorities are those with >10% but <500 km<sup>2</sup> in Status 1 or 2 lands. We applied these criteria to each state to enumerate their respective priority conservation concerns ([Tables 6-1 and 6-2](#)).



**Table 6-1. Number of Ecological Systems of priority conservation concern identified within the SWReGAP project area and by state. (See Chapter 5, Table 5-1 for the list of relevant ecological systems.)**

| Priority | Criteria   | Region | AZ | CO | NV | NM | UT |
|----------|--|--------|----|----|----|----|----|
|          | Ecological System Distribution in Status 1 & 2 Lands |        |    |    |    |    |    |
| First    | <1%  | 6      | 7  | 12 | 0  | 8  | 6  |
| Second   | Between 1-10%  | 34     | 25 | 22 | 12 | 39 | 23 |
| Third    | >10% and < 500 km <sup>2</sup>                       | 36     | 23 | 22 | 41 | 26 | 29 |

**Table 6-2. Number of modeled terrestrial vertebrate species in Southwest Regional Gap Analysis Project and Species of Greatest Conservation Need identified by each state in Comprehensive Wildlife Conservation Strategies by priority of concern. (See Chapter 5, Appendix 5-15 for the list of relevant animal species.)**

| Priority | Criteria                                     | Region  |      | AZ      |      | CO      |      | NV      |      | NM      |      | UT      |      |
|----------|--|---------|------|---------|------|---------|------|---------|------|---------|------|---------|------|
|          |  | SWReGAP | SGCN | SWReGAP | SGCN | SWReGAP | SGCN | SWReGAP | SGCN | SWReGAP | SGCN | SWReGAP | SGCN |
|          | Animal Species Habitat in Status 1 & 2 Lands |         |      |         |      |         |      |         |      |         |      |         |      |
| First    | <1%  | 25      | 11   | 25      | 9    | 50      | 9    | 13      | 0    | 44      | 6    | 13      | 0    |
| Second   | Between 1-10%                                | 284     | 190  | 168     | 116  | 260     | 62   | 72      | 20   | 400     | 63   | 115     | 25   |
| Third    | >10% and < 500 km <sup>2</sup>               | 107     | 84   | 133     | 109  | 63      | 13   | 141     | 41   | 96      | 34   | 123     | 28   |

## Priority Conservation Concerns By State

### Arizona

For Arizona, 13.4% of the state's total land base is categorized as Status 1 and 2 lands. The majority of this (38%) is managed by BLM, followed by U.S. Forest Service (19%), National Park Service (19%), U.S. Fish & Wildlife Service (17%), and Department of Defense and/or Department of Energy (3%). All other stewards manage approximately 1% or less of Arizona's Status 1 and 2 lands.

Arizona has 7 ecological systems with <1% of their distribution in Status 1 and 2 lands (Table 6-1). Twenty-five ecological systems have between 1 and <10% of their distribution in Status 1 and 2 lands. An additional 23 ecological systems have >10% but <500 km<sup>2</sup> (<50,000 ha) of their distribution in Status 1 and 2 lands, 19 of these have <100 km<sup>2</sup> (<10,000ha).

For Arizona, there are 25 species with less than 1% of their predicted habitat in Status 1 and 2 lands (Table 6-2). Of these 25 species, 9 species were identified as SGCN. There are 168 species with less than 10% of their predicted habitat in Status 1 and 2 lands, 116 of which are SGCN species. There are 133 species (109 SGCN) with more than 10% of

their predicted habitat in Status 1 and 2 lands and <500 km<sup>2</sup> (<50,000 ha), 87 of these have <100 km<sup>2</sup> (<10,000ha).

The primary habitats identified in Arizona's CWCS are: Lower Colorado Sonoran Desert Scrub, Upland Sonoran Desert Scrub, Chihuahuan Desert Scrub, Mohave Desert Scrub, Semi-desert Grassland, Plains & Great Basin Grassland, Subalpine Grassland, Chaparral, Madrean Evergreen Forest, Great Basin Conifer Forest, Montane Conifer Forest, Subalpine Conifer Forest, Alpine Tundra, Wetlands/Springs, Streams/Rivers, Lakes/Reservoirs, and Human-dominated landscapes (AGFD 2005).

### Colorado

For Colorado, 10.2% of the state's total land base is categorized as Status 1 and 2 lands. The majority of this is managed by U.S. Forest Service (53%), followed by BLM (21%), National Park Service (9%), State Wildlife Areas (8%), State Land Board (4%), The Nature Conservancy (3%), and Native American Land (2%). All other stewards manage approximately 1% or less of Colorado's Status 1 and 2 lands.

Colorado has 12 ecological systems with less than 1% of their distribution in Status 1 and 2 lands (Table 6-1), 8 of these have no representation at all in these areas. The three ecological systems of highest priority within the state are: *Western Great Plains Cliff and Outcrop* (S008), *Southern Rocky Mountain Juniper Woodland and Savanna* (S074), and *Western Great Plains Sand Prairie* (S089). Twenty-two ecological systems have between 1 and <10% of their distribution in Status 1 and 2 lands. An additional 22 ecological systems have more than 10% but <500 km<sup>2</sup> (<50,000 ha) of their distribution in Status 1 and 2 lands, 11 of these have <100 km<sup>2</sup> (<10,000ha).

For Colorado, there are 50 species with less than 1% of their predicted habitat in Status 1 and 2 lands, 9 being identified as SGCN (Table 6-2). There are 260 species (62 SGCN) with less than 10% of their predicted habitat in Status 1 and 2 lands. There are 63 species (13 SGCN) with more than 10% of their predicted habitat in Status 1 and 2 lands and <500 km<sup>2</sup> (<50,000 ha), 32 of these have <100 km<sup>2</sup> (<10,000ha).

Fourteen key habitats were identified in the Colorado Division of Wildlife's CWCS, which are the following: Aspen, Eastern Plains Rivers, Exposed Rock, Foothills/Mountain Grasslands, Grass-forb Dominated Wetlands, Midgrass Prairie, Open Water, Playas, Pinyon-Juniper, Ponderosa Pine, Sagebrush, Shortgrass Prairie, Shrub Dominated Wetlands, and Western Rivers (CDOW 2005).

### New Mexico

For New Mexico, 6.3% of the state's total land base is categorized as Status 1 and 2 lands. The majority of this (41%) is managed by U.S. Forest Service, followed by BLM (34%), National Park Service (8%), U.S. Fish & Wildlife Service (8%), Local Land Trust Preserve/Easement (5%), and State Wildlife Reserves (3%). All other stewards manage approximately 1% or less of New Mexico's Status 1 and 2 lands.

New Mexico has 8 ecological systems with <1% of their distribution in Status 1 and 2 lands (Table 6-1). New Mexico has 39 ecological systems with between 1 and 10% of their distribution in Status 1 and 2 lands. An additional 26 ecological systems have >10% but <500 km<sup>2</sup> (<50,000 ha) of their distribution in Status 1 and 2 lands, 16 of these have <100 km<sup>2</sup> (<10,000ha).

For New Mexico, there are 44 species with less than 1% of their predicted habitat in Status 1 and 2 lands, 6 being identified as SGCN (Table 6-2). There are 400 species (63 SGCN) with less than 10% of their predicted habitat in Status 1 and 2 lands. There are 96 species (34 SGCN) with more than 10% of their predicted habitat in Status 1 and 2 lands and <500 km<sup>2</sup> (<50,000 ha), 54 of these have <100 km<sup>2</sup> (<10,000ha).

Nineteen key habitats were identified in New Mexico's CWCS effort with 9 terrestrial types identified (NMDFG 2005). New Mexico's CWCS relied on the SWReGAP land cover map for terrestrial habitat types and created its own aquatic habitat classification. NMDGF grouped several SWReGAP land cover types because of ecological similarity and ease of use. Key habitats identified within the CWCS are Chihuahuan Semi-Desert Grassland, Intermountain Basins Big Sagebrush Shrubland, Madrean Encinal, Madrean Pine-Oak/Conifer-Oak Forest and Woodland, Riparian, Western Great Plains Sand Sagebrush Shrubland, Western Great Plains Shortgrass Prairie, Rocky Mountain Alpine-Montane Wet Meadow, and Rocky Mountain Montane Mixed Conifer Forest and Woodland.

### Nevada

For Nevada, 14.7% of the state's total land base is categorized as Status 1 and 2 lands. The majority of this is managed by BLM (59%), followed by U.S. Fish & Wildlife Service (22%), U.S. Forest Service (11%), and National Park Service (6%). All other stewards manage approximately 1% or less of Nevada's Status 1 and 2 lands.

There are no ecological systems with <1% of their distribution in Status 1 and 2 lands in Nevada (Table 6-1). Nevada has 12 ecological systems with between 1 and <10% of their distribution in Status 1 and 2 lands. Nevada has 41 ecological systems with >10% but <500 km<sup>2</sup> (<50,000 ha) of their distribution in Status 1 and 2 lands, 34 of these have <100 km<sup>2</sup> (<10,000ha).

For Nevada, there are 13 species with less than 1% of their predicted habitat in Status 1 and 2 lands, none were identified as SGCN (Table 6-2). There are 72 species (20 SGCN) with less than 10% of their predicted habitat in Status 1 and 2 lands. There are 141 species (41 SGCN) with more than 10% of their predicted habitat in Status 1 and 2 lands and <500 km<sup>2</sup> (<50,000 ha), 32 of these have <100 km<sup>2</sup> (<10,000ha).

Nevada's Department of Wildlife identified 27 key habitats in their SWAP: Intermountain Cold Desert Scrub, Mojave/Sonoran Warm Desert Scrub, Mojave/Mid-Elevation Mixed Desert Scrub, Sagebrush, Lower Montane Woodlands, Lower Montane Chaparral, Intermountain Conifer Forests and Woodlands, Sierra Conifer Forests and

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Woodlands, Grasslands and Meadows, Aspen Woodland, Alpine and Tundra, Intermountain Rivers and Streams, Sierra Rivers and Streams, Mojave Rivers and Streams, Wet Meadows, Springs and Springbrooks, Mesquite Bosques and Desert Washes, Marshes, Lakes and Reservoirs, Desert Playas and Ephemeral Pools, Sand Dunes and Badlands, Cliffs and Canyons, Caves and Mines (Subterranean Landscapes), Exotic Grasslands and Forblands, Developed Landscapes, Agricultural Lands, and Barren Landscapes (NDOW 2005).

### Utah

For Utah, 14% of the state's total land base is categorized as Status 1 and 2 lands. The majority of this is managed by BLM (66%), followed by U.S. Forest Service (14%), National Park Service (12%), and State Wildlife Reserves (6%). All other stewards manage approximately 1% or less of Utah's Status 1 and 2 lands.

Six ecological systems have less than 1% of their distribution in Status 1 and 2 lands (Table 6-1), four of these have no representation at all within these areas. Twenty-three ecological systems have between 1 and <10% of their distribution in Status 1 and 2 lands. An additional 29 ecological systems have >10% but <500 km<sup>2</sup> (<50,000 ha) of their distribution in Status 1 and 2 lands, 10 of which have <100 km<sup>2</sup> (<10,000ha).

For Utah, there are 13 species with less than 1% of their predicted habitat in Status 1 and 2 lands, none being identified as SGCN (Table 6-2). There are 115 species (25 SGCN) with less than 10% of their predicted habitat in Status 1 and 2 lands. There are 123 species (28 SGCN) with more than 10% of their predicted habitat in Status 1 and 2 lands and <500 km<sup>2</sup> (<50,000 ha), 35 of these have <100 km<sup>2</sup> (<10,000ha).

Ten key habitats were identified in Utah's Division of Wildlife Resources CWCS: Aspen, Grassland, Lowland Riparian, Mountain Riparian, Mountain Shrub, Shrub-steppe, Water-Lentic (standing), Water-Lotic (flowing), Wet meadow, and Wetland (UDWR 2005).

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# ADDITIONAL DATA NEEDS AND ANALYSES

## Land Cover

The SWReGAP land cover data set provides a seamless representation of land cover for the 5-state region based on satellite imagery from the time period of 1999-2001. The data set has many uses beyond the gap analysis conducted for SWReGAP. As noted in Chapter 2, no land cover map is perfect, and when possible land cover maps can and should be updated and improved. With this in mind, we suggest the following for future work related to the SWReGAP land cover data set:

- **Refined mapping of targeted land cover classes and/or regions.**

The SWReGAP land cover data set was created based on the premise that there is value in landscape data covering large geographic regions. Some ecoregions and land cover classes within the 5-state region may have greater importance for conservation of biodiversity than others. We suggest that the SWReGAP land cover data set be refined by focusing additional attention on these select ecoregions and/or land cover classes. In other words, the SWReGAP land cover data set may be used as a stratifier for finer scale mapping of specific land cover classes (e.g. riparian classes), or updated to reflect additional information regarding the spatial distribution of land cover in the region. Furthermore, at finer scales it may be possible to include information pertaining to relative ‘condition classes’ within land cover types, which would greatly improve the overall utility of the land cover data set for species habitat modeling.

- **Map accuracy assessment.**

Chapter 2 provides a detailed description of the map validation procedure used to assess the quality of the land cover data set. While we used an approach that provides a quantitative measure of map quality using withheld samples, and fuzzy set analysis, this is not an assessment of map accuracy. Assessing map accuracy is an expensive and time-consuming exercise and one of great importance. Map users will have greater confidence in the map product if a more robust assessment of map accuracy is performed. Such an assessment should be based on a design using sufficient and unbiased samples (Stehman and Czaplewski 1998, Congalton and Green 1999). The completion of a formal map accuracy assessment could be conducted as a separate and independent exercise if additional data and financial resources were made available.

- **Extend and edge-match land cover data to neighboring states.**

While SWReGAP encompasses a large geographic area covering several ecoregions, it is nevertheless bounded by neighboring states - some of which have been recently mapped and edge-matched to the SWReGAP land cover data set with good success (see SHRUBMAP Project, available from: <http://sagemap.wr.usgs.gov/>). We believe that the degree to which the SWReGAP

land cover data set can be edge-matched to adjoining states and Mexico depends on using standardized mapping legends and mapping methods. We recommend further research in improving and standardizing the mapping legend (i.e. ecological systems) and mapping methodologies (i.e. decision trees) used by SWReGAP.

- **Assessment of land cover change over time.**

The SWReGAP land cover data set represents the status of land cover in the 5-state region at one period in time. This provides a great deal of information about biodiversity in the region (see Chapter 5) and its implications for land management. An important methodological objective in SWReGAP was to make the procedures as transparent and readily interpretable as possible. We suggest further research in assessing and monitoring land cover change over time. This may involve additional research into “backcasting” land cover in time to assess changes that have occurred to date, and anticipating future mapping efforts that utilize SWReGAP data to monitor land cover into the future.

## **Predicted Animal Habitat Distributions**

The SWReGAP data set provides data and habitat models for the entire 5-state region. From a regional standpoint, the habitat modeling data sets provide the opportunity for a wide variety of stakeholders to look at species habitat conservation over wide expanses and entire ecoregions. Further work with this data set is suggested and includes:

- **Habitat model refinement is needed to provide end-users information beyond the standard presence/absence level provided.**

Habitat model refinement is needed as new information becomes available and as experts provide new information to the process. These refinements should also include the use of species occurrence points and an inductive modeling approach. Refinements in the modeling process could also lead to the extension of the current presence/absence models to include preferred habitat or to provide probabilities of occupancy for the suitable habitat. Additionally, models could be refined to address spatially explicit considerations related to contiguity and adjacency of habitat elements.

- **Accuracy assessment of the habitat models and end user validation.**

Habitat models should be the subject of accuracy assessment and validation. A statistically driven accuracy assessment is warranted for this data set and would provide end-users information regarding the accuracy of the models and the potential errors within each model. Model validation will occur if and when these models are incorporated into the conservation planning and other natural resource planning efforts. Further, testing the habitat models will provide additional insight into the accuracy and usefulness of the models. Various data sets are available within and between states and we encourage the use of these data to provide an indication of the accuracy of the SWReGAP habitat models.

- **Analysis of animal guilds determined necessary for conservation.**

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- Guilds, focal species, and functional groups of species may provide a better surrogate to conservation in some parts of the region. USFWS Region 2 for example, has identified specific conservation targets that may serve as the functional groups. The Species of Greatest Conservation Need lists, already derived by state wildlife agencies, may also provide a starting point for this process. This concept needs to be further pursued and tested for application.
- **Incorporation into the Comprehensive Wildlife Conservation Strategy format.** State Comprehensive Wildlife Conservation Strategies provide a blueprint for state conservation. Gap data is well suited to assist state agencies in current and future planning. There is a need for further outreach to the agencies and to work collaboratively with them to incorporate GAP data within the agencies and to modify GAP data based on agency input.
  - **Further collaboration between GAP personnel and agencies charged with conservation of our natural resources.** There is a need for collaboration between land management agencies and natural resources agencies (state and federal) to better incorporate gap analysis data sets into the planning efforts of these agencies. This would also help facilitate the understanding of GAP personnel on specific needs and uses of spatial data sets by these land managers. Collaboration could include the identification of guilds or suites of species that better identify conservation opportunities or risks within a smaller landscape.
  - **Demonstrate successful use of the data sets in conservation applications and identify associated limitations or inaccuracies.** Gap analysis data sets provide a useful tool for obtaining information in the larger ecological context particularly for large land stewards and agencies responsible for the management of natural resources or developing multiple-species habitat conservation plans.

## Land Stewardship

The SWReGAP land stewardship data set provides stewardship and management status data for the entire 5-state region. This layer provides the context for conducting the final gap analysis. From a regional standpoint, the land stewardship data set provides the opportunity for stakeholders to look at stewardship and management status over large landscapes including entire ecoregions. Suggestions for further work related to this data set include the following:

- **Incorporate changing stewardship and management goals within the region.** Stewardship and management status are evolving constantly throughout the region. Management plans, such as the Region 3 forest management plan updates, change periodically, thus affecting that status of the stewardship data set and subsequent gap analyses. Changes such as these should be incorporated iteratively into the land stewardship data set to reflect the most current conditions.
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- **Work with land stewards to incorporate actual land management beyond the intent identified within the GAP process.**

Documentation and intent are not always the driving factor in actual parcel management. Additionally, there are efforts in place that may not meet GAP standards for long term maintenance but certainly affect the conservation landscape. Condition of the managed land has a significant effect on the conservation potential of that landscape.

- **Institutionalize the stewardship data set with state or federal agencies for future modification.**

The land stewardship data set evolves continuously as parcels change ownership and protection management mandates are updated. These changes may be most readily incorporated if the data set is institutionalized and becomes a standard for use by agencies at the regional or state level.

- **Conduct outreach to provide context of the data set and potential uses and misuses.**

Outreach is needed to work with agencies and organizations to use gap analysis data to identify conservation opportunities and pursue conservation objectives with all potential partners. For example, public outreach may help to identify opportunities for potential land swapping and boundary adjustments to maximize economic benefit while maintaining areas important for conservation.

- **Provide a more detailed assessment of conservation status.**

The definitions supporting the four biodiversity management status categories may benefit from re-evaluation. Because of the regional focus of this project we were not able to achieve this aspect though the need is stronger now than before. Individual species and land cover types behave differently and may need more focused individual attention. Additionally, there is a perception in some agencies that Status 3 lands are inferred to be in ‘poor’ condition, which is not necessarily true. Likewise, Status 1 and 2 lands may not be in ‘good’ condition.

## Gap Analyses

The gap analyses should be responsive to changes in the input data sets. When the land cover, habitat models, or land stewardship are modified substantially there should be a concerted effort to revise the input data sets and reanalyze for gaps in biodiversity conservation. A streamlined system to document, archive, and run the analyses would need to be maintained and developed to facilitate such updates.

It is important to recognize that many land cover types and terrestrial vertebrate species are relatively common throughout the region and are associated with many diverse land stewards. Having minimal representation in Status 1 and 2 lands does not necessarily mean there is currently a “gap” in protection, but that the long-term trends and conditions



of these land cover types and species should probably be monitored now and in the future.

## FUTURE DIRECTIONS FOR GAP

Regional analyses are important for range-wide conservation of species. As more regional data sets become available through the Northwest GAP and Southeast GAP efforts, conservation partners will be provided a more complete picture on species conservation. Analysis will be possible within entire ecoregions, and such analyses will inform individual state efforts. Further utility in these data sets will be enhanced if topics such as ecosystem services, ecological economics, and adaptive management are included.

One objective of SWReGAP is to provide end users with data sets that can be used and modified to fit within user needs. Part of that objective is met by providing the majority of the source data used for these analyses on-line (<http://fws-nmcfwru.nmsu.edu/swregap/> and <http://earth.gis.usu.edu/swgap/index.html>). Many of the tools created for this project are similarly available. The USGS GAP Portal will also provide internet access to SWReGAP data sets for viewing or downloading (<http://gapanalysis.nbi.gov>). All of these provide unique opportunities for both informative and research use of SWReGAP data.

Application of SWReGAP data into the conservation planning effort has already occurred at varying levels within state and federal agencies. An outreach effort has been initiated to provide agencies with help in understanding and implementing SWReGAP data in their conservation activities. The outreach provides background on the gap analysis project, assistance in implementing the data in other analyses, and cooperative identification of new projects in which SWReGAP data can be utilized. Current and future efforts that use or plan to use SWReGAP data include the development of multi-species habitat conservation plans at the county level (Clark County, Nevada and Pima County, Arizona), the Forest Stewardship Program's Spatial Analysis Project (Utah Division of Forestry, Fire, and State Lands), and the development of the Region 2 Conservation Targets Database (USFWS). These efforts further enhance the SWReGAP data set, providing an even greater foundation for future work by other agencies. For example, state wildlife agency use of SWReGAP animal habitat models should extend beyond the comprehensive wildlife conservation strategies to planning efforts of state land offices, parks, and other state agencies. SWReGAP data is well suited to provide the foundation of meaningful conservation at many levels.

SWReGAP collaborators are pursuing further analyses and conservation applications using SWReGAP data for fire modeling, alternative future analyses, and historic habitat change analyses. Ecoregional gap analyses such as those completed for the Colorado Plateau Ecoregion (Boykin et al. 2008, Ernst and Prior-Magee 2008, Langs et al. 2008) and Sonoran Desert Ecoregion (Thomas et al. In Review) provide context for

conservation at the ecoregional level. Maintaining updates to the current land cover data set over time may, with the cooperation of land management agencies, be managed by the Intermountain Region Digital Image Archive Center (IRDIAAC).

SWReGAP data provides another tool for land managers to use in conservation planning and application in concert with current and future data sets (e.g., TNC Ecoregion Analysis, State Wildlife Action Plans). These and other tools when combined with human intellect have the capacity to provide for long term conservation in the Southwest.

# CHAPTER 7

## PRODUCT USE AND AVAILABILITY

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Photo from SWReGAP Training Site Image Library

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# HOW TO OBTAIN THE PRODUCTS

It is the goal of the Gap Analysis Program and the USGS Biological Resources Discipline (BRD) to make the data and associated information as widely available as possible. Use of the data requires specialized software called geographic information systems (GIS) and substantial computing power. Additional information on how to use the data or obtain GIS services is provided below and on the GAP home page (URL below). While a DVD or CD-ROM of the data will be the most convenient way to obtain the data, it may also be downloaded via the Internet from the national GAP web site at:

<http://gapanalysis.nbii.gov>

The web site will also provide, over the long term, information on the status of our regional project, future updates, data availability, and contacts. Following this project's completion, DVD/CD-ROMs of the final report and data should be available at a nominal cost--the above home page will provide ordering information. To find information on this GAP project's status and data, follow the links to "Projects" and then to the particular region of interest.

The Southwest Regional Gap Analysis Project (SWReGAP) data will also be available from the following sites: the SWReGAP website <http://fws-nmcfwru.nmsu.edu/swregap/> and the Utah State University Remote Sensing/GIS Lab website <http://earth.gis.usu.edu/swgap>.

Minimum GIS Required for Data Use: The regional data are provided as Arc/Info grids or Erdas Imagine (img) files for land cover, Erdas Imagine (img) for habitat models, and personal geodatabase or shapefile for land stewardship. This requires users to have access either to Spatial Analyst within ESRI's family of products, Erdas Imagine, or the ability to convert and view the data in another raster format. The complete datasets and the final report will require several terabytes of disk space (approximately 2.5 terabytes) for complete uncompressed datasets. This is comprised mostly of habitat models at 30-m resolution and 8-bit. These models can be converted to 4-bit to take up less space. Habitat models at 240-m resolution are smaller and will use approximately 37 gigabytes. Currently most computers can easily manage the functions necessary for display and navigating through the individual layers. Additional analysis may require tiling of the data or the use of more efficient algorithms.

## **Disclaimer**

Following is the official Biological Resources Discipline (BRD) disclaimer as of 29 January 1996, followed by additional disclaimers from GAP. Prior to using the data, you should consult the GAP home page (see How to Obtain the Products, above) for the current disclaimer.

Although these data have been processed successfully on a computer system at the BRD, no warranty expressed or implied is made regarding the accuracy or utility of the data on any other system or for general or scientific purposes, nor shall the act of distribution constitute any such warranty. This disclaimer applies both to individual use of the data and aggregate use with other data. It is strongly recommended that these data are directly acquired from a BRD server [see above for approved data providers] and not indirectly through other sources which may have changed the data in some way. It is also strongly recommended that careful attention be paid to the content of the metadata file associated with these data. The Biological Resources Discipline shall not be held liable for improper or incorrect use of the data described and/or contained herein.

These data were compiled with regard to the following standards. Please be aware of the limitations of the data. These data are meant to be used at a scale of 1:100,000 or smaller (such as 1:250,000 or 1:500,000) for the purpose of assessing the conservation status of animals and vegetation types over large geographic regions. The data may or may not have been assessed for statistical accuracy. Data evaluation and improvement may be ongoing. The Biological Resources Discipline makes no claim as to the data's suitability for other purposes. This is writable data which may have been altered from the original product if not obtained from a designated data distributor identified above.

## **Metadata**

Proper documentation of information sources and processes used to assemble GAP data layers is central to the successful application of GAP data. Metadata is a description of the content, quality, lineage, contact, condition, and other characteristics of data. It is a valuable tool that preserves the usefulness of data over time by detailing methods for data collection and data set creation. It greatly minimizes duplication of effort in the collection of expensive digital data and fosters sharing of digital data resources. Metadata supports local data asset management such as local inventory and data catalogs, and external user communities such as Clearinghouses and websites. It provides adequate guidance for end-use application of data such as detailed lineage and context. Metadata makes it possible for data users to search, retrieve, and evaluate data set information by providing standardized descriptions of geospatial and biological data.

The Federal Geographic Data Committee (FGDC) approved the Content Standard for Digital Geospatial Metadata (FGDC-STD-001-1998) in June 1998 and the National Biological Information Infrastructure (NBII) <<http://www.nbio.gov>> approved the Biological Data Profile (BDP) in 1999. The BDP adds fields for biological information such as taxonomy, analytical tools, and methodology to the FGDC standard core set of elements. Visit <<http://www.nbio.gov>> – Metadata – FGDC Metadata – Standards for more information. Executive Order 12906 requires that any spatial data sets generated with federal dollars will have FGDC-compliant metadata.

Each spatial data layer submitted must be accompanied by its metadata (\*.html file) in the same directory. The data producer must also submit an additional directory (called “meta\_master”) which will include each metadata file in four forms (\*.txt, \*.html, \*.xml, and \*.sgml). There are many tools available for metadata creation. For some examples,

see <<http://www.nbii.gov>> – Metadata – FGDC Metadata – Tools. Please note that some tools are free, and some are not. The redundancy in output format is to provide one file for error checking (\*.txt), one for presentation on the Internet (\*.html), and two for indexing elements for the spatial data clearinghouse (\*.xml, \*.sgml). Remember, metadata describes the development of the spatial data set being documented. If there are companion files to the GIS data, use metadata to reference (reports, spreadsheet, another GIS layer).

USGS (NBII and FGDC) personnel conduct metadata training to meet FGDC standards and to include biological data. Metadata workshops provide an introduction to the metadata standard with hands-on practice producing documentation for a sample data set using appropriate software: Intergraph's "Spatial Metadata Management System" (SMMS) and USDA Forest Service North Central Research Station's "Metavist" are commonly used. The workshops provide an understanding of the FGDC metadata standard and also cover topics such as the metadata clearinghouse, metadata development tools, and strategies for metadata production. See <<http://www.nbii.gov>> – Metadata – FGDC Metadata – Training for more information and access to the training calendar.

### **Appropriate and Inappropriate Use of These Data**

All information is created with a specific end use or uses in mind. This is especially true for GIS data, which is expensive to produce and must be directed to meet the immediate program needs. For GAP, minimum standards were set (see *A Handbook for Gap Analysis*, Scott et al. 1993) to meet program objectives. These standards include: scale or resolution (1:100,000 or 100 hectare minimum mapping unit), accuracy (80% accurate at 95% confidence), and format (ARC/INFO coverage tiled to the 30' x 60' USGS quadrangle). For complete project standards, refer to the *Gap Analysis Handbook* available from the "Conducting a Gap Analysis" section of the National GAP web site <http://gapanalysis.nbii.gov>.

Recognizing, however, that GAP would be the first, and for many years likely the only, source of statewide biological GIS maps, the data were created with the expectation that they would be used for other applications. Therefore, we list below both appropriate and inappropriate uses. This list is in no way exhaustive but should serve as a guide to assess whether a proposed use can or cannot be supported by GAP data. For most uses, it is unlikely that GAP will provide the only data needed, and for uses with a regulatory outcome, field surveys should verify the result. In the end, it will be the responsibility of each data user to determine if GAP data can answer the question being asked, and if they are the best tool to answer that question.

Scale: First we must address the issue of appropriate scale to which these data may be applied. The data were produced with an intended application at the ecoregion level, that is, geographic areas from several hundred thousand to millions of hectares in size. The data provide a coarse-filter approach to analysis, meaning that not every occurrence of every plant community or animal species habitat is mapped, only larger, more generalized distributions. The data are also based on the USGS 1:100,000 scale of

mapping in both detail and precision. When determining whether to apply GAP data to a particular use, there are two primary questions: do you want to use the data as a map for the particular geographic area, or do you wish to use the data to provide context for a particular area? The distinction can be made with the following example: You could use GAP land cover to determine the approximate amount of oak woodland occurring in a county, or you could map oak woodland with aerial photography to determine the exact amount. You then could use GAP data to determine the approximate percentage of all oak woodland in the region or state that occurs in the county, and thus gain a sense of how important the county's distribution is to maintaining that plant community.

Appropriate Uses: The above example illustrates two appropriate uses of the data: as a coarse map for a large area such as a county, and to provide context for finer-level maps. Specific case-study examples are provided in [Appendix 7-1](#), but following is a general list of applications:

- Statewide biodiversity planning
- Regional (Councils of Government) planning
- Regional habitat conservation planning
- County comprehensive planning
- Large-area resource management planning
- Coarse-filter evaluation of potential impacts or benefits of major projects or plan initiatives on biodiversity, such as utility or transportation corridors, wilderness proposals, regional open space and recreation proposals, etc.
- Determining relative amounts of management responsibility for specific biological resources among land stewards to facilitate cooperative management and planning.
- Basic research on regional distributions of plants and animals and to help target both specific species and geographic areas for needed research.
- Environmental impact assessment for large projects or military activities.
- Estimation of potential economic impacts from loss of biological resource-based activities.
- Education at all levels and for both students and citizens.

Inappropriate Uses: It is far easier to identify appropriate uses than inappropriate ones, however, there is a "fuzzy line" that is eventually crossed when the differences in resolution of the data, size of geographic area being analyzed, and precision of the answer required for the question are no longer compatible. Examples include:

- Using the data to map small areas (less than thousands of hectares), typically requiring mapping resolution at 1:24,000 scale and using aerial photographs or ground surveys.
- Combining GAP data with other data finer than 1:100,000 scale to produce new hybrid maps or answer queries.
- Generating specific areal measurements from the data finer than the nearest thousand hectares (minimum mapping unit size and accuracy affect this precision).
- Establishing exact boundaries for regulation or acquisition.

- Establishing definite occurrence or non-occurrence of any feature for an exact geographic area (for land cover, the percent accuracy will provide a measure of probability).
- Determining abundance, health, or condition of any feature.
- Establishing a measure of accuracy of any other data by comparison with GAP data.
- Altering the data in any way and redistributing them as a GAP data product.
- Using the data without acquiring and reviewing the metadata and this report.



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# GLOSSARY

aerial videography - video images of the land surface taken from an airplane

algorithm - a procedure to solve a problem or model a solution (In GAP typically refers to a GIS procedure used to model animal distributions.)

alliance level - a land unit made up of an "alliance" of natural communities that have the same dominant or co-dominant plant species or, in the absence of vegetation, by the dominant land cover typically described according to the Anderson land cover classification (see "Natural Community Alliance" in Grossman et al. 1995)

alpha diversity - a single within-habitat measure of species diversity regardless of internal pattern, generally over an area of 0.1 to 1,000 hectares (see Whittaker 1960, 1977) -

Anderson Level II - the second hierarchical level in the Anderson land cover classification system (see Anderson et al. 1976)

anthropogenic - caused by man

assemblages - a group of ecologically interrelated plant and animal species

at-sensor reflectance – Reflectance is the ratio of exiting solar radiation from the target divided by total incoming solar radiation. At-sensor reflectance, or apparent reflectance, is the combined reflectance from the earth's surface and atmosphere.

band, spectral - a segment of the electromagnetic spectrum defined by a range of wavelengths (e.g. blue, green, red, near infrared, far infrared) that comprise the Landsat TM imagery

beta diversity - the change in species diversity among different natural communities of a landscape; an index of between-habitat diversity (see Whittaker 1960, 1977)

biodiversity - generally, the variety of life and its interrelated processes

biogeographic - relating to the geographical distribution of plants and animals

biological diversity - see biodiversity

cartographic - pertaining to the art or technique of making maps or charts

classify - to assign objects, features, or areas on an image to spectral classes based upon their appearance as opposed to 'classification' referring to a scheme for describing the hierarchies of vegetation or animal species for an area

coarse filter - the general conservation activities that conserve the common elements of the landscape matrix, as opposed to the "fine filter" conservation activities that are aimed at special cases such as rare elements (see Jenkins 1985)

community - a group of interacting plants and animals

cover type - a non-technical higher-level floristic and structural description of vegetation cover

cross-walking - matching equivalent land cover categories between two or more classification systems

deductive modeling – modeling approach using general information over the range of the species often obtained from literature to model species habitat.

delineate - identifying the boundaries between more or less homogenous areas on remotely sensed images as visible from differences in tone and texture

delta diversity - the change in species diversity between landscapes along major climatic or physiographic gradients (see Whittaker 1977)

digitization - entering spatial data digitally into a Geographic Information System

ecoregion - a large region, usually spanning several million hectares, characterized by having similar biota, climate, and physiography (topography, hydrology, etc).

ecosystem - a biological community (ranging in scale from a single cave to millions of hectares), its physical environment, and the processes through which matter and energy are transferred among the components

edge-matching - the process of connecting polygons at the boundary between two independently created maps, either between TM scenes or between state GAP data sets

element - a plant community or animal species mapped by GAP. May also be referred to as "element of biodiversity".

error of commission - the occurrence of a species (or other map category) is erroneously predicted in an area where it is in fact absent

error of omission - when a model fails to predict the occurrence of a species that is actually present in an area

exact set coverage - a basic optimization problem to determine the best method for identifying general areas that, when selected sequentially, would have the greatest positive cumulative impact on attaining adequate representation of any or all biotic elements of interest

extinction - disappearance of a species throughout its entire range

extirpation - disappearance of a species from part of its range

fine filter - see "coarse filter"

floristic - pertaining to the plant species that make up the vegetation of a given area.

formation level - the level of land cover categorization between Group and Alliance describing the structural attributes of a land unit, for example, "Evergreen Coniferous Woodlands with Rounded Crowns" (see Jennings 1993b)

gamma diversity - the species diversity of a landscape, generally covering 1,000 to 1,000,000 hectares, made up of more than one kind of natural community (see Whittaker 1977)

gap analysis - a comparison of the distribution of elements of biodiversity with that of areas managed for their long-term viability to identify elements with inadequate representation

geographic information systems - computer hardware and software for storing, retrieving, manipulating, and analyzing spatial data

Global Positioning System (GPS) - an instrument that utilizes satellite signals to pinpoint its location on the earth's surface

greedy heuristic - an algorithm for exact set cover analysis (see Kiester et al., in press)

ground truthing - verifying maps by checking the actual occurrence of plant and animal species in the field at representative sample locations

habitat - the physical structure, vegetational composition, and physiognomy of an area, the characteristics of which determine its suitability for particular animal or plant species

hectare - a metric unit of area of 10,000 square meters and equal to 2.47 acres

hex/hexagon - typically refers to the EPA EMAP hexagonal grid of 635 square kilometer units

hyperclustering - a efficient, interactive method for accurately analyzing and classifying remotely-sensed data that reduces data size and computational requirements while retaining the integrity of the original data

inductive modeling – modeling approach using site specific information to model species habitat over the entire range. Data sources are often known point locations of species.

lentic – still, e.g., water in a lake or pond

lotic - flowing, e.g., water in a stream or river

measure of agreement – analysis using two or more different datasets to measure the similarity or “agreement” between datasets.

metadata - information about data, e.g., their source, lineage, content, structure, and availability

minimum mapping unit - the smallest area that is depicted on a map

neotropics - the zoo-geographic region stretching southward from the tropic of Cancer and including southern Mexico, Central and South America, and the West Indies

phenology - the study of periodic biological phenomena, such as flowering, breeding, and migration, especially as related to climate

phenotype - the environmentally and genetically determined observable appearance of an organism, especially as considered with respect to all possible genetically influenced expressions of one specific character

physiognomic - based on physical features

physiographic province - a region having a pattern of relief features or land forms that differ significantly from that of adjacent regions

pixel - the smallest spatial unit in a raster data structure

polygon - an area enclosed by lines in a vector-based Geographic Information System data layer or a region of contiguous homogeneous pixels in a raster system

preprocessing - those operations that prepare data for subsequent analysis, usually by attempts to correct or compensate for systematic, radiometric, and geometric errors

pro-active - acting in anticipation of an event as opposed to reacting after the fact

range - the geographic limit of the species

range unit - a spatial, geographic unit to record and display species geographic range.

raster format - a data structure that uses grid cells as fundamental units for analysis and manipulation in a Geographic Information System

reach - a stream or river segment between inflowing tributaries

registration, spatial - matching different images to each other by finding points on the images that can be matched to known points on the ground

remote sensing - deriving information about the earth's surface from images acquired at a distance, usually relying on measurement of electromagnetic radiation reflected or emitted from the feature of interest

resolution - the ability of a remote sensing system to record and display fine detail in a distinguishable manner or: the smallest feature that can be distinguished or resolved on a map or image, such as a TM pixel

scale, map - the ratio of distance on a map to distance in the real world, expressed as a fraction; the smaller the denominator, the larger the scale, e.g. 1:24,000 is larger than 1:100,000

sensitivity analysis - the consideration of a number of factors involved in the mathematical modeling of an ecosystem and its components. These include feedback and control, and the stability and sensitivity of the system as a whole to changes in some part of the system. Predictions can be made from the analysis..

simulated annealing - an algorithm used for set coverage analysis (see Kiester et al., in press)

species richness - the number of species of a particular interest group found in a given area

spectral cluster - a group of adjacent pixels that are uniform with respect to their brightness values

supervised classification - the process of classifying TM pixels of unknown identity by using samples of known identity (i.e., pixels already assigned to informational classes by ground truthing or registration with known land cover) as training data

synoptic - constituting a brief statement or outline of a subject; presenting a summary

tessellation - the division of a map into areas of equal and uniform shape such as the EPA- EMAP hexagon

Thematic Mapper - a sensor on LANDSAT 4 and 5 satellites that records information in seven spectral bands, has a spatial resolution of about 30 m x 30 m, and represents digital values in 256 levels of brightness per band

transect - a transversely cut line along which physical and biological observations are made

trophic structure - the various levels in a food chain, such as producers (plants), primary consumers (herbivores), and secondary consumers (carnivores)

Universal Transverse Mercator - one of several map projections or systems of transformations that enables locations on the spherical earth to be represented systematically on a flat map

Universal Transverse Mercator grid - a geographic reference system used as the basis for worldwide locational coding of information in a GIS or on a map

unsupervised classification - the definition, identification, labeling, and mapping of natural groups, or classes, of spectral values within a scene. These spectral classes are reasonably uniform in brightness in several spectral channels.

vector format - a data structure that uses polygons, arcs (lines), and points as fundamental units for analysis and manipulation in a Geographic Information System

virtual reality - a computer-generated simulation of reality with which users can interact using specialized peripherals such as data gloves and head-mounted computer graphic displays

visual sensitivity analysis – sensitivity analysis using geographic information systems and concepts of sensitivity analysis (see sensitivity analysis) to provide insight into datasets used in modeling habitat.

wildlife habitat relationship model - a method of linking patterns of known habitat use by animal species with maps of existing vegetation, thereby identifying the spatial extent of important habitat features for use in conservation and management.

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## GLOSSARY OF ACRONYMS

ACEC Area of Critical Environmental Concern  
ACSM American Congress on Surveying and Mapping  
ADAMAS Aquatic Database Management System  
ADEM Alabama Department of Environmental Management  
AML ARC/INFO Macro Language  
ASPRS American Society for Photogrammetry & Remote Sensing  
AVHRR Advanced Very High Resolution Radiometer (satellite system)  
BEST Biomonitoring of Environmental Status and Trends  
BLM Bureau of Land Management  
CAFF Conservation of Arctic Flora and Fauna  
C-CAP Coastwatch Change Analysis Program (NOAA)  
CDC Conservation Data Center  
CEC Council on Environmental Cooperation  
CENR Committee on Environment and Natural Resources  
CERES California Environmental Resources Evaluation System  
CIESIN Consortium for Internat'l Earth Science Information Network  
CODA Conservation Options and Decision Analysis (software)  
CRMP Coordinated Resource Management Plan  
CRT Cathode ray tube (?)  
CRUC Cooperative Research Unit Center  
DLG-E Digital line graph - enhanced  
DOI Department of the Interior  
EDC EROS Data Center  
ECOMAP The National Hierarchical Framework of Ecological Units mapping project of the USDA Forest Service  
EMAP Environmental Monitoring & Assessment Program  
EMAP-LC EMAP-Landscape Characterization (USEPA)  
EMSL Environmental Monitoring & Systems Laboratory (USEPA)  
EMTC Environmental Management Technical Center (NBS)  
EOS Earth Observing System  
EOSAT Earth Observation Satellite Company (the commercial operator of the Landsat satellite system)  
EOSDIS EOS Data & Information System  
ERL Environmental Research Laboratory, Corvallis (USEPA)  
EROS Earth Resources Observation Systems (USGS)  
ESRI Environmental Systems Research Institute  
ETM+ Enhanced Thematic Mapper plus  
FGDC Federal Geographic Data Committee  
FTP file transfer protocol  
FY Fiscal Year  
GAO General Accounting Office (Congress)  
GAP Gap Analysis Program  
GCDIS Global Change Data and Information System

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GLIS Global Land Information System (USGS)  
GLOBE Global Learning and Observations to Benefit the Environment  
GPS Global Positioning System  
GRASS Geographic Resources Analysis Support System  
GRIS Geographic Resource Information Systems  
HRMSI High Resolution Multispectral Stereo Imager  
HUC Hydrologic Unit Code  
IALE International Association of Landscape Ecology  
IDRISI A GIS developed by Clark University  
LAPS Land Acquisition Priority System  
LC/LU Land Cover/Land Use (USGS)  
MIPS Map and Image Processing System  
MOU Memorandum of Understanding  
MMU Minimum mapping unit  
MRLC Multi-Resolution Land Characteristics Consortium  
MSS Multi-Spectral Scanner  
MTPE Mission to Planet Earth  
NAFTA North American Free Trade Agreement  
NALC North American Landscape Characterization (USEPA, USGS)  
NAWQA National Water Quality Assessment (USGS)  
NBII National Biological Information Infrastructure  
NBS National Biological Service  
NCCP Natural Communities Conservation Planning program (in CA)  
NDCDB National Digital Cartographic Data Base  
NERC National Ecology Research Center (Ft. Collins, CO)  
NMD National Mapping Division  
NPS National Park Service  
NSDI National Spatial Data Infrastructure  
NSTC National Science and Technology Council  
NVC National Vegetation Classification  
NWI National Wetlands Inventory (USFWS)  
OMB Office of Management and Budget (Administration)  
OSIS Oregon Species Information System  
PARC Public Access Resource Center  
PI Principal Investigator  
RNA Research Natural Area  
SAB Science Advisory Board (USEPA)  
SCICOLL Scientific Collections Permit Database  
SDTS Spatial Data Transfer Standard  
SGID State Geographic Information Database  
SNEP Sierra Nevada Ecosystem Project  
SOFIA Southern Forest Inventory and Analysis  
SPOT Système Pour l'Observation de la Terre  
RMSE Root mean square error  
TIGER Topologically Integrated Geographic Encoding and Referencing system (used for U.S. census)

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TM Thematic Mapper  
TNC The Nature Conservancy  
UNESCO United Nations Educational, Scientific, and Cultural Organization  
URISA Urban and Regional Information Systems Association.  
URL Universal Resource Locator  
USFS US Forest Service  
USFWS US Fish & Wildlife Service  
US-NVC US National Vegetation Classification  
US-NVCS US National Vegetation Classification System  
UTM Universal Transverse Mercator  
UVM University of Vermont  
WHRM Wildlife/habitat relationship model  
WISCLAND Wisconsin Initiative for Statewide Cooperation on Landscape Analysis and Data

# APPENDICES

## Appendix 1-1. List of Personnel

| State | Last Name   | First Name | Affiliation                               | land cover | habitat modeling | Steward-ship | Analysis | Outreach | Misc |
|-------|-------------|------------|---|------------|------------------|--------------|----------|----------|------|
| AZ    | Drost       | Charles    | USGS, Southwest Biological Science Center |            | X                |              | X        | X        |      |
| AZ    | Dvorak      | Jennifer   | Northern Arizona University               | X          |                  |              |          |          |      |
| AZ    | Falzarano   | Sarah      | USGS, Southwest Biological Science Center | X          |                  |              |          | X        |      |
| AZ    | Hill        | Mar-Elise  | Northern Arizona University               | X          |                  |              |          |          |      |
| AZ    | Hunt        | Rob        | Northern Arizona University               | X          |                  | X            |          |          |      |
| AZ    | Kline       | Chris      | Northern Arizona University               | X          |                  |              |          |          |      |
| AZ    | Lubell      | Eric       | Northern Arizona University               | X          |                  |              |          |          |      |
| AZ    | Persons     | Trevor     | Northern Arizona University               |            | X                |              |          |          |      |
| AZ    | Pohs        | Keith      | Northern Arizona University               | X          |                  |              |          |          |      |
| AZ    | Robinson    | Don        | Northern Arizona University               | X          |                  |              |          |          |      |
| AZ    | Thomas      | Kathryn    | USGS, Southwest Biological Science Center | X          | X                | X            | X        | X        |      |
| AZ    | Thompson    | Kerry      | Northern Arizona University               | X          |                  |              |          |          |      |
| AZ    | Turner      | Matt       | Northern Arizona University               | X          |                  |              |          |          |      |
| AZ    | Tweiten     | Michael    | Northern Arizona University               | X          |                  |              |          |          |      |
| AZ    | Wallace     | Cynthia    | USGS, Southwest Geographic Science Team   | X          |                  |              |          |          |      |
| AZ    | Wynne       | J. Judson  | USGS, Southwest Biological Science Center |            | X                |              |          | X        |      |
| CO    | Barringer   | Debra      | CSU, Natural Resources Ecology Laboratory | X          |                  |              |          |          |      |
| CO    | Berggren    | Scott      | CSU, Natural Resources Ecology Laboratory | X          |                  |              |          |          |      |
| CO    | Buechling   | Arne       | CSU, Natural Resources Ecology Laboratory | X          |                  |              |          |          |      |
| CO    | Cooley      | Casey      | Bureau of Land Management                 | X          |                  |              |          |          |      |
| CO    | Erickson    | Ami        | CSU, Natural Resources Ecology Laboratory | X          |                  |              |          |          |      |
| CO    | Fugate      | Steve      | CSU, Natural Resources Ecology Laboratory | X          |                  |              |          |          |      |
| CO    | Goralski    | Elizabeth  | CSU, Natural Resources Ecology Laboratory | X          |                  |              |          |          |      |
| CO    | Hamer       | Tammy      | CSU, Natural Resources Ecology Laboratory |            | X                |              |          | X        |      |
| CO    | Katers      | Laura      | CSU, Natural Resources Ecology Laboratory | X          |                  |              |          |          |      |
| CO    | McGaugh     | Suzanne    | CSU, Natural Resources Ecology Laboratory | X          |                  |              |          |          |      |
| CO    | Mettenbrink | Chris      | CSU, Natural Resources Ecology Laboratory |            | X                |              |          | X        |      |
| CO    | Musser      | Amanda     | CSU, Natural Resources Ecology Laboratory | X          |                  |              |          |          |      |
| CO    | Nicholas    | Paula      | Colorado Division of Wildlife             |            |                  |              |          |          | X    |
| CO    | Oakes       | KatyJo     | CSU, Natural Resources Ecology Laboratory |            | X                |              |          | X        |      |
| CO    | O'Brien     | Lee        | CSU, Natural Resources Ecology Laboratory | X          | X                | X            | X        | X        |      |
| CO    | Osborne     | Dianne     | Bureau of Land Management                 | X          |                  |              |          | X        |      |
| CO    | Peterson    | Nate       | CSU, Natural Resources Ecology Laboratory |            |                  | X            |          |          |      |
| CO    | Rondeau     | Renee      | CSU, Colorado Natural Heritage Program    | X          |                  |              |          |          |      |
| CO    | Schrupp     | Don        | Colorado Division of Wildlife             | X          | X                | X            | X        | X        |      |
| CO    | Siechrist   | Jack       | CSU, Natural Resources Ecology Laboratory | X          |                  |              |          |          |      |
| CO    | Sinley      | Jim        | Colorado Division of Wildlife             |            |                  |              |          |          | X    |
| CO    | Theobald    | Dave       | CSU, Natural Resources Ecology Laboratory |            |                  | X            |          |          |      |
| CO    | Velasquez   | Cristian   | CSU, Natural Resources Ecology Laboratory | X          |                  |              |          |          |      |
| CO    | Waller      | Eric       | CSU, Natural Resources Ecology Laboratory | X          |                  |              |          | X        |      |
| CO    | Ward        | Jesse      | CSU, Natural Resources Ecology Laboratory | X          |                  |              |          |          |      |
| CO    | Ward        | Sarah      | CSU, Natural Resources Ecology Laboratory | X          |                  |              |          |          |      |

| State | Last Name     | First Name | Affiliation                               | land cover | habitat modeling | Steward-ship | Analysis | Outreach | Misc |
|-------|---------------|------------|---|------------|------------------|--------------|----------|----------|------|
| CO    | Welch         | Phillip    | CSU, Natural Resources Ecology Laboratory | X          |                  |              |          |          |      |
| CO    | Wolk          | Brett      | CSU, Natural Resources Ecology Laboratory | X          |                  |              |          |          |      |
| NM    | Balanchandron | Nikhil     | NMSU/NMCFWRU                              |            | X                |              |          |          |      |
| NM    | Boykin        | Kenneth    | NMSU/NMCFWRU                              | X          | X                | X            | X        | X        |      |
| NM    | Casados       | Tommy      | NMSU/NMCFWRU                              |            | X                |              |          |          | X    |
| NM    | Chavez        | Rachael    | NMSU/NMCFWRU                              |            | X                |              |          |          |      |
| NM    | Coble         | Dave       | NMSU/NMCFWRU                              | X          |                  |              |          |          |      |
| NM    | Deitner       | Bob        | NMSU/NMCFWRU                              |            | X                |              |          | X        |      |
| NM    | DeLorenzo     | Andrea     | NMSU/NMCFWRU                              |            | X                |              |          |          |      |
| NM    | Eckert        | Nick       | NMSU/NMCFWRU                              |            |                  |              |          |          | X    |
| NM    | Ernst         | Andrea     | NMSU/NMCFWRU                              |            | X                | X            | X        | X        |      |
| NM    | Fort          | Whitney    | NMSU/NMCFWRU                              |            |                  |              |          |          | X    |
| NM    | Fort          | Lindsey    | NMSU/NMCFWRU                              |            |                  |              |          |          | X    |
| NM    | Fox           | Jodi       | NMSU/NMCFWRU                              |            | X                |              |          |          |      |
| NM    | Godlewski     | Chris      | NMSU/NMCFWRU                              |            |                  | X            |          |          |      |
| NM    | Kamienski     | Tomas      | NMSU/NMCFWRU                              |            | X                |              |          |          | X    |
| NM    | King          | Cynthia    | NMSU/NMCFWRU                              | X          | X                |              |          |          |      |
| NM    | La Sorte      | Frank      | NMSU/NMCFWRU                              |            | X                |              |          |          |      |
| NM    | Lanser        | Julie      | NMSU/NMCFWRU                              |            | X                |              |          |          |      |
| NM    | Lopez         | Veronica   | NMSU/NMCFWRU                              |            |                  | X            |          |          |      |
| NM    | McNown        | Brad       | NMSU/NMCFWRU                              | X          |                  |              |          |          |      |
| NM    | Moore         | Amy        | NMSU/NMCFWRU                              | X          |                  |              |          |          |      |
| NM    | Prasad        | Maritha    | NMSU/NMCFWRU                              |            | X                |              |          |          |      |
| NM    | Propeck-Gray  | Suzanne    | NMSU/NMCFWRU                              |            | X                |              | X        | X        |      |
| NM    | Puttere       | Jennifer   | NMSU/NMCFWRU                              | X          | X                |              |          |          |      |
| NM    | Rimbert       | Celine     | NMSU/NMCFWRU                              |            | X                |              |          |          |      |
| NM    | Schwenke      | Zach       | NMSU/NMCFWRU                              |            | X                |              |          |          |      |
| NM    | Shrader       | Scott      | NMSU/NMCFWRU                              | X          | X                | X            |          | X        |      |
| NM    | Sizemore      | Erin       | NMSU/NMCFWRU                              | X          |                  |              |          |          |      |
| NM    | Thompson      | Bruce      | NMDGF                                     | X          | X                | X            | X        | X        |      |
| NM    | Torrez        | Steve      | NMSU/NMCFWRU                              |            |                  |              |          |          | X    |
| NM    | Weber         | Ed         | NMSU/NMCFWRU                              | X          |                  |              |          |          |      |
| NM    | Wu            | Rob        | NMSU/NMCFWRU                              |            |                  |              |          |          | X    |
| NM    | Young         | Kendal     | NMSU/NMCFWRU                              |            | X                | X            |          |          |      |
| NM    | Greenlee      | Janet      | NMSU/PSL                                  | X          |                  |              |          |          |      |
| NV    | Blair         | Hank       | Eastern Nevada Landscape Coalition        | X          |                  |              |          |          |      |
| NV    | Bradford      | Dave       | EPA-Las Vegas                             | X          | X                |              | X        |          |      |
| NV    | Brost         | Brian      | Eastern Nevada Landscape Coalition        | X          |                  |              |          |          |      |
| NV    | Cross         | Chad       | EPA-Las Vegas                             |            | X                |              |          |          |      |
| NV    | Darby         | Melanie    | Eastern Nevada Landscape Coalition        | X          |                  |              |          |          |      |
| NV    | Dolans        | Peter      | Eastern Nevada Landscape Coalition        | X          |                  |              |          |          |      |
| NV    | Ellis         | Derrek     | Eastern Nevada Landscape Coalition        | X          |                  |              |          |          |      |
| NV    | Estep         | Brittany   | Eastern Nevada Landscape Coalition        | X          |                  |              |          |          |      |
| NV    | Frakes        | Neil       | Eastern Nevada Landscape Coalition        | X          |                  |              |          |          |      |
| NV    | Hahn          | Lisa       | Eastern Nevada Landscape Coalition        | X          |                  |              |          |          |      |

| State  | Last Name   | First Name  | Affiliation                        | land cover | habitat modeling | Steward-ship | Analysis | Outreach | Misc |
|--------|-------------|-------------|------------------------------------|------------|------------------|--------------|----------|----------|------|
| NV     | Herndon     | Kristine    | UNLV                               | X          | X                |              |          |          |      |
| NV     | Jantz       | Patrick     | Eastern Nevada Landscape Coalition | X          |                  |              |          |          |      |
| NV     | Jones       | Bruce       | EPA-Las Vegas                      |            | X                |              |          |          |      |
| NV     | Kepner      | Bill        | EPA-Las Vegas                      | X          | X                | X            | X        | X        |      |
| NV     | Kreider     | Christopher | Eastern Nevada Landscape Coalition | X          |                  |              |          |          |      |
| NV     | Luna        | Melanie     | UNLV                               | X          | X                |              |          |          |      |
| NV     | Sajwaj      | Todd        | Army Corps/ Lockheed/National Gap  | X          |                  |              | X        |          |      |
| NV     | Schrenk     | Anna        | Eastern Nevada Landscape Coalition | X          |                  |              |          |          |      |
| NV     | Semmands    | Joey        | Eastern Nevada Landscape Coalition | X          |                  |              |          |          |      |
| NV     | Sindihar    | Sudamini    | Eastern Nevada Landscape Coalition | X          |                  |              |          |          |      |
| NV     | Weiner      | William     | Eastern Nevada Landscape Coalition | X          |                  |              |          |          |      |
| Region | Prior-Magee | Julie       | USGS/National Gap                  | X          | X                | X            | X        | X        | X    |
| UT     | Adair       | Bill        | USU, RSGIS Lab                     | X          |                  |              |          |          | X    |
| UT     | Barfuss     | Brad        | USU, RSGIS Lab                     | X          |                  |              |          |          | X    |
| UT     | Chowdary    | Vinod       | USU, RSGIS Lab                     | X          |                  |              |          |          | X    |
| UT     | Cox         | Steven      | USU, RSGIS Lab                     | X          |                  |              |          |          | X    |
| UT     | Ducharme    | Marie       | USU, RSGIS Lab                     | X          |                  |              |          |          |      |
| UT     | Edgar       | Jonathan    | USU, RSGIS Lab                     | X          |                  |              |          |          | X    |
| UT     | Garrard     | Chris       | USU, RSGIS Lab                     | X          |                  |              |          |          | X    |
| UT     | Gilbert     | Jarom       | USU, RSGIS Lab                     | X          |                  |              |          |          | X    |
| UT     | Graves      | Scott       | USU, RSGIS Lab                     | X          |                  |              |          | X        |      |
| UT     | Hurd        | Wendy       | USU, RSGIS Lab                     | X          |                  |              |          |          | X    |
| UT     | Johnson     | Rob         | USU, RSGIS Lab                     |            |                  |              |          |          | X    |
| UT     | Kirby       | Jessica     | USU, RSGIS Lab                     | X          |                  |              |          | X        | X    |
| UT     | Langs       | Lisa        | USU, RSGIS Lab                     | X          |                  | X            | X        | X        |      |
| UT     | Lowry       | John        | USU, RSGIS Lab                     | X          | X                | X            | X        | X        |      |
| UT     | Luce        | Alan        | USU, RSGIS Lab                     |            |                  |              |          |          | X    |
| UT     | Manis       | Gerald      | USU, RSGIS Lab                     | X          |                  |              |          | X        |      |
| UT     | McGinty     | Chris       | USU, RSGIS Lab                     | X          |                  |              |          |          |      |
| UT     | Plourde     | Line        | USU, RSGIS Lab                     | X          |                  |              |          |          | X    |
| UT     | Ramsey      | Doug        | USU, RSGIS Lab                     | X          | X                | X            | X        | X        |      |
| UT     | Rieth       | Wendy       | USU, RSGIS Lab                     | X          | X                |              |          | X        |      |
| UT     | Sajwaj      | Todd        | USU, RSGIS Lab                     | X          |                  |              |          | X        |      |
| UT     | Sant        | Eric        | USU, RSGIS Lab                     | X          |                  |              |          |          |      |
| UT     | Terletzky   | Pat         | USU, RSGIS Lab                     | X          |                  |              |          |          |      |
| UT     | Wolbrink    | Mark        | USU, RSGIS Lab                     | X          |                  |              |          |          | X    |

## Appendix 2-1. Distribution of all samples used for mapping in the SWReGAP region.

Samples collected via air photo interpretation (3 % of total) were collected exclusively by the Utah team. Samples collected via DOQ/Terra Server interpretation were collected by the Arizona and Utah teams (4%). Samples collected via image (Landsat) interpretation (12%) were collected exclusively by the Colorado team, often with interpretive cues from Terraserver. Samples obtained from existing databases (32%) and collected through SWReGAP fieldwork (49%) represent the collective efforts of the five mapping teams.

|  | Source                   |                                |                                 |                      |                   | Total Samples by Land Cover Class |
|--|--------------------------|--------------------------------|---------------------------------|----------------------|-------------------|-----------------------------------|
|  | Air Photo Interpretation | Image (Landsat) Interpretation | DOQ/Terra Server Interpretation | Cooperator Databases | SWReGAP Fieldwork |                                   |
| <b>SPARSELY VEGETATED/BARREN CLASSES</b>                             |                          |                                |                                 |                      |                   |                                   |
| Barren Lands, Non-specific   |                          |                                | 45                              | 55                   | 222               | 322                               |
| Colorado Plateau Mixed Bedrock Canyon and Tableland                  | 82                       | 54                             | 332                             | 64                   | 393               | 925                               |
| Inter-Mountain Basins Active and Stabilized Dune                     | 1                        |                                | 38                              | 27                   | 161               | 227                               |
| Inter-Mountain Basins Cliff and Canyon                               | 12                       | 3                              | 67                              | 17                   | 309               | 408                               |
| Inter-Mountain Basins Playa  |                          | 3                              | 43                              | 59                   | 306               | 411                               |
| Inter-Mountain Basins Shale Badland                                  |                          | 13                             | 86                              | 53                   | 117               | 269                               |
| Inter-Mountain Basins Volcanic Rock and Cinder Land                  | 38                       | 7                              | 42                              | 140                  | 53                | 280                               |
| Inter-Mountain Basins Wash   |                          | 66                             |                                 | 32                   | 56                | 154                               |
| Mediterranean California Alpine Bedrock and Scree                    |                          |                                |                                 |                      | 5                 | 5                                 |
| North American Alpine Ice Field                                      | 4                        |                                | 25                              | 2                    |                   | 31                                |
| North American Warm Desert Active and Stabilized Dune                |                          |                                |                                 | 137                  | 30                | 167                               |
| North American Warm Desert Badland                                   |                          |                                |                                 |                      | 12                | 12                                |
| North American Warm Desert Bedrock Cliff and Outcrop                 |                          |                                | 2                               | 9                    | 204               | 215                               |
| North American Warm Desert Pavement                                  |                          |                                | 3                               | 15                   | 33                | 51                                |
| North American Warm Desert Playa                                     |                          |                                |                                 | 44                   | 131               | 175                               |
| North American Warm Desert Volcanic Rockland                         |                          |                                |                                 | 13                   | 11                | 24                                |
| Rocky Mountain Alpine Bedrock and Scree                              | 117                      | 6                              | 27                              | 236                  | 83                | 469                               |
| Rocky Mountain Alpine Fell-Field                                     | 41                       |                                |                                 | 97                   | 25                | 163                               |
| Rocky Mountain Cliff, Canyon and Massive Bedrock                     | 180                      | 34                             | 94                              | 244                  | 108               | 660                               |
| Sierra Nevada Cliff and Canyon                                       |                          |                                |                                 |                      | 22                | 22                                |
| Western Great Plains Cliff and Outcrop                               |                          | 22                             |                                 | 14                   | 9                 | 45                                |
| <i>Subtotal</i>  | <b>475</b>               | <b>208</b>                     | <b>804</b>                      | <b>1,258</b>         | <b>2,290</b>      | <b>5,035</b>                      |
| <b>DECIDUOUS FOREST CLASSES</b>                                      |                          |                                |                                 |                      |                   |                                   |
| Rocky Mountain Aspen Forest and Woodland                             | 358                      | 59                             | 328                             | 1,040                | 893               | 2,678                             |
| Rocky Mountain Bigtooth Maple Ravine Woodland                        | 30                       |                                | 87                              | 16                   | 46                | 179                               |
| <i>Subtotal</i>  | <b>388</b>               | <b>59</b>                      | <b>415</b>                      | <b>1,056</b>         | <b>939</b>        | <b>2,857</b>                      |
| <b>EVERGREEN FOREST CLASSES</b>                                      |                          |                                |                                 |                      |                   |                                   |
| Colorado Plateau Pinyon-Juniper Woodland                             | 66                       | 92                             | 128                             | 1,648                | 2,320             | 4,254                             |
| Great Basin Pinyon-Juniper Woodland                                  |                          |                                | 36                              | 424                  | 1,753             | 2,213                             |
| Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland     |                          |                                |                                 |                      | 121               | 121                               |
| Madrean Encinal  |                          |                                |                                 | 116                  | 74                | 190                               |
| Madrean Pine-Oak Forest and Woodland                                 |                          |                                |                                 | 40                   | 398               | 438                               |
| Madrean Pinyon-Juniper Woodland                                      |                          |                                |                                 | 469                  | 617               | 1,086                             |
| Madrean Upper Montane Conifer-Oak Forest and Woodland                |                          |                                |                                 | 2                    | 28                | 30                                |
| Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland |                          |                                |                                 |                      | 7                 | 7                                 |
| Mediterranean California Ponderosa-Jeffrey Pine Forest and Woodland  |                          |                                |                                 |                      | 46                | 46                                |

|  | Source                   |                                |                                 |                      |                   | Total Samples by Land Cover Class |
|--|--------------------------|--------------------------------|---------------------------------|----------------------|-------------------|-----------------------------------|
|  | Air Photo Interpretation | Image (Landsat) Interpretation | DOQ/Terra Server Interpretation | Cooperator Databases | SWReGAP Fieldwork |                                   |
| Mediterranean California Red Fir Forest and Woodland               |                          |                                |                                 |                      | 33                | 33                                |
| Northern Pacific Mesic Subalpine Parkland                          |                          |                                |                                 |                      | 26                | 26                                |
| Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland | 44                       | 51                             | 4                               | 895                  | 752               | 1,746                             |
| Rocky Mountain Foothill Limber Pine-Juniper Woodland               |                          | 12                             |                                 |                      |                   | 12                                |
| Rocky Mountain Lodgepole Pine Forest                               | 136                      | 23                             | 7                               | 590                  | 218               | 974                               |
| Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland     | 92                       |                                | 37                              | 76                   | 243               | 448                               |
| Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland  | 92                       | 19                             | 75                              | 1,187                | 480               | 1,853                             |
| Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland      | 158                      |                                | 12                              | 108                  | 203               | 481                               |
| Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland  | 21                       |                                | 1                               | 90                   | 45                | 157                               |
| Sierra Nevada Subalpine Lodgepole Pine Forest and Woodland         |                          |                                |                                 |                      | 17                | 17                                |
| Southern Rocky Mountain Pinyon-Juniper Woodland                    | 39                       | 136                            |                                 | 449                  | 227               | 851                               |
| Southern Rocky Mountain Ponderosa Pine Woodland                    | 128                      | 162                            | 39                              | 1,209                | 2,255             | 3,793                             |
| <b>Subtotal</b>  | <b>776</b>               | <b>495</b>                     | <b>339</b>                      | <b>7,303</b>         | <b>9,863</b>      | <b>18,776</b>                     |
| <b>MIXED FOREST CLASS</b>  |                          |                                |                                 |                      |                   |                                   |
| Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland      | 98                       | 27                             | 59                              | 312                  | 267               | 763                               |
| <b>Subtotal</b>  | <b>98</b>                | <b>27</b>                      | <b>59</b>                       | <b>312</b>           | <b>267</b>        | <b>763</b>                        |
| <b>SCRUB/SHRUB CLASSES</b>   |                          |                                |                                 |                      |                   |                                   |
| Apacherian-Chihuahuan Mesquite Upland Scrub                        |                          |                                |                                 | 228                  | 816               | 1,044                             |
| Chihuahuan Mixed Desert and Thorn Scrub                            |                          |                                |                                 | 601                  | 475               | 1,076                             |
| Chihuahuan Mixed Salt Desert Scrub                                 |                          |                                |                                 | 104                  | 104               | 208                               |
| Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub             |                          |                                |                                 | 216                  | 78                | 294                               |
| Chihuahuan Succulent Desert Scrub                                  |                          |                                |                                 | 15                   | 15                | 30                                |
| Coahuilan Chaparral  |                          |                                |                                 | 43                   | 6                 | 49                                |
| Colorado Plateau Blackbrush-Mormon-tea Shrubland                   |                          | 2                              | 6                               | 36                   | 450               | 494                               |
| Colorado Plateau Mixed Low Sagebrush Shrubland                     | 11                       | 4                              | 39                              | 46                   | 162               | 262                               |
| Colorado Plateau Pinyon-Juniper Shrubland                          | 105                      | 56                             | 168                             | 155                  | 311               | 795                               |
| Great Basin Semi-Desert Chaparral                                  |                          | 11                             |                                 | 13                   | 115               | 139                               |
| Great Basin Xeric Mixed Sagebrush Shrubland                        |                          |                                |                                 | 82                   | 1,821             | 1,903                             |
| Inter-Mountain Basins Big Sagebrush Shrubland                      | 28                       | 107                            | 156                             | 1,622                | 4,524             | 6,437                             |
| Inter-Mountain Basins Mat Saltbush Shrubland                       |                          | 18                             | 16                              | 141                  | 151               | 326                               |
| Inter-Mountain Basins Mixed Salt Desert Scrub                      |                          | 60                             | 36                              | 613                  | 3,313             | 4,022                             |
| Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland     | 32                       | 8                              | 30                              | 62                   | 284               | 416                               |
| Mogollon Chaparral   |                          |                                | 2                               | 303                  | 480               | 785                               |
| Mojave Mid-Elevation Mixed Desert Scrub                            |                          |                                |                                 | 429                  | 548               | 977                               |
| Rocky Mountain Alpine Dwarf-Shrubland                              | 26                       |                                | 3                               | 1                    | 12                | 42                                |
| Rocky Mountain Gambel Oak-Mixed Montane Shrubland                  | 188                      | 437                            | 105                             | 1,039                | 763               | 2,532                             |
| Rocky Mountain Lower Montane-Foothill Shrubland                    |                          | 124                            |                                 | 221                  | 26                | 371                               |
| Sonora-Mojave Creosotebush-White Bursage Desert Scrub              |                          |                                | 74                              | 821                  | 736               | 1,631                             |
| Sonora-Mojave Mixed Salt Desert Scrub                              |                          |                                | 2                               | 67                   | 147               | 216                               |
| Sonora-Mojave Semi-Desert Chaparral                                |                          |                                |                                 |                      | 65                | 65                                |
| Sonoran Mid-Elevation Desert Scrub                                 |                          |                                |                                 | 15                   | 133               | 148                               |
| Sonoran Paloverde-Mixed Cacti Desert Scrub                         |                          |                                | 106                             | 520                  | 687               | 1,313                             |
| Southern Colorado Plateau Sand Shrubland                           |                          |                                | 44                              | 34                   | 316               | 394                               |
| Western Great Plains Mesquite Woodland and Shrubland               |                          |                                |                                 |                      |                   | 0                                 |
| Western Great Plains Sandhill Shrubland                            |                          | 554                            |                                 | 145                  | 153               | 852                               |
| Wyoming Basins Low Sagebrush Shrubland                             |                          | 3                              |                                 | 21                   | 1                 | 25                                |
| <b>Subtotal</b>  | <b>390</b>               | <b>1,384</b>                   | <b>787</b>                      | <b>7,593</b>         | <b>16,692</b>     | <b>26,846</b>                     |
| <b>GRASSLAND/HERBACEOUS CLASSES</b>                                |                          |                                |                                 |                      |                   |                                   |
| Apacherian-Chihuahuan Semi-Desert Grassland and Steppe             |                          |                                |                                 | 1,187                | 501               | 1,688                             |



|  | Source                   |                                |                                 |                      |                   | Total Samples by Land Cover Class |
|--|--------------------------|--------------------------------|---------------------------------|----------------------|-------------------|-----------------------------------|
|  | Air Photo Interpretation | Image (Landsat) Interpretation | DOQ/Terra Server Interpretation | Cooperator Databases | SWReGAP Fieldwork |                                   |
| Central Mixedgrass Prairie   |                          | 35                             |                                 | 3                    | 3                 | 41                                |
| Chihuahuan Gypsophilous Grassland and Steppe                           |                          |                                |                                 | 119                  | 3                 | 122                               |
| Chihuahuan Sandy Plains Semi-Desert Grassland                          |                          |                                |                                 | 77                   | 57                | 134                               |
| Chihuahuan-Sonoran Desert Bottomland and Swale Grassland               |                          | 6                              |                                 | 276                  | 233               | 515                               |
| Inter-Mountain Basins Big Sagebrush Steppe                             | 3                        | 1                              |                                 | 7                    | 448               | 459                               |
| Inter-Mountain Basins Juniper Savanna                                  |                          | 13                             |                                 | 96                   | 286               | 395                               |
| Inter-Mountain Basins Montane Sagebrush Steppe                         | 228                      | 118                            | 260                             | 1,405                | 1,869             | 3,880                             |
| Inter-Mountain Basins Semi-Desert Grassland                            |                          | 24                             | 18                              | 389                  | 1,505             | 1,936                             |
| Inter-Mountain Basins Semi-Desert Shrub-Steppe                         |                          | 4                              | 27                              | 845                  | 2,649             | 3,525                             |
| Madrean Juniper Savanna  |                          |                                |                                 | 30                   | 100               | 130                               |
| North Pacific Montane Grassland  |                          |                                |                                 |                      | 19                | 19                                |
| Rocky Mountain Dry Tundra  | 66                       |                                | 1                               | 219                  | 68                | 354                               |
| Rocky Mountain Subalpine Mesic Meadow                                  | 67                       | 37                             | 27                              | 242                  | 188               | 561                               |
| Southern Rocky Mountain Juniper Woodland and Savanna                   |                          | 89                             |                                 | 71                   | 135               | 295                               |
| Southern Rocky Mountain Montane-Subalpine Grassland                    | 31                       | 29                             | 45                              | 791                  | 497               | 1,393                             |
| Western Great Plains Foothill and Piedmont Grassland                   |                          | 436                            |                                 | 360                  | 44                | 840                               |
| Western Great Plains Sand Prairie                                      |                          | 4                              |                                 | 2                    |                   | 6                                 |
| Western Great Plains Shortgrass Prairie                                |                          | 1,180                          |                                 | 1,125                | 889               | 3,194                             |
| Western Great Plains Tallgrass Prairie                                 |                          |                                |                                 |                      |                   | 0                                 |
| <i>Subtotal</i>  | <b>395</b>               | <b>1,976</b>                   | <b>378</b>                      | <b>7,244</b>         | <b>9,494</b>      | <b>19,487</b>                     |
| <b>WOODY WETLAND CLASSES</b>   |                          |                                |                                 |                      |                   |                                   |
| Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland |                          |                                | 83                              | 4                    | 381               | 468                               |
| Inter-Mountain Basins Greasewood Flat                                  |                          | 45                             | 22                              | 294                  | 1,601             | 1,962                             |
| North American Warm Desert Lower Montane Rip. Woodland & Shrubland     |                          |                                |                                 | 101                  | 118               | 219                               |
| North American Warm Desert Riparian Mesquite Bosque                    |                          |                                | 33                              | 22                   | 33                | 88                                |
| North American Warm Desert Riparian Woodland and Shrubland             |                          |                                | 4                               | 113                  | 42                | 159                               |
| North American Warm Desert Wash  |                          |                                | 6                               | 58                   | 160               | 224                               |
| Rocky Mountain Lower Montane Riparian Woodland and Shrubland           | 73                       | 37                             | 155                             | 383                  | 207               | 855                               |
| Rocky Mountain Subalpine-Montane Riparian Shrubland                    | 47                       | 9                              | 35                              | 453                  | 141               | 685                               |
| Rocky Mountain Subalpine-Montane Riparian Woodland                     | 2                        |                                |                                 | 164                  | 59                | 225                               |
| Western Great Plains Floodplain  |                          | 398                            |                                 |                      | 2                 | 400                               |
| Western Great Plains Riparian Woodland and Shrubland                   |                          | 723                            |                                 | 84                   | 31                | 838                               |
| <i>Subtotal</i>  | <b>122</b>               | <b>1,212</b>                   | <b>338</b>                      | <b>1,676</b>         | <b>2,775</b>      | <b>6,123</b>                      |
| <b>EMERGENT HERBACEOUS WETLAND CLASSES</b>                             |                          |                                |                                 |                      |                   |                                   |
| Mediterranean California Subalpine-Montane Fen                         |                          |                                |                                 |                      | 4                 | 4                                 |
| North American Arid West Emergent Marsh                                |                          |                                | 42                              | 104                  | 194               | 340                               |
| Rocky Mountain Alpine-Montane Wet Meadow                               | 93                       | 6                              | 110                             | 352                  | 141               | 702                               |
| Temperate Pacific Subalpine-Montane Wet Meadow                         |                          |                                |                                 |                      | 9                 | 9                                 |
| Western Great Plains Saline Depression Wetland                         |                          |                                |                                 |                      | 7                 | 7                                 |
| <i>Subtotal</i>  | <b>93</b>                | <b>6</b>                       | <b>152</b>                      | <b>456</b>           | <b>355</b>        | <b>1,062</b>                      |
| <b>ALTERED OR DISTURBED CLASSES</b>                                    |                          |                                |                                 |                      |                   |                                   |
| Disturbed, Non-specific  |                          | 1                              |                                 | 1                    | 10                | 12                                |
| Disturbed, Oil well  |                          |                                |                                 |                      |                   | 0                                 |
| Invasive Annual and Biennial Forbland                                  |                          | 50                             |                                 | 209                  | 483               | 742                               |
| Invasive Annual Grassland  | 6                        | 57                             | 4                               | 275                  | 528               | 870                               |
| Invasive Perennial Forbland  |                          |                                |                                 | 21                   | 16                | 37                                |
| Invasive Perennial Grassland   | 1                        | 194                            | 33                              | 330                  | 217               | 775                               |
| Invasive Southwest Riparian Woodland and Shrubland                     | 31                       | 226                            | 11                              | 114                  | 179               | 561                               |
| Recently Burned  | 21                       | 27                             | 1                               | 15                   | 35                | 99                                |

|                                       | Source                   |                                |                                 |                      |                   | Total Samples by Land Cover Class |
|---------------------------------------|--------------------------|--------------------------------|---------------------------------|----------------------|-------------------|-----------------------------------|
|                                       | Air Photo Interpretation | Image (Landsat) Interpretation | DOQ/Terra Server Interpretation | Cooperator Databases | SWReGAP Fieldwork |                                   |
| Recently Chained Pinyon-Juniper Areas | 37                       | 28                             | 42                              | 91                   | 4                 | 202                               |
| Recently Logged Areas                 | 73                       | 16                             | 6                               | 113                  | 46                | 254                               |
| Recently Mined or Quarried            |                          | 52                             |                                 | 54                   | 32                | 138                               |
| <i>Subtotal</i>                       | <b>169</b>               | <b>651</b>                     | <b>97</b>                       | <b>1,223</b>         | <b>1,550</b>      | <b>3,690</b>                      |
| <b>OTHER CLASSES</b>                  |                          |                                |                                 |                      |                   |                                   |
| Agriculture                           | 10                       | 4,625                          |                                 | 1,290                | 977               | 6,902                             |
| Developed, Medium - High Intensity    |                          | 104                            |                                 | 77                   | 6                 | 187                               |
| Developed, Open Space - Low Intensity |                          | 189                            |                                 | 51                   | 7                 | 247                               |
| Barren Lands, Non-specific            |                          |                                | 45                              | 55                   | 222               | 322                               |
| Open Water                            | 18                       | 756                            |                                 | 182                  | 216               | 1,172                             |
| <i>Subtotal</i>                       | <b>28</b>                | <b>5,674</b>                   | <b>45</b>                       | <b>1,655</b>         | <b>1,428</b>      | <b>8,830</b>                      |
| <b>Grand Total by Source</b>          | <b>2,934</b>             | <b>11,692</b>                  | <b>3,414</b>                    | <b>29,776</b>        | <b>45,653</b>     | <b>93,469</b>                     |

## Appendix 2-2. Total land cover mapped in square kilometers summarized by land cover class and state political boundaries.

|  | Land Cover in Square Kilometers |               |               |              |               | Region Wide   |
|--|---------------------------------|---------------|---------------|--------------|---------------|---------------|
|  | Arizona                         | Colorado      | Nevada        | New Mexico   | Utah          |               |
| <b>SPARSLEY VEGETATED/BARREN CLASSES</b>                             |                                 |               |               |              |               |               |
| Barren Lands, Non-specific   | 1,119                           | 11            | 195           | 54           | 42            | 1,421         |
| Colorado Plateau Mixed Bedrock Canyon and Tableland                  | 6,974                           | 675           | 2             | 2,466        | 14,196        | 24,313        |
| Inter-Mountain Basins Active and Stabilized Dune                     | 352                             | 130           | 79            | 735          | 1,807         | 3,103         |
| Inter-Mountain Basins Cliff and Canyon                               |                                 | 4             | 2,487         |              | 382           | 2,873         |
| Inter-Mountain Basins Playa  | 14                              | 46            | 6,234         | 2            | 11,284        | 17,581        |
| Inter-Mountain Basins Shale Badland                                  | 730                             | 258           |               | 482          | 1,828         | 3,297         |
| Inter-Mountain Basins Volcanic Rock and Cinder Land                  | 573                             |               |               | 470          | 317           | 1,360         |
| Inter-Mountain Basins Wash   | 4                               | 20            | 18            | 3            | 1             | 46            |
| Mediterranean California Alpine Bedrock and Scree                    |                                 |               | 23            |              |               | 23            |
| North American Alpine Ice Field                                      |                                 | 2             |               |              | 21            | 23            |
| North American Warm Desert Active and Stabilized Dune                | 1,016                           |               | 16            | 1,695        |               | 2,728         |
| North American Warm Desert Badland                                   | 34                              |               | 78            |              |               | 112           |
| North American Warm Desert Bedrock Cliff and Outcrop                 | 761                             |               | 1,842         | 838          | 127           | 3,568         |
| North American Warm Desert Pavement                                  | 45                              |               | 168           | 180          |               | 393           |
| North American Warm Desert Playa                                     | 48                              |               | 527           | 535          | 6             | 1,115         |
| North American Warm Desert Volcanic Rockland                         | 205                             |               | 78            | 700          | 8             | 992           |
| Rocky Mountain Alpine Bedrock and Scree                              | 5                               | 2,888         | 148           | 7            | 815           | 3,863         |
| Rocky Mountain Alpine Fell-Field                                     |                                 | 584           |               |              | 177           | 761           |
| Rocky Mountain Cliff, Canyon and Massive Bedrock                     | 92                              | 989           |               | 417          | 1,467         | 2,965         |
| Sierra Nevada Cliff and Canyon                                       |                                 |               | 123           |              |               | 123           |
| Western Great Plains Cliff and Outcrop                               |                                 | 88            |               | 221          |               | 309           |
| <i>Subtotal</i>  | <b>11,972</b>                   | <b>5,695</b>  | <b>12,018</b> | <b>8,805</b> | <b>32,478</b> | <b>70,969</b> |
| <b>DECIDUOUS FOREST CLASSES</b>                                      |                                 |               |               |              |               |               |
| Rocky Mountain Aspen Forest and Woodland                             | 443                             | 11,436        | 1,289         | 1,483        | 6,335         | 20,986        |
| Rocky Mountain Bigtooth Maple Ravine Woodland                        |                                 |               | 1             |              | 887           | 888           |
| <i>Subtotal</i>  | <b>443</b>                      | <b>11,436</b> | <b>1,290</b>  | <b>1,483</b> | <b>7,222</b>  | <b>21,874</b> |
| <b>EVERGREEN FOREST CLASSES</b>                                      |                                 |               |               |              |               |               |
| Colorado Plateau Pinyon-Juniper Woodland                             | 32,495                          | 15,136        |               | 27,864       | 22,360        | 97,855        |
| Great Basin Pinyon-Juniper Woodland                                  | 3,414                           |               | 36,376        |              | 10,986        | 50,776        |
| Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland     |                                 |               | 635           |              | 32            | 666           |
| Madrean Encinal  | 3,008                           |               |               | 1,350        |               | 4,358         |
| Madrean Pine-Oak Forest and Woodland                                 | 4,008                           |               |               | 1,725        |               | 5,733         |
| Madrean Pinyon-Juniper Woodland                                      | 13,163                          |               |               | 8,754        |               | 21,917        |
| Madrean Upper Montane Conifer-Oak Forest and Woodland                | 123                             |               |               | 672          |               | 795           |
| Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland |                                 |               | 2             |              |               | 2             |
| Mediterranean California Ponderosa-Jeffrey Pine Forest and Woodland  |                                 |               | 209           |              |               | 209           |
| Mediterranean California Red Fir Forest and Woodland                 |                                 |               | 106           |              |               | 106           |
| Northern Pacific Mesic Subalpine Parkland                            |                                 |               | 42            |              |               | 42            |
| Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland   | 1,030                           | 3,152         | 196           | 2,865        | 1,710         | 8,953         |
| Rocky Mountain Foothill Limber Pine-Juniper Woodland                 |                                 | 6             |               |              |               | 6             |
| Rocky Mountain Lodgepole Pine Forest                                 |                                 | 6,940         |               | 7            | 1,817         | 8,764         |
| Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland       | 439                             | 3,603         | 216           | 1,610        | 1,427         | 7,295         |

|   | Land Cover in Square Kilometers |               |                |               |               | Region Wide    |
|---|---------------------------------|---------------|----------------|---------------|---------------|----------------|
|   | Arizona                         | Colorado      | Nevada         | New Mexico    | Utah          |                |
| Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland | 223                             | 10,189        | 190            | 982           | 3,230         | 14,814         |
| Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland     | 120                             | 8,151         | 175            | 640           | 1,273         | 10,359         |
| Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland | 2                               | 369           | 14             | 376           | 39            | 801            |
| Sierra Nevada Subalpine Lodgepole Pine Forest and Woodland        |                                 |               | 20             |               |               | 21             |
| Southern Rocky Mountain Pinyon-Juniper Woodland                   | 1                               | 4,835         |                | 10,468        |               | 15,305         |
| Southern Rocky Mountain Ponderosa Pine Woodland                   | 16,240                          | 10,792        | 7              | 21,163        | 2,019         | 50,221         |
| <i>Subtotal</i>   | <b>74,266</b>                   | <b>63,173</b> | <b>38,188</b>  | <b>78,476</b> | <b>44,893</b> | <b>298,998</b> |
| <b>MIXED FOREST CLASS</b>   |                                 |               |                |               |               |                |
| Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland     |                                 | 1,951         | 84             | 182           | 1,222         | 3,439          |
| <i>Subtotal</i>   |                                 | <b>1,951</b>  | <b>84</b>      | <b>182</b>    | <b>1,222</b>  | <b>3,439</b>   |
| <b>SHRUB/SCRUB CLASSES</b>  |                                 |               |                |               |               |                |
| Apacherian-Chihuahuan Mesquite Upland Scrub                       | 16,546                          |               |                | 15,137        |               | 31,683         |
| Chihuahuan Mixed Desert and Thorn Scrub                           | 6,319                           | 9             |                | 21,079        |               | 27,407         |
| Chihuahuan Mixed Salt Desert Scrub                                | 2,816                           |               |                | 1,597         |               | 4,413          |
| Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub            | 187                             |               |                | 5,538         |               | 5,725          |
| Chihuahuan Succulent Desert Scrub                                 | 109                             |               |                | 78            |               | 187            |
| Coahuilan Chaparral   |                                 |               |                | 93            |               | 94             |
| Colorado Plateau Blackbrush-Mormon Tea Shrubland                  | 4,037                           | 97            | 4              | 141           | 9,031         | 13,310         |
| Colorado Plateau Mixed Low Sagebrush Shrubland                    | 489                             | 66            |                | 329           | 1,517         | 2,401          |
| Colorado Plateau Pinyon-Juniper Shrubland                         | 354                             | 1,765         |                |               | 9,417         | 11,535         |
| Great Basin Semi-Desert Chaparral                                 |                                 |               | 162            |               |               | 163            |
| Great Basin Xeric Mixed Sagebrush Shrubland                       |                                 |               | 31,799         |               | 3,635         | 35,434         |
| Inter-Mountain Basins Big Sagebrush Shrubland                     | 5,200                           | 13,384        | 66,020         | 3,934         | 19,941        | 108,480        |
| Inter-Mountain Basins Mat Saltbush Shrubland                      | 75                              | 1,019         |                |               | 3,037         | 4,130          |
| Inter-Mountain Basins Mixed Salt Desert Scrub                     | 7,005                           | 2,324         | 50,646         | 3,791         | 15,527        | 79,294         |
| Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland    |                                 | 1             | 1,924          |               | 626           | 2,550          |
| Mogollon Chaparral  | 9,637                           |               | 425            | 870           | 583           | 11,515         |
| Mojave Mid-Elevation Mixed Desert Scrub                           | 5,416                           |               | 10,520         |               | 826           | 16,762         |
| Rocky Mountain Alpine Dwarf-Shrubland                             |                                 |               |                |               | 109           | 110            |
| Rocky Mountain Gambel Oak-Mixed Montane Shrubland                 | 128                             | 10,229        | 108            | 1,888         | 6,597         | 18,950         |
| Rocky Mountain Lower Montane-Foothill Shrubland                   |                                 | 2,305         |                | 266           | 252           | 2,823          |
| Sonora-Mojave Creosotebush-White Bursage Desert Scrub             | 38,922                          |               | 19,030         |               | 808           | 58,760         |
| Sonora-Mojave Mixed Salt Desert Scrub                             | 1,011                           |               | 1,528          |               | 10            | 2,549          |
| Sonora-Mojave Semi-Desert Chaparral                               |                                 |               | 86             |               | 3             | 89             |
| Sonoran Mid-Elevation Desert Scrub                                | 5,391                           |               |                | 2             |               | 5,393          |
| Sonoran Paloverde-Mixed Cacti Desert Scrub                        | 39,790                          |               |                |               |               | 39,791         |
| Southern Colorado Plateau Sand Shrubland                          | 6,074                           | 13            |                | 79            | 855           | 7,021          |
| Western Great Plains Mesquite Woodland and Shrubland              |                                 | 10            |                | 1,787         |               | 1,797          |
| Western Great Plains Sandhill Shrubland                           |                                 | 8,682         |                | 5,212         |               | 13,894         |
| Wyoming Basins Low Sagebrush Shrubland                            |                                 | 43            |                |               | 4             | 47             |
| <i>Subtotal</i>   | <b>149,506</b>                  | <b>39,947</b> | <b>182,252</b> | <b>61,821</b> | <b>72,778</b> | <b>506,307</b> |
| <b>GRASSLAND/HERBACEOUS CLASSES</b>                               |                                 |               |                |               |               |                |
| Apacherian-Chihuahuan Semi-Desert Grassland and Steppe            | 11,353                          |               |                | 34,358        |               | 45,711         |
| Central Mixedgrass Prairie  |                                 | 120           |                |               |               | 120            |
| Chihuahuan Gypsophilous Grassland and Steppe                      |                                 |               |                | 804           |               | 804            |
| Chihuahuan Sandy Plains Semi-Desert Grassland                     | 16                              |               |                | 970           |               | 986            |
| Chihuahuan-Sonoran Desert Bottomland and Swale Grassland          |                                 |               |                |               |               |                |
| Inter-Mountain Basins Big Sagebrush Steppe                        |                                 |               | 1,275          |               | 523           | 1,798          |
| Inter-Mountain Basins Juniper Savanna                             | 4,002                           | 281           | 1              | 1,298         | 9             | 5,590          |

|  | Land Cover in Square Kilometers |               |               |                |               | Region Wide    |
|--|---------------------------------|---------------|---------------|----------------|---------------|----------------|
|  | Arizona                         | Colorado      | Nevada        | New Mexico     | Utah          |                |
| Inter-Mountain Basins Montane Sagebrush Steppe                           | 1                               | 8,504         | 17,817        | 283            | 14,049        | 40,654         |
| Inter-Mountain Basins Semi-Desert Grassland                              | 11,250                          | 863           | 3,114         | 16,400         | 2,014         | 33,640         |
| Inter-Mountain Basins Semi-Desert Shrub-Steppe                           | 15,474                          | 3,354         | 5,974         | 14,486         | 8,330         | 47,618         |
| Madrean Juniper Savanna  | 336                             | 1             |               | 657            |               | 994            |
| North Pacific Montane Grassland  |                                 |               | 27            |                |               | 27             |
| Rocky Mountain Dry Tundra  |                                 | 2,447         | 20            | 19             | 293           | 2,779          |
| Rocky Mountain Subalpine Mesic Meadow                                    |                                 | 1,507         | 24            | 147            | 499           | 2,177          |
| Southern Rocky Mountain Juniper Woodland and Savanna                     |                                 | 2,149         |               | 9,808          |               | 11,956         |
| Southern Rocky Mountain Montane-Subalpine Grassland                      | 587                             | 7,252         | 2             | 1,859          | 594           | 10,294         |
| Western Great Plains Foothill and Piedmont Grassland                     |                                 | 4,365         |               | 701            |               | 5,066          |
| Western Great Plains Sand Prairie  |                                 | 18            |               |                |               | 18             |
| Western Great Plains Shortgrass Prairie                                  |                                 | 45,651        |               | 67,511         |               | 113,162        |
| Western Great Plains Tallgrass Prairie                                   |                                 | 1             |               |                |               | 1              |
| <b>Subtotal</b>  | <b>43,019</b>                   | <b>76,513</b> | <b>28,254</b> | <b>149,301</b> | <b>26,311</b> | <b>323,395</b> |
| <b>WOODY WETLAND CLASSES</b>   |                                 |               |               |                |               |                |
| Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland   |                                 |               | 1,068         |                | 293           | 1,360          |
| Inter-Mountain Basins Greasewood Flat                                    | 1,237                           | 2,281         | 10,673        | 2,269          | 7,310         | 23,770         |
| North American Warm Desert Lower Montane Riparian Woodland and Shrubland | 180                             |               | 32            | 194            | 20            | 426            |
| North American Warm Desert Riparian Mesquite Bosque                      | 801                             |               | 25            | 3              | 3             | 832            |
| North American Warm Desert Riparian Woodland and Shrubland               | 283                             |               | 5             | 125            | 10            | 422            |
| North American Warm Desert Wash  | 153                             | 1             | 288           | 199            | 10            | 652            |
| Rocky Mountain Lower Montane Riparian Woodland and Shrubland             | 24                              | 569           |               | 787            | 847           | 2,226          |
| Rocky Mountain Subalpine-Montane Riparian Shrubland                      |                                 | 2,820         | 3             | 103            | 298           | 3,224          |
| Rocky Mountain Subalpine-Montane Riparian Woodland                       |                                 | 215           | 68            | 5              | 4             | 292            |
| Western Great Plains Floodplain  |                                 | 836           |               |                |               | 836            |
| Western Great Plains Riparian Woodland and Shrubland                     |                                 | 859           |               | 855            |               | 1,714          |
| <b>Subtotal</b>  | <b>2,678</b>                    | <b>7,581</b>  | <b>12,162</b> | <b>4,540</b>   | <b>8,795</b>  | <b>35,754</b>  |
| <b>EMERGENT HERBACEOUS WETLAND CLASSES</b>                               |                                 |               |               |                |               |                |
| Mediterranean California Subalpine-Montane Fen                           |                                 |               | 2             |                |               | 2              |
| North American Arid West Emergent Marsh                                  | 32                              | 45            | 409           | 86             | 482           | 1,053          |
| Rocky Mountain Alpine-Montane Wet Meadow                                 |                                 | 1,331         | 10            | 136            | 479           | 1,956          |
| Temperate Pacific Subalpine-Montane Wet Meadow                           |                                 |               | 2             |                |               | 2              |
| Western Great Plains Saline Depression Wetland                           |                                 |               |               | 41             |               | 41             |
| <b>Subtotal</b>  | <b>32</b>                       | <b>1,376</b>  | <b>423</b>    | <b>263</b>     | <b>961</b>    | <b>3,054</b>   |
| <b>ALTERED OR DISTURBED CLASSES</b>                                      |                                 |               |               |                |               |                |
| Disturbed, Non-specific  |                                 | 2             |               |                | 90            | 93             |
| Disturbed, Oil Well  |                                 |               |               |                | 46            | 46             |
| Invasive Annual and Biennial Forbland                                    | 127                             | 634           | 1,134         | 48             | 695           | 2,638          |
| Invasive Annual Grassland  | 72                              | 372           | 4,611         |                | 3,237         | 8,291          |
| Invasive Perennial Forbland  |                                 | 1             |               |                |               | 1              |
| Invasive Perennial Grassland   | 13                              | 2,083         | 187           | 30             | 526           | 2,839          |
| Invasive Southwest Riparian Woodland and Shrubland                       | 484                             | 493           | 149           | 27             | 456           | 1,609          |
| Recently Burned  | 168                             | 313           | 574           | 806            | 172           | 2,033          |
| Recently Chained Pinyon-Juniper Areas                                    |                                 | 231           |               |                | 458           | 689            |
| Recently Logged Areas  |                                 | 541           |               | 8              | 287           | 836            |
| Recently Mined or Quarried   | 470                             | 89            | 322           | 182            | 177           | 1,240          |
| <b>Subtotal</b>  | <b>1,334</b>                    | <b>4,759</b>  | <b>6,977</b>  | <b>1,101</b>   | <b>6,144</b>  | <b>20,315</b>  |
| <b>OTHER CLASSES</b>   |                                 |               |               |                |               |                |
| Agriculture  | 5,635                           | 52,901        | 2,223         | 6,025          | 9,197         | 75,981         |

|  | Land Cover in Square Kilometers |                |                |                |                | Region Wide      |
|--|---------------------------------|----------------|----------------|----------------|----------------|------------------|
|  | Arizona                         | Colorado       | Nevada         | New Mexico     | Utah           |                  |
| Developed, Medium - High Intensity       | 4,048                           | 1,074          | 210            | 1,108          | 1,099          | 7,539            |
| Developed, Open Space - Low Intensity    | 1,711                           | 2,013          | 726            | 977            | 1,997          | 7,425            |
| Open Water                               | 702                             | 1,316          | 1,481          | 792            | 6,733          | 11,023           |
| <i>Subtotal</i>                          | <b>12,096</b>                   | <b>57,304</b>  | <b>4,640</b>   | <b>8,902</b>   | <b>19,026</b>  | <b>101,968</b>   |
| <b>Total by State Political Boundary</b> | <b>295,346</b>                  | <b>269,735</b> | <b>286,288</b> | <b>314,874</b> | <b>219,830</b> | <b>1,386,073</b> |

## Appendix 2-3. Ecological similarity codes, types, and descriptions for four major types of ecological similarity recognized within the region.

| Ecological Similarity Code | Ecological Similarity Type                                      | Ecological Similarity Description  |
|----------------------------|---|--|
| A                          | Physiognomic Structure (Map and reference have same NLCD class) | Where reference and mapped classes share the same NLCD Class, such as:   |
|                            |   | N30 Barren (Includes all Barren Lands)   |
|                            |   | N40 Forest (Includes all Deciduous Forest, Evergreen Forest and Mixed Forest types)  |
|                            |   | N50 Shrubland (Includes all Shrub, Dwarf Shrub and Shrub/Scrub types)  |
|                            |   | N70 Herbaceous (Includes all Grassland, Herbaceous, Savanna and Shrub-Steppe types)  |
|                            |   | N90 Wetlands (Includes all Wetland, Riparian, Emergent Wetlands, Wet Meadows and Greasewood Flats)   |
| B                          | Dominant Species Composition                                    | Where reference and mapped classes share dominant/diagnostic species as specified in concept of Ecological Systems. For example, if systems share <i>dominant</i> or <i>codominant</i> species, then species composition is similar. If systems share species that are only <i>present</i> , then species composition is not similar. Would also apply if the confusion occurs between systems where the dominant/codominant species is common, but has been identified to a different subspecies (i.e. <i>Artemisia tridentata</i> spp.). |
| C                          | Juxtaposition   | Where reference and mapped classes commonly form a mosaic, such as where patch or linear systems occur within matrix systems, or where broad ecotonal boundaries between the classes occur with regularity. This often relates to minimum mapping unit (scale) issues with mosaics of similar landcover types. Refrain from using this code when the possibility of juxtaposition is only a rare occurrence.   |
| D                          | Special Substrates  | Where reference and mapped classes share substrates with special properties that ecologically define each Ecological System. Apply with the following substrates only:   |
|                            |   | - Eolian (sandsheets and dunes)  |
|                            |   | - Bedrock (exposed weathering parent material); sparse vegetation (Barren) classes only  |
|                            |   | - High Salinity (exposed marine shales, saline overflow /playas)   |

## Appendix 2-4. Example of an original error matrix for mapping zone UT-5.

This matrix was produced using 20% withheld data. This table and similar tables for other mapping zones can be found at: <http://earth.gis.usu.edu/swgap/mapquality.html>

|                       |  | REFERENCE  |      |      |      |      |      |      |      |      |      |      |      |      |      |       |          |
|-----------------------|--|------------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|----------|
| LAND COVER CLASS NAME |  | class code | S009 | S023 | S028 | S040 | S050 | S054 | S055 | S065 | S071 | S078 | S090 | S096 | S118 | TOTAL | ACCURACY |
| MAPPED                | Inter-Mountain Basins Cliff and Canyon                                 | S009       | 5    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 6     | 83%      |
|                       | Rocky Mountain Aspen Forest and Woodland                               | S023       | 0    | 4    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 4     | 100%     |
|                       | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland      | S028       | 0    | 0    | 5    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 5     | 100%     |
|                       | Great Basin Pinyon-Juniper Woodland                                    | S040       | 0    | 0    | 0    | 17   | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 18    | 94%      |
|                       | Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland         | S050       | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1     | 100%     |
|                       | Inter-Mountain Basins Big Sagebrush Shrubland                          | S054       | 0    | 0    | 0    | 1    | 0    | 54   | 12   | 2    | 2    | 6    | 3    | 1    | 0    | 81    | 67%      |
|                       | Great Basin Xeric Mixed Sagebrush Shrubland                            | S055       | 0    | 0    | 0    | 0    | 0    | 2    | 8    | 1    | 2    | 1    | 0    | 0    | 0    | 14    | 57%      |
|                       | Inter-Mountain Basins Mixed Salt Desert Scrub                          | S065       | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 2    | 0    | 0    | 0    | 0    | 0    | 3     | 67%      |
|                       | Inter-Mountain Basins Montane Sagebrush Steppe                         | S071       | 1    | 2    | 0    | 0    | 1    | 1    | 3    | 0    | 18   | 2    | 1    | 1    | 0    | 30    | 60%      |
|                       | Inter-Mountain Basins Big Sagebrush Steppe                             | S078       | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 2     | 0%       |
|                       | Inter-Mountain Basins Semi-Desert Grassland                            | S090       | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 3    | 0    | 0    | 4     | 75%      |
|                       | Inter-Mountain Basins Greasewood Flat                                  | S096       | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 1    | 0    | 2     | 50%      |
|                       | Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland | S118       | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 6    | 6     | 100%     |
|                       | <b>TOTAL</b>   |            | 6    | 6    | 5    | 18   | 2    | 59   | 25   | 6    | 22   | 9    | 8    | 4    | 6    | 176   |          |
|                       | <b>ACCURACY</b>  |            | 83%  | 67%  | 100% | 94%  | 50%  | 92%  | 32%  | 33%  | 82%  | 0%   | 38%  | 25%  | 100% |       | 70%      |

Kappa: 0.603367

Standard error of kappa: 0.0304283

Z-Score for kappa: 19.8291



**Appendix 2-5. Example for UT-5 of ecological type similarity matrix showing the application of recognized similarity codes (Appendix 2-3) to off-diagonal (misclassification) cells from the original error matrix (Appendix 2-4).**

This table and similar tables for other mapping zones can be found at: <http://earth.gis.usu.edu/swgap/mapquality.html>

|        |      | REFERENCE |      |      |      |      |      |      |      |      |      |      |      |      |
|--------|------|-----------|------|------|------|------|------|------|------|------|------|------|------|------|
| CLASS  |      | S009      | S023 | S028 | S040 | S050 | S054 | S055 | S065 | S071 | S078 | S090 | S096 | S118 |
| MAPPED | S009 | ABCD      |      |      |      |      |      | 0    |      |      |      |      |      |      |
|        | S023 |           | ABCD |      |      |      |      |      |      |      |      |      |      |      |
|        | S028 |           |      | ABCD |      |      |      |      |      |      |      |      |      |      |
|        | S040 |           |      |      | ABCD |      |      |      |      |      |      | C    |      |      |
|        | S050 |           |      |      |      | ABCD |      |      |      |      |      |      |      |      |
|        | S054 |           |      |      | C    |      | ABCD | ABC  | AC   | BC   | BC   | C    | C    |      |
|        | S055 |           |      |      |      |      | ABC  | ABCD | AC   | C    | BC   |      |      |      |
|        | S065 |           |      |      |      |      |      | AC   | ABCD |      |      |      |      |      |
|        | S071 | C         | C    |      |      | AC   | BC   | C    |      | ABCD | ABC  | 0    | 0    |      |
|        | S078 |           |      |      |      |      | BC   |      |      |      | ABCD |      | C    |      |
|        | S090 |           |      |      |      |      | C    |      |      |      |      | ABCD |      |      |
|        | S096 |           |      |      |      |      |      |      | BCD  |      |      |      | ABCD |      |
|        | S118 |           |      |      |      |      |      |      |      |      |      |      |      | ABCD |

## Appendix 2-6. Relative similarity scoring system based on four major ecological similarity types (Appendix 2-3).

| Ecological Similarity Code            | Relative Similarity Category | Example   | Explanation  | Relative Similarity Score |
|---------------------------------------|------------------------------|---|--|---------------------------|
| No Similarity (0)                     | INCORRECT                    | <i>Intermountain Basins Mixed Salt Desert Scrub</i> versus <i>Rocky Mountain Aspen Forest &amp; Woodland</i>                    | No Major Types of Ecological Similarity are shared between these two Ecological Systems. Relationship is Incorrect.  | 1                         |
| A<br>C<br>D                           | SOMEWHAT SIMILAR             | <i>Rocky Mountain Gambel-Oak Mixed Montane Shrubland</i> versus <i>Inter-Mountain Basins Mixed Salt Desert Scrub</i>            | These two Ecological Systems are nested within the same NLCD Class for shrub/scrub and therefore share A- Physiognomy. No other Major Type of Ecological Similarity is shared. Relationship is Somewhat Similar. | 2                         |
| B<br>AB<br>AC<br>AD<br>BC<br>BD<br>CD | MODERATELY SIMILAR           | <i>Inter-Mountain Basins Greasewood Flat</i> versus <i>Inter-Mountain Basins Playa</i>  | These two Ecological Systems are similar in terms of C- Juxtaposition and D- Special Substrates. Relationship is Moderately Similar.   | 3                         |
| ABC<br>ABD<br>ACD<br>BCD<br>ABCD      | VERY SIMILAR                 | <i>Inter-Mountain West Aspen - Mixed Conifer Forest &amp; Woodland</i> versus <i>Rocky Mountain Aspen Forest &amp; Woodland</i> | These two Ecological Systems are similar relative to A- Physiognomic Structure, B- Dominant Species Composition and C- Juxtaposition. Relationship is Very Similar.  | 4                         |
| Diagonal Cell (blank)                 | CORRECT                      | <i>Mogollon Chaparral</i> versus <i>Mogollon Chaparral</i>  | The reference and mapped classes are identical. Relationship is Correct.   | 5                         |

**Appendix 2-7. Example for UT-5 relative similarity scoring matrix showing the application of relative similarity scores to off-diagonal (misclassification) cells of the ecological similarity matrix (Appendix 2-4).**

This table and similar tables for other mapping zones can be found at: <http://earth.gis.usu.edu/swgap/mapquality.html>

|                            |       | REFERENCE |      |      |      |      |      |      |      |      |      |      |      |      |  |
|----------------------------|-------|-----------|------|------|------|------|------|------|------|------|------|------|------|------|--|
| M<br>A<br>P<br>P<br>E<br>D | CLASS | S009      | S023 | S028 | S040 | S050 | S054 | S055 | S065 | S071 | S078 | S090 | S096 | S118 |  |
|                            | S009  | 5         |      |      |      |      |      | 1    |      |      |      |      |      |      |  |
|                            | S023  |           | 5    |      |      |      |      |      |      |      |      |      |      |      |  |
|                            | S028  |           |      | 5    |      |      |      |      |      |      |      |      |      |      |  |
|                            | S040  |           |      |      | 5    |      |      |      |      |      |      | 2    |      |      |  |
|                            | S050  |           |      |      |      | 5    |      |      |      |      |      |      |      |      |  |
|                            | S054  |           |      |      | 2    |      | 5    | 4    | 2    | 3    | 3    | 2    | 2    |      |  |
|                            | S055  |           |      |      |      |      | 4    | 5    | 2    | 2    | 3    |      |      |      |  |
|                            | S065  |           |      |      |      |      |      | 2    | 5    |      |      |      |      |      |  |
|                            | S071  | 2         | 2    |      |      | 2    | 3    | 2    |      | 5    | 4    | 1    | 1    |      |  |
|                            | S078  |           |      |      |      |      | 3    |      |      |      | 5    |      | 2    |      |  |
|                            | S090  |           |      |      |      |      | 2    |      |      |      |      | 5    |      |      |  |
|                            | S096  |           |      |      |      |      |      |      | 4    |      |      |      | 5    |      |  |
|                            | S118  |           |      |      |      |      |      |      |      |      |      |      |      | 5    |  |

**Appendix 2-8. Revised error matrix: Correct and very similar are considered “correct” (i.e. scores 4 moved to diagonal).**

This table and similar tables for other mapping zones can be found at: <http://earth.gis.usu.edu/swgap/mapquality.html>

|        |          | REFERENCE |      |      |      |      |      |      |      |      |      |      |      |      |       |          |
|--------|----------|-----------|------|------|------|------|------|------|------|------|------|------|------|------|-------|----------|
|        | CLASS    | S009      | S023 | S028 | S040 | S050 | S054 | S055 | S065 | S071 | S078 | S090 | S096 | S118 | TOTAL | ACCURACY |
| MAPPED | S009     | 5         | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 6     | 83%      |
|        | S023     | 0         | 4    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 4     | 100%     |
|        | S028     | 0         | 0    | 5    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 5     | 100%     |
|        | S040     | 0         | 0    | 0    | 17   | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 18    | 94%      |
|        | S050     | 0         | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1     | 100%     |
|        | S054     | 0         | 0    | 0    | 1    | 0    | 56   | 0    | 2    | 2    | 6    | 3    | 1    | 0    | 71    | 79%      |
|        | S055     | 0         | 0    | 0    | 0    | 0    | 0    | 20   | 1    | 2    | 1    | 0    | 0    | 0    | 24    | 83%      |
|        | S065     | 0         | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 3    | 0    | 0    | 0    | 0    | 4     | 75%      |
|        | S071     | 1         | 2    | 0    | 0    | 1    | 1    | 3    | 0    | 18   | 0    | 1    | 1    | 0    | 28    | 60%      |
|        | S078     | 0         | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 2    | 0    | 1    | 0    | 4     | 50%      |
|        | S090     | 0         | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 3    | 0    | 0    | 4     | 75%      |
|        | S096     | 0         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 2     | 50%      |
| S118   | 0        | 0         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 6    | 6    | 100%  |          |
|        | TOTAL    | 6         | 6    | 5    | 18   | 2    | 59   | 25   | 6    | 22   | 9    | 8    | 4    | 6    | 176   | 0%       |
|        | ACCURACY | 83%       | 67%  | 100% | 94%  | 50%  | 95%  | 80%  | 50%  | 82%  | 22%  | 38%  | 25%  | 100% | 0%    | 80%      |

**Appendix 2-9. Revised error matrix: Correct, very similar, and moderately similar are considered “correct” (i.e. scores 4 and 3 moved to diagonal).**

This table and similar tables for other mapping zones can be found at: <http://earth.gis.usu.edu/swgap/mapquality.html>

|               |                 | REFERENCE |      |      |      |      |      |      |      |      |      |      |      |      |       |          |
|---------------|-----------------|-----------|------|------|------|------|------|------|------|------|------|------|------|------|-------|----------|
|               | CLASS           | S009      | S023 | S028 | S040 | S050 | S054 | S055 | S065 | S071 | S078 | S090 | S096 | S118 | TOTAL | ACCURACY |
| <b>MAPPED</b> | <b>S009</b>     | 5         | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 6     | 83%      |
|               | <b>S023</b>     | 0         | 4    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 4     | 100%     |
|               | <b>S028</b>     | 0         | 0    | 5    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 5     | 100%     |
|               | <b>S040</b>     | 0         | 0    | 0    | 17   | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 18    | 94%      |
|               | <b>S050</b>     | 0         | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 2     | 100%     |
|               | <b>S054</b>     | 0         | 0    | 0    | 1    | 0    | 58   | 0    | 0    | 0    | 0    | 3    | 1    | 0    | 63    | 92%      |
|               | <b>S055</b>     | 0         | 0    | 0    | 0    | 0    | 0    | 24   | 0    | 0    | 0    | 0    | 0    | 0    | 24    | 100%     |
|               | <b>S065</b>     | 0         | 0    | 0    | 0    | 0    | 0    | 0    | 6    | 0    | 0    | 0    | 0    | 0    | 6     | 100%     |
|               | <b>S071</b>     | 1         | 2    | 0    | 0    | 0    | 0    | 0    | 0    | 22   | 0    | 1    | 1    | 0    | 27    | 82%      |
|               | <b>S078</b>     | 0         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 9    | 0    | 1    | 0    | 10    | 90%      |
|               | <b>S090</b>     | 0         | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 3    | 0    | 0    | 4     | 75%      |
|               | <b>S096</b>     | 0         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 1     | 100%     |
| <b>S118</b>   | 0               | 0         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 6    | 6    | 100%  |          |
|               | <b>TOTAL</b>    | 6         | 6    | 5    | 18   | 2    | 59   | 25   | 6    | 22   | 9    | 8    | 4    | 6    | 176   | 0%       |
|               | <b>ACCURACY</b> | 83%       | 67%  | 100% | 94%  | 50%  | 98%  | 96%  | 100% | 100% | 100% | 38%  | 25%  | 100% | 0%    | 91%      |

**Appendix 2-10. Revised error matrix: Correct, very similar, moderately similar, and somewhat similar are considered “correct” (i.e. scores 4, 3 and 2 moved to diagonal).**

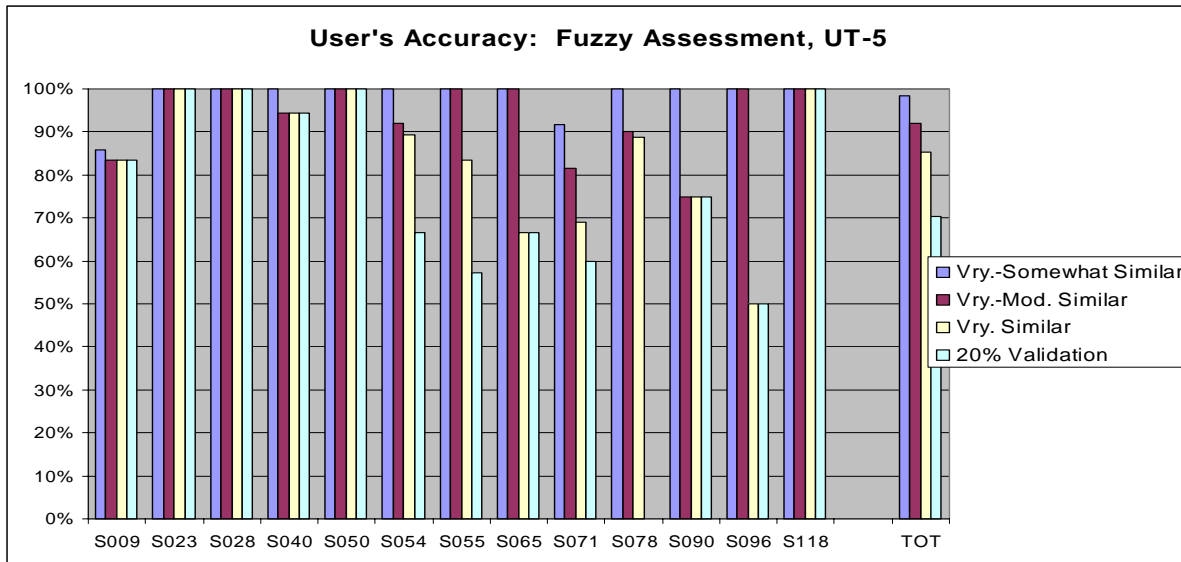
This table and similar tables for other mapping zones can be found at: <http://earth.gis.usu.edu/swgap/mapquality.html>

|               |                 | REFERENCE |      |      |      |      |      |      |      |      |      |      |      |      |       |          |
|---------------|-----------------|-----------|------|------|------|------|------|------|------|------|------|------|------|------|-------|----------|
|               | CLASS           | S009      | S023 | S028 | S040 | S050 | S054 | S055 | S065 | S071 | S078 | S090 | S096 | S118 | TOTAL | ACCURACY |
| <b>MAPPED</b> | <b>S009</b>     | 6         | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 7     | 86%      |
|               | <b>S023</b>     | 0         | 6    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 6     | 100%     |
|               | <b>S028</b>     | 0         | 0    | 5    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 5     | 100%     |
|               | <b>S040</b>     | 0         | 0    | 0    | 18   | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 18    | 100%     |
|               | <b>S050</b>     | 0         | 0    | 0    | 0    | 2    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 2     | 100%     |
|               | <b>S054</b>     | 0         | 0    | 0    | 0    | 0    | 59   | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 59    | 100%     |
|               | <b>S055</b>     | 0         | 0    | 0    | 0    | 0    | 0    | 24   | 0    | 0    | 0    | 0    | 0    | 0    | 24    | 100%     |
|               | <b>S065</b>     | 0         | 0    | 0    | 0    | 0    | 0    | 0    | 6    | 0    | 0    | 0    | 0    | 0    | 6     | 100%     |
|               | <b>S071</b>     | 0         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 22   | 0    | 1    | 1    | 0    | 24    | 92%      |
|               | <b>S078</b>     | 0         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 9    | 0    | 0    | 0    | 9     | 100%     |
|               | <b>S090</b>     | 0         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 7    | 0    | 0    | 7     | 100%     |
|               | <b>S096</b>     | 0         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 3    | 0    | 3     | 100%     |
| <b>S118</b>   | 0               | 0         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 6    | 6    | 100%  |          |
|               | <b>TOTAL</b>    | 6         | 6    | 5    | 18   | 2    | 59   | 25   | 6    | 22   | 9    | 8    | 4    | 6    | 176   | 0%       |
|               | <b>ACCURACY</b> | 100%      | 100% | 100% | 100% | 100% | 100% | 96%  | 100% | 100% | 100% | 88%  | 75%  | 100% | 0%    | 98%      |

**Appendix 2-11. Example for UT-5. Summary of user’s accuracy for all levels of fuzzy assessment and the original error matrix.**

This table and graph summarize map quality given different levels of multiple class membership (expressed by recognized ecological similarities) among classes. For example, recognizing the possibility of multiple class membership between cover class S055 (Great Basin Xeric Sagebrush Shrubland) and other mapped classes at the ‘very similar’ level, ‘user accuracy’ for S055 increases from 57% to 83%.

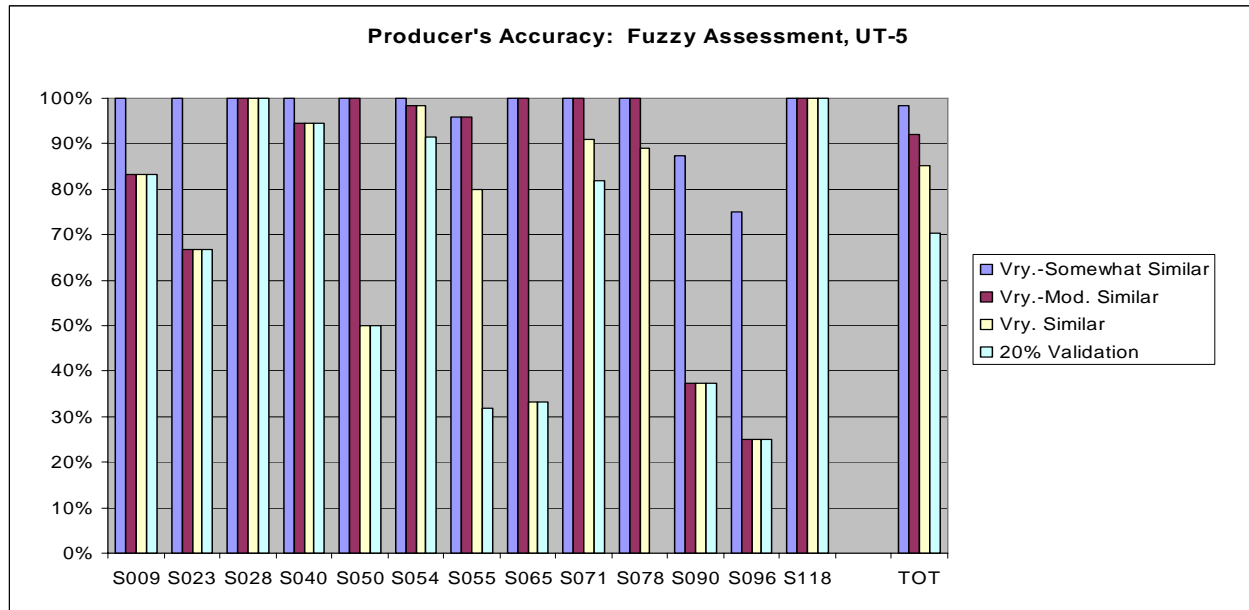
| USER'S ACCURACY       | Land Cover Class |      |      |      |      |      |      |      |      |      |      |      |      | TOT  |     |
|-----------------------|------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|
|                       | S009             | S023 | S028 | S040 | S050 | S054 | S055 | S065 | S071 | S078 | S090 | S096 | S118 |      |     |
| Vry.-Somewhat Similar | 86%              | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 92%  | 100% | 100% | 100% | 100% | 98% |
| Vry.-Mod. Similar     | 83%              | 100% | 100% | 94%  | 50%  | 92%  | 100% | 100% | 100% | 82%  | 90%  | 75%  | 100% | 100% | 91% |
| Vry. Similar          | 83%              | 100% | 100% | 94%  | 100% | 79%  | 83%  | 75%  | 60%  | 50%  | 75%  | 50%  | 100% | 100% | 80% |
| 20% Validation        | 83%              | 100% | 100% | 94%  | 100% | 67%  | 57%  | 67%  | 60%  | 0%   | 75%  | 50%  | 100% | 100% | 70% |
| No. Samples           | 6                | 4    | 5    | 18   | 1    | 81   | 14   | 3    | 30   | 2    | 4    | 2    | 6    | 176  |     |



## Appendix 2-12. Example for UT-5. Summary of producer’s accuracy for all levels of fuzzy assessment and the original error matrix.

This table and graph summarize map quality given different levels of multiple class membership (expressed by recognized ecological similarities) among classes. For example, recognizing the possibility of multiple class membership between cover class S055 (Great Basin Xeric Sagebrush Shrubland) and other mapped classes at the ‘very similar’ level, “producers accuracy” for S055 increases from 32% to 80%.

| PRODUCERS'S ACCURACY  | Land Cover Class |      |      |      |      |      |      |      |      |      |      |      |      |  | TOT |
|-----------------------|------------------|------|------|------|------|------|------|------|------|------|------|------|------|--|-----|
|                       | S009             | S023 | S028 | S040 | S050 | S054 | S055 | S065 | S071 | S078 | S090 | S096 | S118 |  |     |
| Vry.-Somewhat Similar | 100%             | 100% | 100% | 100% | 100% | 100% | 96%  | 100% | 100% | 100% | 88%  | 75%  | 100% |  | 98% |
| Vry.-Mod. Similar     | 83%              | 67%  | 100% | 94%  | 50%  | 98%  | 96%  | 100% | 100% | 100% | 38%  | 25%  | 100% |  | 91% |
| Vry. Similar          | 83%              | 67%  | 100% | 94%  | 50%  | 95%  | 80%  | 50%  | 82%  | 22%  | 38%  | 25%  | 100% |  | 80% |
| 20% Validation        | 83%              | 67%  | 100% | 94%  | 50%  | 92%  | 32%  | 33%  | 82%  | 0%   | 38%  | 25%  | 100% |  | 70% |
| No. Samples           | 6                | 6    | 5    | 18   | 2    | 59   | 25   | 6    | 22   | 9    | 8    | 4    | 6    |  | 176 |





## Appendix 2-13. Regional summary of land cover area and validation results sorted into 5 validation groups and organized by NLCD land cover classes.

The first validation group contains classes that were not assessed (na) regionally because of limited validation plots (n < 20) or were non-natural classes and not the primary focus of the mapping effort.

| MAPPED LAND COVER CLASSES (SWReGAP)                                  | Land Area   |                    | Validation Results       |          |      |
|--|-------------|--------------------|--------------------------|----------|------|
|  | Area Sq. Km | Percent Total Area | Number Reference Samples | Producer | User |
| <b>GRP 1: VALIDATION NOT ASSESSED FOR 5-STATE REGION</b>             |             |                    |                          |          |      |
| <i>Sparsely Vegetated/Barren Classes</i>                             |             |                    |                          |          |      |
| Inter-Mountain Basins Volcanic Rock and Cinder Land                  | 1,360       | 0.10%              | na                       | na       | na   |
| Inter-Mountain Basins Wash   | 46          | 0.00%              | na                       | na       | na   |
| Mediterranean California Alpine Bedrock and Scree                    | 23          | 0.00%              | na                       | na       | na   |
| North American Alpine Ice Field                                      | 23          | 0.00%              | na                       | na       | na   |
| North American Warm Desert Badland                                   | 112         | 0.01%              | na                       | na       | na   |
| North American Warm Desert Volcanic Rockland                         | 992         | 0.07%              | na                       | na       | na   |
| Sierra Nevada Cliff and Canyon                                       | 123         | 0.01%              | na                       | na       | na   |
| Western Great Plains Cliff and Outcrop                               | 309         | 0.02%              | na                       | na       | na   |
| <i>Evergreen Forest Classes</i>                                      |             |                    |                          |          |      |
| Madrean Upper Montane Conifer-Oak Forest and Woodland                | 795         | 0.06%              | na                       | na       | na   |
| Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland | 2           | 0.00%              | na                       | na       | na   |
| Mediterranean California Ponderosa-Jeffrey Pine Forest and Woodland  | 209         | 0.02%              | na                       | na       | na   |
| Mediterranean California Red Fir Forest and Woodland                 | 106         | 0.01%              | na                       | na       | na   |
| Northern Pacific Mesic Subalpine Parkland                            | 42          | 0.00%              | na                       | na       | na   |
| Rocky Mountain Foothill Limber Pine-Juniper Woodland                 | 6           | 0.00%              | na                       | na       | na   |
| Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland       | 7,295       | 0.53%              | na                       | na       | na   |
| Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland        | 10,359      | 0.75%              | na                       | na       | na   |
| Sierra Nevada Subalpine Lodgepole Pine Forest and Woodland           | 21          | 0.00%              | na                       | na       | na   |
| <i>Shrub/Scrub Classes</i>   |             |                    |                          |          |      |
| Chihuahuan Succulent Desert Scrub                                    | 187         | 0.01%              | na                       | na       | na   |
| Coahuilan Chaparral  | 94          | 0.01%              | na                       | na       | na   |
| Rocky Mountain Alpine Dwarf-Shrubland                                | 110         | 0.01%              | na                       | na       | na   |
| Sonora-Mojave Semi-Desert Chaparral                                  | 89          | 0.01%              | na                       | na       | na   |
| Western Great Plains Mesquite Woodland and Shrubland                 | 1,797       | 0.13%              | na                       | na       | na   |
| Wyoming Basins Low Sagebrush Shrubland                               | 47          | 0.00%              | na                       | na       | na   |
| <i>Grassland/Herbaceous Classes</i>                                  |             |                    |                          |          |      |
| Central Mixedgrass Prairie   | 120         | 0.01%              | na                       | na       | na   |
| North Pacific Montane Grassland                                      | 27          | 0.00%              | na                       | na       | na   |
| Western Great Plains Sand Prairie                                    | 18          | 0.00%              | na                       | na       | na   |
| Western Great Plains Tallgrass Prairie                               | 1           | 0.00%              | na                       | na       | na   |

| MAPPED LAND COVER CLASSES (SWReGAP)   | Land Area      |                    | Validation Results       |          |      |
|---|----------------|--------------------|--------------------------|----------|------|
|   | Area Sq. Km    | Percent Total Area | Number Reference Samples | Producer | User |
| <i>Woody Wetland Classes</i>  |                |                    |                          |          |      |
| North American Warm Desert Riparian Mesquite Bosque                         | 832            | 0.06%              | na                       | na       | na   |
| <i>Emergent Wetland Classes</i>   |                |                    |                          |          |      |
| Mediterranean California Subalpine-Montane Fen                              | 2              | 0.00%              | na                       | na       | na   |
| Temperate Pacific Subalpine-Montane Wet Meadow                              | 2              | 0.00%              | na                       | na       | na   |
| Western Great Plains Saline Depression Wetland                              | 41             | 0.00%              | na                       | na       | na   |
| <i>Altered or Disturbed Classes</i>   |                |                    |                          |          |      |
| Disturbed, Non-specific   | 93             | 0.01%              | na                       | na       | na   |
| Disturbed, Oil Well   | 46             | 0.00%              | na                       | na       | na   |
| Invasive Perennial Forbland   | 1              | 0.00%              | na                       | na       | na   |
| Recently Burned   | 2,033          | 0.15%              | na                       | na       | na   |
| Recently Chained Pinyon-Juniper Areas                                       | 689            | 0.05%              | na                       | na       | na   |
| <i>Other Classes</i>  |                |                    |                          |          |      |
| Agriculture   | 75,981         | 5.48%              | na                       | na       | na   |
| Developed, Medium - High Intensity  | 7,539          | 0.54%              | na                       | na       | na   |
| Developed, Open Space - Low Intensity                                       | 7,425          | 0.54%              | na                       | na       | na   |
| Open Water  | 11,023         | 0.80%              | na                       | na       | na   |
| <b>TOTAL AREA NOT ASSESSED</b>  | <b>130,020</b> | <b>9.39%</b>       |                          |          |      |
| <b>GRP 2: VALIDATION RESULTS WITH &lt; 30% AGREEMENT (USER'S PERSPECT.)</b> |                |                    |                          |          |      |
| <i>Grassland/Herbaceous Classes</i>   |                |                    |                          |          |      |
| Chihuahuan Sandy Plains Semi-Desert Grassland                               | 986            | 0.07%              | 28                       | 11%      | 21%  |
| Inter-Mountain Basins Big Sagebrush Steppe                                  | 1,798          | 0.13%              | 82                       | 12%      | 26%  |
| Madrean Juniper Savanna   | 994            | 0.07%              | 32                       | 6%       | 25%  |
| <b>TOTAL AREA &lt; 30% AGREEMENT</b>  | <b>3,778</b>   | <b>0.27%</b>       |                          |          |      |
| <b>GRP 3: VALIDATION WITH 30 - 49% AGREEMENT (USER'S PERSPECTIVE)</b>       |                |                    |                          |          |      |
| <i>Sparsely Vegetated/Barren Classes</i>                                    |                |                    |                          |          |      |
| North American Warm Desert Pavement   | 393            | 0.03%              | 21                       | 14%      | 33%  |
| <i>Evergreen Forest Classes</i>   |                |                    |                          |          |      |
| Madrean Encinal   | 4,358          | 0.31%              | 45                       | 51%      | 44%  |
| Madrean Pine-Oak Forest and Woodland  | 5,733          | 0.41%              | 104                      | 42%      | 46%  |
| Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland           | 801            | 0.06%              | 31                       | 13%      | 44%  |
| <i>Mixed Forest Class</i>   |                |                    |                          |          |      |
| Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland               | 3,439          | 0.25%              | 159                      | 30%      | 49%  |
| <i>Shrub/Scrub Classes</i>  |                |                    |                          |          |      |
| Apacherian-Chihuahuan Mesquite Upland Scrub                                 | 31,683         | 2.29%              | 215                      | 41%      | 41%  |
| Chihuahuan Mixed Desert and Thorn Scrub                                     | 27,407         | 1.98%              | 174                      | 45%      | 45%  |
| Chihuahuan Mixed Salt Desert Scrub  | 4,413          | 0.32%              | 45                       | 22%      | 33%  |
| Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub                      | 5,725          | 0.41%              | 59                       | 49%      | 48%  |

| MAPPED LAND COVER CLASSES (SWReGAP)                                   | Land Area      |                    | Validation Results       |          |      |
|---|----------------|--------------------|--------------------------|----------|------|
|   | Area Sq. Km    | Percent Total Area | Number Reference Samples | Producer | User |
| Sonora-Mojave Mixed Salt Desert Scrub                                 | 2,549          | 0.18%              | 23                       | 26%      | 30%  |
| <i>Grassland/Herbaceous Classes</i>                                   |                |                    |                          |          |      |
| Chihuahuan-Sonoran Desert Bottomland and Swale Grassland              | 0              | 0.00%              | 104                      | 32%      | 41%  |
| Inter-Mountain Basins Semi-Desert Grassland                           | 33,640         | 2.43%              | 392                      | 32%      | 41%  |
| <i>Woody Wetland Classes</i>  |                |                    |                          |          |      |
| North American Warm Desert Lower Montane Riparian Woodland and Shrub  | 426            | 0.03%              | 43                       | 19%      | 32%  |
| North American Warm Desert Riparian Woodland and Shrubland            | 422            | 0.03%              | 45                       | 18%      | 35%  |
| North American Warm Desert Wash                                       | 652            | 0.05%              | 50                       | 24%      | 34%  |
| <i>Emergent Wetland Classes</i>                                       |                |                    |                          |          |      |
| Rocky Mountain Alpine-Montane Wet Meadow                              | 1,956          | 0.14%              | 118                      | 35%      | 48%  |
| <i>Altered or Disturbed Classes</i>                                   |                |                    |                          |          |      |
| Invasive Annual Grassland   | 8,291          | 0.60%              | 174                      | 22%      | 42%  |
| <b>TOTAL AREA 30 - 49% AGREEMENT</b>                                  | <b>131,888</b> | <b>9.52%</b>       |                          |          |      |
| <b>GRP 4: VALIDATION WITH 50 - 70% AGREEMENT (USER'S PERSPECTIVE)</b> |                |                    |                          |          |      |
| <i>Sparsely Vegetated/Barren Classes</i>                              |                |                    |                          |          |      |
| Barren Lands, Non-specific  | 1,421          | 0.10%              | 54                       | 19%      | 56%  |
| Inter-Mountain Basins Cliff and Canyon                                | 2,873          | 0.21%              | 83                       | 43%      | 64%  |
| Inter-Mountain Basins Shale Badland                                   | 3,297          | 0.24%              | 59                       | 37%      | 50%  |
| North American Warm Desert Active and Stabilized Dune                 | 2,728          | 0.20%              | 37                       | 43%      | 67%  |
| North American Warm Desert Bedrock Cliff and Outcrop                  | 3,568          | 0.26%              | 38                       | 53%      | 67%  |
| North American Warm Desert Playa                                      | 1,115          | 0.08%              | 20                       | 70%      | 64%  |
| Rocky Mountain Alpine Fell-Field                                      | 761            | 0.05%              | 27                       | 48%      | 59%  |
| Rocky Mountain Cliff, Canyon and Massive Bedrock                      | 2,965          | 0.21%              | 143                      | 56%      | 67%  |
| <i>Evergreen Forest Classes</i>                                       |                |                    |                          |          |      |
| Colorado Plateau Pinyon-Juniper Woodland                              | 97,855         | 7.06%              | 972                      | 81%      | 69%  |
| Great Basin Pinyon-Juniper Woodland                                   | 50,776         | 3.66%              | 441                      | 84%      | 65%  |
| Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland      | 666            | 0.05%              | 21                       | 38%      | 50%  |
| Madrean Pinyon-Juniper Woodland                                       | 21,917         | 1.58%              | 233                      | 71%      | 54%  |
| Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland    | 8,953          | 0.65%              | 458                      | 52%      | 57%  |
| Rocky Mountain Lodgepole Pine Forest                                  | 8,764          | 0.63%              | 199                      | 60%      | 60%  |
| Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland     | 14,814         | 1.07%              | 466                      | 76%      | 66%  |
| Southern Rocky Mountain Pinyon-Juniper Woodland                       | 15,305         | 1.10%              | 172                      | 64%      | 63%  |
| Southern Rocky Mountain Ponderosa Pine Woodland                       | 50,221         | 3.62%              | 785                      | 77%      | 66%  |
| <i>Shrub/Scrub Classes</i>  |                |                    |                          |          |      |
| Colorado Plateau Blackbrush-Mormon-tea Shrubland                      | 13,310         | 0.96%              | 106                      | 73%      | 54%  |
| Colorado Plateau Mixed Low Sagebrush Shrubland                        | 2,401          | 0.17%              | 50                       | 28%      | 50%  |
| Colorado Plateau Pinyon-Juniper Shrubland                             | 11,535         | 0.83%              | 149                      | 61%      | 57%  |
| Great Basin Semi-Desert Chaparral                                     | 163            | 0.01%              | 21                       | 43%      | 50%  |
| Great Basin Xeric Mixed Sagebrush Shrubland                           | 35,434         | 2.56%              | 417                      | 47%      | 55%  |
| Inter-Mountain Basins Big Sagebrush Shrubland                         | 108,480        | 7.83%              | 1394                     | 77%      | 59%  |

| MAPPED LAND COVER CLASSES (SWReGAP)                                   | Land Area      |                    | Validation Results       |          |      |
|---|----------------|--------------------|--------------------------|----------|------|
|   | Area Sq. Km    | Percent Total Area | Number Reference Samples | Producer | User |
| Inter-Mountain Basins Mat Saltbush Shrubland                          | 4,130          | 0.30%              | 64                       | 55%      | 51%  |
| Inter-Mountain Basins Mixed Salt Desert Scrub                         | 79,294         | 5.72%              | 826                      | 59%      | 53%  |
| Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland        | 2,550          | 0.18%              | 81                       | 27%      | 55%  |
| Mogollon Chaparral  | 11,515         | 0.83%              | 169                      | 49%      | 52%  |
| Rocky Mountain Lower Montane-Foothill Shrubland                       | 2,823          | 0.20%              | 102                      | 44%      | 68%  |
| Sonoran Mid-Elevation Desert Scrub                                    | 5,393          | 0.39%              | 36                       | 36%      | 50%  |
| Southern Colorado Plateau Sand Shrubland                              | 7,021          | 0.51%              | 81                       | 56%      | 56%  |
| Apacherian-Chihuahuan Semi-Desert Grassland and Steppe                | 45,711         | 3.30%              | 343                      | 63%      | 51%  |
| Chihuahuan Gypsophilous Grassland and Steppe                          | 804            | 0.06%              | 25                       | 56%      | 56%  |
| Inter-Mountain Basins Juniper Savanna                                 | 5,590          | 0.40%              | 89                       | 36%      | 51%  |
| Inter-Mountain Basins Montane Sagebrush Steppe                        | 40,654         | 2.93%              | 781                      | 72%      | 63%  |
| Inter-Mountain Basins Semi-Desert Shrub-Steppe                        | 47,618         | 3.44%              | 699                      | 38%      | 52%  |
| Rocky Mountain Subalpine Mesic Meadow                                 | 2,177          | 0.16%              | 120                      | 48%      | 56%  |
| Southern Rocky Mountain Juniper Woodland and Savanna                  | 11,956         | 0.86%              | 59                       | 53%      | 53%  |
| Southern Rocky Mountain Montane-Subalpine Grassland                   | 10,294         | 0.74%              | 292                      | 58%      | 64%  |
| Western Great Plains Foothill and Piedmont Grassland                  | 5,066          | 0.37%              | 135                      | 65%      | 63%  |
| <b>Woody Wetland Classes</b>  |                |                    |                          |          |      |
| Great Basin Foothill and Lower Montane Riparian Woodland and Shrub    | 1,360          | 0.10%              | 102                      | 60%      | 68%  |
| Inter-Mountain Basins Greasewood Flat                                 | 23,770         | 1.71%              | 405                      | 46%      | 52%  |
| Rocky Mountain Lower Montane Riparian Woodland and Shrubland          | 2,226          | 0.16%              | 177                      | 45%      | 67%  |
| Rocky Mountain Subalpine-Montane Riparian Shrubland                   | 3,224          | 0.23%              | 135                      | 49%      | 62%  |
| Rocky Mountain Subalpine-Montane Riparian Woodland                    | 292            | 0.02%              | 46                       | 7%       | 50%  |
| Western Great Plains Floodplain                                       | 836            | 0.06%              | 66                       | 67%      | 70%  |
| <b>Emergent Wetland Classes</b>                                       |                |                    |                          |          |      |
| North American Arid West Emergent Marsh                               | 1,053          | 0.08%              | 64                       | 38%      | 65%  |
| <b>Altered or Disturbed Classes</b>                                   |                |                    |                          |          |      |
| Invasive Annual and Biennial Forbland                                 | 2,638          | 0.19%              | 138                      | 17%      | 52%  |
| Invasive Perennial Grassland  | 2,839          | 0.20%              | 136                      | 38%      | 67%  |
| Invasive Southwest Riparian Woodland and Shrubland                    | 1,609          | 0.12%              | 116                      | 59%      | 66%  |
| Recently Mined or Quarried  | 1,240          | 0.09%              | 23                       | 61%      | 67%  |
| <b>TOTAL AREA 50 - 70% AGREEMENT</b>                                  | <b>783,005</b> | <b>56.48%</b>      |                          |          |      |
| <b>GRP 5: VALIDATION WITH &gt; 70% AGREEMENT (USER'S PERSPECTIVE)</b> |                |                    |                          |          |      |
| <b>Sparsely Vegetated/Barren Classes</b>                              |                |                    |                          |          |      |
| Colorado Plateau Mixed Bedrock Canyon and Tableland                   | 24,313         | 1.75%              | 248                      | 75%      | 72%  |
| Inter-Mountain Basins Active and Stabilized Dune                      | 3,103          | 0.22%              | 39                       | 44%      | 71%  |
| Inter-Mountain Basins Playa   | 17,581         | 1.27%              | 81                       | 68%      | 77%  |
| Rocky Mountain Alpine Bedrock and Scree                               | 3,863          | 0.28%              | 100                      | 81%      | 84%  |
| <b>Deciduous Forest Classes</b>                                       |                |                    |                          |          |      |
| Rocky Mountain Aspen Forest and Woodland                              | 20,986         | 1.51%              | 582                      | 81%      | 74%  |
| Rocky Mountain Bigtooth Maple Ravine Woodland                         | 888            | 0.06%              | 34                       | 68%      | 74%  |

| MAPPED LAND COVER CLASSES (SWReGAP)                   | Land Area        |                    | Validation Results       |          |      |
|---|------------------|--------------------|--------------------------|----------|------|
|   | Area Sq. Km      | Percent Total Area | Number Reference Samples | Producer | User |
| <i>Shrub/Scrub Classes</i>                            |                  |                    |                          |          |      |
| Mojave Mid-Elevation Mixed Desert Scrub               | 16,762           | 1.21%              | 168                      | 71%      | 75%  |
| Rocky Mountain Gambel Oak-Mixed Montane Shrubland     | 18,950           | 1.37%              | 524                      | 69%      | 71%  |
| Sonora-Mojave Creosotebush-White Bursage Desert Scrub | 58,760           | 4.24%              | 292                      | 68%      | 76%  |
| Sonoran Paloverde-Mixed Cacti Desert Scrub            | 39,791           | 2.87%              | 280                      | 83%      | 74%  |
| Western Great Plains Sandhill Shrubland               | 13,894           | 1.00%              | 159                      | 72%      | 74%  |
| <i>Grassland/Herbaceous Classes</i>                   |                  |                    |                          |          |      |
| Rocky Mountain Dry Tundra                             | 2,779            | 0.20%              | 68                       | 76%      | 78%  |
| Western Great Plains Shortgrass Prairie               | 113,162          | 8.16%              | 668                      | 88%      | 72%  |
| <i>Woody Wetland Classes</i>                          |                  |                    |                          |          |      |
| Western Great Plains Riparian Woodland and Shrubland  | 1,714            | 0.12%              | 153                      | 75%      | 80%  |
| <i>Altered or Disturbed Classes</i>                   |                  |                    |                          |          |      |
| Recently Logged Areas                                 | 836              | 0.06%              | 35                       | 37%      | 93%  |
| <b>TOTAL AREA &gt; 70% AGREEMENT</b>                  | <b>337,382</b>   | <b>24.32%</b>      |                          |          |      |
| <b>TOTALS FOR 5-STATE REGION</b>                      | <b>1,386,073</b> | <b>100.00%</b>     | <b>17,030</b>            |          |      |

### Appendix 3-1. List of species reviewed and modeled in Southwest Regional Gap Analysis Project (\* Indicates species not modeled in effort).

| Taxon Group | ITIS   | Lead State | Common Name                    | Scientific Name                  |
|-------------|--------|------------|--------------------------------|----------------------------------|
| A           | 173429 | CO         | COUCH'S SPADEFOOT              | <i>Scaphiopus couchii</i>        |
| A           | 173438 | UT         | GREEN FROG                     | <i>Rana clamitans</i>            |
| A           | 173440 | CO         | WOOD FROG                      | <i>Rana sylvatica</i>            |
| A           | 173441 | NM         | BULLFROG                       | <i>Rana catesbeiana</i>          |
| A           | 173443 | CO         | NORTHERN LEOPARD FROG          | <i>Rana pipiens</i>              |
| A           | 173446 | NV         | RED-LEGGED FROG                | <i>Rana aurora</i>               |
| A           | 173447 | NM         | RIO GRANDE LEOPARD FROG        | <i>Rana berlandieri</i>          |
| A           | 173448 | CO         | PLAINS LEOPARD FROG            | <i>Rana blairi</i>               |
| A           | 173451 | NM         | CHIRICAHUA LEOPARD FROG        | <i>Rana chiricahuensis</i>       |
| A           | 173454 | NV         | MOUNTAIN YELLOW-LEGGED FROG    | <i>Rana muscosa</i>              |
| A           | 173457 | NV         | RELICT LEOPARD FROG            | <i>Rana onca</i>                 |
| A           | 173458 | UT         | SPOTTED FROG*                  | <i>Rana pretiosa</i>             |
| A           | 173461 | AZ         | TARAHUMARA FROG*               | <i>Rana tarahumarae</i>          |
| A           | 173462 | AZ         | YAVAPAI LEOPARD FROG           | <i>Rana yavapaiensis</i>         |
| A           | 173468 | CO         | GREAT PLAINS NARROWMOUTH TOAD  | <i>Gastrophryne olivacea</i>     |
| A           | 173476 | NM         | WOODHOUSE'S TOAD               | <i>Bufo woodhousii</i>           |
| A           | 173481 | AZ         | COLORADO RIVER TOAD            | <i>Bufo alvarius</i>             |
| A           | 173482 | CO         | WESTERN TOAD                   | <i>Bufo boreas</i>               |
| A           | 173484 | NM         | GREAT PLAINS TOAD              | <i>Bufo cognatus</i>             |
| A           | 173485 | NM         | GREEN TOAD                     | <i>Bufo debilis</i>              |
| A           | 173490 | AZ         | SOUTHWESTERN TOAD              | <i>Bufo microscaphus</i>         |
| A           | 173491 | NM         | RED-SPOTTED TOAD               | <i>Bufo punctatus</i>            |
| A           | 173492 | AZ         | SONORAN GREEN TOAD             | <i>Bufo retiformis</i>           |
| A           | 173493 | NM         | TEXAS TOAD                     | <i>Bufo speciosus</i>            |
| A           | 173510 | AZ         | CANYON TREEFROG                | <i>Hyla arenicolor</i>           |
| A           | 173513 | AZ         | MOUNTAIN TREEFROG              | <i>Hyla eximia</i>               |
| A           | 173520 | CO         | NORTHERN CRICKET FROG          | <i>Acris crepitans</i>           |
| A           | 173525 | AZ         | WESTERN CHORUS FROG*           | <i>Pseudacris triseriata</i>     |
| A           | 173534 | AZ         | LOWLAND BURROWING TREEFROG     | <i>Pternohyla fodiens</i>        |
| A           | 173549 | AZ         | AFRICAN CLAWED FROG*           | <i>Xenopus laevis</i>            |
| A           | 173592 | AZ         | TIGER SALAMANDER               | <i>Ambystoma tigrinum</i>        |
| A           | 173663 | NM         | JEMEZ MOUNTAINS SALAMANDER     | <i>Plethodon neomexicanus</i>    |
| A           | 173702 | NM         | SACRAMENTO MOUNTAIN SALAMANDER | <i>Aneides hardii</i>            |
| A           | 206989 | NM         | PLAINS SPADEFOOT               | <i>Spea bombifrons</i>           |
| A           | 206991 | CO         | GREAT BASIN SPADEFOOT          | <i>Spea intermontana</i>         |
| A           | 206993 | AZ         | NEW MEXICO SPADEFOOT           | <i>Spea multiplicata</i>         |
| A           | 207312 | UT         | BOREAL CHORUS FROG             | <i>Pseudacris maculata</i>       |
| A           | 207313 | NV         | PACIFIC CHORUS FROG            | <i>Pseudacris regilla</i>        |
| A           | 207724 | NM         | BARKING FROG                   | <i>Eleutherodactylus augusti</i> |
| A           | 550236 | NV         | AMARGOSA TOAD                  | <i>Bufo nelsoni</i>              |
| A           | 550241 | AZ         | RAMSEY CANYON LEOPARD FROG*    | <i>Rana subaquavocalis</i>       |
| A           | 550546 | UT         | COLUMBIA SPOTTED FROG          | <i>Rana luteiventris</i>         |
| B           | 174469 | NM         | COMMON LOON                    | <i>Gavia immer</i>               |
| B           | 174470 | CO         | YELLOW-BILLED LOON             | <i>Gavia adamsii</i>             |

| Taxon Group | ITIS   | Lead State | Common Name                  | Scientific Name                  |
|-------------|--------|------------|------------------------------|----------------------------------|
| B           | 174474 | CO         | RED-THROATED LOON            | <i>Gavia stellata</i>            |
| B           | 174475 | CO         | PACIFIC LOON                 | <i>Gavia pacifica</i>            |
| B           | 174479 | CO         | RED-NECKED GREBE             | <i>Podiceps grisegena</i>        |
| B           | 174482 | UT         | HORNED GREBE                 | <i>Podiceps auritus</i>          |
| B           | 174485 | NM         | EARED GREBE                  | <i>Podiceps nigricollis</i>      |
| B           | 174503 | NM         | WESTERN GREBE                | <i>Aechmophorus occidentalis</i> |
| B           | 174505 | NM         | PIED-BILLED GREBE            | <i>Podilymbus podiceps</i>       |
| B           | 174684 | CO         | AMERICAN WHITE PELICAN       | <i>Pelecanus erythrorhynchos</i> |
| B           | 174717 | UT         | DOUBLE-CRESTED CORMORANT     | <i>Phalacrocorax auritus</i>     |
| B           | 174773 | NM         | GREAT BLUE HERON             | <i>Ardea herodias</i>            |
| B           | 174793 | NM         | GREEN HERON                  | <i>Butorides virescens</i>       |
| B           | 174803 | NM         | CATTLE EGRET                 | <i>Bubulcus ibis</i>             |
| B           | 174813 | NM         | SNOWY EGRET                  | <i>Egretta thula</i>             |
| B           | 174827 | NM         | LITTLE BLUE HERON            | <i>Egretta caerulea</i>          |
| B           | 174832 | NM         | BLACK-CROWNED NIGHT-HERON    | <i>Nycticorax nycticorax</i>     |
| B           | 174842 | CO         | YELLOW-CROWNED NIGHT-HERON   | <i>Nyctanassa violacea</i>       |
| B           | 174846 | NM         | LEAST BITTERN                | <i>Ixobrychus exilis</i>         |
| B           | 174856 | NM         | AMERICAN BITTERN             | <i>Botaurus lentiginosus</i>     |
| B           | 174926 | NM         | WHITE-FACED IBIS             | <i>Plegadis chihi</i>            |
| B           | 174987 | NV         | TUNDRA SWAN                  | <i>Cygnus columbianus</i>        |
| B           | 174992 | CO         | TRUMPETER SWAN               | <i>Cygnus buccinator</i>         |
| B           | 174999 | NM         | CANADA GOOSE                 | <i>Branta canadensis</i>         |
| B           | 175011 | CO         | BRANT*                       | <i>Branta bernicla</i>           |
| B           | 175020 | NM         | GREATER WHITE-FRONTED GOOSE  | <i>Anser albifrons</i>           |
| B           | 175038 | NM         | SNOW GOOSE                   | <i>Chen caerulescens</i>         |
| B           | 175041 | NM         | ROSS'S GOOSE                 | <i>Chen rossii</i>               |
| B           | 175044 | AZ         | BLACK-BELLIED WHISTLING-DUCK | <i>Dendrocygna autumnalis</i>    |
| B           | 175063 | NM         | MALLARD                      | <i>Anas platyrhynchos</i>        |
| B           | 175068 | CO         | AMERICAN BLACK DUCK          | <i>Anas rubripes</i>             |
| B           | 175073 | NM         | GADWALL                      | <i>Anas strepera</i>             |
| B           | 175074 | NM         | NORTHERN PINTAIL             | <i>Anas acuta</i>                |
| B           | 175081 | NM         | GREEN-WINGED TEAL            | <i>Anas crecca</i>               |
| B           | 175086 | NM         | BLUE-WINGED TEAL             | <i>Anas discors</i>              |
| B           | 175089 | NM         | CINNAMON TEAL                | <i>Anas cyanoptera</i>           |
| B           | 175092 | NV         | EURASIAN WIGEON*             | <i>Anas penelope</i>             |
| B           | 175094 | NM         | AMERICAN WIGEON              | <i>Anas americana</i>            |
| B           | 175096 | NM         | NORTHERN SHOVELER            | <i>Anas clypeata</i>             |
| B           | 175122 | NM         | WOOD DUCK                    | <i>Aix sponsa</i>                |
| B           | 175125 | NM         | REDHEAD                      | <i>Aythya americana</i>          |
| B           | 175128 | NM         | RING-NECKED DUCK             | <i>Aythya collaris</i>           |
| B           | 175129 | NV         | CANVASBACK                   | <i>Aythya valisineria</i>        |
| B           | 175130 | UT         | GREATER SCAUP                | <i>Aythya marila</i>             |
| B           | 175134 | NV         | LESSER SCAUP                 | <i>Aythya affinis</i>            |
| B           | 175141 | NM         | COMMON GOLDENEYE             | <i>Bucephala clangula</i>        |
| B           | 175144 | CO         | BARROW'S GOLDENEYE           | <i>Bucephala islandica</i>       |
| B           | 175145 | NM         | BUFFLEHEAD                   | <i>Bucephala albeola</i>         |
| B           | 175147 | CO         | LONG-TAILED DUCK             | <i>Clangula hyemalis</i>         |
| B           | 175149 | CO         | HARLEQUIN DUCK*              | <i>Histrionicus histrionicus</i> |

| Taxon Group | ITIS   | Lead State | Common Name                   | Scientific Name                    |
|-------------|--------|------------|-------------------------------|------------------------------------|
| B           | 175163 | CO         | WHITE-WINGED SCOTER           | <i>Melanitta fusca</i>             |
| B           | 175170 | CO         | SURF SCOTER                   | <i>Melanitta perspicillata</i>     |
| B           | 175175 | NM         | RUDDY DUCK                    | <i>Oxyura jamaicensis</i>          |
| B           | 175183 | NM         | HOODED MERGANSER              | <i>Lophodytes cucullatus</i>       |
| B           | 175185 | NM         | COMMON MERGANSER              | <i>Mergus merganser</i>            |
| B           | 175187 | NM         | RED-BREASTED MERGANSER        | <i>Mergus serrator</i>             |
| B           | 175265 | NM         | TURKEY VULTURE                | <i>Cathartes aura</i>              |
| B           | 175272 | AZ         | BLACK VULTURE*                | <i>Coragyps atratus</i>            |
| B           | 175274 | UT         | CALIFORNIA CONDOR             | <i>Gymnogyps californianus</i>     |
| B           | 175282 | AZ         | WHITE-TAILED KITE             | <i>Elanus leucurus</i>             |
| B           | 175300 | NM         | NORTHERN GOSHAWK              | <i>Accipiter gentilis</i>          |
| B           | 175304 | NM         | SHARP-SHINNED HAWK            | <i>Accipiter striatus</i>          |
| B           | 175309 | NM         | COOPER'S HAWK                 | <i>Accipiter cooperii</i>          |
| B           | 175350 | NM         | RED-TAILED HAWK               | <i>Buteo jamaicensis</i>           |
| B           | 175365 | CO         | BROAD-WINGED HAWK             | <i>Buteo platypterus</i>           |
| B           | 175367 | NM         | SWAINSON'S HAWK               | <i>Buteo swainsoni</i>             |
| B           | 175368 | AZ         | ZONE-TAILED HAWK              | <i>Buteo albonotatus</i>           |
| B           | 175373 | NM         | ROUGH-LEGGED HAWK             | <i>Buteo lagopus</i>               |
| B           | 175377 | CO         | FERRUGINOUS HAWK              | <i>Buteo regalis</i>               |
| B           | 175397 | AZ         | HARRIS'S HAWK                 | <i>Parabuteo unicinctus</i>        |
| B           | 175402 | AZ         | COMMON BLACK-HAWK             | <i>Buteogallus anthracinus</i>     |
| B           | 175407 | NM         | GOLDEN EAGLE                  | <i>Aquila chrysaetos</i>           |
| B           | 175420 | CO         | BALD EAGLE                    | <i>Haliaeetus leucocephalus</i>    |
| B           | 175430 | NM         | NORTHERN HARRIER              | <i>Circus cyaneus</i>              |
| B           | 175590 | NM         | OSPREY                        | <i>Pandion haliaetus</i>           |
| B           | 175599 | CO         | GYRFALCON                     | <i>Falco rusticolus</i>            |
| B           | 175603 | NM         | PRAIRIE FALCON                | <i>Falco mexicanus</i>             |
| B           | 175604 | CO         | PEREGRINE FALCON              | <i>Falco peregrinus</i>            |
| B           | 175610 | NM         | APLOMADO FALCON               | <i>Falco femoralis</i>             |
| B           | 175613 | NM         | MERLIN                        | <i>Falco columbarius</i>           |
| B           | 175622 | NM         | AMERICAN KESTREL              | <i>Falco sparverius</i>            |
| B           | 175790 | UT         | RUFFED GROUSE                 | <i>Bonasa umbellus</i>             |
| B           | -2     | CO         | GUNNISON SAGE-GROUSE          | <i>Centrocercus minimus</i>        |
| B           | 175827 | CO         | WHITE-TAILED PTARMIGAN        | <i>Lagopus leucurus</i>            |
| B           | 175834 | CO         | GREATER PRAIRIE-CHICKEN       | <i>Tympanuchus cupido</i>          |
| B           | 175838 | CO         | LESSER PRAIRIE-CHICKEN        | <i>Tympanuchus pallidicinctus</i>  |
| B           | 175841 | CO         | SHARP-TAILED GROUSE*          | <i>Tympanuchus phasianellus</i>    |
| B           | 175848 | CO         | SHARP-TAILED GROUSE-COLUMBIAN | <i>T. phasianellus columbianus</i> |
| B           | 175852 | CO         | SHARP-TAILED GROUSE-PLAINS    | <i>T. phasianellus jamesi</i>      |
| B           | 175855 | CO         | GREATER SAGE-GROUSE           | <i>Centrocercus urophasianus</i>   |
| B           | 175860 | NM         | BLUE GROUSE                   | <i>Dendragapus obscurus</i>        |
| B           | 175863 | NM         | NORTHERN BOBWHITE             | <i>Colinus virginianus</i>         |
| B           | 175872 | NM         | SCALED QUAIL                  | <i>Callipepla squamata</i>         |
| B           | 175876 | NV         | CALIFORNIA QUAIL              | <i>Callipepla californica</i>      |
| B           | 175877 | NM         | GAMBEL'S QUAIL                | <i>Callipepla gambelii</i>         |
| B           | 175893 | NV         | MOUNTAIN QUAIL                | <i>Oreortyx pictus</i>             |
| B           | 175900 | AZ         | MONTEZUMA QUAIL               | <i>Cyrtonyx montezumae</i>         |
| B           | 175905 | UT         | RING-NECKED PHEASANT          | <i>Phasianus colchicus</i>         |



| Taxon Group | ITIS   | Lead State | Common Name             | Scientific Name                    |
|-------------|--------|------------|-------------------------|------------------------------------|
| B           | 175908 | NV         | CHUKAR                  | <i>Alectoris chukar</i>            |
| B           | 175915 | UT         | GRAY PARTRIDGE          | <i>Perdix perdix</i>               |
| B           | 176136 | NM         | WILD TURKEY             | <i>Meleagris gallopavo</i>         |
| B           | 176176 | CO         | WHOOPING CRANE          | <i>Grus americana</i>              |
| B           | 176177 | CO         | SANDHILL CRANE          | <i>Grus canadensis</i>             |
| B           | 176177 | CO         | SANDHILL CRANE          | <i>Grus canadensis</i>             |
| B           | 176209 | AZ         | CLAPPER RAIL            | <i>Rallus longirostris</i>         |
| B           | 176221 | NM         | VIRGINIA RAIL           | <i>Rallus limicola</i>             |
| B           | 176221 | NM         | VIRGINIA RAIL           | <i>Rallus limicola</i>             |
| B           | 176242 | NM         | SORA                    | <i>Porzana carolina</i>            |
| B           | 176263 | CO         | BLACK RAIL              | <i>Laterallus jamaicensis</i>      |
| B           | 176284 | NM         | COMMON MOORHEN          | <i>Gallinula chloropus</i>         |
| B           | 176292 | NM         | AMERICAN COOT           | <i>Fulica americana</i>            |
| B           | 176506 | NM         | SEMIPALMATED PLOVER     | <i>Charadrius semipalmatus</i>     |
| B           | 176507 | CO         | PIPING PLOVER           | <i>Charadrius melodus</i>          |
| B           | 176510 | CO         | SNOWY PLOVER            | <i>Charadrius alexandrinus</i>     |
| B           | 176520 | NM         | KILLDEER                | <i>Charadrius vociferus</i>        |
| B           | 176522 | CO         | MOUNTAIN PLOVER         | <i>Charadrius montanus</i>         |
| B           | 176564 | UT         | AMERICAN GOLDEN-PLOVER  | <i>Pluvialis dominica</i>          |
| B           | 176567 | NM         | BLACK-BELLIED PLOVER    | <i>Pluvialis squatarola</i>        |
| B           | 176571 | CO         | RUDDY TURNSTONE         | <i>Arenaria interpres</i>          |
| B           | 176580 | CO         | AMERICAN WOODCOCK*      | <i>Scolopax minor</i>              |
| B           | 176593 | CO         | LONG-BILLED CURLEW      | <i>Numenius americanus</i>         |
| B           | 176599 | CO         | WHIMBREL                | <i>Numenius phaeopus</i>           |
| B           | 176610 | CO         | UPLAND SANDPIPER        | <i>Bartramia longicauda</i>        |
| B           | 176612 | NM         | SPOTTED SANDPIPER       | <i>Actitis macularia</i>           |
| B           | 176615 | NM         | SOLITARY SANDPIPER      | <i>Tringa solitaria</i>            |
| B           | 176619 | NM         | GREATER YELLOWLEGS      | <i>Tringa melanoleuca</i>          |
| B           | 176620 | NM         | LESSER YELLOWLEGS       | <i>Tringa flavipes</i>             |
| B           | 176638 | NV         | WILLET                  | <i>Catoptrophorus semipalmatus</i> |
| B           | 176642 | CO         | RED KNOT                | <i>Calidris canutus</i>            |
| B           | 176653 | CO         | PECTORAL SANDPIPER      | <i>Calidris melanotos</i>          |
| B           | 176654 | CO         | WHITE-RUMPED SANDPIPER  | <i>Calidris fuscicollis</i>        |
| B           | 176655 | CO         | BAIRD'S SANDPIPER       | <i>Calidris bairdii</i>            |
| B           | 176656 | NM         | LEAST SANDPIPER         | <i>Calidris minutilla</i>          |
| B           | 176661 | NV         | DUNLIN                  | <i>Calidris alpina</i>             |
| B           | 176667 | CO         | SEMIPALMATED SANDPIPER  | <i>Calidris pusilla</i>            |
| B           | 176668 | NM         | WESTERN SANDPIPER       | <i>Calidris mauri</i>              |
| B           | 176669 | CO         | SANDERLING              | <i>Calidris alba</i>               |
| B           | 176675 | CO         | SHORT-BILLED DOWITCHER  | <i>Limnodromus griseus</i>         |
| B           | 176679 | NM         | LONG-BILLED DOWITCHER   | <i>Limnodromus scolopaceus</i>     |
| B           | 176684 | CO         | BUFF-BREASTED SANDPIPER | <i>Tryngites subruficollis</i>     |
| B           | 176686 | CO         | MARbled GODWIT          | <i>Limosa fedoa</i>                |
| B           | 176700 | NM         | COMMON SNIPE            | <i>Gallinago gallinago</i>         |
| B           | 176721 | NM         | AMERICAN AVOCET         | <i>Recurvirostra americana</i>     |
| B           | 176726 | NM         | BLACK-NECKED STILT      | <i>Himantopus mexicanus</i>        |
| B           | 176735 | NV         | RED-NECKED PHALAROPE    | <i>Phalaropus lobatus</i>          |
| B           | 176736 | NM         | WILSON'S PHALAROPE      | <i>Phalaropus tricolor</i>         |

| Taxon Group | ITIS   | Lead State | Common Name               | Scientific Name                  |
|-------------|--------|------------|---------------------------|----------------------------------|
| B           | 176808 | UT         | GLAUCOUS GULL             | <i>Larus hyperboreus</i>         |
| B           | 176824 | CO         | HERRING GULL              | <i>Larus argentatus</i>          |
| B           | 176828 | UT         | THAYER'S GULL             | <i>Larus thayeri</i>             |
| B           | 176829 | UT         | CALIFORNIA GULL           | <i>Larus californicus</i>        |
| B           | 176830 | NM         | RING-BILLED GULL          | <i>Larus delawarensis</i>        |
| B           | 176838 | UT         | FRANKLIN'S GULL           | <i>Larus pipixcan</i>            |
| B           | 176839 | NM         | BONAPARTE'S GULL          | <i>Larus philadelphia</i>        |
| B           | 176866 | CO         | SABINE'S GULL             | <i>Xema sabini</i>               |
| B           | 176887 | CO         | FORSTER'S TERN            | <i>Sterna forsteri</i>           |
| B           | 176888 | UT         | COMMON TERN               | <i>Sterna hirundo</i>            |
| B           | 176923 | CO         | LEAST TERN                | <i>Sterna antillarum</i>         |
| B           | 176924 | NV         | CASPIAN TERN              | <i>Sterna caspia</i>             |
| B           | 176959 | NV         | BLACK TERN                | <i>Chlidonias niger</i>          |
| B           | 177065 | NM         | BAND-TAILED PIGEON        | <i>Columba fasciata</i>          |
| B           | 177071 | NM         | ROCK DOVE                 | <i>Columba livia</i>             |
| B           | 177121 | NM         | WHITE-WINGED DOVE         | <i>Zenaida asiatica</i>          |
| B           | 177125 | NM         | MOURNING DOVE             | <i>Zenaida macroura</i>          |
| B           | 177134 | UT         | SPOTTED DOVE*             | <i>Streptopelia chinensis</i>    |
| B           | 177152 | AZ         | COMMON GROUND-DOVE        | <i>Columbina passerina</i>       |
| B           | 177162 | AZ         | INCA DOVE                 | <i>Columbina inca</i>            |
| B           | 177831 | AZ         | YELLOW-BILLED CUCKOO      | <i>Coccyzus americanus</i>       |
| B           | 177834 | CO         | BLACK-BILLED CUCKOO       | <i>Coccyzus erythrophthalmus</i> |
| B           | 177836 | NM         | GREATER ROADRUNNER        | <i>Geococcyx californianus</i>   |
| B           | 177851 | NM         | COMMON BARN-OWL           | <i>Tyto alba</i>                 |
| B           | 177856 | CO         | EASTERN SCREECH-OWL       | <i>Otus asio</i>                 |
| B           | 177875 | AZ         | WHISKERED SCREECH-OWL     | <i>Otus trichopsis</i>           |
| B           | 177878 | AZ         | FLAMMULATED OWL           | <i>Otus flammeolus</i>           |
| B           | 177884 | NM         | GREAT HORNED OWL          | <i>Bubo virginianus</i>          |
| B           | 177896 | CO         | SNOWY OWL                 | <i>Nyctea scandiaca</i>          |
| B           | 177902 | AZ         | NORTHERN PYGMY-OWL        | <i>Glaucidium gnoma</i>          |
| B           | 177908 | AZ         | FERRUGINOUS PYGMY-OWL     | <i>Glaucidium brasilianum</i>    |
| B           | 177912 | AZ         | ELF OWL                   | <i>Micrathene whitneyi</i>       |
| B           | 177925 | CO         | SPOTTED OWL               | <i>Strix occidentalis</i>        |
| B           | 177932 | NM         | LONG-EARED OWL            | <i>Asio otus</i>                 |
| B           | 177935 | UT         | SHORT-EARED OWL           | <i>Asio flammeus</i>             |
| B           | 177938 | CO         | BOREAL OWL                | <i>Aegolius funereus</i>         |
| B           | 177942 | NM         | NORTHERN SAW-WHET OWL     | <i>Aegolius acadicus</i>         |
| B           | 177946 | CO         | BURROWING OWL             | <i>Athene cunicularia</i>        |
| B           | 177961 | AZ         | WHIP-POOR-WILL            | <i>Caprimulgus vociferus</i>     |
| B           | 177966 | AZ         | BUFF-COLLARED NIGHTJAR    | <i>Caprimulgus ridgwayi</i>      |
| B           | 177979 | NM         | COMMON NIGHTHAWK          | <i>Chordeiles minor</i>          |
| B           | 177988 | NM         | LESSER NIGHTHAWK          | <i>Chordeiles acutipennis</i>    |
| B           | 177997 | NM         | BLACK SWIFT               | <i>Cypseloides niger</i>         |
| B           | 178001 | CO         | CHIMNEY SWIFT             | <i>Chaetura pelagica</i>         |
| B           | 178002 | NV         | VAUX'S SWIFT*             | <i>Chaetura vauxi</i>            |
| B           | 178014 | NM         | WHITE-THROATED SWIFT      | <i>Aeronautes saxatalis</i>      |
| B           | 178030 | AZ         | LUCIFER HUMMINGBIRD       | <i>Calothorax lucifer</i>        |
| B           | 178033 | AZ         | BLACK-CHINNED HUMMINGBIRD | <i>Archilochus alexandri</i>     |

| Taxon Group | ITIS   | Lead State | Common Name                | Scientific Name                   |
|-------------|--------|------------|----------------------------|-----------------------------------|
| B           | 178035 | AZ         | COSTA'S HUMMINGBIRD        | <i>Calypte costae</i>             |
| B           | 178036 | AZ         | ANNA'S HUMMINGBIRD         | <i>Calypte anna</i>               |
| B           | 178038 | AZ         | BROAD-TAILED HUMMINGBIRD   | <i>Selasphorus platycercus</i>    |
| B           | 178040 | AZ         | RUFIOUS HUMMINGBIRD        | <i>Selasphorus rufus</i>          |
| B           | 178041 | NV         | ALLEN'S HUMMINGBIRD        | <i>Selasphorus sasin</i>          |
| B           | 178048 | NV         | CALLIOPE HUMMINGBIRD       | <i>Stellula calliope</i>          |
| B           | 178050 | AZ         | MAGNIFICENT HUMMINGBIRD    | <i>Eugenes fulgens</i>            |
| B           | 178054 | AZ         | BLUE-THROATED HUMMINGBIRD  | <i>Lampornis clemenciae</i>       |
| B           | 178065 | AZ         | BERYLLINE HUMMINGBIRD*     | <i>Amazilia beryllina</i>         |
| B           | 178066 | AZ         | VIOLET-CROWNED HUMMINGBIRD | <i>Amazilia violiceps</i>         |
| B           | 178069 | AZ         | WHITE-EARED HUMMINGBIRD*   | <i>Hylocharis leucotis</i>        |
| B           | 178073 | AZ         | BROAD-BILLED HUMMINGBIRD   | <i>Cyanthus latirostris</i>       |
| B           | 178096 | AZ         | ELEGANT TROGON             | <i>Trogon elegans</i>             |
| B           | 178101 | AZ         | EARED TROGON*              | <i>Euptilotis neoxenus</i>        |
| B           | 178112 | AZ         | GREEN KINGFISHER*          | <i>Chloroceryle americana</i>     |
| B           | 178119 | NM         | BELTED KINGFISHER          | <i>Ceryle alcyon</i>              |
| B           | 178154 | NM         | NORTHERN FLICKER           | <i>Colaptes auratus</i>           |
| B           | 178164 | AZ         | GILDED FLICKER             | <i>Colaptes chrysoides</i>        |
| B           | 178186 | CO         | RED-HEADED WOODPECKER      | <i>Melanerpes erythrocephalus</i> |
| B           | 178189 | AZ         | ACORN WOODPECKER           | <i>Melanerpes formicivorus</i>    |
| B           | 178195 | CO         | RED-BELLIED WOODPECKER     | <i>Melanerpes carolinus</i>       |
| B           | 178196 | NM         | LEWIS'S WOODPECKER         | <i>Melanerpes lewis</i>           |
| B           | 178198 | AZ         | GILA WOODPECKER            | <i>Melanerpes uropygialis</i>     |
| B           | 178208 | NM         | WILLIAMSON'S SAPSUCKER     | <i>Sphyrapicus thyroideus</i>     |
| B           | 178211 | NM         | RED-NAPED SAPSUCKER        | <i>Sphyrapicus nuchalis</i>       |
| B           | 178212 | NV         | RED-BREASTED SAPSUCKER     | <i>Sphyrapicus ruber</i>          |
| B           | 178251 | NM         | THREE-TOED WOODPECKER      | <i>Picoides tridactylus</i>       |
| B           | 178256 | NV         | WHITE-HEADED WOODPECKER    | <i>Picoides albolarvatus</i>      |
| B           | 178259 | NM         | DOWNY WOODPECKER           | <i>Picoides pubescens</i>         |
| B           | 178260 | NM         | LADDER-BACKED WOODPECKER   | <i>Picoides scalaris</i>          |
| B           | 178261 | AZ         | STRICKLAND'S WOODPECKER    | <i>Picoides stricklandi</i>       |
| B           | 178262 | NM         | HAIRY WOODPECKER           | <i>Picoides villosus</i>          |
| B           | 178279 | CO         | EASTERN KINGBIRD           | <i>Tyrannus tyrannus</i>          |
| B           | 178282 | AZ         | TROPICAL KINGBIRD          | <i>Tyrannus melancholicus</i>     |
| B           | 178287 | NM         | WESTERN KINGBIRD           | <i>Tyrannus verticalis</i>        |
| B           | 178288 | NM         | CASSIN'S KINGBIRD          | <i>Tyrannus vociferans</i>        |
| B           | 178292 | AZ         | THICK-BILLED KINGBIRD      | <i>Tyrannus crassirostris</i>     |
| B           | 178293 | NM         | SCISSOR-TAILED FLYCATCHER  | <i>Tyrannus forficatus</i>        |
| B           | 178305 | AZ         | SULPHUR-BELLIED FLYCATCHER | <i>Myiodynastes luteiventris</i>  |
| B           | 178309 | CO         | GREAT CRESTED FLYCATCHER   | <i>Myiarchus crinitus</i>         |
| B           | 178312 | AZ         | BROWN-CRESTED FLYCATCHER   | <i>Myiarchus tyrannulus</i>       |
| B           | 178316 | NM         | ASH-THROATED FLYCATCHER    | <i>Myiarchus cinerascens</i>      |
| B           | 178319 | AZ         | DUSKY-CAPPED FLYCATCHER    | <i>Myiarchus tuberculifer</i>     |
| B           | 178329 | CO         | EASTERN PHOEBE             | <i>Sayornis phoebe</i>            |
| B           | 178330 | NM         | BLACK PHOEBE               | <i>Sayornis nigricans</i>         |
| B           | 178333 | NM         | SAY'S PHOEBE               | <i>Sayornis saya</i>              |
| B           | 178340 | CO         | ALDER FLYCATCHER           | <i>Empidonax alnorum</i>          |
| B           | 178341 | CO         | WILLOW FLYCATCHER          | <i>Empidonax traillii</i>         |

| Taxon Group | ITIS   | Lead State | Common Name                   | Scientific Name                        |
|-------------|--------|------------|-------------------------------|--|
| B           | 178346 | NM         | DUSKY FLYCATCHER              | <i>Empidonax oberholseri</i>           |
| B           | 178347 | NM         | GRAY FLYCATCHER               | <i>Empidonax wrightii</i>              |
| B           | 178348 | AZ         | PACIFIC-SLOPE FLYCATCHER*     | <i>Empidonax difficilis</i>            |
| B           | 178352 | AZ         | BUFF-BREASTED FLYCATCHER      | <i>Empidonax fulvifrons</i>            |
| B           | 178356 | AZ         | GREATER PEWEE                 | <i>Contopus pertinax</i>               |
| B           | 178360 | NM         | WESTERN WOOD-PEWEE            | <i>Contopus sordidulus</i>             |
| B           | 178371 | NM         | VERMILION FLYCATCHER          | <i>Pyrocephalus rubinus</i>            |
| B           | 178376 | AZ         | NORTHERN BEARDLESS-TYRANNULET | <i>Camptostoma imberbe</i>             |
| B           | 178384 | AZ         | ROSE-THROATED BECARD*         | <i>Pachyramphus aglaiae</i>            |
| B           | 178427 | NM         | VIOLET-GREEN SWALLOW          | <i>Tachycineta thalassina</i>          |
| B           | 178431 | NM         | TREE SWALLOW                  | <i>Tachycineta bicolor</i>             |
| B           | 178436 | NM         | BANK SWALLOW                  | <i>Riparia riparia</i>                 |
| B           | 178443 | NM         | NORTHERN ROUGH-WINGED SWALLOW | <i>Stelgidopteryx serripennis</i>      |
| B           | 178448 | NM         | BARN SWALLOW                  | <i>Hirundo rustica</i>                 |
| B           | 178455 | NM         | CLIFF SWALLOW                 | <i>Petrochelidon pyrrhonota</i>        |
| B           | 178460 | NM         | CAVE SWALLOW                  | <i>Petrochelidon fulva</i>             |
| B           | 178464 | NM         | PURPLE MARTIN                 | <i>Progne subis</i>                    |
| B           | 178499 | CO         | SPRAGUE'S PIPIT               | <i>Anthus spragueii</i>                |
| B           | 178511 | NM         | NORTHERN SHRIKE               | <i>Lanius excubitor</i>                |
| B           | 178515 | NM         | LOGGERHEAD SHRIKE             | <i>Lanius ludovicianus</i>             |
| B           | 178529 | CO         | BOHEMIAN WAXWING              | <i>Bombycilla garrulus</i>             |
| B           | 178532 | CO         | CEDAR WAXWING                 | <i>Bombycilla cedrorum</i>             |
| B           | 178536 | NM         | AMERICAN DIPPER               | <i>Cinclus mexicanus</i>               |
| B           | 178541 | NM         | HOUSE WREN                    | <i>Troglodytes aedon</i>               |
| B           | 178547 | NV         | WINTER WREN                   | <i>Troglodytes troglodytes</i>         |
| B           | 178562 | NM         | BEWICK'S WREN                 | <i>Thryomanes bewickii</i>             |
| B           | 178581 | CO         | CAROLINA WREN                 | <i>Thryothorus ludovicianus</i>        |
| B           | 178587 | AZ         | CACTUS WREN                   | <i>Campylorhynchus brunneicapillus</i> |
| B           | 178605 | CO         | SEDGE WREN                    | <i>Cistothorus platensis</i>           |
| B           | 178608 | NM         | MARSH WREN                    | <i>Cistothorus palustris</i>           |
| B           | 178610 | NM         | CANYON WREN                   | <i>Catherpes mexicanus</i>             |
| B           | 178614 | NM         | ROCK WREN                     | <i>Salpinctes obsoletus</i>            |
| B           | 178620 | NM         | NORTHERN MOCKINGBIRD          | <i>Mimus polyglottos</i>               |
| B           | 178625 | NM         | GRAY CATBIRD                  | <i>Dumetella carolinensis</i>          |
| B           | 178627 | CO         | BROWN THRASHER                | <i>Toxostoma rufum</i>                 |
| B           | 178636 | NM         | BENDIRE'S THRASHER            | <i>Toxostoma bendirei</i>              |
| B           | 178637 | NM         | CURVE-BILLED THRASHER         | <i>Toxostoma curvirostre</i>           |
| B           | 178645 | AZ         | LE CONTE'S THRASHER           | <i>Toxostoma lecontei</i>              |
| B           | 178652 | AZ         | CRISSAL THRASHER              | <i>Toxostoma crissale</i>              |
| B           | 178654 | NM         | SAGE THRASHER                 | <i>Oreoscoptes montanus</i>            |
| B           | 178759 | AZ         | VERDIN                        | <i>Auriparus flaviceps</i>             |
| B           | 178764 | NM         | BUSHTIT                       | <i>Psaltriparus minimus</i>            |
| B           | 178775 | NM         | WHITE-BREASTED NUTHATCH       | <i>Sitta carolinensis</i>              |
| B           | 178784 | NM         | RED-BREASTED NUTHATCH         | <i>Sitta canadensis</i>                |
| B           | 178788 | NM         | PYGMY NUTHATCH                | <i>Sitta pygmaea</i>                   |
| B           | 178803 | NM         | BROWN CREEPER                 | <i>Certhia americana</i>               |
| B           | 178841 | AZ         | RUFIOUS-CAPPED WARBLER*       | <i>Basileuterus rufifrons</i>          |
| B           | 178844 | CO         | BLACK-AND-WHITE WARBLER       | <i>Mniotilta varia</i>                 |

| Taxon Group | ITIS   | Lead State | Common Name                 | Scientific Name                      |
|-------------|--------|------------|-----------------------------|--------------------------------------|
| B           | 178855 | CO         | TENNESSEE WARBLER           | <i>Vermivora peregrina</i>           |
| B           | 178856 | NM         | ORANGE-CROWNED WARBLER      | <i>Vermivora celata</i>              |
| B           | 178861 | NV         | NASHVILLE WARBLER           | <i>Vermivora ruficapilla</i>         |
| B           | 178864 | NM         | VIRGINIA'S WARBLER          | <i>Vermivora virginiae</i>           |
| B           | 178866 | AZ         | LUCY'S WARBLER              | <i>Vermivora luciae</i>              |
| B           | 178874 | AZ         | OLIVE WARBLER               | <i>Peucedramus taeniatus</i>         |
| B           | 178878 | NM         | YELLOW WARBLER              | <i>Dendroica petechia</i>            |
| B           | 178891 | NM         | YELLOW-RUMPED WARBLER       | <i>Dendroica coronata</i>            |
| B           | 178896 | NM         | BLACK-THROATED GRAY WARBLER | <i>Dendroica nigrescens</i>          |
| B           | 178897 | NM         | TOWNSEND'S WARBLER          | <i>Dendroica townsendi</i>           |
| B           | 178902 | NV         | HERMIT WARBLER              | <i>Dendroica occidentalis</i>        |
| B           | 178909 | NM         | GRACE'S WARBLER             | <i>Dendroica graciae</i>             |
| B           | 178913 | CO         | BLACKPOLL WARBLER           | <i>Dendroica striata</i>             |
| B           | 178918 | CO         | PRAIRIE WARBLER             | <i>Dendroica discolor</i>            |
| B           | 178921 | CO         | PALM WARBLER                | <i>Dendroica palmarum</i>            |
| B           | 178927 | CO         | OVENBIRD                    | <i>Seiurus aurocapillus</i>          |
| B           | 178931 | NM         | NORTHERN WATERTHRUSH        | <i>Seiurus noveboracensis</i>        |
| B           | 178940 | NM         | MACGILLIVRAY'S WARBLER      | <i>Oporornis tolmiei</i>             |
| B           | 178944 | NM         | COMMON YELLOWTHROAT         | <i>Geothlypis trichas</i>            |
| B           | 178964 | NM         | YELLOW-BREASTED CHAT        | <i>Icteria virens</i>                |
| B           | 178970 | AZ         | RED-FACED WARBLER           | <i>Cardellina rubrifrons</i>         |
| B           | 178973 | NM         | WILSON'S WARBLER            | <i>Wilsonia pusilla</i>              |
| B           | 178979 | CO         | AMERICAN REDSTART           | <i>Setophaga ruticilla</i>           |
| B           | 178986 | AZ         | PAINTED REDSTART            | <i>Myioborus pictus</i>              |
| B           | 178997 | AZ         | HUTTON'S VIREO              | <i>Vireo huttoni</i>                 |
| B           | 179003 | AZ         | BELL'S VIREO                | <i>Vireo bellii</i>                  |
| B           | 179008 | NM         | GRAY VIREO                  | <i>Vireo vicinior</i>                |
| B           | 179021 | CO         | RED-EYED VIREO              | <i>Vireo olivaceus</i>               |
| B           | 179023 | NM         | WARBLING VIREO              | <i>Vireo gilvus</i>                  |
| B           | 179032 | CO         | BOBOLINK                    | <i>Dolichonyx oryzivorus</i>         |
| B           | 179034 | NM         | EASTERN MEADOWLARK          | <i>Sturnella magna</i>               |
| B           | 179039 | NM         | WESTERN MEADOWLARK          | <i>Sturnella neglecta</i>            |
| B           | 179043 | NM         | YELLOW-HEADED BLACKBIRD     | <i>Xanthocephalus xanthocephalus</i> |
| B           | 179045 | NM         | RED-WINGED BLACKBIRD        | <i>Agelaius phoeniceus</i>           |
| B           | 179060 | NV         | TRICOLORED BLACKBIRD        | <i>Agelaius tricolor</i>             |
| B           | 179064 | CO         | ORCHARD ORIOLE              | <i>Icterus spurius</i>               |
| B           | 179070 | AZ         | HOODED ORIOLE               | <i>Icterus cucullatus</i>            |
| B           | 179079 | AZ         | STREAK-BACKED ORIOLE        | <i>Icterus pustulatus</i>            |
| B           | 179082 | NM         | SCOTT'S ORIOLE              | <i>Icterus parisorum</i>             |
| B           | 179083 | CO         | BALTIMORE ORIOLE            | <i>Icterus galbula</i>               |
| B           | 179094 | NM         | BREWER'S BLACKBIRD          | <i>Euphagus cyanocephalus</i>        |
| B           | 179104 | CO         | COMMON GRACKLE              | <i>Quiscalus quiscula</i>            |
| B           | 179109 | NM         | GREAT-TAILED GRACKLE        | <i>Quiscalus mexicanus</i>           |
| B           | 179112 | NM         | BROWN-HEADED COWBIRD        | <i>Molothrus ater</i>                |
| B           | 179116 | AZ         | BRONZED COWBIRD             | <i>Molothrus aeneus</i>              |
| B           | 179124 | AZ         | NORTHERN CARDINAL           | <i>Cardinalis cardinalis</i>         |
| B           | 179132 | AZ         | PYRRHULOXIA                 | <i>Cardinalis sinuatus</i>           |
| B           | 179139 | NM         | ROSE-BREASTED GROSBEAK      | <i>Pheucticus ludovicianus</i>       |

| Taxon Group | ITIS   | Lead State | Common Name             | Scientific Name                   |
|-------------|--------|------------|-------------------------|-----------------------------------|
| B           | 179140 | NM         | BLACK-HEADED GROSBEEK   | <i>Pheucticus melanocephalus</i>  |
| B           | 179145 | NM         | BLUE GROSBEEK           | <i>Guiraca caerulea</i>           |
| B           | 179150 | NM         | INDIGO BUNTING          | <i>Passerina cyanea</i>           |
| B           | 179151 | NM         | LAZULI BUNTING          | <i>Passerina amoena</i>           |
| B           | 179152 | AZ         | VARIED BUNTING          | <i>Passerina versicolor</i>       |
| B           | 179156 | NM         | PAINTED BUNTING         | <i>Passerina ciris</i>            |
| B           | 179165 | CO         | DICKCISSEL              | <i>Spiza americana</i>            |
| B           | 179173 | NM         | EVENING GROSBEEK        | <i>Coccothraustes vespertinus</i> |
| B           | 179186 | NV         | PURPLE FINCH            | <i>Carpodacus purpureus</i>       |
| B           | 179190 | NM         | CASSIN'S FINCH          | <i>Carpodacus cassinii</i>        |
| B           | 179191 | NM         | HOUSE FINCH             | <i>Carpodacus mexicanus</i>       |
| B           | 179205 | NM         | PINE GROSBEEK           | <i>Pinicola enucleator</i>        |
| B           | 179215 | NV         | GRAY-CROWNED ROSY-FINCH | <i>Leucosticte tephrocotis</i>    |
| B           | 179222 | UT         | BLACK ROSY-FINCH        | <i>Leucosticte atrata</i>         |
| B           | 179223 | CO         | BROWN-CAPPED ROSY-FINCH | <i>Leucosticte australis</i>      |
| B           | 179230 | CO         | COMMON REDPOLL          | <i>Carduelis flammea</i>          |
| B           | 179232 | AZ         | LAWRENCE'S GOLDFINCH    | <i>Carduelis lawrencei</i>        |
| B           | 179233 | NM         | PINE SISKIN             | <i>Carduelis pinus</i>            |
| B           | 179234 | NM         | LESSER GOLDFINCH        | <i>Carduelis psaltria</i>         |
| B           | 179236 | NM         | AMERICAN GOLDFINCH      | <i>Carduelis tristis</i>          |
| B           | 179259 | NM         | RED CROSSBILL           | <i>Loxia curvirostra</i>          |
| B           | 179268 | UT         | WHITE-WINGED CROSSBILL  | <i>Loxia leucoptera</i>           |
| B           | 179293 | NM         | CANYON TOWHEE           | <i>Pipilo fuscus</i>              |
| B           | 179307 | AZ         | ABERT'S TOWHEE          | <i>Pipilo aberti</i>              |
| B           | 179310 | NM         | GREEN-TAILED TOWHEE     | <i>Pipilo chlorurus</i>           |
| B           | 179312 | CO         | LARK BUNTING            | <i>Calamospiza melanocorys</i>    |
| B           | 179314 | NM         | SAVANNAH SPARROW        | <i>Passerculus sandwichensis</i>  |
| B           | 179333 | NM         | GRASSHOPPER SPARROW     | <i>Ammodramus savannarum</i>      |
| B           | 179339 | NM         | BAIRD'S SPARROW         | <i>Ammodramus bairdii</i>         |
| B           | 179345 | CO         | LE CONTE'S SPARROW      | <i>Ammodramus leconteii</i>       |
| B           | 179366 | NM         | VESPER SPARROW          | <i>Poocetes gramineus</i>         |
| B           | 179371 | NM         | LARK SPARROW            | <i>Chondestes grammacus</i>       |
| B           | 179375 | AZ         | RUFIOUS-WINGED SPARROW  | <i>Aimophila carpalis</i>         |
| B           | 179377 | NM         | RUFIOUS-CROWNED SPARROW | <i>Aimophila ruficeps</i>         |
| B           | 179390 | AZ         | BOTTERI'S SPARROW       | <i>Aimophila botterii</i>         |
| B           | 179393 | NM         | CASSIN'S SPARROW        | <i>Aimophila cassinii</i>         |
| B           | 179395 | AZ         | BLACK-THROATED SPARROW  | <i>Amphispiza bilineata</i>       |
| B           | 179402 | NM         | SAGE SPARROW            | <i>Amphispiza belli</i>           |
| B           | 179410 | NM         | DARK-EYED JUNCO         | <i>Junco hyemalis</i>             |
| B           | 179427 | AZ         | YELLOW-EYED JUNCO       | <i>Junco phaeonotus</i>           |
| B           | 179432 | NM         | AMERICAN TREE SPARROW   | <i>Spizella arborea</i>           |
| B           | 179435 | NM         | CHIPPING SPARROW        | <i>Spizella passerina</i>         |
| B           | 179439 | NM         | CLAY-COLORED SPARROW    | <i>Spizella pallida</i>           |
| B           | 179440 | NM         | BREWER'S SPARROW        | <i>Spizella breweri</i>           |
| B           | 179443 | CO         | FIELD SPARROW           | <i>Spizella pusilla</i>           |
| B           | 179448 | AZ         | BLACK-CHINNED SPARROW   | <i>Spizella atrogularis</i>       |
| B           | 179454 | CO         | HARRIS'S SPARROW        | <i>Zonotrichia querula</i>        |
| B           | 179455 | NM         | WHITE-CROWNED SPARROW   | <i>Zonotrichia leucophrys</i>     |

| Taxon Group | ITIS   | Lead State | Common Name                | Scientific Name                  |
|-------------|--------|------------|----------------------------|----------------------------------|
| B           | 179461 | NV         | GOLDEN-CROWNED SPARROW     | <i>Zonotrichia atricapilla</i>   |
| B           | 179462 | NM         | WHITE-THROATED SPARROW     | <i>Zonotrichia albicollis</i>    |
| B           | 179464 | NM         | FOX SPARROW                | <i>Passerella iliaca</i>         |
| B           | 179484 | NM         | LINCOLN'S SPARROW          | <i>Melospiza lincolni</i>        |
| B           | 179488 | NM         | SWAMP SPARROW              | <i>Melospiza georgiana</i>       |
| B           | 179492 | NM         | SONG SPARROW               | <i>Melospiza melodia</i>         |
| B           | 179525 | CO         | MCCOWN'S LONGSPUR          | <i>Calcarius mccownii</i>        |
| B           | 179526 | CO         | LAPLAND LONGSPUR           | <i>Calcarius lapponicus</i>      |
| B           | 179530 | NM         | CHESTNUT-COLLARED LONGSPUR | <i>Calcarius ornatus</i>         |
| B           | 179532 | UT         | SNOW BUNTING               | <i>Plectrophenax nivalis</i>     |
| B           | 179628 | NM         | HOUSE SPARROW              | <i>Passer domesticus</i>         |
| B           | 179637 | NM         | EUROPEAN STARLING          | <i>Sturnus vulgaris</i>          |
| B           | 179667 | NM         | GRAY JAY                   | <i>Perisoreus canadensis</i>     |
| B           | 179680 | CO         | BLUE JAY                   | <i>Cyanocitta cristata</i>       |
| B           | 179685 | NM         | STELLER'S JAY              | <i>Cyanocitta stelleri</i>       |
| B           | 179707 | AZ         | MEXICAN JAY                | <i>Aphelocoma ultramarina</i>    |
| B           | 179720 | NM         | BLACK-BILLED MAGPIE        | <i>Pica hudsonia</i>             |
| B           | 179725 | NM         | COMMON RAVEN               | <i>Corvus corax</i>              |
| B           | 179730 | NM         | CHIHUAHUAN RAVEN           | <i>Corvus cryptoleucus</i>       |
| B           | 179731 | NM         | AMERICAN CROW              | <i>Corvus brachyrhynchos</i>     |
| B           | 179748 | NM         | PINYON JAY                 | <i>Gymnorhinus cyanocephalus</i> |
| B           | 179750 | NM         | CLARK'S NUTCRACKER         | <i>Nucifraga columbiana</i>      |
| B           | 179759 | NM         | AMERICAN ROBIN             | <i>Turdus migratorius</i>        |
| B           | 179773 | NV         | VARIED THRUSH              | <i>Ixoreus naevius</i>           |
| B           | 179777 | CO         | WOOD THRUSH                | <i>Hylocichla mustelina</i>      |
| B           | 179779 | NM         | HERMIT THRUSH              | <i>Catharus guttatus</i>         |
| B           | 179788 | NM         | SWAINSON'S THRUSH          | <i>Catharus ustulatus</i>        |
| B           | 179793 | CO         | GRAY-CHEEKED THRUSH        | <i>Catharus minimus</i>          |
| B           | 179796 | CO         | VEERY                      | <i>Catharus fuscescens</i>       |
| B           | 179801 | NM         | EASTERN BLUEBIRD           | <i>Sialia sialis</i>             |
| B           | 179806 | NM         | WESTERN BLUEBIRD           | <i>Sialia mexicana</i>           |
| B           | 179811 | NM         | MOUNTAIN BLUEBIRD          | <i>Sialia currucoides</i>        |
| B           | 179824 | NM         | TOWNSEND'S SOLITAIRE       | <i>Myadestes townsendi</i>       |
| B           | 179853 | NM         | BLUE-GRAY GNATCATCHER      | <i>Polioptila caerulea</i>       |
| B           | 179857 | AZ         | BLACK-TAILED GNATCATCHER   | <i>Polioptila melanura</i>       |
| B           | 179863 | AZ         | BLACK-CAPPED GNATCATCHER*  | <i>Polioptila nigriceps</i>      |
| B           | 179865 | NM         | GOLDEN-CROWNED KINGLET     | <i>Regulus satrapa</i>           |
| B           | 179870 | NM         | RUBY-CROWNED KINGLET       | <i>Regulus calendula</i>         |
| B           | 179877 | NM         | PHAINOPEPLA                | <i>Phainopepla nitens</i>        |
| B           | 179882 | NM         | WESTERN TANAGER            | <i>Piranga ludoviciana</i>       |
| B           | 179884 | NM         | HEPATIC TANAGER            | <i>Piranga flava</i>             |
| B           | 179888 | NM         | SUMMER TANAGER             | <i>Piranga rubra</i>             |
| B           | 179891 | AZ         | FLAME-COLORED TANAGER*     | <i>Piranga bidentata</i>         |
| B           | 554027 | NV         | CLARK'S GREBE              | <i>Aechmophorus clarkii</i>      |
| B           | 554030 | AZ         | FIVE-STRIPED SPARROW       | <i>Aimophila quinquestriata</i>  |
| B           | 554127 | NM         | AMERICAN PIPIT             | <i>Anthus rubescens</i>          |
| B           | 554128 | NM         | WESTERN SCRUB-JAY          | <i>Aphelocoma californica</i>    |
| B           | 554135 | NM         | GREAT EGRET                | <i>Ardea alba</i>                |

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|-------------|--------|------------|-----------------------------|----------------------------------|
| B           | 554137 | AZ         | GRAY HAWK                   | <i>Asturina nitida</i>           |
| B           | 554139 | NM         | JUNIPER TITMOUSE            | <i>Baeolophus ridgwayi</i>       |
| B           | 554141 | AZ         | BRIDLED TITMOUSE            | <i>Baeolophus wollweberi</i>     |
| B           | 554145 | CO         | STILT SANDPIPER             | <i>Calidris himantopus</i>       |
| B           | 554146 | AZ         | CRESTED CARACARA            | <i>Caracara plancus</i>          |
| B           | 554221 | NM         | OLIVE-SIDED FLYCATCHER      | <i>Contopus cooperi</i>          |
| B           | 554254 | NM         | HAMMOND'S FLYCATCHER        | <i>Empidonax hammondii</i>       |
| B           | 554255 | NM         | CORDILLERAN FLYCATCHER      | <i>Empidonax occidentalis</i>    |
| B           | 554256 | NM         | HORNED LARK                 | <i>Eremophila alpestris</i>      |
| B           | 554267 | NM         | BULLOCK'S ORIOLE            | <i>Icterus bullockii</i>         |
| B           | 554268 | NM         | MISSISSIPPI KITE            | <i>Ictinia mississippiensis</i>  |
| B           | 554375 | AZ         | NEOTROPIC CORMORANT         | <i>Phalacrocorax brasilianus</i> |
| B           | 554376 | CO         | RED PHALAROPE               | <i>Phalaropus fulicaria</i>      |
| B           | 554380 | NM         | SPOTTED TOWHEE              | <i>Pipilo maculatus</i>          |
| B           | 554382 | CO         | BLACK-CAPPED CHICKADEE      | <i>Poecile atricapilla</i>       |
| B           | 554385 | NM         | MOUNTAIN CHICKADEE          | <i>Poecile gambeli</i>           |
| B           | 554388 | AZ         | MEXICAN CHICKADEE           | <i>Poecile sclateri</i>          |
| B           | 554456 | NV         | CASSIN'S VIREO              | <i>Vireo cassinii</i>            |
| B           | 554477 | NM         | PLUMBEOUS VIREO             | <i>Vireo plumbeus</i>            |
| B           | 555388 | AZ         | WESTERN SCREECH-OWL         | <i>Otus kennicottii</i>          |
| B           | 555544 | NM         | COMMON POORWILL             | <i>Phalaenoptilus nuttallii</i>  |
| M           | -3     | NM         | ARIZONA MYOTIS              | <i>Myotis occultus</i>           |
| M           | 179921 | CO         | VIRGINIA OPOSSUM            | <i>Didelphis virginiana</i>      |
| M           | 179929 | CO         | MASKED SHREW                | <i>Sorex cinereus</i>            |
| M           | 179932 | UT         | VAGRANT SHREW               | <i>Sorex vagrans</i>             |
| M           | 179933 | NM         | NORTHERN WATER SHREW        | <i>Sorex palustris</i>           |
| M           | 179939 | AZ         | ARIZONA SHREW               | <i>Sorex arizonae</i>            |
| M           | 179946 | CO         | PYGMY SHREW                 | <i>Sorex hoyi</i>                |
| M           | 179949 | NM         | MERRIAM'S SHREW             | <i>Sorex merriami</i>            |
| M           | 179950 | NM         | MONTANE SHREW               | <i>Sorex monticolus</i>          |
| M           | 179951 | NM         | DWARF SHREW                 | <i>Sorex nanus</i>               |
| M           | 179954 | UT         | PREBLE'S SHREW              | <i>Sorex preblei</i>             |
| M           | 179955 | NV         | INYO SHREW                  | <i>Sorex tenellus</i>            |
| M           | 179956 | NV         | TROWBRIDGE'S SHREW          | <i>Sorex trowbridgii</i>         |
| M           | 179969 | CO         | ELLIOT'S SHORT-TAILED SHREW | <i>Blarina hylophaga</i>         |
| M           | 179971 | CO         | LEAST SHREW                 | <i>Cryptotis parva</i>           |
| M           | 179973 | NM         | DESERT SHREW                | <i>Notiosorex crawfordi</i>      |
| M           | 179979 | CO         | EASTERN MOLE                | <i>Scalopus aquaticus</i>        |
| M           | 179981 | NV         | BROAD-FOOTED MOLE           | <i>Scapanus latimanus</i>        |
| M           | 179988 | NM         | LITTLE BROWN BAT            | <i>Myotis lucifugus</i>          |
| M           | 179990 | NM         | LONG-LEGGED MYOTIS          | <i>Myotis volans</i>             |
| M           | 179991 | NM         | CALIFORNIA MYOTIS           | <i>Myotis californicus</i>       |
| M           | 179992 | AZ         | SOUTHWESTERN MYOTIS         | <i>Myotis auriculus</i>          |
| M           | 179995 | NM         | LONG-EARED MYOTIS           | <i>Myotis evotis</i>             |
| M           | 179999 | CO         | WESTERN SMALL-FOOTED MYOTIS | <i>Myotis leibii</i>             |
| M           | 180002 | NM         | FRINGED MYOTIS              | <i>Myotis thysanodes</i>         |
| M           | 180003 | NM         | CAVE MYOTIS                 | <i>Myotis velifer</i>            |
| M           | 180004 | NM         | YUMA MYOTIS                 | <i>Myotis yumanensis</i>         |



| Taxon Group | ITIS   | Lead State | Common Name                    | Scientific Name                      |
|-------------|--------|------------|--------------------------------|--------------------------------------|
| M           | 180006 | NM         | PALLID BAT                     | <i>Antrozous pallidus</i>            |
| M           | 180008 | NM         | BIG BROWN BAT                  | <i>Eptesicus fuscus</i>              |
| M           | 180010 | UT         | SPOTTED BAT                    | <i>Euderma maculatum</i>             |
| M           | 180012 | AZ         | ALLEN'S BIG-EARED BAT          | <i>Idionycteris phyllotis</i>        |
| M           | 180014 | NM         | SILVER-HAIRED BAT              | <i>Lasionycteris noctivagans</i>     |
| M           | 180016 | UT         | WESTERN RED BAT                | <i>Lasiurus blossevillii</i>         |
| M           | 180017 | NM         | HOARY BAT                      | <i>Lasiurus cinereus</i>             |
| M           | 180018 | AZ         | SOUTHERN YELLOW BAT            | <i>Lasiurus ega</i>                  |
| M           | 180024 | NM         | WESTERN PIPISTRELLE            | <i>Pipistrellus hesperus</i>         |
| M           | 180062 | AZ         | MEXICAN LONG-TONGUED BAT       | <i>Choeronycteris mexicana</i>       |
| M           | 180068 | NM         | MEXICAN LONG-NOSED BAT         | <i>Leptonycteris nivalis</i>         |
| M           | 180071 | AZ         | CALIFORNIA LEAF-NOSED BAT      | <i>Macrotus californicus</i>         |
| M           | 180080 | AZ         | WESTERN MASTIFF BAT            | <i>Eumops perotis</i>                |
| M           | 180081 | AZ         | UNDERWOOD'S MASTIFF BAT        | <i>Eumops underwoodi</i>             |
| M           | 180085 | AZ         | POCKETED FREE-TAILED BAT       | <i>Nyctinomops femorosaccus</i>      |
| M           | 180086 | NM         | BIG FREE-TAILED BAT            | <i>Nyctinomops macrotis</i>          |
| M           | 180088 | NM         | BRAZILIAN FREE-TAILED BAT      | <i>Tadarida brasiliensis</i>         |
| M           | 180103 | NM         | NINE-BANDED ARMADILLO          | <i>Dasybus novemcinctus</i>          |
| M           | 180109 | CO         | AMERICAN PIKA                  | <i>Ochotona princeps</i>             |
| M           | 180112 | CO         | SNOWSHOE HARE                  | <i>Lepus americanus</i>              |
| M           | 180114 | AZ         | ANTELOPE JACK RABBIT           | <i>Lepus alleni</i>                  |
| M           | 180115 | NM         | BLACK-TAILED JACK RABBIT       | <i>Lepus californicus</i>            |
| M           | 180116 | NM         | WHITE-SIDED JACK RABBIT        | <i>Lepus callotis</i>                |
| M           | 180118 | NM         | WHITE-TAILED JACK RABBIT       | <i>Lepus townsendii</i>              |
| M           | 180122 | NM         | DESERT COTTONTAIL              | <i>Sylvilagus audubonii</i>          |
| M           | 180124 | NM         | EASTERN COTTONTAIL             | <i>Sylvilagus floridanus</i>         |
| M           | 180126 | NM         | MOUNTAIN COTTONTAIL            | <i>Sylvilagus nuttallii</i>          |
| M           | 180133 | NV         | MOUNTAIN BEAVER                | <i>Aplodontia rufa</i>               |
| M           | 180140 | NM         | YELLOW-BELLIED MARMOT          | <i>Marmota flaviventris</i>          |
| M           | 180147 | UT         | UINTA GROUND SQUIRREL          | <i>Spermophilus armatus</i>          |
| M           | 180148 | NV         | CALIFORNIA GROUND SQUIRREL     | <i>Spermophilus beecheyi</i>         |
| M           | 180149 | NV         | BELDING'S GROUND SQUIRREL      | <i>Spermophilus beldingi</i>         |
| M           | 180152 | CO         | WYOMING GROUND SQUIRREL        | <i>Spermophilus elegans</i>          |
| M           | 180154 | NM         | GOLDEN-MANTLED GROUND SQUIRREL | <i>Spermophilus lateralis</i>        |
| M           | 180155 | NM         | MEXICAN GROUND SQUIRREL        | <i>Spermophilus mexicanus</i>        |
| M           | 180159 | NM         | SPOTTED GROUND SQUIRREL        | <i>Spermophilus spilosoma</i>        |
| M           | 180160 | AZ         | ROUND-TAILED GROUND SQUIRREL   | <i>Spermophilus tereticaudus</i>     |
| M           | 180161 | NV         | TOWNSEND'S GROUND SQUIRREL*    | <i>Spermophilus townsendii</i>       |
| M           | 180162 | CO         | THIRTEEN-LINED GROUND SQUIRREL | <i>Spermophilus tridecemlineatus</i> |
| M           | 180163 | NM         | ROCK SQUIRREL                  | <i>Spermophilus variegatus</i>       |
| M           | 180166 | NM         | RED SQUIRREL                   | <i>Tamiasciurus hudsonicus</i>       |
| M           | 180167 | NV         | DOUGLAS' SQUIRREL              | <i>Tamiasciurus douglasii</i>        |
| M           | 180169 | UT         | NORTHERN FLYING SQUIRREL       | <i>Glaucomys sabrinus</i>            |
| M           | 180172 | CO         | FOX SQUIRREL                   | <i>Sciurus niger</i>                 |
| M           | 180173 | NM         | ABERT'S SQUIRREL               | <i>Sciurus aberti</i>                |
| M           | 180174 | AZ         | ARIZONA GRAY SQUIRREL          | <i>Sciurus arizonensis</i>           |
| M           | 180176 | NV         | WESTERN GRAY SQUIRREL          | <i>Sciurus griseus</i>               |
| M           | 180177 | AZ         | NAYARIT SQUIRREL               | <i>Sciurus nayaritensis</i>          |

| Taxon Group | ITIS   | Lead State | Common Name                    | Scientific Name                   |
|-------------|--------|------------|--------------------------------|-----------------------------------|
| M           | 180179 | AZ         | HARRIS' ANTELOPE SQUIRREL      | <i>Ammospermophilus harrisi</i>   |
| M           | 180180 | NM         | TEXAS ANTELOPE SQUIRREL        | <i>Ammospermophilus interpres</i> |
| M           | 180181 | NM         | WHITE-TAILED ANTELOPE SQUIRREL | <i>Ammospermophilus leucurus</i>  |
| M           | 180184 | NM         | GUNNISON'S PRAIRIE DOG         | <i>Cynomys gunnisoni</i>          |
| M           | 180185 | CO         | WHITE-TAILED PRAIRIE DOG       | <i>Cynomys leucurus</i>           |
| M           | 180186 | CO         | BLACK-TAILED PRAIRIE DOG       | <i>Cynomys ludovicianus</i>       |
| M           | 180187 | UT         | UTAH PRAIRIE DOG               | <i>Cynomys parvidens</i>          |
| M           | 180190 | NV         | YELLOW-PINE CHIPMUNK           | <i>Tamias amoenus</i>             |
| M           | 180191 | NM         | GRAY-FOOTED CHIPMUNK           | <i>Tamias canipes</i>             |
| M           | 180192 | AZ         | GRAY-COLLARED CHIPMUNK         | <i>Tamias cinereicollis</i>       |
| M           | 180193 | NM         | CLIFF CHIPMUNK                 | <i>Tamias dorsalis</i>            |
| M           | 180195 | NM         | LEAST CHIPMUNK                 | <i>Tamias minimus</i>             |
| M           | 180198 | NV         | PALMER'S CHIPMUNK              | <i>Tamias palmeri</i>             |
| M           | 180199 | NV         | PANAMINT CHIPMUNK              | <i>Tamias panamintinus</i>        |
| M           | 180200 | NV         | LONG-EARED CHIPMUNK            | <i>Tamias quadrimaculatus</i>     |
| M           | 180201 | CO         | COLORADO CHIPMUNK              | <i>Tamias quadrivittatus</i>      |
| M           | 180203 | NV         | ALLEN'S CHIPMUNK               | <i>Tamias senex</i>               |
| M           | 180206 | NV         | LODGEPOLE CHIPMUNK             | <i>Tamias speciosus</i>           |
| M           | 180208 | NV         | TOWNSEND'S CHIPMUNK*           | <i>Tamias townsendii</i>          |
| M           | 180209 | NV         | UINTA CHIPMUNK                 | <i>Tamias umbrinus</i>            |
| M           | 180212 | NM         | BEAVER                         | <i>Castor canadensis</i>          |
| M           | 180215 | NM         | DESERT POCKET GOPHER           | <i>Geomys arenarius</i>           |
| M           | 180216 | CO         | PLAINS POCKET GOPHER           | <i>Geomys bursarius</i>           |
| M           | 180220 | NM         | YELLOW-FACED POCKET GOPHER     | <i>Pappogeomys castanops</i>      |
| M           | 180222 | NM         | BOTTA'S POCKET GOPHER          | <i>Thomomys bottae</i>            |
| M           | 180225 | UT         | IDAHO POCKET GOPHER            | <i>Thomomys idahoensis</i>        |
| M           | 180227 | NV         | MOUNTAIN POCKET GOPHER         | <i>Thomomys monticola</i>         |
| M           | 180228 | NM         | NORTHERN POCKET GOPHER         | <i>Thomomys talpoides</i>         |
| M           | 180229 | NV         | TOWNSEND'S POCKET GOPHER       | <i>Thomomys townsendii</i>        |
| M           | 180230 | AZ         | SOUTHERN POCKET GOPHER         | <i>Thomomys umbrinus</i>          |
| M           | 180236 | UT         | DESERT KANGAROO RAT            | <i>Dipodomys deserti</i>          |
| M           | 180241 | NM         | MERRIAM'S KANGAROO RAT         | <i>Dipodomys merriami</i>         |
| M           | 180242 | UT         | CHISEL-TOOTHED KANGAROO RAT    | <i>Dipodomys microps</i>          |
| M           | 180244 | NM         | ORD'S KANGAROO RAT             | <i>Dipodomys ordii</i>            |
| M           | 180245 | NV         | PANAMINT KANGAROO RAT          | <i>Dipodomys panamintinus</i>     |
| M           | 180246 | NM         | BANNER-TAILED KANGAROO RAT     | <i>Dipodomys spectabilis</i>      |
| M           | 180252 | NV         | DARK KANGAROO MOUSE            | <i>Microdipodops megacephalus</i> |
| M           | 180253 | NV         | PALE KANGAROO MOUSE            | <i>Microdipodops pallidus</i>     |
| M           | 180256 | AZ         | ARIZONA POCKET MOUSE           | <i>Perognathus amplus</i>         |
| M           | 180260 | CO         | OLIVE-BACKED POCKET MOUSE      | <i>Perognathus fasciatus</i>      |
| M           | 180261 | NM         | PLAINS POCKET MOUSE            | <i>Perognathus flavescens</i>     |
| M           | 180262 | NM         | SILKY POCKET MOUSE             | <i>Perognathus flavus</i>         |
| M           | 180267 | NV         | LITTLE POCKET MOUSE            | <i>Perognathus longimembris</i>   |
| M           | 180269 | NV         | GREAT BASIN POCKET MOUSE       | <i>Perognathus parvus</i>         |
| M           | 180276 | NM         | DEER MOUSE                     | <i>Peromyscus maniculatus</i>     |
| M           | 180278 | NM         | WHITE-FOOTED MOUSE             | <i>Peromyscus leucopus</i>        |
| M           | 180282 | NM         | BRUSH MOUSE                    | <i>Peromyscus boylii</i>          |
| M           | 180284 | AZ         | CANYON MOUSE                   | <i>Peromyscus crinitus</i>        |

| Taxon Group | ITIS   | Lead State | Common Name                | Scientific Name                   |
|-------------|--------|------------|----------------------------|-----------------------------------|
| M           | 180286 | AZ         | CACTUS MOUSE               | <i>Peromyscus eremicus</i>        |
| M           | 180287 | AZ         | BLACK-EARED MOUSE*         | <i>Peromyscus melanotis</i>       |
| M           | 180288 | AZ         | MERRIAM'S MOUSE            | <i>Peromyscus merriami</i>        |
| M           | 180289 | NM         | WHITE-ANKLED MOUSE         | <i>Peromyscus pectoralis</i>      |
| M           | 180291 | NM         | PINON MOUSE                | <i>Peromyscus truei</i>           |
| M           | 180294 | NM         | SOUTHERN RED-BACKED VOLE   | <i>Clethrionomys gapperi</i>      |
| M           | 180297 | CO         | MEADOW VOLE                | <i>Microtus pennsylvanicus</i>    |
| M           | 180299 | NM         | LONG-TAILED VOLE           | <i>Microtus longicaudus</i>       |
| M           | 180310 | NM         | MONTANE VOLE               | <i>Microtus montanus</i>          |
| M           | 180312 | CO         | PRAIRIE VOLE               | <i>Microtus ochrogaster</i>       |
| M           | 180315 | UT         | WATER VOLE                 | <i>Microtus richardsoni</i>       |
| M           | 180318 | NM         | MUSKRAT                    | <i>Ondatra zibethicus</i>         |
| M           | 180341 | AZ         | FULVOUS HARVEST MOUSE      | <i>Reithrodontomys fulvescens</i> |
| M           | 180343 | NM         | WESTERN HARVEST MOUSE      | <i>Reithrodontomys megalotis</i>  |
| M           | 180344 | NM         | PLAINS HARVEST MOUSE       | <i>Reithrodontomys montanus</i>   |
| M           | 180347 | AZ         | ARIZONA COTTON RAT         | <i>Sigmodon arizonae</i>          |
| M           | 180348 | AZ         | TAWNY-BELLIED COTTON RAT   | <i>Sigmodon fulviventor</i>       |
| M           | 180349 | AZ         | HISPID COTTON RAT          | <i>Sigmodon hispidus</i>          |
| M           | 180350 | AZ         | YELLOW-NOSED COTTON RAT    | <i>Sigmodon ochrognathus</i>      |
| M           | 180359 | CO         | HEATHER VOLE               | <i>Phenacomys intermedius</i>     |
| M           | 180366 | NM         | HOUSE MOUSE                | <i>Mus musculus</i>               |
| M           | 180368 | AZ         | NORTHERN PYGMY MOUSE       | <i>Baiomys taylori</i>            |
| M           | 180370 | NM         | WHITE-THROATED WOODRAT     | <i>Neotoma albigula</i>           |
| M           | 180371 | NM         | BUSHY-TAILED WOODRAT       | <i>Neotoma cinerea</i>            |
| M           | 180372 | CO         | EASTERN WOODRAT            | <i>Neotoma floridana</i>          |
| M           | 180374 | NV         | DESERT WOODRAT             | <i>Neotoma lepida</i>             |
| M           | 180375 | NM         | MEXICAN WOODRAT            | <i>Neotoma mexicana</i>           |
| M           | 180376 | NM         | SOUTHERN PLAINS WOODRAT    | <i>Neotoma micropus</i>           |
| M           | 180377 | AZ         | STEPHENS' WOODRAT          | <i>Neotoma stephensi</i>          |
| M           | 180381 | NM         | MEARNS' GRASSHOPPER MOUSE  | <i>Onychomys arenicola</i>        |
| M           | 180382 | NM         | NORTHERN GRASSHOPPER MOUSE | <i>Onychomys leucogaster</i>      |
| M           | 180383 | AZ         | SOUTHERN GRASSHOPPER MOUSE | <i>Onychomys torridus</i>         |
| M           | 180386 | CO         | MEADOW JUMPING MOUSE       | <i>Zapus hudsonius</i>            |
| M           | 180387 | NM         | WESTERN JUMPING MOUSE      | <i>Zapus princeps</i>             |
| M           | 180393 | NM         | PORCUPINE                  | <i>Erethizon dorsatum</i>         |
| M           | 180543 | CO         | BROWN BEAR                 | <i>Ursus arctos</i>               |
| M           | 180544 | NM         | AMERICAN BLACK BEAR        | <i>Ursus americanus</i>           |
| M           | 180549 | CO         | RIVER OTTER                | <i>Lontra canadensis</i>          |
| M           | 180551 | CO         | WOLVERINE                  | <i>Gulo gulo</i>                  |
| M           | 180553 | CO         | MINK                       | <i>Mustela vison</i>              |
| M           | 180555 | UT         | ERMINE                     | <i>Mustela erminea</i>            |
| M           | 180556 | NM         | LONG-TAILED WEASEL         | <i>Mustela frenata</i>            |
| M           | 180557 | CO         | BLACK-FOOTED FERRET        | <i>Mustela nigripes</i>           |
| M           | 180559 | CO         | MARTEN                     | <i>Martes americana</i>           |
| M           | 180560 | UT         | FISHER                     | <i>Martes pennanti</i>            |
| M           | 180562 | NM         | STRIPED SKUNK              | <i>Mephitis mephitis</i>          |
| M           | 180563 | AZ         | HOODED SKUNK               | <i>Mephitis macroura</i>          |
| M           | 180565 | NM         | BADGER                     | <i>Taxidea taxus</i>              |

| Taxon Group | ITIS   | Lead State | Common Name               | Scientific Name                 |
|-------------|--------|------------|---------------------------|---------------------------------|
| M           | 180568 | AZ         | HOG-NOSED SKUNK           | <i>Conepatus mesoleucus</i>     |
| M           | 180570 | CO         | EASTERN SPOTTED SKUNK     | <i>Spilogale putorius</i>       |
| M           | 180575 | NM         | RACCOON                   | <i>Procyon lotor</i>            |
| M           | 180577 | NM         | RINGTAIL                  | <i>Bassariscus astutus</i>      |
| M           | 180582 | NM         | BOBCAT                    | <i>Lynx rufus</i>               |
| M           | 180585 | CO         | LYNX                      | <i>Lynx canadensis</i>          |
| M           | 180593 | NM         | JAGUAR                    | <i>Panthera onca</i>            |
| M           | 180596 | CO         | GRAY WOLF                 | <i>Canis lupus</i>              |
| M           | 180599 | NM         | COYOTE                    | <i>Canis latrans</i>            |
| M           | 180604 | NM         | RED FOX                   | <i>Vulpes vulpes</i>            |
| M           | 180606 | CO         | KIT FOX                   | <i>Vulpes macrotis</i>          |
| M           | 180607 | CO         | SWIFT FOX                 | <i>Vulpes velox</i>             |
| M           | 180609 | NM         | GRAY FOX                  | <i>Urocyon cinereoargenteus</i> |
| M           | 180695 | NM         | WAPITI                    | <i>Cervus elaphus</i>           |
| M           | 180698 | NM         | MULE DEER                 | <i>Odocoileus hemionus</i>      |
| M           | 180699 | NM         | WHITE-TAILED DEER         | <i>Odocoileus virginianus</i>   |
| M           | 180703 | UT         | MOOSE                     | <i>Alces alces</i>              |
| M           | 180711 | NM         | BIGHORN SHEEP             | <i>Ovis canadensis</i>          |
| M           | 180713 | CO         | MOUNTAIN GOAT             | <i>Oreamnos americanus</i>      |
| M           | 180717 | NM         | PRONGHORN                 | <i>Antilocapra americana</i>    |
| M           | 180719 | NM         | BARBARY SHEEP             | <i>Ammotragus lervia</i>        |
| M           | 203452 | NM         | TOWNSEND'S BIG-EARED BAT  | <i>Corynorhinus townsendii</i>  |
| M           | 203618 | CO         | BISON                     | <i>Bos bison</i>                |
| M           | 552462 | AZ         | WHITE-NOSED COATI         | <i>Nasua narica</i>             |
| M           | 552464 | AZ         | SOUTHERN LONG-NOSED BAT   | <i>Leptonycteris curasoae</i>   |
| M           | 552466 | UT         | WESTERN SPOTTED SKUNK     | <i>Spilogale gracilis</i>       |
| M           | 552470 | AZ         | OCELOT*                   | <i>Leopardus pardalis</i>       |
| M           | 552479 | CO         | MOUNTAIN LION             | <i>Puma concolor</i>            |
| M           | 552480 | NM         | MOGOLLON VOLE             | <i>Microtus mogollonensis</i>   |
| M           | 552482 | NV         | LONG-TAILED POCKET MOUSE  | <i>Chaetodipus formosus</i>     |
| M           | 552483 | NM         | HISPID POCKET MOUSE       | <i>Chaetodipus hispidus</i>     |
| M           | 552484 | AZ         | ROCK POCKET MOUSE         | <i>Chaetodipus intermedius</i>  |
| M           | 552486 | AZ         | DESERT POCKET MOUSE       | <i>Chaetodipus penicillatus</i> |
| M           | 552487 | AZ         | SPINY POCKET MOUSE*       | <i>Chaetodipus spinatus</i>     |
| M           | 552488 | NM         | MERRIAM'S POCKET MOUSE    | <i>Perognathus merriami</i>     |
| M           | 552490 | NV         | SAGEBRUSH VOLE            | <i>Lemmyscus curtatus</i>       |
| M           | 552494 | UT         | ARIZONA WOODRAT           | <i>Neotoma devia</i>            |
| M           | 552495 | NM         | OSGOOD'S MOUSE            | <i>Peromyscus gratus</i>        |
| M           | 552496 | NM         | ROCK MOUSE                | <i>Peromyscus nasutus</i>       |
| M           | 552499 | NV         | MERRIAM'S GROUND SQUIRREL | <i>Spermophilus canus</i>       |
| M           | 552503 | CO         | HOPI CHIPMUNK             | <i>Tamias rufus</i>             |
| M           | 552504 | UT         | PIUTE GROUND SQUIRREL     | <i>Spermophilus mollis</i>      |
| M           | 552512 | NM         | EASTERN RED BAT           | <i>Lasiurus borealis</i>        |
| M           | 552520 | AZ         | BAILEY'S POCKET MOUSE     | <i>Chaetodipus baileyi</i>      |
| M           | 552521 | NV         | PYGMY RABBIT              | <i>Brachylagus idahoensis</i>   |
| M           | 552761 | AZ         | COLLARED PECCARY          | <i>Pecari tajacu</i>            |
| M           | 555657 | NM         | NEW MEXICO SHREW          | <i>Sorex neomexicanus</i>       |

| Taxon Group | ITIS   | Lead State | Common Name                        | Scientific Name                     |
|-------------|--------|------------|------------------------------------|-------------------------------------|
| M           | 555658 | NM         | DAVIS MOUNTAIN COTTONTAIL          | <i>Silvilagus robustus</i>          |
| M           | 625180 | NM         | ORYX                               | <i>Oryx gazella</i>                 |
| R           | -1     | CO         | TRIPLOID CHECKERED WHIPTAIL        | <i>Cnemidophorus neotesselatus</i>  |
| R           | 173752 | NM         | SNAPPING TURTLE                    | <i>Chelydra serpentina</i>          |
| R           | 173766 | CO         | YELLOW MUD TURTLE                  | <i>Kinosternon flavescens</i>       |
| R           | 173768 | AZ         | SONORAN MUD TURTLE                 | <i>Kinosternon sonoriense</i>       |
| R           | 173774 | NV         | WESTERN POND TURTLE                | <i>Clemmys marmorata</i>            |
| R           | 173778 | NM         | ORNATE BOX TURTLE                  | <i>Terrapene ornata</i>             |
| R           | 173783 | NM         | PAINTED TURTLE                     | <i>Chrysemys picta</i>              |
| R           | 173819 | NM         | COMMON SLIDER                      | <i>Trachemys scripta</i>            |
| R           | 173856 | AZ         | DESERT TORTOISE                    | <i>Gopherus agassizii</i>           |
| R           | 173865 | NM         | EASTERN FENCE LIZARD               | <i>Sceloporus undulatus</i>         |
| R           | 173868 | AZ         | CLARK'S SPINY LIZARD               | <i>Sceloporus clarkii</i>           |
| R           | 173870 | NM         | SAGEBRUSH LIZARD                   | <i>Sceloporus graciosus</i>         |
| R           | 173872 | AZ         | YARROW'S SPINY LIZARD              | <i>Sceloporus jarrovii</i>          |
| R           | 173873 | AZ         | DESERT SPINY LIZARD                | <i>Sceloporus magister</i>          |
| R           | 173875 | UT         | WESTERN FENCE LIZARD               | <i>Sceloporus occidentalis</i>      |
| R           | 173878 | NM         | CREVICE SPINY LIZARD               | <i>Sceloporus poinsettii</i>        |
| R           | 173879 | AZ         | BUNCH GRASS LIZARD                 | <i>Sceloporus scalaris</i>          |
| R           | 173881 | AZ         | STRIPED PLATEAU LIZARD             | <i>Sceloporus virgatus</i>          |
| R           | 173906 | NV         | ZEBRA-TAILED LIZARD                | <i>Callisaurus draconoides</i>      |
| R           | 173910 | NM         | GREATER EARLESS LIZARD             | <i>Cophosaurus texanus</i>          |
| R           | 173912 | NM         | COLLARED LIZARD                    | <i>Crotaphytus collaris</i>         |
| R           | 173921 | AZ         | DESERT IGUANA                      | <i>Dipsosaurus dorsalis</i>         |
| R           | 173924 | CO         | LONG-NOSED LEOPARD LIZARD          | <i>Gambelia wislizenii</i>          |
| R           | 173927 | NM         | LESSER EARLESS LIZARD              | <i>Holbrookia maculata</i>          |
| R           | 173938 | CO         | TEXAS HORNED LIZARD                | <i>Phrynosoma cornutum</i>          |
| R           | 173941 | AZ         | FLAT-TAILED HORNED LIZARD          | <i>Phrynosoma mcallii</i>           |
| R           | 173942 | NM         | ROUND-TAILED HORNED LIZARD         | <i>Phrynosoma modestum</i>          |
| R           | 173943 | NV         | DESERT HORNED LIZARD               | <i>Phrynosoma platyrhinos</i>       |
| R           | 173944 | AZ         | REGAL HORNED LIZARD                | <i>Phrynosoma solare</i>            |
| R           | 173949 | AZ         | COLORADO DESERT FRINGE-TOED LIZARD | <i>Uma notata</i>                   |
| R           | 173950 | AZ         | MOJAVE FRINGE-TOED LIZARD          | <i>Uma scoparia</i>                 |
| R           | 173952 | AZ         | LONG-TAILED BRUSH LIZARD           | <i>Urosaurus graciosus</i>          |
| R           | 173954 | AZ         | TREE LIZARD                        | <i>Urosaurus ornatus</i>            |
| R           | 173956 | NM         | SIDE-BLOTCHED LIZARD               | <i>Uta stansburiana</i>             |
| R           | 173964 | AZ         | MOUNTAIN SKINK                     | <i>Eumeces callicephalus</i>        |
| R           | 173966 | NV         | GILBERT'S SKINK                    | <i>Eumeces gilberti</i>             |
| R           | 173967 | NM         | MANY-LINED SKINK                   | <i>Eumeces multivirgatus</i>        |
| R           | 173968 | NM         | GREAT PLAINS SKINK                 | <i>Eumeces obsoletus</i>            |
| R           | 173970 | NV         | WESTERN SKINK                      | <i>Eumeces skiltonianus</i>         |
| R           | 173971 | NM         | FOUR-LINED SKINK                   | <i>Eumeces tetragrammus</i>         |
| R           | 174014 | CO         | SIX-LINED RACERUNNER               | <i>Cnemidophorus sexlineatus</i>    |
| R           | 174015 | AZ         | CANYON SPOTTED WHIPTAIL            | <i>Cnemidophorus burti</i>          |
| R           | 174016 | NM         | GRAY-CHECKERED WHIPTAIL            | <i>Cnemidophorus dixonii</i>        |
| R           | 174017 | NM         | CHIHUAHUAN SPOTTED WHIPTAIL        | <i>Cnemidophorus exsangui</i>       |
| R           | 174018 | AZ         | GILA SPOTTED WHIPTAIL              | <i>Cnemidophorus flagellicaudus</i> |

| Taxon Group | ITIS   | Lead State | Common Name                      | Scientific Name                   |
|-------------|--------|------------|----------------------------------|-----------------------------------|
| R           | 174019 | NM         | TEXAS SPOTTED WHIPTAIL           | <i>Cnemidophorus gularis</i>      |
| R           | 174021 | AZ         | LITTLE STRIPED WHIPTAIL          | <i>Cnemidophorus inornatus</i>    |
| R           | 174024 | NM         | NEW MEXICO WHIPTAIL              | <i>Cnemidophorus neomexicanus</i> |
| R           | 174025 | AZ         | SONORAN SPOTTED WHIPTAIL         | <i>Cnemidophorus sonorae</i>      |
| R           | 174026 | CO         | CHECKERED WHIPTAIL               | <i>Cnemidophorus tessellatus</i>  |
| R           | 174038 | NM         | TEXAS BANDED GECKO               | <i>Coleonyx brevis</i>            |
| R           | 174041 | AZ         | WESTERN BANDED GECKO             | <i>Coleonyx variegatus</i>        |
| R           | 174092 | NV         | DESERT NIGHT LIZARD              | <i>Xantusia vigilis</i>           |
| R           | 174113 | AZ         | GILA MONSTER                     | <i>Heloderma suspectum</i>        |
| R           | 174136 | NM         | COMMON GARTER SNAKE              | <i>Thamnophis sirtalis</i>        |
| R           | 174140 | NV         | WESTERN AQUATIC GARTER SNAKE     | <i>Thamnophis couchii</i>         |
| R           | 174141 | NM         | BLACK-NECKED GARTER SNAKE        | <i>Thamnophis cyrtopsis</i>       |
| R           | 174142 | NM         | WESTERN TERRESTRIAL GARTER SNAKE | <i>Thamnophis elegans</i>         |
| R           | 174143 | AZ         | MEXICAN GARTER SNAKE             | <i>Thamnophis eques</i>           |
| R           | 174144 | NM         | CHECKERED GARTER SNAKE           | <i>Thamnophis marcianus</i>       |
| R           | 174146 | NM         | WESTERN RIBBON SNAKE             | <i>Thamnophis proximus</i>        |
| R           | 174147 | CO         | PLAINS GARTER SNAKE              | <i>Thamnophis radix</i>           |
| R           | 174148 | AZ         | NARROW-HEADED GARTER SNAKE       | <i>Thamnophis rufipunctatus</i>   |
| R           | 174155 | NM         | WESTERN HOG-NOSED SNAKE          | <i>Heterodon nasicus</i>          |
| R           | 174158 | NM         | RING-NECKED SNAKE                | <i>Diadophis punctatus</i>        |
| R           | 174169 | NM         | RACER                            | <i>Coluber constrictor</i>        |
| R           | 174175 | NM         | CORN SNAKE                       | <i>Elaphe guttata</i>             |
| R           | 174187 | NM         | MILK SNAKE                       | <i>Lampropeltis triangulum</i>    |
| R           | 174192 | AZ         | SONORAN MOUNTAIN KINGSSNAKE      | <i>Lampropeltis pyromelana</i>    |
| R           | 174202 | NM         | GLOSSY SNAKE                     | <i>Arizona elegans</i>            |
| R           | 174210 | AZ         | BANDED SAND SNAKE                | <i>Chilomeniscus cinctus</i>      |
| R           | 174212 | AZ         | WESTERN SHOVEL-NOSED SNAKE       | <i>Chionactis occipitalis</i>     |
| R           | 174213 | AZ         | SONORAN SHOVEL-NOSED SNAKE       | <i>Chionactis palarostris</i>     |
| R           | 174230 | NM         | WESTERN HOOK-NOSED SNAKE         | <i>Gyalopion canum</i>            |
| R           | 174233 | NM         | NIGHT SNAKE                      | <i>Hypsiglena torquata</i>        |
| R           | 174237 | AZ         | SONORAN WHIPSNAKE                | <i>Masticophis bilineatus</i>     |
| R           | 174238 | NM         | COACHWHIP                        | <i>Masticophis flagellum</i>      |
| R           | 174240 | NM         | STRIPED WHIPSNAKE                | <i>Masticophis taeniatus</i>      |
| R           | 174244 | NM         | PLAIN-BELLIED WATER SNAKE        | <i>Nerodia erythrogaster</i>      |
| R           | 174251 | CO         | NORTHERN WATER SNAKE             | <i>Nerodia sipedon</i>            |
| R           | 174258 | AZ         | BROWN VINE SNAKE                 | <i>Oxybelis aeneus</i>            |
| R           | 174260 | AZ         | SADDLED LEAF-NOSED SNAKE         | <i>Phyllorhynchus browni</i>      |
| R           | 174261 | AZ         | SPOTTED LEAF-NOSED SNAKE         | <i>Phyllorhynchus decurtatus</i>  |
| R           | 174267 | NM         | LONG-NOSED SNAKE                 | <i>Rhinocheilus lecontei</i>      |
| R           | 174269 | NM         | BIG BEND PATCH-NOSED SNAKE*      | <i>Salvadora deserticola</i>      |
| R           | 174270 | NM         | MOUNTAIN PATCH-NOSED SNAKE       | <i>Salvadora grahamiae</i>        |
| R           | 174271 | AZ         | WESTERN PATCH-NOSED SNAKE        | <i>Salvadora hexalepis</i>        |
| R           | 174275 | AZ         | GROUND SNAKE                     | <i>Sonora semiannulata</i>        |
| R           | 174282 | AZ         | SOUTHWESTERN BLACK-HEADED SNAKE  | <i>Tantilla hobartsmithi</i>      |
| R           | 174283 | NM         | PLAINS BLACK-HEADED SNAKE        | <i>Tantilla nigriceps</i>         |
| R           | 174288 | AZ         | CHIHUAHUAN BLACK-HEADED SNAKE    | <i>Tantilla wilcoxi</i>           |
| R           | 174289 | AZ         | YAQUI BLACK-HEADED SNAKE         | <i>Tantilla yaquia</i>            |

| Taxon Group | ITIS   | Lead State | Common Name                        | Scientific Name                |
|-------------|--------|------------|------------------------------------|--------------------------------|
| R           | 174291 | AZ         | WESTERN LYRE SNAKE                 | <i>Trimorphodon biscutatus</i> |
| R           | 174293 | NM         | LINED SNAKE                        | <i>Tropidoclonion lineatum</i> |
| R           | 174304 | CO         | MASSASAUGA                         | <i>Sistrurus catenatus</i>     |
| R           | 174310 | NM         | WESTERN DIAMONDBACK<br>RATTLESNAKE | <i>Crotalus atrox</i>          |
| R           | 174311 | AZ         | SIDEWINDER                         | <i>Crotalus cerastes</i>       |
| R           | 174312 | NM         | ROCK RATTLESNAKE                   | <i>Crotalus lepidus</i>        |
| R           | 174313 | AZ         | SPECKLED RATTLESNAKE               | <i>Crotalus mitchellii</i>     |
| R           | 174314 | AZ         | BLACK-TAILED RATTLESNAKE           | <i>Crotalus molossus</i>       |
| R           | 174315 | AZ         | TWIN-SPOTTED RATTLESNAKE           | <i>Crotalus pricei</i>         |
| R           | 174317 | AZ         | MOJAVE RATTLESNAKE                 | <i>Crotalus scutulatus</i>     |
| R           | 174318 | AZ         | TIGER RATTLESNAKE                  | <i>Crotalus tigris</i>         |
| R           | 174319 | CO         | WESTERN RATTLESNAKE                | <i>Crotalus viridis</i>        |
| R           | 174320 | AZ         | RIDGE-NOSED RATTLESNAKE            | <i>Crotalus willardi</i>       |
| R           | 174326 | NV         | RUBBER BOA                         | <i>Charina bottae</i>          |
| R           | 174336 | CO         | TEXAS BLIND SNAKE                  | <i>Leptotyphlops dulcis</i>    |
| R           | 174337 | NV         | WESTERN BLIND SNAKE                | <i>Leptotyphlops humilis</i>   |
| R           | 174352 | AZ         | WESTERN CORAL SNAKE                | <i>Micruroides euryxanthus</i> |
| R           | 208657 | NM         | BIG BEND SLIDER                    | <i>Trachemys gaigeae</i>       |
| R           | 208677 | NM         | SMOOTH SOFTSHELL TURTLE            | <i>Apalone mutica</i>          |
| R           | 208680 | NM         | SPINY SOFTSHELL TURTLE             | <i>Apalone spinifera</i>       |
| R           | 208791 | UT         | MOJAVE BLACK-COLLARED LIZARD       | <i>Crotaphytus bicinctores</i> |
| R           | 208896 | CO         | VARIABLE SKINK*                    | <i>Eumeces gaigeae</i>         |
| R           | 208940 | AZ         | WESTERN WHIPTAIL                   | <i>Cnemidophorus tigris</i>    |
| R           | 208947 | AZ         | DESERT GRASSLAND WHIPTAIL          | <i>Cnemidophorus uniparens</i> |
| R           | 208948 | AZ         | PLATEAU STRIPED WHIPTAIL           | <i>Cnemidophorus velox</i>     |
| R           | 209008 | NV         | NORTHERN ALLIGATOR LIZARD          | <i>Elgaria coerulea</i>        |
| R           | 209017 | AZ         | MADREAN ALLIGATOR LIZARD           | <i>Elgaria kingii</i>          |
| R           | 209247 | CO         | COMMON KINGSNAKE                   | <i>Lampropeltis getula</i>     |
| R           | 209266 | NM         | GRAY-BANDED KINGSNAKE              | <i>Lampropeltis alterna</i>    |
| R           | 209400 | NM         | BULLSNAKE                          | <i>Pituophis catenifer</i>     |
| R           | 209455 | NM         | TRANS-PECOS RAT SNAKE              | <i>Bogertophis subocularis</i> |
| R           | 209458 | AZ         | GREEN RAT SNAKE                    | <i>Senticolis triaspis</i>     |
| R           | 551766 | NM         | RIO GRANDE RIVER COOTER            | <i>Pseudemys gorzugi</i>       |
| R           | 563907 | AZ         | ROSY BOA                           | <i>Charina trivirgata</i>      |
| R           | 563909 | AZ         | THORNSCRUB HOOK-NOSED SNAKE        | <i>Gyalopion quadrangulare</i> |
| R           | 563910 | CO         | SMOOTH GREEN SNAKE                 | <i>Liochlorophis vernalis</i>  |
| R           | 564567 | NV         | PYGMY SHORT-HORNED LIZARD          | <i>Phrynosoma douglasii</i>    |
| R           | 564571 | AZ         | BLACK SPINY-TAILED IGUANA*         | <i>Ctenosaura hemilopha</i>    |
| R           | 564574 | NM         | SAND DUNE LIZARD                   | <i>Sceloporus arenicolus</i>   |
| R           | 564594 | NV         | GREATER SHORT-HORNED LIZARD        | <i>Phrynosoma hernandesi</i>   |
| R           | 564596 | AZ         | COMMON CHUCKWALLA                  | <i>Sauromalus ater</i>         |

## **Appendix 3-2. Decision Rules for Taxa inclusion**

[http://fws-nmcfwru.nmsu.edu/swregap/report/Appendix\\_HM-2.pdf](http://fws-nmcfwru.nmsu.edu/swregap/report/Appendix_HM-2.pdf)



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## Appendix 3-3. Habitat Modeling Protocol

This appendix summarizes the major habitat modeling components included in the Wildlife Habitat Relationships database and associated user interface, for the SWReGAP project. The complete protocol and instructions on the user interface are available at [http://fws-nmcfwru.nmsu.edu/swregap/report/Appendix\\_HM-3.pdf](http://fws-nmcfwru.nmsu.edu/swregap/report/Appendix_HM-3.pdf)

**Model Description:** This is the description of the model and includes any information regarding the assumptions used within the creation of the model including information regarding seasonality of model or restricted range of model.

**Life History:** This is available to enter information regarding life history traits or other important information about the species that may be useful in modeling. It may be important to identify plant species or vegetation/landscape features that a taxon is associated with.

**Description Changes:** This field provides information regarding the modifications that have been made to the database. We want information regarding the modifications of the model including general attributes that were changed.

**Weighted Overlay:** We are interested in pursuing weighted overlay modeling. Please indicate if factors such as expert knowledge, data, and literature are sufficient to pursue a weighted model. If there are sufficient data of high quality check this box.

**Sensitive Data:** This entry is to identify if the data or work presented is sensitive and should be handled differently than other data.

**Patch Size:** Patch size refers to the minimum habitat patch size in hectares. This information filters patches too small to be used by a taxon. Patch size information may not be available for many species, if it is indicate that it is available and the minimum size applicable. Patch size is an important species specific modeling consideration and we should view patch size in a meta-population context. Hollings (1992) examines the relationship of home-range size to body mass.

**Slope:** Check if data information is available. Slope should be entered in degrees with minimum and maximum values. If only a maximum value is present include that value and indicate there is no minimum value with a (0).

**Aspect:** Check if this is identified as a factor or is not known to be a factor. If this is identified then aspect categories, in degrees, associated with the taxa should be checked. If all aspects are used check only the Aspect All box and if flat aspects are used check Aspect Flat.

**Elevation:** If elevation data is available, elevation should be entered in meters with both the minimum and maximum indicated appropriately. Elevation is a constraining layer.

**Landform:** The landform coverage provided by USU may contain certain associations that can be identified for use in modeling. If this information is available check the land form available box. Check all that are appropriate.

**Hydrology:** Proximity to hydrological features can be an important modeling factor. We want to include several features including the type of hydrological feature the taxon is associated with and at what distance is the taxon associated with water. Check for each feature which this applies. If any feature is checked then the distance to water feature must be assigned a value in meters.

| Hydrological Feature Description |   |
|----------------------------------|---|
| Stream/riparian buffer           | Species has an affinity to streams or riparian areas that can be identified                       |
| Lakes/Ponds                      | Species has an affinity to lakes or ponds that can be identified                                  |
| Reservoirs                       | Species has an affinity to reservoirs that can be identified                                      |
| Springs/Seeps                    | Species has an affinity to springs/seeps that can be identified.                                  |
| Wetlands                         | Species has an affinity to wetlands that can be identified.                                       |
| Intermittent Waters              | Species has an affinity to intermittent streams that can be identified.                           |
| Distance to water (in meters)    | Species has an affinity to water and a distance to water function can be derived for the species. |

**Land Cover:** WHR's were built using associations with the Ecological Systems.

**Soil Type Categories:** Soil Type refers to the predominant soil particle size. Use the soil types below to identify the associations. Be as specific as possible.

[Choices available: Clay, Silt, Sand, Loam, Gravel, Cobble, Stone, Boulder, Rocky]

**Soil Depth Class:** Depth Class is an indication of the depth to bedrock. This is particularly helpful when modeling fossorial species. Information should be input; if minimum depth to bedrock is available. This should be provided in centimeters (cm) if available, if not use categories below

Shallow – less than 50 cm

Pan – Restrictive root zone

Deep – greater than 50 cm

**Percent Rock Outcrop:** The Percent Rock Outcrop may be helpful with certain species associating to rock outcrops. Association information should be identified by the below categories.

< 15 %

15 – 30 %

30 – 65 %

> 65%

**Appendix 3-4. Example habitat modeling data form**

[http://fws-nmcfwru.nmsu.edu/swregap/report/Appendix\\_HM-4.pdf](http://fws-nmcfwru.nmsu.edu/swregap/report/Appendix_HM-4.pdf)

**Appendix 3-5. Complete list of references used in creating habitat models.**

[http://fws-nmcfwru.nmsu.edu/swregap/report/Appendix\\_HM-5.pdf](http://fws-nmcfwru.nmsu.edu/swregap/report/Appendix_HM-5.pdf)

### Appendix 3-6. List of Animal Habitat Model external reviewers.

The following experts reviewed our habitat models and provided expertise and comments to modify the models. Habitat modelers took this information and modified the model based on the regional aspect of the project. We appreciate the comments made by the reviewers. All errors remain the responsibility of SWReGAP. A = Amphibians, B = Birds, M = Mammals, R = Reptiles.

| Name                    | Affiliation  | State          | A | B | M | R |
|-------------------------|--|----------------|---|---|---|---|
| Abele, Steve            | Abele Inc.   | Region         |   | x |   |   |
| Abele, Susan            | The Nature Conservancy                               | NV             |   |   | x |   |
| Alexander, Lois         | University of Nevada at Las Vegas                    | NV, Region     |   |   | x |   |
| Ammon, Elisabeth        | Great Basin Bird Observatory                         | NV             |   | x |   |   |
| Armstrong, Dave         | University of Colorado                               | CO, Region     |   |   | x |   |
| Baldino, Cristi         | U.S. Fish and Wildlife Service                       | NV, NM         |   |   | x |   |
| Bauman, Bradley         | Nevada Department of Wildlife                        | NV             |   | x | x |   |
| Beier, Paul             | Northern Arizona University                          | AZ             |   |   | x |   |
| Blair, Kathleen         | USFWS - Bill Williams River National Wildlife Refuge | AZ, Region     | x |   | x | x |
| Bogan, Michael          | USGS   | AZ, NM         |   |   | x |   |
| Boydston, Erin          | USGS   | NV, Region     |   |   | x |   |
| Boyle, Steve            | BIO-Logic Environmental                              | CO, Region     |   | x |   |   |
| Bunnell, Kevin          | Utah Division of Wildlife Resources                  | UT             |   |   | x |   |
| Burroughs, Michael      | USFWS  | NV, Region     | x |   |   | x |
| Catalano, David P.      | Nevada Department of Wildlife                        | NV             |   |   | x | x |
| Chung-MacCoubrey, Alice | USDA Forest Service                                  | NM             |   |   | x |   |
| Corman, Troy            | Arizona Game and Fish Department                     | AZ             |   | x |   |   |
| Dewey, Tanya            | University of Michigan Museum of Zoology             | Region         |   |   | x |   |
| Eidel, Jim              | Great Basin Bird Observatory                         |                |   |   |   |   |
| Fellows, Suzanne        | USFWS  | Region         |   | x |   |   |
| Frey, Jennifer          | New Mexico State University                          | NM, Region     |   |   | x |   |
| Gammonley, Jim          | Colorado Division of Wildlife                        | Region         |   | x |   |   |
| Ganey, Joseph           | USDA Rocky Mountain Research Station                 | Region         |   | x |   |   |
| Hafner, John C.         | Occidental College                                   | Region         |   |   | x |   |
| Hall, Derek             | US Department of Energy                              | NV             |   |   | x |   |
| Hall, Linnea            | Western Foundation of Vertebrate Zoology             | Region         |   | x |   |   |
| Hammerson, Geoff        | The Nature Conservancy - Nature Serve                | Region         | x |   |   |   |
| Hayes, Chuck            | New Mexico Department of Game and Fish               | Region         |   |   | x |   |
| Heindl, Alex            | University of Nevada at Las Vegas                    | NV             |   |   |   | x |
| Hickman, Gerald         | BLM  | AZ, NV         |   | x |   |   |
| Hodson, Ron             | Utah Division of Wildlife Resources                  | UT             |   |   | x |   |
| Jackson, Tina           | Colorado Division of Wildlife                        | CO             | x |   |   | x |
| Jeffers, Jennifer       | Nevada Department of Wildlife                        | NV             |   |   | x |   |
| Jezkova, Tereza         | University of Nevada at Las Vegas                    | Region         |   |   | x |   |
| Jones, Cheri            | University of Colorado, Denver                       | CO             |   |   | x |   |
| Jones, Stephanie L.     | USFWS  | AZ, CO, Region |   | x |   |   |
| Klinger, Christina      | Nevada Department of Wildlife                        | NV             |   |   |   | x |
| Klute, Dave             | Colorado Division of Wildlife                        | CO             |   | x |   |   |

| Name                          | Affiliation  | State          | A | B | M | R |
|-------------------------------|--|----------------|---|---|---|---|
| Kritz, Kevin                  | USFWS  | NV             |   | x |   |   |
| Lambeth, Ron                  | BLM  | CO             |   | x |   |   |
| Leukering, Tony               | Rocky Mountain Bird Observatory                                    | CO             |   | x |   |   |
| Levad, Rich                   | Rocky Mountain Bird Observatory                                    | CO             |   | x |   |   |
| Livo, Lauren                  | University of Colorado, Boulder                                    | CO, Region     | x |   |   | x |
| Loeffler, Chuck               | Retired - Colorado Division of Wildlife                            | CO             | x |   |   | x |
| Mantooth, Stacy               | University of Nevada at Las Vegas                                  | NV             |   |   | x |   |
| Marlow, Ron                   | University of Nevada at Reno                                       | NV             |   |   |   | x |
| Maxfield, Brian               | Utah Division of Wildlife Resources                                | UT             |   |   | x |   |
| Medica, Philip                | USGS/Biological Resources Division                                 | Region         |   |   |   | x |
| Mitchell, Dean                | Utah Division of Wildlife Resources                                | UT             |   | x |   |   |
| Navo, Kirk                    | Colorado Division of Wildlife                                      | CO             |   |   | x |   |
| Neel, Larry                   | Nevada Department of Wildlife                                      | NV, UT, Region |   | x |   |   |
| Newmark, Jennifer             | Nevada Natural Heritage Program                                    | NV             |   |   | x |   |
| NM CWCS Review                | New Mexico Department of Game and Fish                             | NM             | x | x | x | x |
| Nowak, Erika                  | USGS Colorado Plateau Research Station                             | AZ, Region     | x |   |   | x |
| Oliver, George                | Utah Natural Heritage Program, Utah Division of Wildlife Resources | UT             | x |   | x | x |
| Painter, Charles              | New Mexico Department of Game and Fish                             | NM             | x |   |   | x |
| Prather, John                 | Northern Arizona University  | Region         |   | x |   |   |
| Rickart, Eric                 | Utah Museum of Natural History, University of Utah                 | NV, UT, Region |   |   | x |   |
| Schnurr, Pam                  | Colorado Division of Wildlife                                      | CO             |   |   | x |   |
| Schorr, Rob                   | Colorado Natural Heritage Program/Colorado State University        | CO             |   |   | x |   |
| Schwalbe, Cecil               | USGS, Southwest Biological Science Center                          | AZ             | x |   |   |   |
| Seglund, Amy                  | Utah Division of Wildlife Resources                                | Region         |   |   | x |   |
| Shaul, Anita                  | Nevada Department of Wildlife                                      | NV             | x |   |   | x |
| Stoner, David                 | Utah State University  | UT             |   |   | x |   |
| Stuart, Jim                   | New Mexico Department of Game and Fish                             | NM             |   |   | x |   |
| Swett, John                   | US Bureau of Reclamation   | NV             |   | x |   |   |
| Tomlinson, Cris               | Nevada Department of Wildlife                                      | NV             |   | x | x |   |
| Toolen, John                  | Colorado Division of Wildlife                                      | CO, Region     |   | x |   |   |
| Utah Natural Heritage Program |  | UT             |   |   | x | x |
| Van Pelt, Bill                | Arizona Game and Fish Department                                   | AZ             |   |   | x |   |
| Wasley, Tony                  | Nevada Department of Wildlife                                      | NV             |   |   | x |   |
| Williams, Jason               | Nevada Department of Wildlife                                      | NV, Region     |   |   | x |   |

<sup>1</sup>NM CWCS Review – New Mexico Department of Game and Fish provided land cover associations reviews of draft species habitat models.

<sup>2</sup>Utah Natural Heritage Program- Heritage staff provided review of models

### **Appendix 3-7. Examples of model documents including Model Report, Range, and Model**

Model reports for all species are available from the SWReGAP web Site (<http://fws-nmcfwru.nmsu.edu/swregap/habitareview/Review.asp>) Below is a link to an example set for the Northern Flying Squirrel (*Glaucomys sabrinus*).

#### **Report**

<http://fws-nmcfwru.nmsu.edu/swregap/habitareview/TextModels/180169.pdf>

#### **Range**

<http://fws-nmcfwru.nmsu.edu/swregap/habitareview/Range/180169.pdf>

#### **Model**

<http://fws-nmcfwru.nmsu.edu/swregap/habitareview/Models/180169.pdf>

### **Appendix 3-8. Review Documentation for Habitat Models**

[http://fws-nmcfwru.nmsu.edu/swregap/report/Appendix\\_HM-8.pdf](http://fws-nmcfwru.nmsu.edu/swregap/report/Appendix_HM-8.pdf)

## Appendix 3-9. Example Vertebrate Habitat Distribution Metadata

<http://fws-nmcfwru.nmsu.edu/swregap/habitatreview/swregaphabitatmodelmetadata.htm>

### SWReGAP Vertebrate Habitat Distribution Models

Metadata also available as

#### Metadata:

- [Identification Information](#)
- [Data Quality Information](#)
- [Spatial Data Organization Information](#)
- [Spatial Reference Information](#)
- [Entity and Attribute Information](#)
- [Distribution Information](#)
- [Metadata Reference Information](#)

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#### Identification\_Information:

*Citation:*

*Citation\_Information:*

*Originator:* New Mexico Cooperative Fish and Wildlife Research Unit

*Publication\_Date:* 20050930

*Title:* SWReGAP Vertebrate Habitat Distribution Models

*Edition:* 1.0

*Geospatial\_Data\_Presentation\_Form:* raster digital data

*Publication\_Information:*

*Publication\_Place:* Las Cruces, NM

*Online\_Linkage:* <<http://fws-nmcfwru.nmsu.edu/swregap/>>

*Larger\_Work\_Citation:*

*Citation\_Information:*

*Originator:* USGS GAP Analysis Program

*Publication\_Date:* 20050930

*Publication\_Time:* Unknown

*Title:* Southwest Regional Gap Analysis Project: Final Report

*Other\_Citation\_Details:* <<http://fws-nmcfwru.nmsu.edu/swregap/>>

*Online\_Linkage:* <<http://www.gap.uidaho.edu/>>

*Description:*

*Abstract:*

Mapping of terrestrial vertebrates focuses on linking a spatial representation of species-habitat matrices to geographic distribution. Each model is a combination of distribution from regional and state references in association with contiguous appropriate habitats. Ranges for all species were based on 8-digit HUCs. Habitats were based on a raster SWReGAP 1 acre MMU land cover data set, with hydrology habitats added in from USGS NHD dataset directly or through modeling. Habitat association information was obtained from various state, regional, and national references with updates from scientific literature. This portion of the Southwest Regional Gap Analysis Project produced predicted habitat distribution maps for 820 species.

*Purpose:*

The digital dataset was created for the creation of habitat models for a regional biodiversity assessment. These data are not intended to be used at scales larger than 1:100,000. This data was prepared in compliance with the National GAP effort. Distributions of 37 amphibians, 132 reptiles, 436 birds and 215 mammals were predicted by 8-digit HUC using a variety of sources. Most (650 of 820) models benefitted from review by taxa experts throughout the Southwest Regional Gap Analysis Project area. Habitat relationships for all terrestrial vertebrates were taken from various databases and most recent published

scientific literature on each taxa, with review of collected relationships by species experts. These habitat relationships were cross-linked to one or several of the 52 land cover/vegetation types delineated on the Southwest Regional Gap Analysis Project land cover map. Predicted distribution maps were produced for each species based on county of occurrence and habitat affinities

*Supplemental\_Information:*

Species List including ITIS CODE, Common Name and Scientific Name; -3 ARIZONA MYOTIS *Myotis occultus* -2 GUNNISON SAGE-GROUSE *Centrocercus minimus* -1 TRIPLOID CHECKERED WHIPTAIL *Cnemidophorus neotesselatus* 173429 COUCH'S SPADEFOOT *Scaphiopus couchii* 173438 GREEN FROG *Rana clamitans* 173440 WOOD FROG *Rana sylvatica* 173441 BULLFROG *Rana catesbeiana* 173443 NORTHERN LEOPARD FROG *Rana pipiens* 173446 RED-LEGGED FROG *Rana aurora* 173447 RIO GRANDE LEOPARD FROG *Rana berlandieri* 173448 PLAINS LEOPARD FROG *Rana blairi* 173451 CHIRICAHUA LEOPARD FROG *Rana chiricahuensis* 173454 MOUNTAIN YELLOW-LEGGED FROG *Rana muscosa* 173457 RELICT LEOPARD FROG *Rana onca* 173458 SPOTTED FROG *Rana pretiosa* 173461 TARAHUMARA FROG *Rana tarahumarae* 173462 YAVAPAI LEOPARD FROG *Rana yavapaiensis* 173468 GREAT PLAINS NARROWMOUTH TOAD *Gastrophryne olivacea* 173476 WOODHOUSE'S TOAD *Bufo woodhousii* 173481 COLORADO RIVER TOAD *Bufo alvarius* 173482 WESTERN TOAD *Bufo boreas* 173484 GREAT PLAINS TOAD *Bufo cognatus* 173485 GREEN TOAD *Bufo debilis* 173490 SOUTHWESTERN TOAD *Bufo microscaphus* 173491 RED-SPOTTED TOAD *Bufo punctatus* 173492 SONORAN GREEN TOAD *Bufo retiformis* 173493 TEXAS TOAD *Bufo speciosus* 173510 CANYON TREEFROG *Hyla arenicolor* 173513 MOUNTAIN TREEFROG *Hyla eximia* 173520 NORTHERN CRICKET FROG *Acris crepitans* 173525 WESTERN CHORUS FROG *Pseudacris triseriata* 173534 LOWLAND BURROWING TREEFROG *Pternohyla fodiens* 173549 AFRICAN CLAWED FROG *Xenopus laevis* 173592 TIGER SALAMANDER *Ambystoma tigrinum* 173663 JEMEZ MOUNTAINS SALAMANDER *Plethodon neomexicanus* 173702 SACRAMENTO MOUNTAIN SALAMANDER *Aneides hardii* 173752 SNAPPING TURTLE *Chelydra serpentina* 173766 YELLOW MUD TURTLE *Kinosternon flavescens* 173768 SONORAN MUD TURTLE *Kinosternon sonoriense* 173774 WESTERN POND TURTLE *Clemmys marmorata* 173778 ORNATE BOX TURTLE *Terrapene ornata* 173783 PAINTED TURTLE *Chrysemys picta* 173819 COMMON SLIDER *Trachemys scripta* 173856 DESERT TORTOISE *Gopherus agassizii* 173865 EASTERN FENCE LIZARD *Sceloporus undulatus* 173868 CLARK'S SPINY LIZARD *Sceloporus clarkii* 173870 SAGEBRUSH LIZARD *Sceloporus graciosus* 173872 YARROW'S SPINY LIZARD *Sceloporus jarrovi* 173873 DESERT SPINY LIZARD *Sceloporus magister* 173875 WESTERN FENCE LIZARD *Sceloporus occidentalis* 173878 CREVICE SPINY LIZARD *Sceloporus poinsettii* 173879 BUNCH GRASS LIZARD *Sceloporus scalaris* 173881 STRIPED PLATEAU LIZARD *Sceloporus virgatus* 173906 ZEBRA-TAILED LIZARD *Callisaurus draconoides* 173910 GREATER EARLESS LIZARD *Cophosaurus texanus* 173912 COLLARED LIZARD *Crotaphytus collaris* 173921 DESERT IGUANA *Dipsosaurus dorsalis* 173924 LONG-NOSED LEOPARD LIZARD *Gambelia wislizenii* 173927 LESSER EARLESS LIZARD *Holbrookia maculata* 173938 TEXAS HORNED LIZARD *Phrynosoma cornutum* 173941 FLAT-TAILED HORNED LIZARD *Phrynosoma mcallii* 173942 ROUND-TAILED HORNED LIZARD *Phrynosoma modestum* 173943 DESERT HORNED LIZARD *Phrynosoma platyrhinos* 173944 REGAL HORNED LIZARD *Phrynosoma solare* 173949 COLORADO DESERT FRINGE-TOED LIZARD *Uma notata* 173950 MOJAVE FRINGE-TOED LIZARD *Uma scoparia* 173952 LONG-TAILED BRUSH LIZARD *Urosaurus graciosus* 173954 TREE LIZARD *Urosaurus ornatus* 173956 SIDE-BLOTCHED LIZARD *Uta stansburiana* 173964 MOUNTAIN SKINK *Eumeces callicephalus* 173966 GILBERT'S SKINK *Eumeces gilberti* 173967 MANY-LINED SKINK *Eumeces multivirgatus* 173968 GREAT PLAINS SKINK *Eumeces obsoletus* 173970 WESTERN SKINK *Eumeces skiltonianus* 173971 FOUR-LINED SKINK *Eumeces tetragrammus* 174014 SIX-LINED RACERUNNER *Cnemidophorus sexlineatus* 174015 CANYON SPOTTED WHIPTAIL *Cnemidophorus burti* 174016 GRAY-CHECKERED WHIPTAIL *Cnemidophorus dixonii* 174017 CHIHUAHUAN SPOTTED WHIPTAIL *Cnemidophorus exsanguis* 174018 GILA SPOTTED WHIPTAIL *Cnemidophorus flagellicaudus* 174019 TEXAS SPOTTED WHIPTAIL *Cnemidophorus gularis* 174021 LITTLE STRIPED WHIPTAIL *Cnemidophorus inornatus* 174024 NEW MEXICO WHIPTAIL *Cnemidophorus neomexicanus* 174025 SONORAN SPOTTED WHIPTAIL *Cnemidophorus sonorae* 174026 CHECKERED WHIPTAIL *Cnemidophorus tessellatus* 174038 TEXAS BANDED GECKO *Coleonyx brevis* 174041 WESTERN BANDED GECKO *Coleonyx variegatus* 174092 DESERT NIGHT LIZARD *Xantusia vigilis* 174113 GILA MONSTER *Heloderma suspectum* 174136 COMMON GARTER SNAKE *Thamnophis sirtalis* 174140 WESTERN AQUATIC



GARTER SNAKE *Thamnophis couchii* 174141 BLACK-NECKED GARTER SNAKE *Thamnophis cyrtopsis* 174142 WESTERN TERRESTRIAL GARTER SNAKE *Thamnophis elegans* 174143 MEXICAN GARTER SNAKE *Thamnophis eques* 174144 CHECKERED GARTER SNAKE *Thamnophis marcianus* 174146 WESTERN RIBBON SNAKE *Thamnophis proximus* 174147 PLAINS GARTER SNAKE *Thamnophis radix* 174148 NARROW-HEADED GARTER SNAKE *Thamnophis rufipunctatus* 174155 WESTERN HOG-NOSED SNAKE *Heterodon nasicus* 174158 RING-NECKED SNAKE *Diadophis punctatus* 174169 RACER *Coluber constrictor* 174175 CORN SNAKE *Elaphe guttata* 174187 MILK SNAKE *Lampropeltis triangulum* 174192 SONORAN MOUNTAIN KING SNAKE *Lampropeltis pyromelana* 174202 GLOSSY SNAKE *Arizona elegans* 174210 BANDED SAND SNAKE *Chilomeniscus cinctus* 174212 WESTERN SHOVEL-NOSED SNAKE *Chionactis occipitalis* 174213 SONORAN SHOVEL-NOSED SNAKE *Chionactis palarostris* 174230 WESTERN HOOK-NOSED SNAKE *Gyalopion canum* 174233 NIGHT SNAKE *Hypsiglena torquata* 174237 SONORAN WHIPSNAKE *Masticophis bilineatus* 174238 COACHWHIP *Masticophis flagellum* 174240 STRIPED WHIPSNAKE *Masticophis taeniatus* 174244 PLAIN-BELLIED WATER SNAKE *Nerodia erythrogaster* 174251 NORTHERN WATER SNAKE *Nerodia sipedon* 174258 BROWN VINE SNAKE *Oxybelis aeneus* 174260 SADDLED LEAF-NOSED SNAKE *Phyllorhynchus browni* 174261 SPOTTED LEAF-NOSED SNAKE *Phyllorhynchus decurtatus* 174267 LONG-NOSED SNAKE *Rhinocheilus lecontei* 174269 BIG BEND PATCH-NOSED SNAKE *Salvadora deserticola* 174270 MOUNTAIN PATCH-NOSED SNAKE *Salvadora grahamiae* 174271 WESTERN PATCH-NOSED SNAKE *Salvadora hexalepis* 174275 GROUND SNAKE *Sonora semiannulata* 174282 SOUTHWESTERN BLACK-HEADED SNAKE *Tantilla hobartsmithi* 174283 PLAINS BLACK-HEADED SNAKE *Tantilla nigriceps* 174288 CHIHUAHUAN BLACK-HEADED SNAKE *Tantilla wilcoxi* 174289 YAQUI BLACK-HEADED SNAKE *Tantilla yaquia* 174291 WESTERN LYRE SNAKE *Trimorphodon biscutatus* 174293 LINED SNAKE *Tropidoclonion lineatum* 174304 MASSASAUGA *Sistrurus catenatus* 174310 WESTERN DIAMONDBACK RATTLESNAKE *Crotalus atrox* 174311 SIDEWINDER *Crotalus cerastes* 174312 ROCK RATTLESNAKE *Crotalus lepidus* 174313 SPECKLED RATTLESNAKE *Crotalus mitchellii* 174314 BLACK-TAILED RATTLESNAKE *Crotalus molossus* 174315 TWIN-SPOTTED RATTLESNAKE *Crotalus pricei* 174317 MOJAVE RATTLESNAKE *Crotalus scutulatus* 174318 TIGER RATTLESNAKE *Crotalus tigris* 174319 WESTERN RATTLESNAKE *Crotalus viridis* 174320 RIDGE-NOSED RATTLESNAKE *Crotalus willardi* 174326 RUBBER BOA *Charina bottae* 174336 TEXAS BLIND SNAKE *Leptotyphlops dulcis* 174337 WESTERN BLIND SNAKE *Leptotyphlops humilis* 174352 WESTERN CORAL SNAKE *Micruroides euryxanthus* 174469 COMMON LOON *Gavia immer* 174470 YELLOW-BILLED LOON *Gavia adamsii* 174474 RED-THROATED LOON *Gavia stellata* 174475 PACIFIC LOON *Gavia pacifica* 174479 RED-NECKED GREBE *Podiceps grisegena* 174482 HORNED GREBE *Podiceps auritus* 174485 EARED GREBE *Podiceps nigricollis* 174503 WESTERN GREBE *Aechmophorus occidentalis* 174505 PIED-BILLED GREBE *Podilymbus podiceps* 174684 AMERICAN WHITE PELICAN *Pelecanus erythrorhynchos* 174717 DOUBLE-CRESTED CORMORANT *Phalacrocorax auritus* 174773 GREAT BLUE HERON *Ardea herodias* 174793 GREEN HERON *Butorides virescens* 174803 CATTLE EGRET *Bubulcus ibis* 174813 SNOWY EGRET *Egretta thula* 174827 LITTLE BLUE HERON *Egretta caerulea* 174832 BLACK-CROWNED NIGHT-HERON *Nycticorax nycticorax* 174842 YELLOW-CROWNED NIGHT-HERON *Nyctanassa violacea* 174846 LEAST BITTERN *Ixobrychus exilis* 174856 AMERICAN BITTERN *Botaurus lentiginosus* 174926 WHITE-FACED IBIS *Plegadis chihi* 174987 TUNDRA SWAN *Cygnus columbianus* 174992 TRUMPETER SWAN *Cygnus buccinator* 174999 CANADA GOOSE *Branta canadensis* 175011 BRANT *Branta bernicla* 175020 GREATER WHITE-FRONTED GOOSE *Anser albifrons* 175038 SNOW GOOSE *Chen caerulescens* 175041 ROSS'S GOOSE *Chen rossii* 175044 BLACK-BELLIED WHISTLING-DUCK *Dendrocygna autumnalis* 175063 MALLARD *Anas platyrhynchos* 175068 AMERICAN BLACK DUCK *Anas rubripes* 175073 GADWALL *Anas strepera* 175074 NORTHERN PINTAIL *Anas acuta* 175081 GREEN-WINGED TEAL *Anas crecca* 175086 BLUE-WINGED TEAL *Anas discors* 175089 CINNAMON TEAL *Anas cyanoptera* 175092 EURASIAN WIGEON *Anas penelope* 175094 AMERICAN WIGEON *Anas americana* 175096 NORTHERN SHOVELER *Anas clypeata* 175122 WOOD DUCK *Aix sponsa* 175125 REDHEAD *Aythya americana* 175128 RING-NECKED DUCK *Aythya collaris* 175129 CANVASBACK *Aythya valisineria* 175130 GREATER SCAUP *Aythya marila* 175134 LESSER SCAUP *Aythya affinis* 175141 COMMON GOLDENEYE *Bucephala clangula* 175144 BARROW'S GOLDENEYE *Bucephala islandica* 175145 BUFFLEHEAD *Bucephala albeola* 175147 LONG-TAILED DUCK *Clangula hyemalis* 175149 HARLEQUIN DUCK *Histrionicus histrionicus* 175163 WHITE-WINGED SCOTER *Melanitta*

fusca 175170 SURF SCOTER *Melanitta perspicillata* 175175 RUDDY DUCK *Oxyura jamaicensis* 175183  
 HOODED MERGANSER *Lophodytes cucullatus* 175185 COMMON MERGANSER *Mergus merganser*  
 175187 RED-BREASTED MERGANSER *Mergus serrator* 175265 TURKEY VULTURE *Cathartes aura*  
 175272 BLACK VULTURE *Coragyps atratus* 175274 CALIFORNIA CONDOR *Gymnogyps californianus*  
 175282 WHITE-TAILED KITE *Elanus leucurus* 175300 NORTHERN GOSHAWK *Accipiter gentilis*  
 175304 SHARP-SHINNED HAWK *Accipiter striatus* 175309 COOPER'S HAWK *Accipiter cooperii*  
 175350 RED-TAILED HAWK *Buteo jamaicensis* 175365 BROAD-WINGED HAWK *Buteo platypterus*  
 175367 SWAINSON'S HAWK *Buteo swainsoni* 175368 ZONE-TAILED HAWK *Buteo albonotatus*  
 175373 ROUGH-LEGGED HAWK *Buteo lagopus* 175377 FERRUGINOUS HAWK *Buteo regalis* 175397  
 HARRIS'S HAWK *Parabuteo unicinctus* 175402 COMMON BLACK-HAWK *Buteogallus anthracinus*  
 175407 GOLDEN EAGLE *Aquila chrysaetos* 175420 BALD EAGLE *Haliaeetus leucocephalus* 175430  
 NORTHERN HARRIER *Circus cyaneus* 175590 OSPREY *Pandion haliaetus* 175599 GYRFALCON *Falco*  
*rusticolus* 175603 PRAIRIE FALCON *Falco mexicanus* 175604 PEREGRINE FALCON *Falco peregrinus*  
 175610 APLOMADO FALCON *Falco femoralis* 175613 MERLIN *Falco columbarius* 175622  
 AMERICAN KESTREL *Falco sparverius* 175790 RUFFED GROUSE *Bonasa umbellus* 175827 WHITE-  
 TAILED PTARMIGAN *Lagopus leucurus* 175834 GREATER PRAIRIE-CHICKEN *Tympanuchus cupido*  
 175838 LESSER PRAIRIE-CHICKEN *Tympanuchus pallidicinctus* 175841 SHARP-TAILED GROUSE  
*Tympanuchus phasianellus* 175848 SHARP-TAILED GROUSE-COLUMBIAN *Tympanuchus*  
*phasianellus columbianus* 175852 SHARP-TAILED GROUSE-PLAINS *Tympanuchus phasianellus jamesi*  
 175855 GREATER SAGE-GROUSE *Centrocercus urophasianus* 175860 BLUE GROUSE *Dendragapus*  
*obscurus* 175863 NORTHERN BOBWHITE *Colinus virginianus* 175872 SCALED QUAIL *Callipepla*  
*squamata* 175876 CALIFORNIA QUAIL *Callipepla californica* 175877 GAMBEL'S QUAIL *Callipepla*  
*gambelii* 175893 MOUNTAIN QUAIL *Oreortyx pictus* 175900 MONTEZUMA QUAIL *Cyrtonyx*  
*montezumae* 175905 RING-NECKED PHEASANT *Phasianus colchicus* 175908 CHUKAR *Alectoris*  
*chukar* 175915 GRAY PARTRIDGE *Perdix perdix* 176136 WILD TURKEY *Meleagris gallopavo* 176176  
 WHOOPING CRANE *Grus americana* 176177 SANDHILL CRANE *Grus canadensis* 176177 SANDHILL  
 CRANE *Grus canadensis* 176209 CLAPPER RAIL *Rallus longirostris* 176221 VIRGINIA RAIL *Rallus*  
*limicola* 176221 VIRGINIA RAIL *Rallus limicola* 176242 SORA *Porzana carolina* 176263 BLACK RAIL  
*Laterallus jamaicensis* 176284 COMMON MOORHEN *Gallinula chloropus* 176292 AMERICAN COOT  
*Fulica americana* 176506 SEMIPALMATED PLOVER *Charadrius semipalmatus* 176507 PIPING  
 PLOVER *Charadrius melodus* 176510 SNOWY PLOVER *Charadrius alexandrinus* 176520 KILLDEER  
*Charadrius vociferus* 176522 MOUNTAIN PLOVER *Charadrius montanus* 176564 AMERICAN  
 GOLDEN-PLOVER *Pluvialis dominica* 176567 BLACK-BELLIED PLOVER *Pluvialis squatarola* 176571  
 RUDDY TURNSTONE *Arenaria interpres* 176580 AMERICAN WOODCOCK *Scolopax minor* 176593  
 LONG-BILLED CURLEW *Numenius americanus* 176599 WHIMBREL *Numenius phaeopus* 176610  
 UPLAND SANDPIPER *Bartramia longicauda* 176612 SPOTTED SANDPIPER *Actitis macularia* 176615  
 SOLITARY SANDPIPER *Tringa solitaria* 176619 GREATER YELLOWLEGS *Tringa melanoleuca*  
 176620 LESSER YELLOWLEGS *Tringa flavipes* 176638 WILLET *Catoptrophorus semipalmatus* 176642  
 RED KNOT *Calidris canutus* 176653 PECTORAL SANDPIPER *Calidris melanotos* 176654 WHITE-  
 RUMPED SANDPIPER *Calidris fuscicollis* 176655 BAIRD'S SANDPIPER *Calidris bairdii* 176656  
 LEAST SANDPIPER *Calidris minutilla* 176661 DUNLIN *Calidris alpina* 176667 SEMIPALMATED  
 SANDPIPER *Calidris pusilla* 176668 WESTERN SANDPIPER *Calidris mauri* 176669 SANDERLING  
*Calidris alba* 176675 SHORT-BILLED DOWITCHER *Limnodromus griseus* 176679 LONG-BILLED  
 DOWITCHER *Limnodromus scolopaceus* 176684 BUFF-BREASTED SANDPIPER *Tryngites*  
*subruficollis* 176686 MARBLED GODWIT *Limosa fedoa* 176700 COMMON SNIPE *Gallinago gallinago*  
 176721 AMERICAN AVOCET *Recurvirostra americana* 176726 BLACK-NECKED STILT *Himantopus*  
*mexicanus* 176735 RED-NECKED PHALAROPE *Phalaropus lobatus* 176736 WILSON'S PHALAROPE  
*Phalaropus tricolor* 176808 GLAUCOUS GULL *Larus hyperboreus* 176824 HERRING GULL *Larus*  
*argentatus* 176828 THAYER'S GULL *Larus thayeri* 176829 CALIFORNIA GULL *Larus californicus*  
 176830 RING-BILLED GULL *Larus delawarensis* 176838 FRANKLIN'S GULL *Larus pipixcan* 176839  
 BONAPARTE'S GULL *Larus philadelphia* 176866 SABINE'S GULL *Xema sabini* 176887 FORSTER'S  
 TERN *Sterna forsteri* 176888 COMMON TERN *Sterna hirundo* 176923 LEAST TERN *Sterna antillarum*  
 176924 CASPIAN TERN *Sterna caspia* 176959 BLACK TERN *Chlidonias niger* 177065 BAND-TAILED  
 PIGEON *Columba fasciata* 177071 ROCK DOVE *Columba livia* 177121 WHITE-WINGED DOVE  
*Zenaida asiatica* 177125 MOURNING DOVE *Zenaida macroura* 177134 SPOTTED DOVE *Streptopelia*  
*chinensis* 177152 COMMON GROUND-DOVE *Columbina passerina* 177162 INCA DOVE *Columbina*

inca 177831 YELLOW-BILLED CUCKOO *Coccyzus americanus* 177834 BLACK-BILLED CUCKOO  
*Coccyzus erythrophthalmus* 177836 GREATER ROADRUNNER *Geococcyx californianus* 177851  
 COMMON BARN-OWL *Tyto alba* 177856 EASTERN SCREECH-OWL *Otus asio* 177875 WHISKERED  
 SCREECH-OWL *Otus trichopsis* 177878 FLAMMULATED OWL *Otus flammeolus* 177884 GREAT  
 HORNED OWL *Bubo virginianus* 177896 SNOWY OWL *Nyctea scandiaca* 177902 NORTHERN  
 PYGMY-OWL *Glaucidium gnoma* 177908 FERRUGINOUS PYGMY-OWL *Glaucidium brasilianum*  
 177912 ELF OWL *Micrathene whitneyi* 177925 SPOTTED OWL *Strix occidentalis* 177932 LONG-  
 EARED OWL *Asio otus* 177935 SHORT-EARED OWL *Asio flammeus* 177938 BOREAL OWL *Aegolius*  
*funereus* 177942 NORTHERN SAW-WHET OWL *Aegolius acadicus* 177946 BURROWING OWL  
*Athene cunicularia* 177961 WHIP-POOR-WILL *Caprimulgus vociferus* 177966 BUFF-COLLARED  
 NIGHTJAR *Caprimulgus ridgwayi* 177979 COMMON NIGHTHAWK *Chordeiles minor* 177988 LESSER  
 NIGHTHAWK *Chordeiles acutipennis* 177997 BLACK SWIFT *Cypseloides niger* 178001 CHIMNEY  
 SWIFT *Chaetura pelagica* 178002 VAUX'S SWIFT *Chaetura vauxi* 178014 WHITE-THROATED SWIFT  
*Aeronautes saxatalis* 178030 LUCIFER HUMMINGBIRD *Calothorax lucifer* 178033 BLACK-CHINNED  
 HUMMINGBIRD *Archilochus alexandri* 178035 COSTA'S HUMMINGBIRD *Calypte costae* 178036  
 ANNA'S HUMMINGBIRD *Calypte anna* 178038 BROAD-TAILED HUMMINGBIRD *Selasphorus*  
*platycercus* 178040 RUFOUS HUMMINGBIRD *Selasphorus rufus* 178041 ALLEN'S HUMMINGBIRD  
*Selasphorus sasin* 178048 CALLIOPE HUMMINGBIRD *Stellula calliope* 178050 MAGNIFICENT  
 HUMMINGBIRD *Eugenes fulgens* 178054 BLUE-THROATED HUMMINGBIRD *Lampornis clemenciae*  
 178065 BERYLLINE HUMMINGBIRD *Amazilia beryllina* 178066 VIOLET-CROWNED  
 HUMMINGBIRD *Amazilia violiceps* 178069 WHITE-EARED HUMMINGBIRD *Hylocharis leucotis*  
 178073 BROAD-BILLED HUMMINGBIRD *Cyanthus latirostris* 178096 ELEGANT TROGON *Trogon*  
*elegans* 178101 EARED TROGON *Euptilotis neoxenus* 178112 GREEN KINGFISHER *Chloroceryle*  
*americana* 178119 BELTED KINGFISHER *Ceryle alcyon* 178154 NORTHERN FLICKER *Colaptes*  
*auratus* 178164 GILDED FLICKER *Colaptes chrysoides* 178186 RED-HEADED WOODPECKER  
*Melanerpes erythrocephalus* 178189 ACORN WOODPECKER *Melanerpes formicivorus* 178195 RED-  
 BELLIED WOODPECKER *Melanerpes carolinus* 178196 LEWIS'S WOODPECKER *Melanerpes lewis*  
 178198 GILA WOODPECKER *Melanerpes uropygialis* 178208 WILLIAMSON'S SAPSUCKER  
*Sphyrapicus thyroideus* 178211 RED-NAPED SAPSUCKER *Sphyrapicus nuchalis* 178212 RED-  
 BREASTED SAPSUCKER *Sphyrapicus ruber* 178251 THREE-TOED WOODPECKER *Picoides*  
*tridactylus* 178256 WHITE-HEADED WOODPECKER *Picoides albolarvatus* 178259 DOWNY  
 WOODPECKER *Picoides pubescens* 178260 LADDER-BACKED WOODPECKER *Picoides scalaris*  
 178261 STRICKLAND'S WOODPECKER *Picoides stricklandi* 178262 HAIRY WOODPECKER *Picoides*  
*villosus* 178279 EASTERN KINGBIRD *Tyrannus tyrannus* 178282 TROPICAL KINGBIRD *Tyrannus*  
*melancholicus* 178287 WESTERN KINGBIRD *Tyrannus verticalis* 178288 CASSIN'S KINGBIRD  
*Tyrannus vociferans* 178292 THICK-BILLED KINGBIRD *Tyrannus crassirostris* 178293 SCISSOR-  
 TAILED FLYCATCHER *Tyrannus forficatus* 178305 SULPHUR-BELLIED FLYCATCHER  
*Myiodynastes luteiventris* 178309 GREAT CRESTED FLYCATCHER *Myiarchus crinitus* 178312  
 BROWN-CRESTED FLYCATCHER *Myiarchus tyrannulus* 178316 ASH-THROATED FLYCATCHER  
*Myiarchus cinerascens* 178319 DUSKY-CAPPED FLYCATCHER *Myiarchus tuberculifer* 178329  
 EASTERN PHOEBE *Sayornis phoebe* 178330 BLACK PHOEBE *Sayornis nigricans* 178333 SAY'S  
 PHOEBE *Sayornis saya* 178340 ALDER FLYCATCHER *Empidonax alnorum* 178341 WILLOW  
 FLYCATCHER *Empidonax traillii* 178346 DUSKY FLYCATCHER *Empidonax oberholseri* 178347  
 GRAY FLYCATCHER *Empidonax wrightii* 178348 PACIFIC-SLOPE FLYCATCHER *Empidonax*  
*difficilis* 178352 BUFF-BREASTED FLYCATCHER *Empidonax fulvifrons* 178356 GREATER PEWEE  
*Contopus pertinax* 178360 WESTERN WOOD-PEWEE *Contopus sordidulus* 178371 VERMILION  
 FLYCATCHER *Pyrocephalus rubinus* 178376 NORTHERN BEARDLESS-TYRANNULET  
*Camptostoma imberbe* 178384 ROSE-THROATED BECARD *Pachyramphus aglaiae* 178427 VIOLET-  
 GREEN SWALLOW *Tachycineta thalassina* 178431 TREE SWALLOW *Tachycineta bicolor* 178436  
 BANK SWALLOW *Riparia riparia* 178443 NORTHERN ROUGH-WINGED SWALLOW *Stelgidopteryx*  
*serripennis* 178448 BARN SWALLOW *Hirundo rustica* 178455 CLIFF SWALLOW *Petrochelidon*  
*pyrrhonota* 178460 CAVE SWALLOW *Petrochelidon fulva* 178464 PURPLE MARTIN *Progne subis*  
 178499 SPRAGUE'S PIPIT *Anthus spragueii* 178511 NORTHERN SHRIKE *Lanius excubitor* 178515  
 LOGGERHEAD SHRIKE *Lanius ludovicianus* 178529 BOHEMIAN WAXWING *Bombcilla garrulus*  
 178532 CEDAR WAXWING *Bombcilla cedrorum* 178536 AMERICAN DIPPER *Cinclus mexicanus*  
 178541 HOUSE WREN *Troglodytes aedon* 178547 WINTER WREN *Troglodytes troglodytes* 178562

BEWICK'S WREN *Thryomanes bewickii* 178581 CAROLINA WREN *Thryothorus ludovicianus* 178587  
 CACTUS WREN *Campylorhynchus brunneicapillus* 178605 SEDGE WREN *Cistothorus platensis* 178608  
 MARSH WREN *Cistothorus palustris* 178610 CANYON WREN *Catherpes mexicanus* 178614 ROCK  
 WREN *Salpinctes obsoletus* 178620 NORTHERN MOCKINGBIRD *Mimus polyglottos* 178625 GRAY  
 CATBIRD *Dumetella carolinensis* 178627 BROWN THRASHER *Toxostoma rufum* 178636 BENDIRE'S  
 THRASHER *Toxostoma bendirei* 178637 CURVE-BILLED THRASHER *Toxostoma curvirostre* 178645  
 LE CONTE'S THRASHER *Toxostoma lecontei* 178652 CRISSAL THRASHER *Toxostoma crissale*  
 178654 SAGE THRASHER *Oreoscoptes montanus* 178759 VERDIN *Auriparus flaviceps* 178764  
 BUSHTIT *Psaltriparus minimus* 178775 WHITE-BREASTED NUTHATCH *Sitta carolinensis* 178784  
 RED-BREASTED NUTHATCH *Sitta canadensis* 178788 PYGMY NUTHATCH *Sitta pygmaea* 178803  
 BROWN CREEPER *Certhia americana* 178841 RUFIOUS-CAPPED WARBLER *Basileuterus rufifrons*  
 178844 BLACK-AND-WHITE WARBLER *Mniotilta varia* 178855 TENNESSEE WARBLER *Vermivora*  
*peregrina* 178856 ORANGE-CROWNED WARBLER *Vermivora celata* 178861 NASHVILLE  
 WARBLER *Vermivora ruficapilla* 178864 VIRGINIA'S WARBLER *Vermivora virginiae* 178866 LUCY'S  
 WARBLER *Vermivora luciae* 178874 OLIVE WARBLER *Peucedramus taeniatus* 178878 YELLOW  
 WARBLER *Dendroica petechia* 178891 YELLOW-RUMPED WARBLER *Dendroica coronata* 178896  
 BLACK-THROATED GRAY WARBLER *Dendroica nigrescens* 178897 TOWNSEND'S WARBLER  
*Dendroica townsendi* 178902 HERMIT WARBLER *Dendroica occidentalis* 178909 GRACE'S  
 WARBLER *Dendroica graciae* 178913 BLACKPOLL WARBLER *Dendroica striata* 178918 PRAIRIE  
 WARBLER *Dendroica discolor* 178921 PALM WARBLER *Dendroica palmarum* 178927 OVENBIRD  
*Seiurus aurocapillus* 178931 NORTHERN WATERTHRUSH *Seiurus noveboracensis* 178940  
 MACGILLIVRAY'S WARBLER *Oporornis tolmiei* 178944 COMMON YELLOWTHROAT *Geothlypis*  
*trichas* 178964 YELLOW-BREASTED CHAT *Icteria virens* 178970 RED-FACED WARBLER *Cardellina*  
*rubrifrons* 178973 WILSON'S WARBLER *Wilsonia pusilla* 178979 AMERICAN REDSTART *Setophaga*  
*ruticilla* 178986 PAINTED REDSTART *Myioborus pictus* 178997 HUTTON'S VIREO *Vireo huttoni*  
 179003 BELL'S VIREO *Vireo bellii* 179008 GRAY VIREO *Vireo vicinior* 179021 RED-EYED VIREO  
*Vireo olivaceus* 179023 WARBLING VIREO *Vireo gilvus* 179032 BOBOLINK *Dolichonyx oryzivorus*  
 179034 EASTERN MEADOWLARK *Sturnella magna* 179039 WESTERN MEADOWLARK *Sturnella*  
*neglecta* 179043 YELLOW-HEADED BLACKBIRD *Xanthocephalus xanthocephalus* 179045 RED-  
 WINGED BLACKBIRD *Agelaius phoeniceus* 179060 TRICOLORED BLACKBIRD *Agelaius tricolor*  
 179064 ORCHARD ORIOLE *Icterus spurius* 179070 HOODED ORIOLE *Icterus cucullatus* 179079  
 STREAK-BACKED ORIOLE *Icterus pustulatus* 179082 SCOTT'S ORIOLE *Icterus parisorum* 179083  
 BALTIMORE ORIOLE *Icterus galbula* 179094 BREWER'S BLACKBIRD *Euphagus cyanocephalus*  
 179104 COMMON GRACKLE *Quiscalus quiscula* 179109 GREAT-TAILED GRACKLE *Quiscalus*  
*mexicanus* 179112 BROWN-HEADED COWBIRD *Molothrus ater* 179116 BRONZED COWBIRD  
*Molothrus aeneus* 179124 NORTHERN CARDINAL *Cardinalis cardinalis* 179132 PYRRHULOXIA  
*Cardinalis sinuatus* 179139 ROSE-BREASTED GROSBEAK *Pheucticus ludovicianus* 179140 BLACK-  
 HEADED GROSBEAK *Pheucticus melanocephalus* 179145 BLUE GROSBEAK *Guiraca caerulea* 179150  
 INDIGO BUNTING *Passerina cyanea* 179151 LAZULI BUNTING *Passerina amoena* 179152 VARIED  
 BUNTING *Passerina versicolor* 179156 PAINTED BUNTING *Passerina ciris* 179165 DICKCISSEL *Spiza*  
*americana* 179173 EVENING GROSBEAK *Coccothraustes vespertinus* 179186 PURPLE FINCH  
*Carpodacus purpureus* 179190 CASSIN'S FINCH *Carpodacus cassinii* 179191 HOUSE FINCH  
*Carpodacus mexicanus* 179205 PINE GROSBEAK *Pinicola enucleator* 179215 GRAY-CROWNED  
 ROSY-FINCH *Leucosticte tephrocotis* 179222 BLACK ROSY-FINCH *Leucosticte atrata* 179222 BLACK  
 ROSY-FINCH *Leucosticte atrata* 179223 BROWN-CAPPED ROSY-FINCH *Leucosticte australis* 179223  
 BROWN-CAPPED ROSY-FINCH *Leucosticte australis* 179230 COMMON REDPOLL *Carduelis*  
*flammea* 179232 LAWRENCE'S GOLDFINCH *Carduelis lawrencei* 179233 PINE SISKIN *Carduelis*  
*pinus* 179234 LESSER GOLDFINCH *Carduelis psaltria* 179236 AMERICAN GOLDFINCH *Carduelis*  
*tristis* 179259 RED CROSSBILL *Loxia curvirostra* 179268 WHITE-WINGED CROSSBILL *Loxia*  
*leucoptera* 179293 CANYON TOWHEE *Pipilo fuscus* 179307 ABERT'S TOWHEE *Pipilo aberti* 179310  
 GREEN-TAILED TOWHEE *Pipilo chlorurus* 179312 LARK BUNTING *Calamospiza melanocorys*  
 179314 SAVANNAH SPARROW *Passerculus sandwichensis* 179333 GRASSHOPPER SPARROW  
*Ammodramus savannarum* 179339 BAIRD'S SPARROW *Ammodramus bairdii* 179345 LE CONTE'S  
 SPARROW *Ammodramus lecontei* 179366 VESPER SPARROW *Poocetes gramineus* 179371 LARK  
 SPARROW *Chondestes grammacus* 179375 RUFIOUS-WINGED SPARROW *Aimophila carpalis* 179377  
 RUFIOUS-CROWNED SPARROW *Aimophila ruficeps* 179390 BOTTERI'S SPARROW *Aimophila*

botterii 179393 CASSIN'S SPARROW *Aimophila cassinii* 179395 BLACK-THROATED SPARROW  
*Amphispiza bilineata* 179402 SAGE SPARROW *Amphispiza belli* 179410 DARK-EYED JUNCO *Junco*  
*hyemalis* 179427 YELLOW-EYED JUNCO *Junco phaeonotus* 179432 AMERICAN TREE SPARROW  
*Spizella arborea* 179435 CHIPPING SPARROW *Spizella passerina* 179439 CLAY-COLORED  
 SPARROW *Spizella pallida* 179440 BREWER'S SPARROW *Spizella breweri* 179443 FIELD SPARROW  
*Spizella pusilla* 179448 BLACK-CHINNED SPARROW *Spizella atrogularis* 179454 HARRIS'S  
 SPARROW *Zonotrichia querula* 179455 WHITE-CROWNED SPARROW *Zonotrichia leucophrys* 179461  
 GOLDEN-CROWNED SPARROW *Zonotrichia atricapilla* 179462 WHITE-THROATED SPARROW  
*Zonotrichia albicollis* 179464 FOX SPARROW *Passerella iliaca* 179484 LINCOLN'S SPARROW  
*Melospiza lincolni* 179488 SWAMP SPARROW *Melospiza georgiana* 179492 SONG SPARROW  
*Melospiza melodia* 179525 MCCOWN'S LONGSPUR *Calcarius mccownii* 179526 LAPLAND  
 LONGSPUR *Calcarius lapponicus* 179530 CHESTNUT-COLLARED LONGSPUR *Calcarius ornatus*  
 179532 SNOW BUNTING *Plectrophenax nivalis* 179628 HOUSE SPARROW *Passer domesticus* 179637  
 EUROPEAN STARLING *Sturnus vulgaris* 179667 GRAY JAY *Perisoreus canadensis* 179680 BLUE JAY  
*Cyanocitta cristata* 179685 STELLER'S JAY *Cyanocitta stelleri* 179707 MEXICAN JAY *Aphelocoma*  
*ultramarina* 179720 BLACK-BILLED MAGPIE *Pica hudsonia* 179725 COMMON RAVEN *Corvus corax*  
 179730 CHIHUAHUAN RAVEN *Corvus cryptoleucus* 179731 AMERICAN CROW *Corvus*  
*brachyrhynchos* 179748 PINYON JAY *Gymnorhinus cyanocephalus* 179750 CLARK'S NUTCRACKER  
*Nucifraga columbiana* 179759 AMERICAN ROBIN *Turdus migratorius* 179773 VARIED THRUSH  
*Ixoreus naevius* 179777 WOOD THRUSH *Hylocichla mustelina* 179779 HERMIT THRUSH *Catharus*  
*guttatus* 179788 SWAINSON'S THRUSH *Catharus ustulatus* 179793 GRAY-CHEEKED THRUSH  
*Catharus minimus* 179796 VEERY *Catharus fuscescens* 179801 EASTERN BLUEBIRD *Sialia sialis*  
 179806 WESTERN BLUEBIRD *Sialia mexicana* 179811 MOUNTAIN BLUEBIRD *Sialia currucoides*  
 179824 TOWNSEND'S SOLITAIRE *Myadestes townsendi* 179853 BLUE-GRAY GNATCATCHER  
*Polioptila caerulea* 179857 BLACK-TAILED GNATCATCHER *Polioptila melanura* 179863 BLACK-  
 CAPPED GNATCATCHER *Polioptila nigriceps* 179865 GOLDEN-CROWNED KINGLET *Regulus*  
*satrapa* 179870 RUBY-CROWNED KINGLET *Regulus calendula* 179877 PHAINOPEPLA *Phainopepla*  
*nitens* 179882 WESTERN TANAGER *Piranga ludoviciana* 179884 HEPATIC TANAGER *Piranga flava*  
 179888 SUMMER TANAGER *Piranga rubra* 179891 FLAME-COLORED TANAGER *Piranga bidentata*  
 179921 VIRGINIA OPOSSUM *Didelphis virginiana* 179929 MASKED SHREW *Sorex cinereus* 179932  
 VAGRANT SHREW *Sorex vagrans* 179933 NORTHERN WATER SHREW *Sorex palustris* 179939  
 ARIZONA SHREW *Sorex arizonae* 179946 PYGMY SHREW *Sorex hoyi* 179949 MERRIAM'S SHREW  
*Sorex merriami* 179950 MONTANE SHREW *Sorex monticolus* 179951 DWARF SHREW *Sorex nanus*  
 179954 PREBLE'S SHREW *Sorex preblei* 179955 INYO SHREW *Sorex tenellus* 179956  
 TROWBRIDGE'S SHREW *Sorex trowbridgii* 179969 ELLIOT'S SHORT-TAILED SHREW *Blarina*  
*hylophaga* 179971 LEAST SHREW *Cryptotis parva* 179973 DESERT SHREW *Notiosorex crawfordi*  
 179979 EASTERN MOLE *Scalopus aquaticus* 179981 BROAD-FOOTED MOLE *Scapanus latimanus*  
 179988 LITTLE BROWN BAT *Myotis lucifugus* 179990 LONG-LEGGED MYOTIS *Myotis volans*  
 179991 CALIFORNIA MYOTIS *Myotis californicus* 179992 SOUTHWESTERN MYOTIS *Myotis*  
*auriculus* 179995 LONG-EARED MYOTIS *Myotis evotis* 179999 WESTERN SMALL-FOOTED  
 MYOTIS *Myotis leibii* 180002 FRINGED MYOTIS *Myotis thysanodes* 180003 CAVE MYOTIS *Myotis*  
*velifer* 180004 YUMA MYOTIS *Myotis yumanensis* 180006 PALLID BAT *Antrozous pallidus* 180008  
 BIG BROWN BAT *Eptesicus fuscus* 180010 SPOTTED BAT *Euderma maculatum* 180012 ALLEN'S  
 BIG-EARED BAT *Idionycteris phyllotis* 180014 SILVER-HAIRED BAT *Lasionycteris noctivagans*  
 180016 WESTERN RED BAT *Lasiurus blossevillii* 180017 HOARY BAT *Lasiurus cinereus* 180018  
 SOUTHERN YELLOW BAT *Lasiurus ega* 180024 WESTERN PIPISTRELLE *Pipistrellus hesperus*  
 180062 MEXICAN LONG-TONGUED BAT *Choeronycteris mexicana* 180068 MEXICAN LONG-  
 NOSED BAT *Leptonycteris nivalis* 180071 CALIFORNIA LEAF-NOSED BAT *Macrotus californicus*  
 180080 WESTERN MASTIFF BAT *Eumops perotis* 180081 UNDERWOOD'S MASTIFF BAT *Eumops*  
*underwoodi* 180085 POCKETED FREE-TAILED BAT *Nyctinomops femorosaccus* 180086 BIG FREE-  
 TAILED BAT *Nyctinomops macrotis* 180088 BRAZILIAN FREE-TAILED BAT *Tadarida brasiliensis*  
 180103 NINE-BANDED ARMADILLO *Dasypus novemcinctus* 180109 AMERICAN PIKA *Ochotona*  
*princeps* 180112 SNOWSHOE HARE *Lepus americanus* 180114 ANTELOPE JACK RABBIT *Lepus*  
*alleni* 180115 BLACK-TAILED JACK RABBIT *Lepus californicus* 180116 WHITE-SIDED JACK  
 RABBIT *Lepus callotis* 180118 WHITE-TAILED JACK RABBIT *Lepus townsendii* 180122 DESERT  
 COTTONTAIL *Sylvilagus audubonii* 180124 EASTERN COTTONTAIL *Sylvilagus floridanus* 180126

MOUNTAIN COTTONTAIL *Sylvilagus nuttallii* 180133 MOUNTAIN BEAVER *Aplodontia rufa* 180140  
 YELLOW-BELLIED MARMOT *Marmota flaviventris* 180147 UINTA GROUND SQUIRREL  
*Spermophilus armatus* 180148 CALIFORNIA GROUND SQUIRREL *Spermophilus beecheyi* 180149  
 BELDING'S GROUND SQUIRREL *Spermophilus beldingi* 180152 WYOMING GROUND SQUIRREL  
*Spermophilus elegans* 180154 GOLDEN-MANTLED GROUND SQUIRREL *Spermophilus lateralis*  
 180155 MEXICAN GROUND SQUIRREL *Spermophilus mexicanus* 180159 SPOTTED GROUND  
 SQUIRREL *Spermophilus spilosoma* 180160 ROUND-TAILED GROUND SQUIRREL *Spermophilus*  
*tereticaudus* 180161 TOWNSEND'S GROUND SQUIRREL *Spermophilus townsendii* 180162  
 THIRTEEN-LINED GROUND SQUIRREL *Spermophilus tridecemlineatus* 180163 ROCK SQUIRREL  
*Spermophilus variegatus* 180166 RED SQUIRREL *Tamiasciurus hudsonicus* 180167 DOUGLAS'  
 SQUIRREL *Tamiasciurus douglasii* 180169 NORTHERN FLYING SQUIRREL *Glaucomys sabrinus*  
 180172 FOX SQUIRREL *Sciurus niger* 180173 ABERT'S SQUIRREL *Sciurus aberti* 180174 ARIZONA  
 GRAY SQUIRREL *Sciurus arizonensis* 180176 WESTERN GRAY SQUIRREL *Sciurus griseus* 180177  
 NAYARIT SQUIRREL *Sciurus nayaritensis* 180179 HARRIS' ANTELOPE SQUIRREL  
*Ammospermophilus harrisi* 180180 TEXAS ANTELOPE SQUIRREL *Ammospermophilus interpres*  
 180181 WHITE-TAILED ANTELOPE SQUIRREL *Ammospermophilus leucurus* 180184 GUNNISON'S  
 PRAIRIE DOG *Cynomys gunnisoni* 180185 WHITE-TAILED PRAIRIE DOG *Cynomys leucurus* 180186  
 BLACK-TAILED PRAIRIE DOG *Cynomys ludovicianus* 180187 UTAH PRAIRIE DOG *Cynomys*  
*parvidens* 180190 YELLOW-PINE CHIPMUNK *Tamias amoenus* 180191 GRAY-FOOTED CHIPMUNK  
*Tamias canipes* 180192 GRAY-COLLARED CHIPMUNK *Tamias cinereicollis* 180193 CLIFF  
 CHIPMUNK *Tamias dorsalis* 180195 LEAST CHIPMUNK *Tamias minimus* 180198 PALMER'S  
 CHIPMUNK *Tamias palmeri* 180199 PANAMINT CHIPMUNK *Tamias panamintinus* 180200 LONG-  
 EARED CHIPMUNK *Tamias quadrimaculatus* 180201 COLORADO CHIPMUNK *Tamias quadrivittatus*  
 180203 ALLEN'S CHIPMUNK *Tamias senex* 180206 LODGEPOLE CHIPMUNK *Tamias speciosus*  
 180208 TOWNSEND'S CHIPMUNK *Tamias townsendii* 180209 UINTA CHIPMUNK *Tamias umbrinus*  
 180212 BEAVER *Castor canadensis* 180215 DESERT POCKET GOPHER *Geomys arenarius* 180216  
 PLAINS POCKET GOPHER *Geomys bursarius* 180220 YELLOW-FACED POCKET GOPHER  
*Pappogeomys castanops* 180222 BOTTA'S POCKET GOPHER *Thomomys bottae* 180225 IDAHO  
 POCKET GOPHER *Thomomys idahoensis* 180227 MOUNTAIN POCKET GOPHER *Thomomys*  
*monticola* 180228 NORTHERN POCKET GOPHER *Thomomys talpoides* 180229 TOWNSEND'S  
 POCKET GOPHER *Thomomys townsendii* 180230 SOUTHERN POCKET GOPHER *Thomomys*  
*umbrinus* 180236 DESERT KANGAROO RAT *Dipodomys deserti* 180241 MERRIAM'S KANGAROO  
 RAT *Dipodomys merriami* 180242 CHISEL-TOOTHED KANGAROO RAT *Dipodomys microps* 180244  
 ORD'S KANGAROO RAT *Dipodomys ordii* 180245 PANAMINT KANGAROO RAT *Dipodomys*  
*panamintinus* 180246 BANNER-TAILED KANGAROO RAT *Dipodomys spectabilis* 180252 DARK  
 KANGAROO MOUSE *Microdipodops megacephalus* 180253 PALE KANGAROO MOUSE  
*Microdipodops pallidus* 180256 ARIZONA POCKET MOUSE *Perognathus amplus* 180260 OLIVE-  
 BACKED POCKET MOUSE *Perognathus fasciatus* 180261 PLAINS POCKET MOUSE *Perognathus*  
*flavescens* 180262 SILKY POCKET MOUSE *Perognathus flavus* 180267 LITTLE POCKET MOUSE  
*Perognathus longimembris* 180269 GREAT BASIN POCKET MOUSE *Perognathus parvus* 180276 DEER  
 MOUSE *Peromyscus maniculatus* 180278 WHITE-FOOTED MOUSE *Peromyscus leucopus* 180282  
 BRUSH MOUSE *Peromyscus boylii* 180284 CANYON MOUSE *Peromyscus crinitus* 180286 CACTUS  
 MOUSE *Peromyscus eremicus* 180287 BLACK-EARED MOUSE *Peromyscus melanotis* 180288  
 MERRIAM'S MOUSE *Peromyscus merriami* 180289 WHITE-ANKLED MOUSE *Peromyscus pectoralis*  
 180291 PINON MOUSE *Peromyscus truei* 180294 SOUTHERN RED-BACKED VOLE *Clethrionomys*  
*gapperi* 180297 MEADOW VOLE *Microtus pennsylvanicus* 180299 LONG-TAILED VOLE *Microtus*  
*longicaudus* 180310 MONTANE VOLE *Microtus montanus* 180312 PRAIRIE VOLE *Microtus*  
*ochrogaster* 180315 WATER VOLE *Microtus richardsoni* 180318 MUSKRAT *Ondatra zibethicus* 180341  
 FULVOUS HARVEST MOUSE *Reithrodontomys fulvescens* 180343 WESTERN HARVEST MOUSE  
*Reithrodontomys megalotis* 180344 PLAINS HARVEST MOUSE *Reithrodontomys montanus* 180347  
 ARIZONA COTTON RAT *Sigmodon arizonae* 180348 TAWNY-BELLIED COTTON RAT *Sigmodon*  
*fulviventris* 180349 HISPID COTTON RAT *Sigmodon hispidus* 180350 YELLOW-NOSED COTTON  
 RAT *Sigmodon ochrognathus* 180359 HEATHER VOLE *Phenacomys intermedius* 180366 HOUSE  
 MOUSE *Mus musculus* 180368 NORTHERN PYGMY MOUSE *Baiomys taylori* 180370 WHITE-  
 THROATED WOODRAT *Neotoma albigula* 180371 BUSHY-TAILED WOODRAT *Neotoma cinerea*  
 180372 EASTERN WOODRAT *Neotoma floridana* 180374 DESERT WOODRAT *Neotoma lepida*

180375 MEXICAN WOODRAT *Neotoma mexicana* 180376 SOUTHERN PLAINS WOODRAT *Neotoma micropus* 180377 STEPHENS' WOODRAT *Neotoma stephensi* 180381 MEARNS' GRASSHOPPER MOUSE *Onychomys arenicola* 180382 NORTHERN GRASSHOPPER MOUSE *Onychomys leucogaster* 180383 SOUTHERN GRASSHOPPER MOUSE *Onychomys torridus* 180386 MEADOW JUMPING MOUSE *Zapus hudsonius* 180387 WESTERN JUMPING MOUSE *Zapus princeps* 180393 PORCUPINE *Erethizon dorsatum* 180543 BROWN BEAR *Ursus arctos* 180544 AMERICAN BLACK BEAR *Ursus americanus* 180549 RIVER OTTER *Lontra canadensis* 180551 WOLVERINE *Gulo gulo* 180553 MINK *Mustela vison* 180555 ERMINE *Mustela erminea* 180556 LONG-TAILED WEASEL *Mustela frenata* 180557 BLACK-FOOTED FERRET *Mustela nigripes* 180559 MARTEN *Martes americana* 180560 FISHER *Martes pennanti* 180562 STRIPED SKUNK *Mephitis mephitis* 180563 HOODED SKUNK *Mephitis macroura* 180565 BADGER *Taxidea taxus* 180568 HOG-NOSED SKUNK *Conepatus mesoleucus* 180570 EASTERN SPOTTED SKUNK *Spilogale putorius* 180575 RACCOON *Procyon lotor* 180577 RINGTAIL *Bassariscus astutus* 180582 BOBCAT *Lynx rufus* 180585 LYNX *Lynx canadensis* 180593 JAGUAR *Panthera onca* 180596 GRAY WOLF *Canis lupus* 180599 COYOTE *Canis latrans* 180604 RED FOX *Vulpes vulpes* 180606 KIT FOX *Vulpes macrotis* 180607 SWIFT FOX *Vulpes velox* 180609 GRAY FOX *Urocyon cinereoargenteus* 180695 WAPITI *Cervus elaphus* 180698 MULE DEER *Odocoileus hemionus* 180699 WHITE-TAILED DEER *Odocoileus virginianus* 180703 MOOSE *Alces alces* 180711 BIGHORN SHEEP *Ovis canadensis* 180713 MOUNTAIN GOAT *Oreamnos americanus* 180717 PRONGHORN *Antilocapra americana* 180719 BARBARY SHEEP *Ammotragus lervia* 203452 TOWNSEND'S BIG-EARED BAT *Corynorhinus townsendii* 203618 BISON *Bos bison* 206989 PLAINS SPADEFOOT *Spea bombifrons* 206991 GREAT BASIN SPADEFOOT *Spea intermontana* 206993 NEW MEXICO SPADEFOOT *Spea multiplicata* 207312 BOREAL CHORUS FROG *Pseudacris maculata* 207313 PACIFIC CHORUS FROG *Pseudacris regilla* 207724 BARKING FROG *Eleutherodactylus augusti* 208657 BIG BEND SLIDER *Trachemys gaigeae* 208677 SMOOTH SOFTSHELL TURTLE *Apalone mutica* 208680 SPINY SOFTSHELL TURTLE *Apalone spinifera* 208791 MOJAVE BLACK-COLLARED LIZARD *Crotaphytus bicinctores* 208896 VARIABLE SKINK *Eumeces gaigeae* 208940 WESTERN WHIPTAIL *Cnemidophorus tigris* 208947 DESERT GRASSLAND WHIPTAIL *Cnemidophorus uniparens* 208948 PLATEAU STRIPED WHIPTAIL *Cnemidophorus velox* 209008 NORTHERN ALLIGATOR LIZARD *Elgaria coerulea* 209017 MADREAN ALLIGATOR LIZARD *Elgaria kingii* 209247 COMMON KINGSLAKE *Lampropeltis getula* 209266 GRAY-BANDED KINGSLAKE *Lampropeltis alterna* 209400 BULLSLAKE *Pituophis catenifer* 209455 TRANS-PECOS RAT SNAKE *Bogertophis subocularis* 209458 GREEN RAT SNAKE *Senticolis triaspis* 550236 AMARGOSA TOAD *Bufo nelsoni* 550241 RAMSEY CANYON LEOPARD FROG *Rana subaquavocalis* 550546 COLUMBIA SPOTTED FROG *Rana luteiventris* 551766 RIO GRANDE RIVER COOTER *Pseudemys gorzugi* 552462 WHITE-NOSED COATI *Nasua narica* 552464 SOUTHERN LONG-NOSED BAT *Leptonycteris curasoae* 552466 WESTERN SPOTTED SKUNK *Spilogale gracilis* 552470 OCELOT *Leopardus pardalis* 552479 MOUNTAIN LION *Puma concolor* 552480 MOGOLLON VOLE *Microtus mogollonensis* 552482 LONG-TAILED POCKET MOUSE *Chaetodipus formosus* 552483 HISPID POCKET MOUSE *Chaetodipus hispidus* 552484 ROCK POCKET MOUSE *Chaetodipus intermedius* 552486 DESERT POCKET MOUSE *Chaetodipus penicillatus* 552487 SPINY POCKET MOUSE *Chaetodipus spinatus* 552488 MERRIAM'S POCKET MOUSE *Perognathus merriami* 552490 SAGEBRUSH VOLE *Lemmiscus curtatus* 552494 ARIZONA WOODRAT *Neotoma devia* 552495 OSGOOD'S MOUSE *Peromyscus gratus* 552496 ROCK MOUSE *Peromyscus nasutus* 552499 MERRIAM'S GROUND SQUIRREL *Spermophilus canus* 552503 HOPI CHIPMUNK *Tamias rufus* 552504 PIUTE GROUND SQUIRREL *Spermophilus mollis* 552512 EASTERN RED BAT *Lasiurus borealis* 552520 BAILEY'S POCKET MOUSE *Chaetodipus baileyi* 552521 PYGMY RABBIT *Brachylagus idahoensis* 552761 COLLARED PECCARY *Pecari tajacu* 554027 CLARK'S GREBE *Aechmophorus clarkii* 554030 FIVE-STRIPED SPARROW *Aimophila quinquestriata* 554127 AMERICAN PIPIT *Anthus rubescens* 554128 WESTERN SCRUB-JAY *Aphelocoma californica* 554135 GREAT EGRET *Ardea alba* 554137 GRAY HAWK *Asturina nitida* 554139 JUNIPER TITMOUSE *Baeolophus ridgwayi* 554141 BRIDLED TITMOUSE *Baeolophus wollweberi* 554145 STILT SANDPIPER *Calidris himantopus* 554146 CRESTED CARACARA *Caracara plancus* 554221 OLIVE-SIDED FLYCATCHER *Contopus cooperi* 554254 HAMMOND'S FLYCATCHER *Empidonax hammondi* 554255 CORDILLERAN FLYCATCHER *Empidonax occidentalis* 554256 HORNED LARK *Eremophila alpestris* 554267 BULLOCK'S ORIOLE *Icterus bullockii* 554268 MISSISSIPPI KITE *Ictinia mississippiensis* 554375 NEOTROPIC CORMORANT *Phalacrocorax brasilianus* 554376 RED

PHALAROPE Phalaropus fulicaria 554380 SPOTTED TOWHEE Pipilo maculatus 554382 BLACK-CAPPED CHICKADEE Poecile atricapilla 554385 MOUNTAIN CHICKADEE Poecile gambeli 554388 MEXICAN CHICKADEE Poecile sclateri 554456 CASSIN'S VIREO Vireo cassinii 554477 PLUMBEOUS VIREO Vireo plumbeus 555388 WESTERN SCREECH-OWL Otus kennicottii 555544 COMMON POORWILL Phalaenoptilus nuttallii 555657 NEW MEXICO SHREW Sorex neomexicanus 555658 DAVIS MOUNTAIN COTTONTAIL Silvilagus robustus 563907 ROSY BOA Charina trivirgata 563909 THORNSCRUB HOOK-NOSED SNAKE Gyalopion quadrangulare 563910 SMOOTH GREEN SNAKE Liochlorophis vernalis 564567 PYGMY SHORT-HORNED LIZARD Phrynosoma douglasii 564571 BLACK SPINY-TAILED IGUANA Ctenosaura hemilopha 564574 SAND DUNE LIZARD Sceloporus arenicolus 564594 GREATER SHORT-HORNED LIZARD Phrynosoma hernandesi 564594 GREATER SHORT-HORNED LIZARD Phrynosoma hernandesi 564596 COMMON CHUCKWALLA Sauromalus ater 625180 ORYX Oryx gazella

*Time\_Period\_of\_Content:*

*Time\_Period\_Information:*

*Single\_Date/Time:*

*Calendar\_Date:*

REQUIRED: The year (and optionally month, or month and day) for which the data set corresponds to the ground.

*Currentness\_Reference:* publication date

*Status:*

*Progress:* Complete

*Maintenance\_and\_Update\_Frequency:* None planned

*Spatial\_Domain:*

*Bounding\_Coordinates:*

*West\_Bounding\_Coordinate:* -122.066986

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*North\_Bounding\_Coordinate:* 44.182132

*South\_Bounding\_Coordinate:* 28.940260

*Keywords:*

*Theme:*

*Theme\_Keyword\_Thesaurus:* None

*Theme\_Keyword:* Habitat Modeling

*Theme\_Keyword:* Amphibians

*Theme\_Keyword:* Birds

*Theme\_Keyword:* Mammals

*Theme\_Keyword:* Reptiles

*Theme\_Keyword:* Predicted Habitat

*Place:*

*Place\_Keyword\_Thesaurus:* None

*Place\_Keyword:* Southwest United States

*Place\_Keyword:* Arizona

*Place\_Keyword:* Colorado

*Place\_Keyword:* New Mexico

*Place\_Keyword:* Nevada

*Place\_Keyword:* Utah

*Access\_Constraints:* None; public domain

*Use\_Constraints:*

This database is not intended for site-specific analyses. Interpretations derived from its use are suited for regional and planning purposes only. Acknowledgment of Southwest Regional Gap Analysis Project is appreciated. See limitations and disclaimers in Larger Work Citation, on national GAP home page (<http://www.gap.uidaho.edu>), or New Mexico Cooperative Fish and Wildlife Research Unit (<http://fws-nmcfwru.nmsu.edu/swregap>).

*Point\_of\_Contact:*

*Contact\_Information:*

*Contact\_Organization\_Primary:*

*Contact\_Organization:* New Mexico Cooperative Fish and Wildlife Research Unit



*Contact\_Person:* Ken Boykin  
*Contact\_Position:* Research Specialist  
*Contact\_Address:*  
*Address\_Type:* mailing and physical address  
*Address:* Box 30003, MSC 4901  
*City:* Las Cruces  
*State\_or\_Province:* New Mexico  
*Postal\_Code:* 88003  
*Country:* USA  
*Contact\_Voice\_Telephone:* 505-646-6303  
*Contact\_Facsimile\_Telephone:* 505-646-1281  
*Contact\_Electronic\_Mail\_Address:* kboykin@nmsu.edu  
*Data\_Set\_Credit:*

Arizona: USGS Southwest Biological Science Center, Colorado Plateau Field Station, Northern Arizona University, P.O. Box 5614, Flagstaff, AZ 86011-5614, Principle Investigator: Kathryn Thomas, Habitat Modelers: Charles Drost, J. Judson Wynne . Colorado: Colorado Division of Wildlife, Habitat Resources Section, 6060 N. Broadway, Denver, CO 80216, Principle Investigators: Don Schrupp, Lee O'Brien, Habitat Modelers: Tammy Hamer, Katy Oakes, Chris Mettinbrink.

Nevada: US EPA, National Exposure Research Lab - ESD/LEB, P.O. Box 25047, Las Vegas, NV 89193-3478, Principle Investigators: Bruce Jones, Bill Kepner, David Bradford, Habitat Modelers: David Bradford, Chad Cross, Bruce Jones.

New Mexico: New Mexico Cooperative Fish & Wildlife Research Unit, New Mexico State University, P.O. Box 30003, MSC 4901, Las Cruces, NM 88003, Principle Investigators: Bruce Thompson, Ken Boykin, Database Creator: Robert Deitner, Habitat Modelers: Susanne Propeck-Gray, Jennifer Puttere, Cynthia King, Zachary Schwenke,

Utah: RS/GIS Laboratory, College of Natural Resources, UMC 5275, Utah State University, Logan, UT 84322-5275, Principle Investigators: Doug Ramsey, John Lowry, Habitat Modelers: Wendy Rieth.

NatureServe: NatureServe, 2400 Spruce St., Suite 201, Bolder, CO 80302, Vegetation Ecologists: Keith Schulz, Pat Comer.

USGS/Biological Resources Discipline: P.O. Box 30003, MSC 4901, Las Cruces, NM 88003, SWReGAP Project Coordinator: Julie Prior-Magee.

*Security\_Information:*  
*Security\_Classification:* Unclassified  
*Native\_Data\_Set\_Environment:*  
 Microsoft Windows XP Version 5.1 (Build 2600) Service Pack 2; ESRI ArcCatalog 9.1.0.722

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*Data\_Quality\_Information:*

*Attribute\_Accuracy:*

*Attribute\_Accuracy\_Report:*

We received 1000+ reviews throughout the region on 650 species. Although models were reviewed and modified based on information from taxa experts, any errors in modeling remain the responsibility of SWReGAP. Habitat modelers made final judgments regarding model attributes.

*Logical\_Consistency\_Report:* Not applicable for raster data

*Completeness\_Report:*

Distributions of 37 amphibians, 132 reptiles, 436 birds and 215 mammals were predicted by 8-digit HUC using a variety of sources. All cells within the Southwest regional boundary (AZ, CO, NV, NM and UT) have an attributed CODE. See Process\_Description for more details.

*Lineage:*

*Process\_Step:*

*Process\_Description:*

Habitat models were completed using a gmd file included within the downloaded zip file. For a full description of the procedures involved in constructing this database please refer to the SWReGAP Final Report chapter on "Predicted Animal Distributions and Species Richness" at the URL:

<http://www.gap.uidaho.edu/>

*Process\_Date:* 20050930

*Process\_Contact:*

*Contact\_Information:*

*Contact\_Organization\_Primary:*

*Contact\_Organization:* New Mexico Cooperative Fish and Wildlife Research Unit

*Contact\_Person:* Ken Boykin

*Contact\_Position:* Research Specialist

*Contact\_Address:*

*Address\_Type:* mailing and physical address

*City:* Las Cruces

*State\_or\_Province:* New Mexico

*Postal\_Code:* 88003

*Country:* USA

*Contact\_Voice\_Telephone:* 505-646-6303

*Contact\_Facsimile\_Telephone:* 505-646-1281

*Contact\_Electronic\_Mail\_Address:* kboykin@nmsu.edu

*Process\_Step:*

*Process\_Description:* Metadata imported.

*Source\_Used\_Citation\_Abbreviation:* C:\swregap.xml

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*Direct\_Spatial\_Reference\_Method:* Raster

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*Raster\_Object\_Type:* Pixel

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*Vertical\_Count:* 1

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*Map\_Projection:*

*Map\_Projection\_Name:* Albers Conical Equal Area

*Albers\_Conical\_Equal\_Area:*

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*Standard\_Parallel:* 45.500000

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*Latitude\_of\_Projection\_Origin:* 23.000000

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*False\_Northing:* 0.000000

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*Planar\_Coordinate\_Encoding\_Method:* row and column

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*Ordinate\_Resolution:* 30.000000

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*Ellipsoid\_Name:* Geodetic Reference System 80  
*Semi-major\_Axis:* 6378137.000000  
*Denominator\_of\_Flattening\_Ratio:* 298.257222

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*Attribute\_Definition:* Internal feature number.  
*Attribute\_Definition\_Source:* ESRI  
*Attribute\_Domain\_Values:*  
*Unrepresentable\_Domain:*  
 Sequential unique whole numbers that are automatically generated.  
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*Enumerated\_Domain:*  
*Enumerated\_Domain\_Value:* K24

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*Enumerated\_Domain\_Value\_Definition:* Known or probable occurrence, breeding, wintering and summering

*Enumerated\_Domain:*

*Enumerated\_Domain\_Value:* K33

*Enumerated\_Domain\_Value\_Definition:*

Known or probable occurrence, both breeding and non-breeding, summering

*Enumerated\_Domain:*

*Enumerated\_Domain\_Value:* K34

*Enumerated\_Domain\_Value\_Definition:*

Known or probable occurrence, both breeding and non-breeding, winter and summer

*Enumerated\_Domain:*

*Enumerated\_Domain\_Value:* P34

*Enumerated\_Domain\_Value\_Definition:*

Potential occurrence, both breeding and non-breeding, winter and summer

*Enumerated\_Domain:*

*Enumerated\_Domain\_Value:* X34

*Enumerated\_Domain\_Value\_Definition:* Extirpated, both breeding and non-breeding, winter and summer

*Attribute\_Measurement\_Frequency:* None planned

*Overview\_Description:*

*Entity\_and\_Attribute\_Detail\_Citation:* The following fields are present in the dataset

*Distribution\_Information:*

*Distributor:*

*Contact\_Information:*

*Contact\_Organization\_Primary:*

*Contact\_Organization:* New Mexico Cooperative Fish and Wildlife Research Unit

*Contact\_Person:* Ken Boykin

*Contact\_Address:*

*Address\_Type:* mailing and physical address

*Address:* 2980 South Espina

*City:* Las Cruces

*State\_or\_Province:* New Mexico

*Postal\_Code:* 88003

*Country:* USA

*Contact\_Voice\_Telephone:* 505-646-6303

*Contact\_Facsimile\_Telephone:* 505-646-1281

*Contact\_Electronic\_Mail\_Address:* kboykin@nmsu.edu

*Hours\_of\_Service:* 8:00am-5:00pm Mountain Time Zone

*Resource\_Description:* SWReGAP Vertebrate Habitat Distribution Models Digital Dataset

*Distribution\_Liability:*

The digital data described by this metadata report were prepared by the Southwest Regional Gap Analysis Project. Neither the States involved nor any agency thereof, nor any of their employees, make any warranty, for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed in this report or media or represent that its use would not infringe privately owned rights. Reference therein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the States. Any views and opinions of authors expressed herein do not necessarily state or reflect those of the States involved. Data on this media may have been derived from federal agencies or from other external sources or from data developed by the agencies involved. In those cases where data has been translated from one format to another or initially developed from map or other sources the agencies involved has made all reasonable efforts to preserve the data quality as originally developed, however no warranty, expressed or implied, is made by the agencies involved as to the completeness or accuracy of the data and related materials. The act of distribution does not constitute any such warranty, and no responsibility is assumed by the agencies involved in the use of this data, or related materials.

*Standard\_Order\_Process:*

*Digital\_Form:*

*Digital\_Transfer\_Information:**Format\_Name:*

"ERDAS" ERDAS image files (ERDAS Corporation) or ArcInfo GRID format (ESRI)

*Format\_Version\_Number:* 8.7*File-Decompression\_Technique:* Compression type \*.zip. For windows use WinZip.*Transfer\_Size:* 0.000*Fees:* None

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*Metadata\_Reference\_Information:**Metadata\_Date:* 20051003*Metadata\_Contact:**Contact\_Information:**Contact\_Organization\_Primary:**Contact\_Organization:* New Mexico Cooperative Fish and Wildlife Research Unit*Contact\_Person:* Ken Boykin*Contact\_Address:**Address\_Type:* mailing and physical address*Address:* 2980 South Espina Street*City:* Las Cruces*State\_or\_Province:* New Mexico*Postal\_Code:* 88003*Country:* USA*Contact\_Voice\_Telephone:* 505-646-6303*Contact\_Facsimile\_Telephone:* 505-646-1281*Contact\_Electronic\_Mail\_Address:* kboykin@nmsu.edu*Metadata\_Standard\_Name:* FGDC Content Standards for Digital Geospatial Metadata*Metadata\_Standard\_Version:* FGDC-STD-001-1998*Metadata\_Time\_Convention:* local time*Metadata\_Security\_Information:**Metadata\_Security\_Classification:* Unclassified*Metadata\_Extensions:**Online\_Linkage:* <<http://fws-nmcfwru.nmsu.edu/swregap/>>*Profile\_Name:* NPS NR and GIS Metadata Profile*Metadata\_Extensions:**Online\_Linkage:* <<http://www.esri.com/metadata/esriprof80.html>>*Profile\_Name:* ESRI Metadata Profile

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Generated by [mp](#) version 2.8.6 on Fri Oct 21 08:36:47 2005

## **Appendix 3-10. Database Description**

[http://fws-nmcfwru.nmsu.edu/swregap/report/Appendix\\_HM-10.pdf](http://fws-nmcfwru.nmsu.edu/swregap/report/Appendix_HM-10.pdf)

### Appendix 3-11. Species Richness by Land Cover Type

Species richness for each each land cover type mapped in Southwest Regional Gap Analysis Project by taxon group. Species richness is biased toward the high side, as habitat selection could identify broad categories (e.g. grasslands) with the idea that use of HUCs would constrain habitat models to grasslands within the known range. A = Amphibians, B = Birds, M = Mammals, R = Reptiles.

| Code | Land Cover Description                                | A | B   | M  | R  | Total |
|------|---|---|-----|----|----|-------|
| D01  | Disturbed, NON-SPECIFIC                               |   | 19  | 4  |    | 23    |
| D02  | Recently Burned                                       |   | 8   | 5  |    | 13    |
| D03  | Recently mined or quarried                            |   | 3   | 2  | 1  | 6     |
| D04  | Invasive Southwest Riparian Woodland and Shrubland    | 4 | 45  | 24 | 3  | 76    |
| D06  | Invasive Perennial Grassland                          | 1 | 24  | 8  | 1  | 34    |
| D07  | Invasive Perennial Forbland                           |   | 11  | 2  |    | 13    |
| D08  | Invasive Annual Grassland                             | 1 | 21  | 8  |    | 30    |
| D09  | Invasive Annual and Biennial Forbland                 |   | 10  | 3  | 1  | 14    |
| D10  | Recently Logged Areas                                 |   | 11  | 7  | 1  | 19    |
| D11  | Recently Chained Pinyon-Juniper Areas                 | 1 | 12  | 8  | 5  | 26    |
| D14  | Disturbed, oil well                                   |   | 1   | 2  | 1  | 4     |
| N11  | Open water  | 7 | 125 | 13 | 11 | 156   |
| N21  | Developed, Low Intensity                              |   | 118 | 37 | 8  | 163   |
| N22  | Developed, Medium - High Intensity                    |   | 57  | 18 | 2  | 77    |
| N31  | Barren Lands  |   | 3   | 13 | 3  | 19    |
| N80  | Agriculture   | 2 | 165 | 49 | 12 | 228   |
| S001 | North American Alpine Ice Field                       |   | 3   | 1  |    | 4     |
| S002 | Rocky Mountain Alpine Bedrock and Scree               | 1 | 7   | 11 |    | 19    |
| S003 | Mediterranean California Alpine Bedrock and Scree     |   | 3   | 3  | 1  | 7     |
| S004 | Rocky Mountain Alpine Fell-Field                      | 1 | 7   | 12 | 6  | 26    |
| S006 | Rocky Mountain Cliff and Canyon                       | 2 | 82  | 61 | 24 | 169   |
| S007 | Sierra Nevada Cliff and Canyon                        |   | 20  | 13 | 5  | 38    |
| S008 | Western Great Plains Cliff and Outcrop                | 1 | 22  | 18 | 16 | 57    |
| S009 | Inter-Mountain Basins Cliff and Canyon                | 3 | 63  | 40 | 36 | 142   |
| S010 | Colorado Plateau Mixed Bedrock Canyon and Tableland   | 3 | 71  | 46 | 44 | 164   |
| S011 | Inter-Mountain Basins Shale Badland                   |   | 9   | 10 | 11 | 30    |
| S012 | Inter-Mountain Basins Active and Stabilized Dunes     | 1 | 15  | 33 | 16 | 65    |
| S013 | Inter-Mountain Basins Volcanic Rock and Cinder Land   | 2 | 22  | 52 | 29 | 105   |
| S014 | Inter-Mountain Basins Wash                            | 3 | 18  | 41 | 14 | 76    |
| S015 | Inter-Mountain Basins Playa                           | 2 | 29  | 40 | 13 | 84    |
| S016 | North American Warm Desert Bedrock Cliff and Outcrop  | 3 | 34  | 50 | 43 | 130   |
| S017 | North American Warm Desert Badland                    |   | 4   | 6  | 8  | 18    |
| S018 | North American Warm Desert Active and Stabilized Dune | 2 | 17  | 33 | 26 | 78    |
| S019 | North American Warm Desert Volcanic Rockland          |   | 10  | 18 | 13 | 41    |
| S020 | North American Warm Desert Wash                       | 4 | 60  | 56 | 22 | 142   |
| S021 | North American Warm Desert Pavement                   |   | 8   | 6  | 9  | 23    |
| S022 | North American Warm Desert Playa                      | 4 | 19  | 16 | 11 | 50    |

| Code | Land Cover Description  | A | B   | M  | R  | Total |
|------|---|---|-----|----|----|-------|
| S023 | Rocky Mountain Aspen Forest and Woodland                              | 3 | 79  | 55 | 13 | 150   |
| S024 | Rocky Mountain Bigtooth Maple Ravine Woodland                         | 2 | 50  | 52 | 11 | 115   |
| S025 | Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland     | 1 | 39  | 57 | 7  | 104   |
| S026 | Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland      | 2 | 42  | 64 | 10 | 118   |
| S028 | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland     | 4 | 54  | 57 | 10 | 125   |
| S029 | Northern Pacific Mesic Subalpine Woodland                             | 1 | 17  | 17 | 4  | 39    |
| S030 | Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland         | 5 | 63  | 61 | 9  | 138   |
| S031 | Rocky Mountain Lodgepole Pine Forest                                  | 2 | 49  | 29 | 6  | 86    |
| S032 | Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland    | 5 | 102 | 90 | 17 | 214   |
| S033 | Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland  | 1 | 34  | 23 | 5  | 63    |
| S034 | Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland        | 5 | 95  | 81 | 19 | 200   |
| S035 | Madrean Pine-Oak Forest and Woodland                                  | 4 | 148 | 94 | 61 | 307   |
| S036 | Rocky Mountain Ponderosa Pine Woodland                                | 3 | 101 | 95 | 30 | 229   |
| S038 | Southern Rocky Mountain Pinyon-Juniper Woodland                       | 3 | 107 | 90 | 53 | 253   |
| S039 | Colorado Plateau Pinyon-Juniper Woodland                              | 4 | 100 | 87 | 53 | 244   |
| S040 | Great Basin Pinyon-Juniper Woodland                                   | 4 | 100 | 59 | 47 | 210   |
| S042 | Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland Complex | 2 | 81  | 51 | 10 | 144   |
| S043 | Rocky Mountain Alpine Dwarf-Shrubland                                 |   | 20  | 14 | 1  | 35    |
| S045 | Inter-Mountain Basins Mat Saltbush Shrubland                          | 2 | 15  | 22 | 11 | 50    |
| S046 | Rocky Mountain Gambel Oak-Mixed Montane Shrubland                     | 3 | 96  | 66 | 24 | 189   |
| S047 | Rocky Mountain Lower Montane-Foothill Shrubland                       | 2 | 49  | 41 | 13 | 105   |
| S048 | Western Great Plains Sandhill Shrubland                               | 3 | 36  | 53 | 26 | 118   |
| S050 | Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland        | 2 | 30  | 31 | 13 | 76    |
| S051 | Madrean Encinal   | 2 | 89  | 81 | 48 | 220   |
| S052 | Colorado Plateau Pinyon-Juniper Shrubland                             | 4 | 101 | 71 | 41 | 217   |
| S053 | Great Basin Semi-Desert Chaparral                                     | 1 | 54  | 25 | 17 | 97    |
| S054 | Inter-Mountain Basins Big Sagebrush Shrubland                         | 3 | 70  | 79 | 23 | 175   |
| S055 | Great Basin Xeric Mixed Sagebrush Shrubland                           | 3 | 57  | 48 | 18 | 126   |
| S056 | Colorado Plateau Mixed Low Sagebrush Shrubland                        | 3 | 48  | 46 | 13 | 110   |
| S057 | Mogollon Chaparral  | 1 | 66  | 67 | 25 | 159   |
| S058 | Apacherian-Chihuahuan Mesquite Upland Scrub                           | 7 | 96  | 74 | 62 | 239   |
| S059 | Colorado Plateau Blackbrush-Mormon Tea Shrubland                      | 1 | 30  | 61 | 25 | 117   |
| S060 | Mojave Mid-Elevation Mixed Desert Scrub                               | 3 | 56  | 45 | 28 | 132   |
| S061 | Chihuahuan Succulent Desert Scrub                                     | 6 | 46  | 69 | 39 | 160   |
| S062 | Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub                 | 9 | 65  | 90 | 42 | 206   |
| S063 | Sonoran Paloverde-Mixed Cacti Desert Scrub                            | 3 | 64  | 68 | 49 | 184   |
| S065 | Inter-Mountain Basins Mixed Salt Desert Scrub                         | 3 | 44  | 76 | 16 | 139   |
| S068 | Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub                | 5 | 17  | 30 | 17 | 69    |
| S069 | Sonora-Mojave Creosotebush-White Bursage Desert Scrub                 | 7 | 48  | 74 | 47 | 176   |
| S070 | Sonora-Mojave Desert Mixed Salt Desert Scrub                          | 3 | 41  | 28 | 12 | 84    |
| S071 | Inter-Mountain Basins Montane Sagebrush Steppe                        | 4 | 61  | 70 | 17 | 152   |



| Code | Land Cover Description   | A  | B   | M   | R  | Total |
|------|--|----|-----|-----|----|-------|
| S074 | Southern Rocky Mountain Juniper Woodland and Savanna                     | 4  | 80  | 72  | 46 | 202   |
| S075 | Inter-Mountain Basins Juniper Savanna                                    | 3  | 72  | 64  | 45 | 184   |
| S077 | Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe          | 8  | 106 | 100 | 69 | 283   |
| S078 | Inter-Mountain Basins Big Sagebrush Steppe                               | 1  | 53  | 52  | 12 | 118   |
| S079 | Inter-Mountain Basins Semi-Desert Shrub Steppe                           | 3  | 74  | 104 | 27 | 208   |
| S080 | Chihuahuan Gypsophilous Grassland and Steppe                             | 5  | 52  | 62  | 21 | 140   |
| S081 | Rocky Mountain Dry Tundra  | 1  | 18  | 29  | 2  | 50    |
| S083 | Rocky Mountain Subalpine Mesic Meadow                                    | 2  | 28  | 32  | 8  | 70    |
| S085 | Southern Rocky Mountain Montane-Subalpine Grassland                      | 3  | 61  | 52  | 11 | 127   |
| S086 | Western Great Plains Foothill and Piedmont Grassland                     | 6  | 79  | 49  | 25 | 159   |
| S087 | Central Mixedgrass Prairie   | 3  | 88  | 49  | 22 | 162   |
| S088 | Western Great Plains Shortgrass Prairie                                  | 9  | 87  | 74  | 44 | 214   |
| S089 | Western Great Plains Sandhill Prairie                                    | 3  | 46  | 51  | 23 | 123   |
| S090 | Inter-Mountain Basins Semi-Desert Grassland                              | 7  | 84  | 96  | 43 | 230   |
| S091 | Rocky Mountain Subalpine-Montane Riparian Shrubland                      | 7  | 89  | 47  | 13 | 156   |
| S092 | Rocky Mountain Subalpine-Montane Riparian Woodland                       | 6  | 117 | 85  | 16 | 224   |
| S093 | Rocky Mountain Lower Montane Riparian Woodland and Shrubland             | 10 | 219 | 96  | 36 | 361   |
| S094 | North American Warm Desert Lower Montane Riparian Woodland and Shrubland | 8  | 206 | 74  | 46 | 334   |
| S095 | Western Great Plains Riparian Woodland and Shrubland                     | 6  | 147 | 45  | 25 | 223   |
| S096 | Inter-Mountain Basins Greasewood Flat                                    | 3  | 46  | 61  | 13 | 123   |
| S097 | North American Warm Desert Riparian Woodland and Shrubland               | 7  | 228 | 74  | 58 | 367   |
| S098 | North American Warm Desert Riparian Mesquite Bosque                      | 11 | 143 | 56  | 48 | 258   |
| S100 | North American Arid West Emergent Marsh                                  | 11 | 168 | 50  | 13 | 242   |
| S102 | Rocky Mountain Alpine-Montane Wet Meadow                                 | 5  | 108 | 45  | 16 | 174   |
| S103 | Temperate Pacific Montane Wet Meadow                                     | 1  | 29  | 11  | 4  | 45    |
| S105 | Mediterranean California Subalpine-Montane Fen                           | 1  | 14  | 4   | 2  | 21    |
| S108 | Western Great Plains Saline Depression Wetland                           | 3  | 47  | 6   | 3  | 59    |
| S109 | Chihuahuan-Sonoran Desert Bottomland and Swale Grassland                 | 7  | 61  | 66  | 32 | 166   |
| S111 | Madrean Upper Montane Conifer-Oak Forest and Woodland                    | 4  | 91  | 70  | 18 | 183   |
| S112 | Madrean Pinyon-Juniper Woodland  | 4  | 122 | 89  | 61 | 276   |
| S113 | Chihuahuan Sandy Plains Semi-Desert Grassland                            | 4  | 50  | 55  | 14 | 123   |
| S114 | Sonora-Mojave-Baja Semi-Desert Chaparral                                 | 1  | 40  | 20  | 15 | 76    |
| S115 | Madrean Juniper Savanna  | 2  | 70  | 74  | 57 | 203   |
| S116 | Chihuahuan Mixed Salt Desert Scrub                                       | 2  | 40  | 58  | 33 | 133   |
| S117 | Coahuilan Chaparral  |    | 26  | 15  | 11 | 52    |
| S118 | Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland   | 7  | 161 | 49  | 18 | 235   |
| S120 | Western Great Plains Floodplain Herbaceous Wetland                       | 8  | 170 | 70  | 27 | 275   |
| S121 | Mediterranean California Red Fir Forest and Woodland                     |    | 27  | 23  | 3  | 53    |
| S122 | Sierra Nevada Subalpine Lodgepole Pine Forest and Woodland               |    | 28  | 21  | 1  | 50    |
| S123 | Mediterranean California Ponderosa-Jeffrey Pine Forest and Woodland      |    | 29  | 24  | 3  | 56    |
| S125 | Rocky Mountain Foothill Limber Pine-Juniper Woodland                     | 2  | 72  | 63  | 31 | 168   |
| S128 | Wyoming Basins Low Sagebrush Shrubland                                   | 1  | 18  | 25  | 7  | 51    |
| S129 | Sonoran Mid-Elevation Desert Scrub                                       | 2  | 41  | 44  | 26 | 113   |

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| Code | Land Cover Description                               | A | B  | M  | R  | Total |
|------|--|---|----|----|----|-------|
| S132 | Western Great Plains Tallgrass Prairie               | 2 | 46 | 42 | 18 | 108   |
| S134 | North Pacific Montane Grassland                      | 2 | 17 | 12 | 2  | 33    |
| S136 | Southern Colorado Plateau Sand Shrubland             | 2 | 14 | 20 | 8  | 44    |
| S138 | Western Great Plains Mesquite Woodland and Shrubland | 2 | 12 | 14 | 8  | 36    |

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## Appendix 4-1. Management coding system for land stewardship.

|             |                     |  |      | <b>Land Management Descriptor</b>                     |
|-------------|---------------------|--|------|---|
| <b>1000</b> | <b>Federal Land</b> |  |      |   |
|             | <b>1100</b>         | <b>Bureau of Land Management (BLM)</b> |      |   |
|             |                     |  | 1101 | Area of Critical Environmental Concern (BLM)          |
|             |                     |  | 1102 | Globally Important Bird Area (BLM)                    |
|             |                     |  | 1103 | National Conservation Area (BLM)                      |
|             |                     |  | 1104 | National Monument (BLM)                               |
|             |                     |  | 1105 | National Natural or Historic Landmark (BLM)           |
|             |                     |  | 1106 | National Outstanding Natural Area (BLM)               |
|             |                     |  | 1107 | National Recreation Area (BLM)                        |
|             |                     |  | 1108 | National Scenic Research Area (BLM)                   |
|             |                     |  | 1109 | Research Natural Area (BLM)                           |
|             |                     |  | 1110 | Significant Cave & Cave System (BLM)                  |
|             |                     |  | 1111 | Wild, Scenic & Recreation River (BLM)                 |
|             |                     |  | 1112 | Wilderness Area (BLM)                                 |
|             |                     |  | 1113 | Wilderness Study Area (BLM)                           |
|             |                     |  | 1114 | World Heritage & Biosphere Site (BLM)                 |
|             |                     |  | 1189 | Special Management Area (BLM)                         |
|             |                     |  | 1190 | Bureau of Land Management Public Land (BLM)           |
|             |                     |  | 1193 | Botanical Reserve (BLM)                               |
|             |                     |  | 1194 | Archaeological Area (BLM)                             |
|             |                     |  | 1195 | Wildlife Habitat Area (BLM)                           |
|             |                     |  | 1196 | Special or Extensive Recreation Management Area (BLM) |
|             |                     |  | 1197 | Historical Area (BLM)                                 |
|             |                     |  | 1198 | Fossil Area (BLM)                                     |
|             |                     |  | 1199 | Scenic Area (BLM)                                     |
|             | <b>1200</b>         | <b>Bureau of Reclamation (BOR)</b>     |      |   |
|             |                     |  | 1201 | National Recreation Area (BOR)                        |
|             |                     |  | 1202 | Wildlife/Recreation Management Area (BOR)             |
|             |                     |  | 1290 | Other Bureau of Reclamation Land (BOR)                |
|             | <b>1300</b>         | <b>Fish and Wildlife Service (FWS)</b> |      |   |
|             |                     |  | 1301 | National Wildlife Refuge (FWS)                        |
|             |                     |  | 1302 | Waterfowl Production Area (FWS)                       |
|             |                     |  | 1303 | Wilderness Area (FWS)                                 |
|             |                     |  | 1304 | Conservation Easement (FWS)                           |
|             |                     |  | 1391 | Research Natural Area (FWS)                           |
|             |                     |  | 1392 | Wildlife Management Area (FWS)                        |
|             |                     |  | 1393 | Federal Fish Hatchery (FWS)                           |
|             |                     |  | 1394 | National Wildlife Refuge Overlay (FWS/DOD)            |

## Appendix 4-1. Management coding system for land stewardship (continued).

|             |   |      |  |
|-------------|---|------|--|
| <b>1400</b> | <b>Forest Service (USFS)</b>                                      |      |  |
|             |   | 1401 | Archaeological Area (USFS)                         |
|             |   | 1402 | Botanical Reserve (USFS)                           |
|             |   | 1403 | Geological Area (USFS)                             |
|             |   | 1404 | Municipal Watershed (USFS)                         |
|             |   | 1405 | National Game Refuge (USFS)                        |
|             |   | 1406 | National Monument (USFS)                           |
|             |   | 1407 | National Primitive Area (USFS)                     |
|             |   | 1408 | National Recreation Area (USFS)                    |
|             |   | 1409 | National Scenic Research Area (USFS)               |
|             |   | 1410 | Research Natural Area (USFS)                       |
|             |   | 1411 | Wild, Scenic & Recreation River (USFS)             |
|             |   | 1412 | Wilderness Area (USFS)                             |
|             |   | 1413 | Wilderness Study Area (USFS)                       |
|             |   | 1487 | National Preserve (USFS)                           |
|             |   | 1488 | Demonstration Area (USFS)                          |
|             |   | 1489 | Environmental Study Area (USFS)                    |
|             |   | 1490 | Forest Service Public Land (USFS)                  |
|             |   | 1491 | National Natural or Historic Landmark (USFS)       |
|             |   | 1492 | Historical Area (USFS)                             |
|             |   | 1493 | Habitat Protection Area (USFS)                     |
|             |   | 1494 | Biosphere Reserve (USFS)                           |
|             |   | 1495 | Experimental Forest (USFS)                         |
|             |   | 1496 | National Grassland (USFS)                          |
|             |   | 1497 | Scenic Area (USFS)                                 |
|             |   | 1498 | Other Congressionally Designated Area (USFS)       |
|             |   | 1499 | Zoological Area (USFS)                             |
| <b>1500</b> | <b>Department of Defense (DOD) and Department of Energy (DOE)</b> |      |  |
|             |   | 1501 | Ecological Reserve (DOD)                           |
|             |   | 1503 | Special Resources Area/Research Natural Area (DOD) |
|             |   | 1550 | Army Corps of Engineers (ACE)                      |
|             |   | 1560 | Department of Energy (DOE)                         |
|             |   | 1590 | Military Reservation (DOD)                         |
| <b>1600</b> | <b>National Park Service (NPS)</b>                                |      |  |
|             |   | 1601 | International Historic Site (NPS)                  |
|             |   | 1602 | National Battlefield (NPS)                         |
|             |   | 1603 | National Battlefield Park (NPS)                    |
|             |   | 1604 | National Battlefield Site (NPS)                    |
|             |   | 1605 | National Historical Park (NPS)                     |
|             |   | 1606 | National Historic Site (NPS)                       |

## Appendix 4-1. Management coding system for land stewardship (continued).

|             |   |  |      |   |
|-------------|---|--|------|---|
|             |   |  | 1607 | National Lakeshore (NPS)  |
|             |   |  | 1608 | National Memorial (NPS)   |
|             |   |  | 1609 | National Military Park (NPS)                                      |
|             |   |  | 1610 | National Monument (NPS)   |
|             |   |  | 1611 | National Park (NPS)   |
|             |   |  | 1612 | National Preserve (NPS)   |
|             |   |  | 1613 | National Recreation Area (NPS)                                    |
|             |   |  | 1614 | National Reserve (NPS)  |
|             |   |  | 1615 | National River & Wild & Scenic Riverway (NPS)                     |
|             |   |  | 1616 | National Seashore (NPS)   |
|             |   |  | 1617 | Wilderness Area (NPS)   |
|             |   |  | 1618 | National Cemetery (NPS)   |
|             |   |  | 1619 | National Parkway (NPS)  |
|             |   |  | 1620 | Other NPS Protected Areas (NPS)                                   |
|             |   |  | 1621 | NPS Affiliated Areas (NPS)  |
|             |   |  | 1690 | National Trail (NPS)  |
|             |   |  | 1691 | Research Natural Area (NPS)                                       |
|             |   |  | 1692 | Cave Protection Area (NPS) (Only one 04/06/06)                    |
| <b>1700</b> | <b>Natural Resources Conservation Service (NRCS)</b>          |  |      |   |
|             |   |  | 1701 | Conservation Easement (NRCS)                                      |
|             |   |  | 1702 | Conservation Reserve Program Land (NRCS)                          |
|             |   |  | 1703 | Wetland Reserve Program Land (NRCS)                               |
|             |   |  | 1704 | Wildlife Habitat Incentive Program Land (NRCS)                    |
| <b>1750</b> | <b>Agricultural Research Service (ARS)</b>                    |  |      |   |
|             |   |  | 1751 | Experimental Range (ARS)  |
| <b>1800</b> | <b>Bureau of Indian Affairs (BIA)</b>                         |  |      |   |
|             |   |  | 1801 | Wildlife Reserve (BIA)  |
| <b>1900</b> | <b>National Oceanic and Atmospheric Administration (NOAA)</b> |  |      |   |
|             |   |  | 1901 | National Estuarine Research Reserve (NOAA)                        |
| <b>1950</b> | <b>Department of Commerce (DOC)</b>                           |  |      |   |
|             |   |  | 1951 | National Telecommunications and Information Administration (NTIA) |
| <b>2000</b> | <b>Tribal Land</b>  |  |      |   |
| <b>2200</b> | <b>Tribal Land</b>  |  |      |   |
|             |   |  | 2201 | Native American Reservation                                       |
|             |   |  | 2202 | Tribal Park   |
|             |   |  | 2203 | Indian Allotment  |

## Appendix 4-1. Management coding system for land stewardship (continued).

|             |                                 |  |  |
|-------------|---------------------------------|--|--|
| <b>3000</b> | <i>State Land</i>               |  |  |
|             | <b>3100</b>                     | <b>State Park &amp; Recreation Areas</b> |  |
|             |                                 | 3101                                     | State Park                             |
|             |                                 | 3102                                     | State Recreation Area                  |
|             |                                 | 3103                                     | State Historical Park                  |
|             |                                 | 3104                                     | State Historic Site                    |
|             |                                 | 3105                                     | State Natural Area                     |
|             |                                 | 3106                                     | State Resort Park                      |
|             | <b>3200</b>                     | <b>State Land Board</b>                  |  |
|             |                                 | 3201                                     | State Trust Land                       |
|             |                                 | 3202                                     | State Stewardship Trust Land           |
|             | <b>3300</b>                     | <b>State Wildlife Reserve</b>            |  |
|             |                                 | 3301                                     | State Wildlife Reserve                 |
|             |                                 | 3302                                     | State Habitat Area                     |
|             |                                 | 3303                                     | State Fishing Unit                     |
|             |                                 | 3304                                     | State Wildlife Recreation Area         |
|             |                                 | 3305                                     | State Wildlife Administration Building |
|             |                                 | 3306                                     | State Fish Hatchery                    |
|             | <b>3400</b>                     | <b>Other State Land</b>                  |  |
|             |                                 | 3401                                     | Other State Land                       |
|             |                                 | 3402                                     | State Sovereign Land                   |
| <b>4000</b> | <i>Regional Government Land</i> |  |  |
|             | <b>4100</b>                     | <b>Regional Government Land</b>          |  |
|             |                                 | 4190                                     | Regional Park                          |
|             |                                 | 4191                                     | Regional Open Space                    |
| <b>5000</b> | <i>Local Government Land</i>    |  |  |
|             | <b>5100</b>                     | <b>City Land</b>                         |  |
|             |                                 | 5190                                     | City Park                              |
|             |                                 | 5191                                     | City Open Space                        |
|             |                                 | 5192                                     | City Facility                          |
|             | <b>5200</b>                     | <b>County Land</b>                       |  |
|             |                                 | 5290                                     | County Facility                        |
|             |                                 | 5291                                     | County Park                            |
|             |                                 | 5292                                     | County Playground                      |
|             |                                 | 5293                                     | County Open Space                      |
|             |                                 | 5294                                     | County Conservation Easement           |

## Appendix 4-1. Management coding system for land stewardship (continued).

|             |   |  |  |
|-------------|---|--|--|
| <b>6000</b> | <i>Non-Governmental Organization Land</i> |  |  |
|             | <b>6100</b>                               | <b>Audubon Society</b>   |  |
|             |   |  | 6101 Audubon Society Preserve                                    |
|             | <b>6200</b>                               | <b>Local Land Trust Preserve/Easement</b>                          |  |
|             |   |  | 6201 Local Land Trust Preserve/Easement                          |
|             | <b>6300</b>                               | <b>The Nature Conservancy (TNC)</b>                                |  |
|             |   |  | 6301 Nature Conservancy Easement (TNC)                           |
|             |   |  | 6302 Nature Conservancy Preserve (TNC)                           |
|             |   |  | 6303 Nature Conservancy Cooperative Managed Property (TNC)       |
| <b>7000</b> | <i>Private Land</i>                       |  |  |
|             | <b>7100</b>                               | <b>Private Conservation Easement/Conservation Deed Restriction</b> |  |
|             |   |  | 7101 Private Conservation Easement/Conservation Deed Restriction |
|             | <b>7200</b>                               | <b>Private Institution-Managed for Biodiversity</b>                |  |
|             |   |  | 7201 Private Institution - Managed for Biodiversity              |
|             | <b>7300</b>                               | <b>Private Unrestricted for Development/No Known Restriction</b>   |  |
|             |   |  | 7301 Private Land - No Known Restriction                         |
| <b>8000</b> | <i>Water</i>                              |  |  |
|             | <b>8100</b>                               | <b>Water</b>   |  |
|             |   |  | 8101 Water   |
| <b>9000</b> | <i>Unknown</i>                            |  |  |
|             | <b>9100</b>                               | <b>Unknown</b>   |  |

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**Appendix 4-2. Standardized questionnaire used to interview land managers to guide determination of biodiversity management state codes.**

**GAP STATUS QUESTIONNAIRE**

Date: \_\_\_\_\_

Agency: \_\_\_\_\_

Parcel Name: \_\_\_\_\_

Approximate Size of Parcel: \_\_\_\_\_

Contact Name: \_\_\_\_\_

Contact Position: \_\_\_\_\_

Phone Number: \_\_\_\_\_

What is the primary management objective for this land tract? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

Does this land tract have a written agency or institutional documentation that guides the management of the land, (i.e. management plan)? \_\_\_\_\_

\_\_\_\_\_

Is the land tract subject to forcible protection from land conversion through legislation, deed restrictions, or easements? \_\_\_\_\_

\_\_\_\_\_

If so, is this protection intended for permanent status? How long does it last? \_\_\_\_\_

\_\_\_\_\_

Is this area open to visitor use?: \_\_\_\_\_

\_\_\_\_\_



What types of activities do the visitors participate in? \_\_\_\_\_

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To what extent of the area is impacted by visitor use? \_\_\_\_\_

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What are the general guiding principles for natural resource management? \_\_\_\_\_

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Are natural processes, such as fire, flooding or affects from insects, suppressed or allowed through active management? \_\_\_\_\_

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Are activities such as livestock grazing, mineral extraction, or harvesting/cultivation allowed on this land tract at any time? \_\_\_\_\_

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Other comments: \_\_\_\_\_

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### Appendix 4-3. Documentation of Status 2 lands in Arizona.

| Land Steward              | Name of Status 2 Area in Arizona  | Source of Management Plan   |
|---------------------------|---|---|
| Bureau of Land Management | <p><i>111 Ranch ACEC/RNA; Bear Springs Badlands ACEC; Bowie Mountains Scenic ACEC; Dos Cabezas Peaks ACEC; Eagle Creek Bat Cave ACEC; Guadalupe Canyon ACEC/ONA; San Rafael ACEC/RNA; St. David Cienega ACEC/RNA; Table Mountain ACEC/RNA; Turkey Creek Riparian ACEC; Willcox Playa ACEC/NNL; Dos Cabezas Mountains Wilderness; Fishhooks Wilderness; North Santa Teresa Wilderness; Redfield Canyon Wilderness</i></p>  | <p>Final Safford District Resource Management Plan and Environmental Impact Statement 08/1991</p>   |
| Bureau of Land Management | <p><i>Aubrey Peak Bighorn Sheep Habitat ACEC; Black Mountains ACEC; Burro Creek Riparian and Cultural ACEC; Carrow-Stephens Ranches ACEC; Hualapai Mountain ACEC/RNA; Joshua Tree Forest-Grand Wash Cliffs ACEC; McCracken Desert Tortoise Habitat ACEC; Poachie Desert Tortoise Habitat ACEC; Three Rivers Riparian ACEC; White-Margined Penstemon Reserve ACEC; Wright-Cottonwood Creeks Riparian-Cultural ACEC; Arrastra Mountain Wilderness; Aubrey Peak Wilderness; Mount Nutt Wilderness; Mount Tipton Wilderness; Mount Wilson Wilderness; Tres Alamos Wilderness; Upper Burro Creek Wilderness; Wabayuma Peak Wilderness; Mount Nutt Wilderness; Mount Wilson Wilderness; Tres Alamos Wilderness; Upper Burro Creek Wilderness; Warm Springs Wilderness</i></p> | <p>Record of Decision for the Approval of the Kingman Resource Area Resource Management Plan 03/1995; Kingman Resource Area Resource Management Plan and Final Environmental Impact Statement 01/1992</p> |
| Bureau of Land Management | <p><i>Coffeepot Botanical ACEC; Gila River Cultural ACEC; Vekol Valley Grassland ACEC</i></p>   | <p>Final Lower Gila South Resource Management Plan and Environmental Impact Statement Phoenix District, Arizona 08/1995</p>   |

| <b>Land Steward</b>       | <b>Name of Status 2 Area in Arizona</b>   | <b>Source of Management Plan</b>   |
|---------------------------|---|--|
| Bureau of Land Management | <i>Fort Pierce ACEC; Johnson Spring ACEC; Little Black Mountain ACEC; Lost Spring Mountain ACEC; Marble Canyon ACEC; Moonshine Ridge ACEC; Nampawear ACEC; Pakoona ACEC; Virgin River Corridor ACEC; Virgin Slope ACEC; Witch Pool ACEC; White-Margined Penstemon Reserve ACEC; Wright-Cottonwood Creeks Riparian-Cultural ACEC; Grand Wash Cliffs Wilderness; Kanab Creek Wilderness</i>   | Proposed Arizona Strip District Resource Management Plan and Final Environmental Statement 12/1990   |
| Bureau of Land Management | <i>Perry Mesa ACEC; Tanner Wash ACEC; Waterman Mountains ACEC; White Canyon ACEC; Big Horn Mountains Wilderness; Harquahala Mountains Wilderness; Hassayampa River Canyon Wilderness; Hells Canyon Wilderness; Hummingbird Springs Wilderness; North Maricopa Mountains Wilderness; Sierra Estrella Wilderness; Signal Mountain Wilderness, South Maricopa Mountains Wilderness; Tabletop Wilderness; Woolsey Peak Wilderness</i> | Proposed Phoenix Resource Management Plan and Final Environmental Impact Statement 12/1988   |
| Bureau of Land Management | <i>Gila Box Riparian NCA</i>  | Gila Box Management Plan, Environmental Assessment and Decision Record 01/1998   |
| Bureau of Land Management | <i>Las Cienegas NCA</i>   | Approved Las Cienegas Resource Management Plan and Record of Decision 07/2003  |
| Bureau of Land Management | <i>San Pedro Riparian NCA; Agua Fria NM; Grand Canyon-Parashant NM; Ironwood Forest NM; Sonoran Desert NM; Vermillion Cliffs NM</i>   | Interim Management Policy for BLM National Monuments and BLM National Conservation Areas 10/2001   |
| Bureau of Land Management | <i>Eagletail Mountains Wilderness; Muggins Mountains Wilderness</i>   | Record of Decision for the Yuma District Resource Management Plan and Environmental Impact Statement 04/1987; Final Amendment 01/1992; Final Amendment 03/1996 |

| <b>Land Steward</b>       | <b>Name of Status 2 Area in Arizona</b>  | <b>Source of Management Plan</b>   |
|---------------------------|--|--|
| Bureau of Land Management | <i>Baboquivari Peak Wilderness; Coyote Mountains Wilderness; Harcuvar Mountains Wilderness; Needle's Eye Wilderness; Rawhide Mountains Wilderness; Swansea Wilderness; Trigo Mountains Wilderness; White Canyon Wilderness</i> | Wilderness Management Policy 09/1981   |
| Bureau of Land Management | <i>Baker Canyon WSA, Cactus Plain WSA</i>  | Interim Management Policy for Lands Under Wilderness Review 07/1995  |
| Bureau of Land Management | <i>Aravaipa Canyon Wilderness</i>  | Wilderness Management Plan Aravaipa Canyon Wilderness 02/1988  |
| Bureau of Land Management | <i>Beaver Dam Mountains Wilderness; Paiute Wilderness</i>  | Final Wilderness Management Plan Paiute and Beaver Dam Mountains 06/1990   |
| Bureau of Land Management | <i>Cottonwood Point Wilderness</i>   | Wilderness Management Plan for the Cottonwood Point Wilderness 09/1991   |
| Bureau of Land Management | <i>East Cactus Plain Wilderness</i>  | East Cactus Plain Wilderness Management Plan, Environmental Assessment, and Decision Record 09/1994              |
| Bureau of Land Management | <i>Gibraltar Mountain Wilderness</i>   | Gibraltar Mountain Interdisciplinary Management Plan and Environmental Assessment 03/2001                        |
| Bureau of Land Management | <i>Mount Logan Wilderness; Mount Trumbull Wilderness</i>   | Wilderness Management Plan Mt. Trumbull Wilderness Mt. Logan Wilderness 12/1990                                  |
| Bureau of Land Management | <i>Mount Tipton Wilderness; Wabayuma Peak Wilderness</i>   | Wabayuma Peak and Mount Tipton Wilderness Management Plan, Environmental Assessment, and Decision Record 08/1995 |
| Bureau of Land Management | <i>Paria Canyon-Vermilion Cliffs Wilderness</i>  | Final Wilderness Management Plan Paria Canyon-Vermilion Cliffs 03/1986   |

| <b>Land Steward</b>                                      | <b>Name of Status 2 Area in Arizona</b>   | <b>Source of Management Plan</b>   |
|--|---|--|
| Bureau of Land Management                                | <i>Peloncillo Mountains Wilderness</i>  | Peloncillo Mountains Wilderness Management Plan, Environmental Assessment, and Decision Record 06/1995   |
| Bureau of Land Management / U.S. Fish & Wildlife Service | <i>New Water Mountains Wilderness</i>   | Kofa National Wildlife Refuge & Wilderness and New Water Mountains Wilderness Interagency Management Plan and Environmental Assessment 10/1996 |
| U.S. Fish & Wildlife Service                             | <i>Buenos Aires National Wildlife Refuge</i>  | Buenos Aires National Wildlife Refuge Final Comprehensive Conservation Plan 09/2003  |
| U.S. Fish & Wildlife Service                             | <i>Cabeza Prieta National Wildlife Refuge</i>   | URL:<br><a href="http://www.fws.gov/southwest/refuges/arizona/cabeza.html">http://www.fws.gov/southwest/refuges/arizona/cabeza.html</a>        |
| U.S. Forest Service                                      | <i>Apache NF (MA 18); Blue Range Primitive Area (MA 8); Escudilla Wilderness (MA 13); Hayground RNA (MA 10); Phelps Cabin RNA (MA 10); Sitgreaves NF (MA 16); Wildcat RNA (MA 10)</i>   | Apache-Sitgreaves National Forest Plan 1987; Amendment No. 6. 07/1996  |
| U.S. Forest Service                                      | <i>Arizona Bugbane Botanical Area (MA 6); Franks Lake Geologic-Botanical Area (MA 20); Kendrick Mountain Wilderness (MA 4); Saddle Mountain Wilderness (MA 19); Sycamore Canyon Wilderness (MA 1)</i>   | Kaibab National Forest Land Management Plan 04/1988; Amendment No. 5. 02/2003  |
| U.S. Forest Service                                      | <i>Chiricahua Wilderness (MA 9); Coronado NF (MA 2A &amp; MA 2B); Elgin Research Ranch (MA 8); Galiuro Wilderness (MA 9); Miller Peak Wilderness (MA 9); Mt. Graham WSA (MA 9); Mt. Wrightson Wilderness (MA 9); Pajarita Wilderness (MA 9); Pusch Ridge Wilderness (MA 9); Rincon Mountain Wilderness (MA 9); Santa Teresa Wilderness (MA 9); South Fork of Cave Creek Botanical Area (MA 14); Wild Chili Botanical Area (MA 15-1 &amp; MA 15-4 &amp; MA 15-7)</i> | Coronado National Forest Plan 1986; Forest Plan Change Notice No. 3 06/1999  |

| <b>Land Steward</b>   | <b>Name of Status 2 Area in Arizona</b>  | <b>Source of Management Plan</b>   |
|-----------------------|--|--|
| U.S. Forest Service   | <i>Coconino NF (MA 4 &amp; MA 8); Fossil Springs Wilderness (MA 1); Kachina Peaks Wilderness (MA 1); Kendrick Mountain Wilderness (MA 1); Mazatzal Wilderness (MA 1); Mount Elden ESA (MA 18); Munds Mountain Wilderness (MA 1); Red Mountain Geological Area (MA 17); Red Rock-Secret Mountain Wilderness; Verde Scenic River Area (MA 1); West Clear Creek Wilderness (MA 1); Wet Beaver Wilderness (MA 1)</i>   | Coconino National Forest Plan 08/1987; Amendment No. 17. 12/2002                                       |
| U.S. Forest Service   | <i>Four Peaks Wilderness (MA 3D &amp; MA 6I); Four Peaks Wilderness (MA 6I); Hellsgate Wilderness (MA 4C &amp; MA 5B); Mazatzal Wilderness (MA 1B &amp; MA 3A &amp; MA 4A); Pine Mountain Wilderness (MA 1A); Salome Wilderness (MA 5C &amp; MA 6H); Salt River Canyon Wilderness (MA 2B &amp; MA 6G); Sierra Ancha Wilderness (MA 5A); Sierra Anche Experimental Forest (MA 5E); Superstition Wilderness (MA 2A &amp; MA 2A &amp; MA 3B &amp; MA 3C &amp; MA 6B); Tonto NF(3H&amp; 4E&amp; 6C); Verde National Wild River (MA 1C &amp; MA 4B)</i> | Tonto National Forest Plan 10/1985; Amendment No. 22. 06/1996  |
| U.S. Forest Service   | <i>Granite Mountain Wilderness (MA 6C); Pine Mountain Wilderness (MA 6H); Sycamore Canyon Wilderness (MA 6E); Verde National Wild River (MA 7)</i>   | Prescott National Forest Plan 11/1986; Amendment No. 11. 03/2000                                       |
| National Park Service | <i>Tuzigoot NM</i>   | Statement for Management Tuzigoot National Monument 01/1986  |
| National Park Service | <i>Tumacacori NHP</i>  | General Management Plan and Environmental Impact Statement Tumacacori National Historical Park 09/1996 |
| National Park Service | <i>Chiricahua NM</i>   | Draft Environmental Impact Statement General Management Plan Chiricahua National Monument 12/1999      |
| National Park Service | <i>Coronado National Memorial</i>  | Final General Management Plan/Environmental Impact Statement Coronado National Memorial 01/2004        |

| <b>Land Steward</b>            | <b>Name of Status 2 Area in Arizona</b>  | <b>Source of Management Plan</b>   |
|--------------------------------|--|--|
| National Park Service          | <i>Canyon de Chelly NM</i>   | Joint Management Plan<br>Canyon de Chelly National Monument 10/1989  |
| National Park Service          | <i>Casa Grande Ruins NM</i>  | Master Plan of<br>Casa Grande Ruins National Monument 09/1964  |
| National Park Service          | <i>Montezuma Castle NM</i>   | Final Master Plan<br>Montezuma Castle - Tuzigoot National Monuments 10/1975  |
| National Park Service          | <i>Navajo NM</i>   | Final General Management Plan<br>Environmental Impact Statement<br>Navajo National Monument<br>12/2003   |
| National Park Service          | <i>Pipe Spring NM</i>  | Statement for Management<br>Pipe Spring National Monument<br>02/1987   |
| Native American Lands          | <i>Monument Valley Navajo Tribal Park</i>  | Interviewed Navajo Reservation<br>Zoologist: David Mikesic -<br>02/2004  |
| Department of Defense          | <i>Crater Range SRMA; Gran Desierto Dunes ACEC; Mohawk Mountains &amp; Sand Dunes ACEC; Sentinel Plain Lava Flow SRMA; Tinajas Atlas Mountains ACEC</i>  | Draft Environmental Impact<br>Statement Proposed Integrated<br>Natural Resource Management<br>Plan Barry M. Goldwater Range<br>02/2003               |
| Arizona Game & Fish Department | <i>Roper Lake State Park; Arlington Wildlife Area; Base &amp; Meridian Wildlife Area; Bear Springs; Becker Lake Wildlife Area; Black River Lands; Bog Hole Wildlife Area; Chevelon Canyon Ranch; Chevelon Canyon Wildlife Area; Cluff Ranch Wildlife Area; Concho Lake and Land; Cunningham Tracts; Fool Hollow Lake and Land; Gila River Wildlife Area; Grasslands Wildlife Area; Green Dove Nesting Area; House Rock Ranch; Lee Valley; Luna Lake Wildlife Area; Manhattan Claims; May Memorial Wildlife Area; Mittry Lake Wildlife Area; Nelson Lake; Picacho Reservoir/McFarland; Powers Butte Wildlife Area; Quigley Wildlife Area; Rainbow Lake Land; Raymond Ranch Wildlife Area; Robbins Butte Wildlife Area; Roper Lake; Sipe White Mountain Wildlife Area; Sunflower Flats; Texas Hill; Topock Marsh; Upper Verde River Wildlife Area; Veit Ranch; Wenima Wildlife Area; Whitewater Draw Wildlife Area; Wilcox Playa Wildlife Area</i> | URL: <a href="http://www.azgfd.gov/outdoor_recreation/watchable_wildlife.shtml">http://www.azgfd.gov/outdoor_recreation/watchable_wildlife.shtml</a> |

| <b>Land Steward</b>            | <b>Name of Status 2 Area in Arizona</b>   | <b>Source of Management Plan</b>  |
|--------------------------------|---|---|
| Arizona Game & Fish Department | <i>Sonita Creek State Natural Area; State Trust Land; Alamo Lake Wildlife Area; Painted Rock Wildlife Area; San Rafael Ranch State Park</i>   | URL:<br><a href="http://www.azgfd.gov/outdoor_recreation/watchable_wildlife.shtml">http://www.azgfd.gov/outdoor_recreation/watchable_wildlife.shtml</a>                   |
| Local Land Trust               | <i>Cascabel Hermitage Association Land Trust</i>  | Interviewed Secretary of Cascabel Hermitage Association Land Trust: Daniel Baker - 04/2005  |
| The Nature Conservancy         | <i>Aravaipa Canyon Preserve; Baboquivari; Bingham Cienega; Bingham Cienega Nature Preserve; Buehman Canyon; Cascabel; Desert Foothills Land Trust; Dudleyville-Cook's Lake; Escondido Falls; Fern Mountain; Hartwell Canyon; Holy Joe; Muleshoe Ranch Cooperative Management Area; O'Donnell Creek; Upper San Pedro Partnership</i> | URL:<br><a href="http://www.nature.org/wherewe_work/northamerica/states/arizona/preserves/">http://www.nature.org/wherewe_work/northamerica/states/arizona/preserves/</a> |



#### Appendix 4-4. Documentation of Status 2 lands in Colorado.

| Land Steward              | Name of Status 2 Area in Colorado   | Source of Management Plan  |
|---------------------------|---|--|
| Bureau of Land Management | <i>Black's Gulch ACEC; Coal Draw ACEC; Coal Oil Rim ACEC; Deer Gulch ACEC; Duck Creek ACEC; Dudley Bluffs ACEC; East Douglas Creek ACEC; Lower Greasewood Creek ACEC; Moosehead Mountain ACEC; Oil Spring Mountain ACEC; Raven Ridge ACEC; Ryan Gulch ACEC; South Cathedral Bluffs ACEC; Yanks Gulch/Upper Greasewood Creek ACEC; White River Riparian ACEC</i> | White River Record of Decision and Approved Resource Management Plan 07/1997   |
| Bureau of Land Management | <i>Adobe Badlands ACEC/ONA; Escalante Canyon ACEC; Needle Rock ACEC/ISA/ONA</i>   | Uncompahgre Basin Resource Management Plan and Record of Decision 07/1989  |
| Bureau of Land Management | <i>American Basin ACEC; Dillon Pinnacles ACEC; Redcloud Peak ACEC; Slungullion Earthflow National Natural Landmark ACEC; South Beaver Creek ACEC; West Antelope Creek ACEC</i>  | Gunnison Resource Area Record of Decision, Approved Resource Management Plan, and Rangeland Program Summary 02/1993          |
| Bureau of Land Management | <i>Gunnison Sage-Grouse ACEC/IBA; Native Plant Community ACEC/ONA; Gunnison Gorge NCA; Gunnison Gorge Wilderness</i>  | Gunnison Gorge National Conservation Area Approved Resource Management Plan and Final Environmental Impact Statement 11/2004 |
| Bureau of Land Management | <i>Anasazi Culture Multiple Use Area ACEC; Tabeguache Creek ONA</i>   | San Juan/San Miguel Planning Area Resource Management Plan 09/1985   |
| Bureau of Land Management | <i>Arkansas Canyonlands ACEC; Beaver Creek ACEC; Browns Canyon ACEC; Cucharas Canyon ACEC; Droney Gulch ACEC; Garden Park Fossil Area National Natural Landmark ACEC; Grape Creek ACEC; Phantom Canyon ACEC</i>   | Royal Gorge Resource Area Record of Decision and Approved Resource Management Plan 05/1996                                   |
| Bureau of Land Management | <i>Badger Wash ACEC; Gunnison Gravels ACEC/RNA; Rough Canyon ACEC/RNA; The Palisade ACEC/ONA; Unaweep Seep ACEC/RNA</i>   | Grand Junction Resource Area Resource Management Plan and Record of Decision 01/1987   |

| <b>Land Steward</b>                   | <b>Name of Status 2 Area in Colorado</b>  | <b>Source of Management Plan</b>  |
|---------------------------------------|---|---|
| Bureau of Land Management             | <i>Blanca Wildlife Habitat Area ACEC; Cumbres and Toltec Scenic Railroad Corridor ACEC; Elephant Rocks ACEC; Los Mogotes ACEC; Ra Jadero Canyon ACEC; Rio Grande River Corridor ACEC; Sand Castle ACEC; San Luis Hills/Flattop ACEC; Trickle Mountain ACEC</i>  | San Luis Resource Area Record of Decision and Approved Resource Management Plan 12/1991       |
| Bureau of Land Management             | <i>Blue Hill Archaeological District ACEC; Bull Gulch ACEC; Glenwood Springs Debris Flow Hazard Zone ACEC; Deep Creek ACEC; Lower Colorado River Cooperative Management Area ACEC</i>   | Record of Decision and Resource Management Plan Glenwood Springs Resource Area (Revised 1988) |
| Bureau of Land Management             | <i>Cross Mountain Canyon ACEC; Irish Canyon ACEC; Limestone Ridge ACEC/RNA; Lookout Mountain ACEC; Ace in the Hole BA; Hells Canyon BA; G Gap BA; Vermillion Creek BA; Vermillion Bluffs BA; Horse Draw BA</i>  | Little Snake Resource Management Plan and Record of Decision 06/1989                          |
| Bureau of Land Management             | <i>San Miguel River ACEC</i>  | 1993 - Amendment for San Miguel River ACEC, Recreation, Riparian, & Visual Resources          |
| Bureau of Land Management             | <i>Adobe Badlands WSA; American Flats WSA; Ant Hills WSA; Beaver Creek WSA; Bill Hare Gulch WSA; Black Canyon WSA; Black Mountain WSA; Browns Canyon WSA; Bull Canyon WSA; Bull Gulch WSA; Cahone Canyon WSA; Camel Back WSA; Castle Peak WSA; Chew Winter Camp WSA; Cold Spring West WSA; Cross Canyon WSA; Cross Mountain WSA; Demaree Canyon WSA; Diamond Breaks WSA; Dinosaur Adjacent North WSA; Dolores River Canyon WSA; Dominguez Canyon WSA; Eagle Mountain WSA; Grape Creek WSA; Hack Lake WSA; Handies Peak WSA; Little Book Cliffs WSA; Lower Grape Creek WSA; McIntyre Hills WSA; McKenna Peak WSA</i> | Interim Management Policy for Lands Under Wilderness Review 07/1995                           |
| Bureau of Land Management (continued) | <i>Menefee Mountain WSA; Oil Spring Mountain WSA; Peterson Draw WSA; Platte River Contiguous; Powderhorn ISA; Redcloud Peak WSA; San Luis Hills WSA; Sand Castle WSA; Sewemup Mesa WSA; Skull Creek WSA; Squaw/Papoose Canyon WSA; Tabeguache Creek WSA; Tepee Draw WSA; The Palisade WSA; Troublesome WSA; Upper Grape Creek WSA; Vale of Tears WSA; Weber Mountain WSA; West Cold Springs WSA; Willow Creek WSA; Windy Gulch WSA</i>  | Interim Management Policy for Lands Under Wilderness Review 07/1995                           |

| <b>Land Steward</b>          | <b>Name of Status 2 Area in Colorado</b>  | <b>Source of Management Plan</b>  |
|------------------------------|---|---|
| Bureau of Land Management    | <i>Black Ridge Canyons Wilderness; McInnis Canyons NCA</i>  | Draft Resource Management Plan and Environmental Impact Statement for the Colorado Canyons NCA and Black Ridge Canyons Wilderness 10/2003                                 |
| Bureau of Land Management    | <i>Canyons of the Ancients NM</i>   | Interim Management Policy for BLM National Monuments and BLM National Conservation Areas 10/2001  |
| U.S. Fish & Wildlife Service | <i>Arapaho National Wildlife Refuge</i>   | Arapaho National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Assessment 09/2003   |
| U.S. Fish & Wildlife Service | <i>Two Ponds National Wildlife Refuge</i>   | Two Ponds National Wildlife Refuge Comprehensive Management Plan 09/1997  |
| National Park Service        | <i>Black Canyon of the Gunnison NP</i>  | General Management Plan Black Canyon of the Gunnison National Monument and Curecanti National Recreation Area 12/1997   |
| The Nature Conservancy       | <i>5 Card Draw; Aiken Canyon Preserve; Antelope Canyon; Bohart Ranch &amp; Preserve; Bohart Ranch &amp; Preserve; Cap Rock; Carpenter Ranch &amp; Preserve; Fox Ranch &amp; Preserve; Medano-Zapata Ranch &amp; Preserve; Phantom Canyon Preserve; San Miguel Canyon Preserve; South Fork Preserve; Tabeguache Creek Preserve</i> | URL:<br><a href="http://www.nature.org/wherewework/northamerica/states/colorado/preserves/">http://www.nature.org/wherewework/northamerica/states/colorado/preserves/</a> |
| Colorado State Land Board    | <i>State Stewardship Trust Land</i>   | Interviewed Colorado State Land Board GIS Specialist: Bill Martin - 06/2005   |
| Tribal Lands                 | <i>Ute Mountain Tribal Park</i>   | URL:<br><a href="http://www.utemountainute.com/tribalpark.htm">http://www.utemountainute.com/tribalpark.htm</a>   |

| Land Steward        | Name of Status 2 Area in Colorado  | Source of Management Plan  |
|---------------------|--|--|
| U.S. Forest Service | <p><i>West Stoneham Archeological District SIA (MA 3.1); Grays Peak SIA (MA 3.1); Pawnee Buttes SIA (MA 3.1); Todd Gulch Fen SIA (MA 3.1); Arapaho NRA (MA 3.1); Bowen Gulch RNA (MA 2.2); Hell Canyon RNA (MA 2.2); Pennock Creek RNA (MA 2.2); West Creek RNA (MA 2.2); Cache La Poudre Wild and Scenic River (MA 1.5); Cache La Poudre Wilderness (MA 1.1); Comanche Peak Wilderness (MA 1.1); Indian Peaks Wilderness (MA 1.1); James Peak Wilderness (MA 1.1); Mount Evans Wilderness (MA 1.1); Neota Wilderness (MA 1.1); Never Summer Wilderness (MA 1.1); Rawah Wilderness (MA 1.1); Prairie Ecosystem Demonstration Area SIA (MA 3.1); Arapaho NF (MA 1.2); Roosevelt NF (MA 1.2); Roosevelt NF (MA 1.41 &amp; MA 1.5); Homestead Meadows SIA (MA 3.1); Stuck Creek Splash Dam SIA (MA 3.1); Bowen Gulch Protection Area SIA (MA 3.1); James Peak SIA (MA 3.1); Rist Canyon SIA (MA 3.1); Niwot Ridge Biosphere Reserve (MA 3.1); Fraser Experimental Forest (MA 5.31); Central Plains Experimental Range</i></p> | 1997 Revision of the Land and Resource Management Plan Arapaho and Roosevelt National Forests and Pawnee National Grassland                      |
| U.S. Forest Service | <p><i>Dry Mesa Dinosaur Quarry Paleontological Site SIA (MA 10C); Ophir Needles SIA (MA 10C); Grand Mesa NF (MA 10E); Collegiate Peaks Wilderness (MA 8B); Fossil Ridge Wilderness (MA 8B); La Garita Wilderness (MA 8B &amp; MA 8C); Lizard Head Wilderness (MA 8B); Maroon Bells-Snowmass Wilderness (MA 8B); Mount Sneffels Wilderness (MA 8B &amp; MA 8C); Powderhorn Wilderness (MA 8B &amp; MA 8C); Raggeds Wilderness (MA 8B &amp; MA 8C); Uncompahgre Wilderness (MA 8B &amp; MA 8C); West Elk Wilderness (MA 8B &amp; MA 8C); Slumgullion Earthflow NNL (MA 10C); Alpine Tunnel Historic District SIA (MA 10C); Roubideau Special Management Area OCD; Tabeguache Special Management Area OCD</i></p>   | Amended Land and Resource Management Plan Grand Mesa, Uncompahgre, and Gunnison National Forests 1991  |
| U.S. Forest Service | <p><i>Pike NF (MA 10E); San Isabel NF (MA 10E); Byers Peak Wilderness (MA 1.1); Buffalo Peaks Wilderness (MA 8B); Collegiate Peaks Wilderness (MA 8C); Greenhorn Mountain Wilderness (MA 8B &amp; MA 8C); Holy Cross Wilderness (MA 8C); Lost Creek Wilderness (MA 8B &amp; MA 8C); Mount Evans Wilderness (MA 8B &amp; MA 8C); Mount Massive Wilderness (MA 8B &amp; MA 8C); Sangre de Cristo Wilderness (MA 8B &amp; MA 8C); CSU Southeastern Branch Exp. Station (MA 10B); Manitou Experimental Forest (MA 10B); Picture Canyon Zoological Area (MA 10C); Vasquez Peak Wilderness (MA 1.1)</i></p>  | Land and Resource Management Plan Pike and San Isabel National Forest; Comanche and Cimarron National Grasslands 1984; Amendment No. 24. 04/1992 |

| Land Steward        | Name of Status 2 Area in Colorado   | Source of Management Plan  |
|---------------------|---|--|
| U.S. Forest Service | <i>Elephant Rocks Botanical Area (MA 3.1); Elephant Rocks SIA (MA 3.1); Ripley Milkvetch SIA (MA 3.1); Blowout Pass SIA (MA 3.1); Chama Basin Landslide Geologic Area (MA 3.1); Devil's Hole Geologic Area (MA 3.1); La Garita Wilderness (MA 1.12 &amp; MA 1.13); Sangre de Cristo Wilderness (MA 1.12 &amp; MA 1.13); Rio Grande NF (MA 1.5); John Charles Fremont SIA (MA 3.1); Wagon Wheel Gap Watershed Experiment Station SIA (MA 3.1)</i>  | Revised Land and Resource Management Plan Rio Grande National Forest 11/1996                         |
| U.S. Forest Service | <i>Little Snake SIA (MA 2.1); California Park SIA (MA 2.1); Windy Ridge SIA (MA 2.1 ); Routt NF (MA 3.23); Flat Tops Wilderness (MA 1.13); Mount Zirkel Wilderness (MA 1.12 &amp; MA 1.13); Neota Wilderness (MA 1.12); Never Summer Wilderness (MA 1.12); Platte River Wilderness (MA 1.13); Sarvis Creek Wilderness (MA 1.12 &amp; MA 1.13); Routt NF (MA 1.5); Encampment River SIA (MA 2.1); Teller City SIA (MA 2.1); Black Mountain SIA (MA 2.1); Camp Creek SIA (MA 2.1)</i>   | Revised Forest Plan and Final Environmental Impact Statement for the Routt National Forest 2001      |
| U.S. Forest Service | <i>Chimney Rock Archeological Area SIA (MA 10C); Falls Creek Archeological Area SIA (MA 10C); Lizard Head Wilderness (MA 1.12 &amp; MA 1.13); Piedra Area (MA 1.12 &amp; MA 1.13); South San Juan Wilderness (MA 1.12 &amp; MA 1.13); Weminuche Wilderness (MA 1.11A &amp; MA 1.12 &amp; MA 1.13)</i>   | Amended Land and Resource Management Plan San Juan National Forest 04/1992; Amendment No. 20 08/1998 |
| U.S. Forest Service | <i>Quandry Peak SIA (MA 2.1); Dead Horse Creek SIA (MA 2.1); Collegiate Peaks Wilderness (MA 1.12); Eagles Nest Wilderness (MA 1.12 &amp; MA 1.13); Flat Tops Wilderness (MA 1.12); Holy Cross Wilderness (MA 1.12 &amp; MA 1.13); Hunter-Fryingpan Wilderness (MA 1.12 &amp; MA 1.13); Maroon Bells-Snowmass Wilderness (MA 1.12 &amp; MA 1.13); Ptarmigan Peak Wilderness (MA 1.12); Raggeds Wilderness (MA 1.12); White River NF (MA 1.13 &amp; MA 1.2 &amp; MA 1.5); Continental Divide Land Bridge &amp; Porcupine SIA (MA 2.1); Main Elk SIA (MA 2.1); Mitchell Creek SIA (MA 2.1); Sterry Lake SIA (MA 2.1); Taylor Pass SIA (MA 2.1); Warren Lakes SIA (MA 2.1)</i> | 2002 Revision for Land and Resource Management Plan White River National Forest                      |

| Land Steward                                | Name of Status 2 Area in Colorado   | Source of Management Plan  |
|---|---|--|
| Colorado Department of Wildlife             | <p><i>63 Ranch SWA; Adams SWA; Adobe Creek Reservoir SWA; Alberta Park Reservoir SWA; Alma SWA; Almont Triangle SWA; Andrew's Lake SWA; Antero Reservoir SWA; Apishapa SWA; Arkansas River SWA; Atwood SWA; Badger Basin SWA; Bailey Lake SWA; Banner Lakes SWA; Basalt SWA; Bear Lake Reservoir SWA; Beaver Creek Reservoir SWA; Beaver Creek SWA; Beaver Lake SWA; Beaver Reservoir SWA; Bel Aire SWA; Bellaire Lake SWA; Bergen Peak SWA; Big Creek Reservoir SWA; Big Meadows Reservoir SWA; Big Thompson Ponds SWA; Billy Creek SWA; Bitter Brush SWA; Black Lakes SWA; Blacktail Easement SWA; Blanca SWA; Blinberry Gulch SWA; Bliss SWA; Blue River SWA; Bodo SWA; Boedecker Reservoir SWA; Bosque Del Oso SWA; Boyd Ponds SWA; Brackenbury SWA; Bravo SWA; Brower SWA; Brown Lakes SWA; Brownlee SWA; Brown's Park SWA; Brush Creek SWA; Brush Hollow SWA; Brush Prairie Ponds SWA; Brush SWA; Buena Vista SWA; Burchfield SWA</i></p> | <p><a href="http://wildlife.state.co.us/LandWater/StateWildlifeAreas/">http://wildlife.state.co.us/LandWater/StateWildlifeAreas/</a></p> |
| Colorado Department of Wildlife (continued) | <p><i>Cabin Creek SWA; Centennial SWA; Centennial Valley SWA; Chance Gulch SWA; Cherokee SWA; Chipeta Lakes SWA; Christina SWA; Chuck Lewis SWA; Cimarron SWA; Clear Creek Reservoir SWA; Coalbed Canyon SWA; Cochetopa SWA; Coke Oven SWA; Collier SWA; Colorado River Island SWA; Columbine SWA; Cottonwood Creek SWA; Cottonwood SWA; Cowdry Lake SWA; Crystal River Ranch SWA; Dan Noble SWA; De Weese Reservoir SWA; Deadman SWA; Delaney Butte Lakes SWA; Delta SWA; Devil Creek SWA; Diamond J SWA; Dixon Lake SWA; Dodd Bridge SWA; Dome Lakes SWA; Dome Rock SWA; Douglas Reservoir SWA; Dowdy Lake SWA; Dry Creek Basin SWA; Duck Creek SWA; Dumont Lake SWA; Dune Ridge SWA; Dutch Gulch SWA; Eagle River SWA; Echo Canyon Lake SWA; Elkhead Lake SWA; Elliot SWA; Emerald Mountain SWA; Escalante SWA; Fish Creek SWA; Flagler Reservoir SWA</i></p>  | <p><a href="http://wildlife.state.co.us/LandWater/StateWildlifeAreas/">http://wildlife.state.co.us/LandWater/StateWildlifeAreas/</a></p> |
| Colorado Department of Wildlife (continued) | <p><i>Forks SWA; Frank SWA; Franklin Island SWA; Frenchman Creek SWA; Frying Pan River SWA; Garfield Creek SWA; Georgetown Reservoir SWA; Goose Lake SWA; Granada SWA; Grandview Ponds SWA; Granite SWA; Grieves Easement SWA; Groundhog Reservoir SWA; Gunnison SWA; Gypsum Ponds SWA; Hahn's Peak Reservoir SWA; Hallenbeck Ranch SWA; Haviland Lake SWA; Heckendorf SWA; Higel SWA; Hohnholz Lakes SWA; Hohnholz Lakes SWA; Hohnholz Lakes SWA; Hohnholz Lakes SWA; Holbrook Reservoir SWA; Holly SWA; Holyoke SWA; Home Lake SWA; Horse Creek Reservoir SWA; Horse Thief Canyon SWA; Hot Creek SWA; Hot Sulphur Springs SWA; Hot Sulphur Springs SWA; Hot Sulphur Springs SWA; Huerfano SWA; Hugo SWA; Hunt SWA</i></p>   | <p><a href="http://wildlife.state.co.us/LandWater/StateWildlifeAreas/">http://wildlife.state.co.us/LandWater/StateWildlifeAreas/</a></p> |

| Land Steward                                | Name of Status 2 Area in Colorado  | Source of Management Plan  |
|---|--|--|
| Colorado Department of Wildlife (continued) | <p><i>Idaho Springs Reservoir SWA; Indian Run SWA; Irvine SWA; Jackson Lake SWA; James M. John SWA; James Mark Jones SWA; Jensen SWA; Jerry Creek Reservoir SWA; Joe Moore Reservoir SWA; John Martin Reservoir SWA; Johnson Village SWA; Julesburg SWA; Jumbo Reservoir SWA; Junction Butte SWA; Karval Reservoir SWA; Kemp-Breeze SWA; Knight-Imler SWA; Knudson SWA; Kodak Watchable SWA; La Jara Creek Ranch SWA; La Jara Reservoir SWA; La Jara SWA; Lake Avery SWA; Lake Beckwith SWA; Lake Dorothey SWA</i></p>   | <p><a href="http://wildlife.state.co.us/LandWater/StateWildlifeAreas/">http://wildlife.state.co.us/LandWater/StateWildlifeAreas/</a></p> |
| Colorado Department of Wildlife (continued) | <p><i>Lake Fork of the Gunnison River SWA; Lake John SWA; Las Animas City Pond SWA; Lathrop SWA; Leaps Gulch SWA; Lennartz SWA; Little Snake SWA; Loma Boat Launch SWA; Lon Hagler SWA; Lone Dome SWA; Lonetree Reservoir SWA; Lowell Ponds SWA; Manhattan Creek SWA; Manville SWA; Marcum SWA; Mason Family SWA; McCluskey SWA; Meadow Creek Reservoir SUP; Meeker Pasture SWA; Meredith Reservoir SWA; Mesa Lake SWA; Messex SWA; Mike Higbee SWA; Mitani-Tokoyasu SWA; Mogensen Ponds SWA; Monument Lake SWA; Mount Evans SWA; Mount Werner SWA; Mountain Home Reservoir SWA; Murphy SWA; Nakagawa SWA; Narraguinnep Reservoir SWA; Narrows SWA; Nelson/Prather Easement SWA; North Fork SWA; North Lake SWA; North Sterling Reservoir SWA; North Sterling Reservoir SWA; Oak Ridge SWA; Odd Fellows SWA; Ogilvy SWA; Olney Springs SWA; Overland Trail SWA; Owl Mountain SWA; Ox Bow SWA</i></p> | <p><a href="http://wildlife.state.co.us/LandWater/StateWildlifeAreas/">http://wildlife.state.co.us/LandWater/StateWildlifeAreas/</a></p> |
| Colorado Department of Wildlife (continued) | <p><i>Paonia SWA; Parachute Ponds SWA; Parvin Lake SWA; Pastorius Reservoir SWA; Perins Peak SWA; Piceance SWA; Pikes Peak SWA; Pioneer Park SWA; Plateau Creek SWA; Playa Blanca SWA; Poage Lake SWA; Pony Express SWA; Poudre River SWA; Prewitt Reservoir SWA; Puett Reservoir SWA; Purgatoire River SWA; Queens SWA; Radium SWA; Ralph White SWA; Ralston Creek SWA; Ramah Reservoir SWA; Red Dog SWA; Red Lion SWA; Regan Lake SWA; Richard SWA; Rio Blanco Lake SWA; Rio Grande River SWA; Rio Grande SWA; Rito Hondo Reservoir SWA; Road Canyon Reservoir SWA; Roaring Fork River SWA; Rock Creek SWA; Rocky Ford Pond SWA; Rocky Ford SWA; Rocky Ford West SWA; Rosemont Reservoir SWA; Runyon/Fountain Lakes SWA; Russel Lakes SWA; Saint Charles SWA; San Miguel SWA; Sanchez Reservoir SWA</i></p>  | <p><a href="http://wildlife.state.co.us/LandWater/StateWildlifeAreas/">http://wildlife.state.co.us/LandWater/StateWildlifeAreas/</a></p> |

| Land Steward                                | Name of Status 2 Area in Colorado   | Source of Management Plan  |
|---|---|--|
| Colorado Department of Wildlife (continued) | <p><i>Sand Creek SWA; Sand Draw SWA; Sandsage SWA; Sandy Bluffs SWA; Sawhill Ponds SWA; Sawhill Ponds-City Open Space; Schuck SWA; Seaman Reservoir SWA; Sedgwick Bar SWA; Seeley Reservoir SWA; Sego Springs SWA; Service Creek SWA; Setchfield SWA; Seymour Lake SWA; Sharptail Ridge SWA; Sheets Lake SWA; Silver Creek SWA; Simmons SWA; Simpson Ponds SWA; Skaguay Reservoir SWA; Smith Reservoir SWA; South Republican SWA; Spanish Peaks SWA; Spinney Mountain SWA; Spring Creek Reservoir SWA; Stalker Lake SWA; Steamboat Lake SWA; Summit Reservoir SWA; Swede Lake SWA; Tamarack Ranch SWA; Tarryall Reservoir SWA; Taylor River SWA/MOU</i></p>   | <p><a href="http://wildlife.state.co.us/LandWater/StateWildlifeAreas/">http://wildlife.state.co.us/LandWater/StateWildlifeAreas/</a></p> |
| Colorado Department of Wildlife (continued) | <p><i>Terrance Reservoir SWA; Teter Wetlands SWA; Thurston Reservoir SWA; Tilman Bishop SWA; Timpas Creek SWA; Tomahawk SWA; Totten Reservoir SWA; Trout Lake SWA; Trujillo Meadows Reservoir SWA/SUP; Turk's Pond SWA; Twin Hills SWA; Twin Sisters SWA; Two Buttes Reservoir SWA; Upper Stillwater SWA; Vail Deer Underpass SWA; Vaughn Reservoir SWA; Verner SWA; Wahatoya SWA; Walker SWA; Ward Pond SWA; Watson Divide SWA; Watson Lake SWA; Webster SWA; Wellington Reservoir #4 and Smith Lake SWA; Wellington SWA; West Lake SWA; West Rifle Creek SWA; Wheeler SWA; White Horse SWA; White River SWA; Williams Creel Reservoir SWA; Windy Gap WWA; Woodhouse SWA; Woods Lake SWA; Wrights Lake SWA; Yampa River SWA; Young Gulch SWA</i></p> | <p><a href="http://wildlife.state.co.us/LandWater/StateWildlifeAreas/">http://wildlife.state.co.us/LandWater/StateWildlifeAreas/</a></p> |
| Colorado Department of Wildlife (continued) | <p><i>Adobe Ridge SHA; Akey SHA; Berry Creek SHA; Bollinger SHA; Coaldale Ponds SHA; Copper Spur SHA; Cover Mountain SHA; Crites SHA; Cyprus Yampa Valley SHA; D &amp; T Ranch SHA; Elk Valley Estates SHA; Fadenrecht SHA; Flatiron Mesa SHA; Grizzly T Gulch SHA; Hawxhurst Ranch SHA; Hay Press Lake SHA; Hereford Haven Ranch SHA; Kaichen SHA; Love Meadows Easement SHA; Maggard SHA; Meserve SHA; Minton SHA; Musgrave SHA; Orr SHA; Payne Mesa SHA; Pheasant Habitat Leases SHA; Pinon Mesa - Glade Point SHA; Rush Creek SHA; Saffer SHA; Salt Wash SHA; Shutt SHA; Skylark Creek SHA; Stone SHA; Thunder Mountain SHA; Vermejo Park SHA; Viking Valley SHA; Whittington SHA; Witte SHA</i></p>  | <p><a href="http://wildlife.state.co.us/LandWater/StateWildlifeAreas/">http://wildlife.state.co.us/LandWater/StateWildlifeAreas/</a></p> |



| <b>Land Steward</b>                         | <b>Name of Status 2 Area in Colorado</b>   | <b>Source of Management Plan</b>  |
|---|--|---|
| Colorado Department of Wildlife (continued) | <i>Bellvue SFU; Buena Vista SFU; Chalk Cliffs SFU; Crystal River SFU; Durango SFU; Finger Rock SFU; Glenwood Springs SFU; Las Animas SFU; Mount Ouray SFU; Mount Shavano SFU; Pitkin SFU; Poudre River SFU; Rifle Falls SFU; Roaring Judy SFU; Spicer SFU; Watson Lake SFU; Wray SFU</i> | <a href="http://wildlife.state.co.us/LandWater/StateWildlifeAreas/">http://wildlife.state.co.us/LandWater/StateWildlifeAreas/</a> |

## Appendix 4-5. Documentation of Status 2 lands in Nevada.

| Land Steward                     | Name of Status 2 Area in Nevada   | Source of Management Plan   |
|----------------------------------|---|---|
| <i>Bureau of Land Management</i> | <i>Arden Historic Sites ACEC; Armagosa Mesquite ACEC; Arrow Canyon ACEC; Big Dune ACEC; Bird Spring ACEC; Coyote Springs Valley ACEC; Crescent Townsite ACEC; Devil's Throat ACEC; Gold Butte ACEC - Part A; Gold Butte ACEC - Part B; Gold Butte ACEC - Part C/ Virgin Mountains ACEC; Gold Butte Townsite ACEC; Hidden Valley ACEC; Keyhole Canyon ACEC; Mormon Mesa ACEC - Las Vegas; Piute/ Eldorado Valley ACEC; Rainbow Gardens ACEC; Red Rock Springs ACEC; River Mountains ACEC; Sloan Rock Art District ACEC; Stump Springs ACEC; Virgin River ACEC; Whitney Pockets ACEC; Arrow Canyon Wilderness; Jumbo Springs Wilderness; La Madre Mountain Wilderness; Lime Canyon Wilderness; Mount Charleston Wilderness; Muddy Mountains Wilderness; North McCullough Wilderness; Rainbow Mountain Wilderness; South McCullough Wilderness; Wee Thump Joshua Tree Wilderness</i> | Record of Decision for the Approved Las Vegas Resource Management Plan and Final Environmental Impact Statement 10/1998 |
| <i>Bureau of Land Management</i> | <i>Beaver Dam Slope ACEC; Kane Springs ACEC; Mormon Mesa ACEC - Ely</i>   | Draft Caliente Resource Management Plan and Environmental Impact Statement 1993   |
| <i>Bureau of Land Management</i> | <i>Incandescent Rocks ACEC; Steamboat Hot Springs ACEC</i>  | Proposed Resource Management Plan and Final Environmental Impact Statement for the Lahontan Resource Area 1984          |
| <i>Bureau of Land Management</i> | <i>Osgood Mountains Milkvetch ACEC</i>  | Paradise-Denio and Sonoma-Gerlach Management Framework Plan: Approved Lands Amendment and Decision Record 1999          |
| <i>Bureau of Land Management</i> | <i>Salt Lake ACEC</i>   | Record of Decision Wells Resource Management Plan 06/1985   |
| <i>Bureau of Land Management</i> | <i>Carson Wandering Skipper ACEC; Pah Rah Basin Petroglyph ACEC; Virginia Range Williams Combleaf Habitat ACEC</i>  | Carson City Field Office Consolidated Resource Management Plan 05/2001  |

| Land Steward                          | Name of Status 2 Area in Nevada  | Source of Management Plan  |
|---------------------------------------|--|--|
| Bureau of Land Management             | <i>High Rock Canyon ACEC; Soldier Meadow ACEC; Black Rock Desert-High Rock Canyon Emigrant Trails National Conservation Area; Big Rocks Wilderness; Calico Mountains Wilderness; East Fork High Rock Canyon Wilderness; High Rock Canyon Wilderness; High Rock Lake Wilderness; Little High Rock Canyon Wilderness; North Black Rock Range Wilderness; North Jackson Mountains Wilderness; Pahute Peak Wilderness; South Jackson Mountains Wilderness</i>  | Proposed Resource Management Plan and Final Environmental Impact Statement for the Black Rock Desert-High Rock Canyon Emigrant Trails National Conservation Area (NCA) and Associated Wilderness, and Other Contiguous Lands in Nevada 09/2003 |
| Bureau of Land Management             | <i>Alder Creek WSA; Antelope Range WSA; Antelope WSA; Augusta Mountains WSA; Bad Lands WSA; Blue Eagle WSA; Blue Lakes WSA; Bluebell WSA; Buffalo Hills WSA; Burbank Canyons WSA; Cedar Ridge WSA; China Mountain WSA; Clan Alpine Mountains WSA; Desatoya Mountains WSA; Disaster Peak WSA; Dry Valley Rim WSA; Fandango WSA; Five Springs WSA; Fox Range WSA; Gabbs Valley Range WSA; Goshute Canyon ISA; Goshute Canyon WSA; Goshute Peak WSA; Grapevine Mountains WSA; Heusser Mountain Bristlecone Pine ISA; Job Peak WSA; Kawich WSA; Lahontan Cutthroat Trout ISA; Little Humboldt River WSA; Marble Canyon WSA; Massacre Rim WSA; Million Hills WSA; Morey Peak WSA; Mount Grafton WSA; Mount Limbo WSA; Mount Stirling WSA; Mountain Meadow ISA; N. Fork of the Little Humboldt River WSA; Owyhee Canyon WSA; Palisade Mesa WSA; Park Range WSA; Pigeon Spring WSA; Pinyon Joshua ISA; Pole Creek WSA; Poodle Mountain WSA; Pueblo Mountains WSA; Queer Mountain WSA; Rawhide Mountain WSA; Red Spring WSA; Resting Springs WSA</i> | Interim Management Policy for Lands Under Wilderness Review 07/1995  |
| Bureau of Land Management (continued) | <i>Riordan's Well WSA; Roberts Mountain WSA; Rough Hills WSA; Selenite Mountains WSA; Sheldon Contiguous WSA; Shoshone Ponds ISA; Shoshone Pygmy Sage ISA; Silver Peak Range WSA; Simpson Park WSA; Skedaddle WSA; South Egan Range WSA; South Fork Owyhee River WSA; South Pequop WSA; South Reveille WSA; Stillwater Range WSA; Sunrise Mountain ISA; Swamp Cedar ISA; The Wall WSA; Tobin Range WSA; Twin Peaks WSA; Virgin Mountain ISA; Wall Canyon WSA</i>   | Interim Management Policy for Lands Under Wilderness Review 07/95  |
| Bureau of Land Management             | <i>Red Rock Canyon National Conservation Area</i>  | Proposed General Management Plan and Final Environmental Impact Statement for Red Rock Canyon National Conservation Area 12/2000   |

| <b>Land Steward</b>                     | <b>Name of Status 2 Area in Nevada</b>   | <b>Source of Management Plan</b>   |
|---|--|--|
| <i>Bureau of Land Management</i>        | <i>Sloan Canyon National Conservation Area</i>   | Interim Management Policy for BLM National Monuments and BLM National Conservation Areas 10/2001   |
| <i>Bureau of Land Management</i>        | <i>Clover Mountains Wilderness; Delamar Mountains Wilderness; Far South Egans Wilderness; Fortification Range Wilderness; Meadow Valley Range Wilderness; Mormon Mountains Wilderness; Mount Irish Wilderness; Parsnip Peak Wilderness; South Pahroc Range Wilderness; Tunnel Spring Wilderness; Weepah Spring Wilderness; White Rock Range Wilderness; Worthington Mountains Wilderness</i> | Public Law 108-424 - 11/2004; Wilderness Management Policy 09/1981   |
| <i>U.S. Fish &amp; Wildlife Service</i> | <i>Stillwater WMA; Fallon NWR; Stillwater NWR</i>  | Stillwater National Wildlife Refuge Complex Comprehensive Conservation Plan 06/2003  |
| <i>U.S. Fish &amp; Wildlife Service</i> | <i>Ruby Lake NWR</i>   | Interviewed Refuge Manager: Martha Collins - 10/2004   |
| <i>U.S. Fish &amp; Wildlife Service</i> | <i>Desert National Wildlife Range</i>  | URL:<br><a href="http://www.fws.gov/desertcomplex/">http://www.fws.gov/desertcomplex/</a>  |
| <i>U.S. Forest Service</i>              | <i>Alta Toquima Wilderness; Arc Dome Wilderness; Currant Mountain Wilderness; Mount Rose Wilderness; Table Mountain Wilderness</i>   | Land and Resource Management Plan Toiyabe National Forest 1986   |
| <i>U.S. Forest Service</i>              | <i>Boundary Peak Wilderness</i>  | Land and Resource Management Plan Inyo National Forest 1988  |
| <i>U.S. Forest Service</i>              | <i>Spring Mountains NRA (MA 11&amp; MA 13&amp; MA 14); Mount Stirling WSA (MA 14)</i>  | General Management Plan For the Spring Mountains National Recreation Area: An Amendment to the Land and Resource Management Plan, Toiyabe National Forest 1996 |

| <b>Land Steward</b>                  | <b>Name of Status 2 Area in Nevada</b>  | <b>Source of Management Plan</b>  |
|--------------------------------------|---|---|
| <i>U.S. Forest Service</i>           | <i>Humboldt NF (MA 11); East Humboldts Wilderness; Grant Range Wilderness (MA 15); Jarbidge Wilderness (MA 6); Mount Moriah Wilderness (MA 8); Quinn Canyon Wilderness; Ruby Mountains Wilderness (MA 4); Santa Rosa - Paradise Peak Wilderness</i> | Humboldt National Forest Land and Resource Management Plan 1996   |
| <i>National Park Service</i>         | <i>Lake Mead NRA</i>  | Final General Management Plan Environmental Impact Statement Lake Mead National Recreation Area 12/1986   |
| <i>Nevada Department of Wildlife</i> | <i>Alkali Lake WMA; Fernley WMA; Franklin Lake WMA; Humboldt WMA; Key Pittman WMA; Mason Valley WMA; Overton WMA; Railroad Valley WMA; Scripps WMA; Steptoe Valley WMA; Wayne E. Kirch WMA</i>  | URL:<br><a href="http://www.ndow.org/wild/habitat/wma/">http://www.ndow.org/wild/habitat/wma/</a>   |
| <i>The Nature Conservancy</i>        | <i>Gottfredson/Condor Canyon; McCarran Ranch; River Fork Ranch</i>  | URL:<br><a href="http://www.nature.org/wherework/northamerica/states/nevada/preserves/">http://www.nature.org/wherework/northamerica/states/nevada/preserves/</a> |

## Appendix 4-6. Documentation of Status 2 lands in New Mexico.

| Land Steward              | Name of Status 2 Area in New Mexico   | Source of Management Plan  |
|---------------------------|---|--|
| Bureau of Land Management | <p><i>Adams Canyon ACEC; Angel Peak ACEC; Archuleta River Tract; Ashiih Naa'a ACEC; Bald Eagle ACEC; Beechatuda Tongue Geological Formation; Betonnie Tsosie Fossil Area; Bi Yaazh ACEC; Blanco Mesa ACEC; Blanco Star Panel ACEC; Bohanon Canyon Fossil Complex; Cagle's Site ACEC; Canyon View Ruin ACEC; Carson Fossil Pocket Fossil Area; Cereza Canyon Wildlife Area; Casa del Rio Archaeological Protection Site ACEC; Cedar Hill ACEC; Chacra Mesa Complex ACEC; Cho'li'i (Governador Knob) ACEC; Christmas Tree Ruin ACEC; Crow Canyon ACEC; Crownpoint Steps and Herradura ACEC; Deer House ACEC; Delgadita/Pueblo Canyons ACEC; Delgadita/Pueblo Canyons SMA; Devil's Spring Mesa ACEC; Dzil'na'oodlii ACEC; Encierro Canyon ACEC; Encinada Mesa-Carrizo Canyon ACEC; Frances Mesa ACEC; Gould Pass Camp ACEC; Gobernador and Cereza Canyon Fossil Area; Greenlee Ruin Archaeological Protection Site ACEC; Hummingbird ACEC; Hummingbird Canyon ACEC; Kachina Mask ACEC; Kin Yazhi ACEC; Kiva ACEC; Kutz Canyon Paleontological Area; La Jara ACEC</i></p> | Record of Decision Farmington Proposed Resource Management Plan and Final Environmental Impact Statement 09/2003 |
|                           | <p><i>Lake Valley Archaeological Protection Site ACEC; Largo Canyon Star Ceiling ACEC; Lybrook Fossil Area; Martinez Canyon ACEC; Mexican Spotted Owl ACEC; Moss Trail ACEC; Munoz Canyon ACEC; North Road ACEC; Old Road River Tract; Pinon Mesa Fossil Area; Pointed Butte ACEC; Pork Chop Pass ACEC; Pregnant Basketmaker ACEC; Pretty Woman ACEC; Prieta Mesa ACEC; Rincon Largo District ACEC; Rincon Rockshelter ACEC; River Tracts; San Rafael Canyon ACEC; Santos Peak ACEC; Shield Bearer ACEC; Star Rock ACEC; Star Spring/Jesus Canyon ACEC; String House ACEC; Superior Mesa ACEC; Tapacito and Split Rock ACEC; The Hogback ACEC; Truby's Tower ACEC</i></p>   | Record of Decision Farmington Proposed Resource Management Plan and Final Environmental Impact Statement 09/2003 |
| Bureau of Land Management | <p><i>Fort Stanton ACEC; Mescalero Sands ACEC/ONA; North Pecos River ACEC; Overflow Wetlands ACEC</i></p>   | Record of Decision Proposed Roswell Resource Management Plan 10/1997   |
| Bureau of Land Management | <p><i>Black Mesa ACEC; Copper Hill ACEC; La Cienega ACEC; Lower Gorge ACEC; Ojo Caliente ACEC; Rio Chama Wild and Scenic River; San Antonio Gorge ACEC; Sombrillo ACEC; Winter Range ACEC</i></p>   | Approved Taos Resource Management Plan 10/1988   |

| <b>Land Steward</b>              | <b>Name of Status 2 Area in New Mexico</b>  | <b>Source of Management Plan</b>  |
|----------------------------------|---|---|
| <i>Bureau of Land Management</i> | <i>Alamo Hueco Mountains ACEC; Apache Box ACEC; Big Hatchet Mountains ACEC; Central Peloncillo Mountains ACEC; Cooke's Range ACEC; Dona Ana Mountains ACEC; Florida Mountains ACEC; Gila Lower Box ACEC; Granite Gap ACEC; Kilbourne Hole NNL; Los Tules ACEC; Northern Peloncillo Mountains ACEC; Old Town ACEC; Organ/Franklin Mountains ACEC; Rincon ACEC; Robledo Mountains ACEC; San Diego Mountain ACEC; Uvas Valley ACEC</i> | Las Cruces District Office-Mimbres Resource Area - Mimbres Resource Management Plan 12/1993                           |
| <i>Bureau of Land Management</i> | <i>Agua Fria ACEC; Horse Mountain ACEC; Ladron Mountain ACEC; Sawtooth ACEC; Soaptree ACEC; Harvey Ecological Plot SMA; San Lorenzo Canyon SMA; San Pedro ACEC; Tinajas ACEC; The Box SMA</i>   | Final Socorro Resource Management Plan 08/1989  |
| <i>Bureau of Land Management</i> | <i>Blue Spring Riparian Habitat ACEC; Chosa Draw Caves Complex ACEC; Dark Canyon ACEC; Pecos River/Canyons Complex ACEC</i>   | Approved Carlsbad Resource Management Plan 09/1988  |
| <i>Bureau of Land Management</i> | <i>El Malpais NCA; Cebolla Wilderness; West Malpais Wilderness</i>  | El Malpais Plan: A Resource Management Plan 09/2001   |
| <i>Bureau of Land Management</i> | <i>Kasha-Katuwe Tent Rocks NM</i>   | Interim Management Policy for BLM National Monuments and BLM National Conservation Areas 10/2001                      |
| <i>Bureau of Land Management</i> | <i>Alamo Mountain ACEC; Alkali Lakes ACEC; Cornudas Mountain ACEC; Sacramento Escarpment ACEC; Three Rivers Petroglyph ACEC; Wind Mountain ACEC</i>   | Otero County Areas of Critical Environmental Concern Resource Management Plan Amendment Caballo Resource Area 08/1997 |
| <i>Bureau of Land Management</i> | <i>Ball Ranch ACEC/RNA; Big Bead Mesa NHL; Bluewater Canyon ACEC; Cabezon Peak ACEC; Canon Tapia ACEC; Elk Springs ACEC; Jones Canyon ACEC; Ojito ACEC; Pronoun Cave Complex ACEC/RNA; San Luis Mesa Raptor Area ACEC; Torrejon Fossil Fauna ACEC</i>   | Final Rio Puerco Resource Management Plan and Record of Decision 11/1986  |
| <i>Bureau of Land Management</i> | <i>Bisti Wilderness</i>   | Final Wilderness Management Plan Bisti Wilderness 07/1986   |

| <b>Land Steward</b>                     | <b>Name of Status 2 Area in New Mexico</b>  | <b>Source of Management Plan</b>  |
|---|---|---|
| <i>Bureau of Land Management</i>        | <i>De-Na-Zin Wilderness</i>   | Final De-Na-Zin Wilderness Management Plan 08/89  |
| <i>U.S. Fish &amp; Wildlife Service</i> | <i>Bitter Lake NWR</i>  | Bitter Lake National Wildlife Refuge Comprehensive Conservation Plan 09/1998  |
| <i>U.S. Fish &amp; Wildlife Service</i> | <i>Bosque Del Apache NWR</i>  | URL:<br><a href="http://www.fws.gov/southwest/refuges/newmex/bosque/">http://www.fws.gov/southwest/refuges/newmex/bosque/</a> |
| <i>U.S. Fish &amp; Wildlife Service</i> | <i>Grulla NWR</i>   | Muleshoe and Grulla National Wildlife Refuges Comprehensive Conservation Plan 07/2004   |
| <i>U.S. Fish &amp; Wildlife Service</i> | <i>Las Vegas NWR</i>  | Las Vegas National Wildlife Refuge Final Comprehensive Conservation Plan 06/2004  |
| <i>U.S. Fish &amp; Wildlife Service</i> | <i>Maxwell NWR</i>  | Maxwell National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Assessment 12/2005                   |
| <i>U.S. Fish &amp; Wildlife Service</i> | <i>San Andres NWR</i>   | Final San Andres National Wildlife Refuge Comprehensive Conservation Plan 09/1998   |
| <i>U.S. Fish &amp; Wildlife Service</i> | <i>Sevilleta NWR</i>  | Sevilleta National Wildlife Refuge Comprehensive Conservation Plan 07/2000  |
| <i>U.S. Forest Service</i>              | <i>Gallinas Creek Watershed (MA J); Santa Fe Watershed (MA O); Rio Chama River Canyon Wild and Scenic River (MA C); Chama River Canyon Wilderness (MA H); Dome Wilderness (MA H); Pecos Wilderness (MA H); San Pedro Parks Wilderness (MA H); Santa Fe NF (MA L); Pecos Wild and Scenic River</i> | Santa Fe National Forest Plan 07/1987; Amendment Change Notice No. 1. 09/1994   |
| <i>U.S. Forest Service</i>              | <i>Valles Caldera National Preserve</i>   | Valles Caldera National Preserve Draft Framework and Strategic Guidance for Comprehensive Management 2003                     |



| <b>Land Steward</b>          | <b>Name of Status 2 Area in New Mexico</b>   | <b>Source of Management Plan</b>  |
|------------------------------|--|---|
| <i>U.S. Forest Service</i>   | <i>Gila NF (MA 7D &amp; MA 4D &amp; MA 7C); Aldo Leopold Wilderness (MA 2E &amp; MA 5B &amp; MA 5C); Blue Range Wilderness (MA 3A); Gila Wilderness (MA 2A &amp; MA 2B &amp; MA 4A &amp; MA 4B &amp; MA 5A &amp; MA 6B &amp; MA 7E &amp; MA 7F &amp; MA 7G &amp; MA 8A &amp; MA 5B); Gila WSA (MA 2G &amp; MA 5C &amp; MA 5D); Hells Hole WSA (MA 4C); Lower San Francisco WSA (MA 4B &amp; MA 4C)</i> | Gila National Forest Plan 09/1986; Amendment No. 9 11/2002  |
| <i>U.S. Forest Service</i>   | <i>Apache Kid Wilderness (MA 3); Manzano Mountain Wilderness (MA 3); Sandia Mountain Wilderness (MA 1); Withington Wilderness (MA 3)</i>   | Cibola National Forest Land and Resource Management Plan 07/1985; Amendment No. 8. 11/1996  |
| <i>U.S. Forest Service</i>   | <i>Capitan Mountains Wilderness (MA 1C); White Mountain Wilderness (MA 1F); South Guadalupe Escarpment WSA (MA 3A)</i>   | Lincoln National Forest Plan 1986; Amendment No. 9. 06/1996   |
| <i>U.S. Forest Service</i>   | <i>Guadalupe Canyon Zoological Area (MA 14)</i>  | Coronado National Forest Plan 08/1986; Forest Plan Change Notice No. 3. 06/1999   |
| <i>National Park Service</i> | <i>Chaco Culture NHP</i>   | General Management Plan Development Concept Plan Chaco Culture National Historical Park 09/1985                                       |
| <i>National Park Service</i> | <i>Pecos NHP</i>   | Draft General Management Plan Environmental Impact Statement Pecos National Historical Park 08/1995                                   |
| <i>National Park Service</i> | <i>Aztec Ruins NM</i>  | Aztec Ruins General Management Plan Development Concept Plan 09/1989  |
| <i>National Park Service</i> | <i>El Malpais NM</i>   | General Management Plan Wilderness Suitability Study El Malpais National Monument 10/1990   |
| <i>National Park Service</i> | <i>Petroglyph NM</i>   | Summary of Final General Management Plan Development Concept Plan Environmental Impact Statement Petroglyph National Monument 11/1996 |
| <i>National Park Service</i> | <i>El Morro NM</i>   | El Morro National Monument Statement For Management 05/1992   |

| <b>Land Steward</b>                           | <b>Name of Status 2 Area in New Mexico</b>  | <b>Source of Management Plan</b>  |
|---|---|---|
| <i>National Park Service</i>                  | <i>Salinas Pueblo Missions NM</i>   | General Management Plan Development Concept Plan Salinas National Monument 10/1984  |
| <i>National Park Service</i>                  | <i>Lechuguilla Cave Protection Area</i>   | Lechuguilla Cave Protection Act of 1993   |
| <i>Audubon Society Preserve</i>               | <i>Randall Davey Audubon Preserve</i>   | URL:<br><a href="http://nm.audubon.org/iba/ibawriteups/rdactnc.html">http://nm.audubon.org/iba/ibawriteups/rdactnc.html</a>   |
| <i>Local Land Trust Preserve/Ease ment</i>    | <i>Malpai Borderlands Group (Animas Foundation/Gray Ranch); Malpai Borderlands Group (Bio-Research Ranch); Malpai Borderlands Group (Family Lands Ltd.)</i>   | URL:<br><a href="http://www.malpaiborderlandsgroup.org/about.asp">http://www.malpaiborderlandsgroup.org/about.asp</a>   |
| <i>The Nature Conservancy</i>                 | <i>Corrales Bosque Mngmt. Agreement; Gila NF (Headwaters Ranch - TNC Grazing Allotment); Gray Ranch; Lama Canyon Preserve; Milnesand Prairie Preserve; Ortiz Mountains-Todilto Limestone Cons. Area; Lichty Ecological Research Center; Sabo Preserve</i>   | URL:<br><a href="http://www.nature.org/wherework/northamerica/states/newmexico/preserves/">http://www.nature.org/wherework/northamerica/states/newmexico/preserves/</a> |
| <i>New Mexico Department of Game and Fish</i> | <i>Sugarite Canyon SP</i>   | Interviewed Natural Resource Planner New Mexico State Parks Department: Steve Cary - 05/2005  |
| <i>New Mexico Department of Game and Fish</i> | <i>Claudell; Fenton Lake Fishing Area (and dam); Brantley Wildlife Area; Colin Neblett WMA; Edward Sargent WMA; Elliott Barker WMA; Huey Wildlife Area; Jackson Lake WMA; Marquez WMA; Picacho Bosque Tract; Red Rock WMA; Rio Chama WMA; Rio de los Pinos Wildlife Area; Urraca WMA; Wagon Mound WMA; Water Canyon Wildlife Area; William A. Humphries Wildlife Management Area; Antelope Flats; Belen Waterfowl Management Area; Bernardo Waterfowl Management Area; Black Hills; Bledsoe; Casa Colorada Waterfowl Area; Crossroads #1; Crossroads #2; Crossroads #3; Crossroads #4; Crossroads #5; East Bluit; Farmers Home; Gallinas Wells #1; Gallinas Wells #1A; Gallinas Wells #1B; Gallinas Wells #2; Gallinas Wells #3; Gallinas Wells #4; Gallinas Wells #5; Gallinas Wells #6; La Joya Waterfowl Management Area; Liberty; Little Dipper; Marshall; Milnesand; North Bluit; Pitchfork; South Bluit; Tatum; Wayside; Bear Canyon Lake (and dam); Eagle Nest Lake; Heart Bar WMA</i> | URL:<br><a href="http://www.wildlife.state.nm.us/conservation/index.htm">http://www.wildlife.state.nm.us/conservation/index.htm</a>                                     |

## Appendix 4-7. Documentation of Status 2 lands in Utah.

| <b>Land Steward</b>              | <b>Name of Status 2 Area in Utah</b>   | <b>Source of Management Plan</b>   |
|----------------------------------|--|--|
| <i>Bureau of Land Management</i> | <i>Bonneville Salt Flats ACEC; Horseshoe Springs ACEC</i>  | Record of Decision for the Pony Express Resource Management Plan and Rangeland Program Summary for Utah County 01/1990 |
| <i>Bureau of Land Management</i> | <i>Browns Park Complex ACEC; Lower Green River ACEC; Nine Mile Canyon ACEC; Pariette Wetlands ACEC; Red Creek ACEC; Red Mountain/Dry Fork Complex ACEC</i>   | Diamond Mountain Resource Area Resource Management Plan and Record of Decision 12/1994                                 |
| <i>Bureau of Land Management</i> | <i>Butler Wash ACEC; Cedar Mesa ACEC; Hovenweep ACEC; Indian Creek ACEC; U-95 Scenic Highway Corridor ACEC; Shay Canyon ACEC</i>   | San Juan/San Miguel Planning Area Resource Management Plan 09/1985   |
| <i>Bureau of Land Management</i> | <i>Canaan Mountain ACEC; Little Creek Mountain ACEC; Lower Virgin River ACEC; Red Bluff ACEC; Red Mountain ACEC; Santa Clara-Gunlock ACEC; Santa Clara River-Land Hill ACEC; Upper Beaver Dam Wash ACEC; Warner Ridge/Fort Pearce ACEC</i>   | St. George Field Office Record of Decision and Resource Management Plan 03/1999  |
| <i>Bureau of Land Management</i> | <i>Copper Globe ACEC; Dry Lake Archaeological District ACEC; Highway I-70 Scenic Corridor ACEC; Muddy Creek ACEC; Lower San Rafael Canyon ACEC; Middle San Rafael Canyon ACEC; Upper San Rafael Canyon ACEC; San Rafael Reef South ACEC; Segers Hole ACEC; Sids Mountain ACEC; Swazey Cabin ACEC; Temple Mountain Historic District ACEC; Muddy Creek/Tomsich Butte Emphasis Area ACEC</i> | San Rafael Final Resource Management Plan and Rangeland Program Summary 05/1991  |
| <i>Bureau of Land Management</i> | <i>Crystal Peak ONA/ACEC; Fossil Mountain Historic Site/ACEC; Notch Peak NNL/ACEC; Pavant Butte ACEC</i>   | Warm Springs Resource Area Resource Management Plan Record of Decision Rangeland Program Summary 04/1987               |

| <b>Land Steward</b>              | <b>Name of Status 2 Area in Utah</b>  | <b>Source of Management Plan</b>  |
|----------------------------------|---|---|
| <i>Bureau of Land Management</i> | <i>Deep Creek Mountains ONA/ACEC; Gandy Mountain Caves ACEC; Grandy Salt Marsh ACEC; Rockwell ONA/ACEC</i>  | House Range Resource Area Resource Management Plan and Record of Decision, Rangeland Program Summary 1987                     |
| <i>Bureau of Land Management</i> | <i>Donner Creek/Bettridge Creek ACEC; Old Central Pacific Railroad Grade ACEC; Salt Wells Wildlife Habitat Area ACEC</i>  | Record of Decision and Rangeland Program Summary for the Box Elder Resource Management Plan 1986                              |
| <i>Bureau of Land Management</i> | <i>Gilbert Badlands ACEC/RNA</i>  | Henry Mountain Parker Mountain and Mountain Valley Management Framework Plans Approved Amendments and Record of Decision 1982 |
| <i>Bureau of Land Management</i> | <i>Laketown Canyon ACEC</i>   | Decision Statement Randolph Management Framework Plan 06/1980   |
| <i>Bureau of Land Management</i> | <i>Grand Staircase-Escalante National Monument; Deer Creek Recreation Site</i>  | Grand Staircase-Escalante National Monument Management Plan 02/2000   |
| <i>Bureau of Land Management</i> | <i>Paria Canyon-Vermillion Cliffs Wilderness</i>  | Final Wilderness Management Plan Paria Canyon-Vermillion Cliffs 03/1986   |
| <i>Bureau of Land Management</i> | <i>Beartrap Canyon WSA; Behind the Rocks WSA; Black Ridge Canyons WSA; Book Cliffs ISA; Bull Canyon WSA; Bull Mountain WSA; Burning Hills WSA; Butler Wash WSA; Canaan Mountains WSA; Carcass Canyon WSA; Cedar Mountains WSA; Cheese Box Canyon WSA; Coal Canyon WSA; Conger Mountain WSA; Cottonwood Canyon WSA; Cougar Canyon WSA; Crack Canyon WSA; Cross Canyon WSA; Daniels Canyon WSA; Dark Canyon Complex ISA; Death Ridge WSA; Deep Creek Mountains WSA; Deep Creek WSA; Desolation Canyon WSA; Devils Canyon WSA; Diamond Breaks WSA; Dirty Devil WSA; Escalante Canyons Tract 5 ISA; Fiddler Butte WSA; Fiftymile Mountain WSA; Fish Creek Canyon WSA; Fish Springs WSA; Floy Canyon WSA; Flume Canyon WSA; Fremont Gorge WSA; French Spring-Happy Canyon WSA; Goose Creek Canyon WSA; Grand Gulch Complex ISA (Bullet Canyon); Grand Gulch Complex ISA (Pine Canyon); Grand Gulch ISA Complex (Shieks Flat) WSA; Horseshoe Canyon (North) WSA; Horseshoe Canyon (South) WSA</i> | Interim Management Policy for Lands Under Wilderness Review 07/1995   |

| <b>Land Steward</b>                          | <b>Name of Status 2 Area in Utah</b>  | <b>Source of Management Plan</b>                                       |
|--|---|--|
| <i>Bureau of Land Management</i>             | <i>Howell Peak WSA; Indian Creek WSA; Jack Canyon WSA; King Top WSA; La Verkin Creek WSA; Link Flats ISA; Little Rockies WSA; Lost Spring Canyon WSA; Mancos Mesa WSA; Mexican Mountain WSA; Mill Creek Canyon WSA; Moquith Mountain WSA; Mount Ellen-Blue Hills WSA; Mount Hillers WSA; Mount Pennel WSA; Mud Spring Canyon WSA; Muddy Creek WSA; Mule Canyon WSA; Negro Bill Canyon WSA; North Escalante Canyons/The Gulch ISA; North Fork Virgin River WSA; North Stansbury Mountains WSA; Notch Peak WSA; Orderville Canyon WSA; Paria/Hackberry 202 WSA; Paria/Hackberry WSA; Parunuweap WSA; Red Butte WSA; Red Mountain (202) WSA; Red Mountain WSA; Road Canyon WSA; Rockwell WSA; San Rafael Reef WSA; Scorpion WSA; Sids Cabin WSA; Sids' Mountain WSA; South Needles WSA; Spring Creek Canyon WSA; Spruce Canyon WSA; Squaw and Papoose Canyon WSA; Steep Creek WSA; Swasey Mountain WSA; Taylor Creek Canyon WSA; The Blues WSA</i> | Interim Management Policy for Lands Under Wilderness Review 07/95      |
| <i>Bureau of Land Management (continued)</i> | <i>The Cockscomb WSA; The Watchman WSA; Turtle Canyon WSA; Wah Wah Mountains WSA; Wahweap WSA; Westwater Canyon WSA; White Rock Range WSA; Winter Ridge WSA</i>   | Interim Management Policy for Lands Under Wilderness Review 07/1995    |
| <i>U.S. Fish &amp; Wildlife Service</i>      | <i>Bear River NWR</i>   | Bear River Migratory Bird Refuge Comprehensive Management Plan 04/1997 |
| <i>U.S. Fish &amp; Wildlife Service</i>      | <i>Ouray NWR</i>  | Ouray National Wildlife Refuge Comprehensive Conservation Plan 07/2000 |
| <i>U.S. Forest Service</i>                   | <i>Logan Canyon Botanical Area (MA 2.6 &amp; MA 2.7); Deseret Peak Wilderness (MA 1.2); High Uintas Wilderness (MA 1.2); Lone Peak Wilderness (MA 1.2); Mount Naomi Wilderness (MA 1.2); Mount Olympus Wilderness (MA 1.2); Twin Peaks Wilderness (MA 1.2); Wellsville Mountain Wilderness (MA 1.2); Wasatch-Cache NF (MA 1.2 &amp; MA 2.6); Ben Lomond Peak SIA (MA 2.7); Willard Basin SIA (MA 2.7); T.W. Daniel Experimental Forest (MA 2.7)</i>   | Revised Forest Plan Wasatch-Cache National Forest 02/2003              |
| <i>U.S. Forest Service</i>                   | <i>Sheep Creek Geologic Area (MA E &amp; MA N); High Uintas Wilderness (MA I)</i>   | Land and Resource Management Plan for Ashley National Forest 10/1986   |

| <b>Land Steward</b>           | <b>Name of Status 2 Area in Utah</b>  | <b>Source of Management Plan</b>  |
|-------------------------------|---|---|
| <i>U.S. Forest Service</i>    | <i>Dixie NF (MA 10B); Ashdown Gorge Wilderness (MA 8A); Box-Death Hollow Wilderness (MA 8A); Pine Valley Mountain Wilderness (MA 8A)</i>                    | Land and Resource Management Plan for the Dixie National Forest 09/1986   |
| <i>U.S. Forest Service</i>    | <i>Fishlake NF (MA 10E &amp; MA 3B)</i>   | Land and Resource Management Plan Fishlake National Forest 1986   |
| <i>U.S. Forest Service</i>    | <i>Manti-La Sal NF (MA - Municipal Water Supply); Dark Canyon Wilderness (MA - Wilderness); Manti-La Sal NF (MA - Watershed Protection and Improvement)</i> | Land and Resource Management Plan for Manti-La Sal National Forest; Amendment No. 2. 09/1990  |
| <i>U.S. Forest Service</i>    | <i>Lone Peak Wilderness (MA 1.4); Mount Nebo Wilderness (MA 1.4); Mount Timpanogos Wilderness (MA 1.4); Uinta NF (MA 1.5)</i>                               | 2003 Land and Resource Management Plan Revision Unita National Forest 05/2003   |
| <i>National Park Service</i>  | <i>Golden Spike NHS</i>   | Statement for Management Golden Spike National Historic Site 09/1988  |
| <i>National Park Service</i>  | <i>Rainbow Bridge NM</i>  | General Management Plan/ Development Concept Plan/Resource Management Plan/ Interpretive Prospectus and Environmental Impact Statement Rainbow Bridge National Monument 07/1990 |
| <i>National Park Service</i>  | <i>Capitol Reef NP</i>  | Final Environmental Impact Statement General Management Plan Development Concept Plan Capitol Reef National Park 09/1988  |
| <i>National Park Service</i>  | <i>Timpanogos Cave NM</i>   | Environmental Impact Statement General Management Plan Development Concept Plan Timpanogos Cave National Monument 08/93   |
| <i>The Nature Conservancy</i> | <i>Deep Creek Mountains; Provo River Corridor; South Shore; Dugout Ranch Preserve</i>   | URL:<br><a href="http://www.nature.org/where/ewework/northamerica/states/utah/preserves/">http://www.nature.org/where/ewework/northamerica/states/utah/preserves/</a>           |

| <b>Land Steward</b>                            | <b>Name of Status 2 Area in Utah</b>   | <b>Source of Management Plan</b>  |
|--|--|---|
| <i>Utah State Parks &amp; Recreation</i>       | <i>Antelope Island SP</i>  | Interviewed Conservation Data/GIS Coordinator for Utah Division of Wildlife Resources: Mike Canning - 06/2005 |
| <i>Utah Department of Wildlife</i>             | <i>Annabella WMA; Avintaquin WMA; Bear River Bottoms WMA; Beaver County WMA; Bicknell Bottoms WMA; Black Canyon WMA; Blue Lake WMA; Book Cliffs WMA; Brigham Face WMA; Brown's Park WMA; Bud Phelps WMA; Burraston Ponds/Nephi WMA; Carr Fork WMA; City Creek WMA; Clear Lake WMA; Coldwater Canyon WMA; Currant Creek WMA; Desert Lake WMA; Diamond Mountain WMA; East Canyon/Red Rock WMA; East Fork Little Bear River WMA; Emery Farm Castle Dale WMA; Emery Farn Harvey Place WMA; Farmington Bay WMA; Gordon Creek WMA; Goshen Warm Springs WMA; Hardware Ranch WMA; Harold S. Crane WMA; Heber WMA - Wallsburg Unit; Heber WMA - West Hills Unit; Henefer-Echo WMA; Hixon Canyon WMA; Hobble Creek WMA; Howard Slough WMA; Indian Canyon WMA; Indian Peaks WMA; James Walter Fitzgerald WMA</i>                      | URL:<br><a href="http://www.wildlife.utah.gov/habitat/">http://www.wildlife.utah.gov/habitat/</a>             |
| <i>Utah Department of Wildlife (continued)</i> | <i>Kamas WMA; L Cook WMA; Lake Fork WMA; Layton Wetlands Preserve; Little Montes Creek WMA; Locomotive Springs WMA; Lower Fish Creek WMA; Lower Huntington Canyon WMA; Lower San Rafael River WMA; Lyne Orme WMA; Mallard Springs WMA; Manti Meadows WMA; Marysvale WMA; Middle Fork WMA; Millard County WMA; Mills Meadow WMA; Millville Face; Monroe Mountain WMA; Morgan WMA; Nash Wash WMA; Nephi WMA; North Nebo WMA - Fountain Green Unit; North Nebo WMA - Loafer Mountain Unit; North Nebo WMA - Mona Bench Unit; North Nebo WMA - Santaquin Unit; North Nebo WMA - Spencer Fork Unit; Northwest Manti WMA - Birdseye/Lake Fork Unit; Northwest Manti WMA - Dairy Fork Unit; Northwest Manti WMA - Hilltop Unit; Northwest Manti WMA - Lasson Draw Unit; Northwest Manti WMA - Starvation Unit; Ogden Bay WMA;</i> | URL:<br><a href="http://www.wildlife.utah.gov/habitat/">http://www.wildlife.utah.gov/habitat/</a>             |

| Land Steward  | Name of Status 2 Area in Utah   | Source of Management Plan   |
|---|---|---|
| <p><i>Utah Department of Wildlife (continued)</i></p> | <p><i>Pahvant WMA; Parowan Canyon WMA; Parowan Front WMA; Powell Slough WMA; Public Shooting Grounds WMA; Richfield WMA; Richmond WMA; Salt Creek WMA; Salt Creek WMA; South Nebo WMA - Deep Creek Unit; South Nebo WMA - Levan Unit; South Nebo WMA - Maple Canyon Unit; South Nebo WMA - Triangle Ranch Unit; Southwest Manti WMA - Ephraim Unit; Southwest Manti WMA - Manti Unit; Southwest Manti WMA - Mayfield Unit; Stewart Lake WMA; Stoddard Slough WMA; Strawberry River WMA; Swan Creek WMA; Tabby Mountain WMA; Taylor Flat WMA; Three Corners WMA; Timpanogos WMA; Timpie Springs WMA; Topaz Marsh WMA; Topaz Slough WMA; Upper Huntington Canyon WMA; Upper San Rafael River WMA; Weber Face WMA; Willard Bay Upland Game WMA; Willow Creek WMA; Yankee Meadows WMA; Cedar City Upland Game Sanctuary; Hat Island SHA; Lee Kay Center &amp; Wildlife Conservation Area; Roosevelt Game Farm; Vernal Game Farm; Henefer Fishing Access</i></p> | <p>URL:<br/><a href="http://www.wildlife.utah.gov/habitat/">http://www.wildlife.utah.gov/habitat/</a></p>   |
| <p><i>Agricultural Research Service</i></p>           | <p><i>Desert Experimental Range</i></p>   | <p>URL:<br/><a href="http://www.fs.fed.us/rmrs/experimental-forests/desert-experimental-range/">http://www.fs.fed.us/rmrs/experimental-forests/desert-experimental-range/</a></p> |
| <p><i>Utah State Land Board</i></p>                   | <p><i>State Sovereign Lands</i></p>   | <p>Utah Lake Comprehensive Management Plan:<br/>Introduction Document on Sovereign Land Management 06/2005</p>  |



**Appendix 5-1. Percent distribution of each land cover type among 22 land stewards in the SWReGAP project area.**

| Code                    | Land Cover Type  | Area in region  | BLM   | BOR  | FWS   | USFS  | DOD/D OE | NPS   | ARS  | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wildl | Other State | Reg. Gov | City | County | Aud  | Land Trust | TNC  | Priv-BioDiv | Priv |       |
|-------------------------|--|-----------------|-------|------|-------|-------|----------|-------|------|---------------|------------|------------|------------|-------------|-------------|----------|------|--------|------|------------|------|-------------|------|-------|
|                         |  | km <sup>2</sup> | %     | %    | %     | %     | %        | %     | %    | %             | %          | %          | %          | %           | %           | %        | %    | %      | %    | %          | %    | %           | %    | %     |
| <b>BARREN LANDS</b>     |  |                 |       |      |       |       |          |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |      |       |
| S010                    | Colorado Plateau Mixed Bedrock Canyon and Tableland                  | 24,313          | 38.3% | 0.0% | 0.0%  | 3.0%  | 0.0%     | 17.6% | 0.0% | 0.0%          | 33.4%      | 0.1%       | 4.0%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 3.3%  |
| S012                    | Inter-Mountain Basins Active and Stabilized Dune                     | 3,103           | 34.8% | 0.1% | 2.8%  | 0.5%  | 10.6%    | 8.1%  | 0.0% | 0.0%          | 20.0%      | 0.1%       | 4.7%       | 0.2%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.4%        | 0.1% | 17.5% |
| S009                    | Inter-Mountain Basins Cliff and Canyon                               | 2,873           | 69.5% | 0.0% | 1.5%  | 14.4% | 2.5%     | 0.2%  | 0.3% | 0.0%          | 1.6%       | 0.0%       | 0.7%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 9.2%  |
| S015                    | Inter-Mountain Basins Playa  | 17,581          | 49.0% | 0.9% | 1.7%  | 0.0%  | 28.8%    | 0.0%  | 0.0% | 0.0%          | 0.7%       | 0.0%       | 3.9%       | 0.8%        | 0.9%        | 0.0%     | 0.0% | 0.2%   | 0.0% | 0.0%       | 0.2% | 0.0%        | 0.0% | 10.3% |
| S011                    | Inter-Mountain Basins Shale Badland                                  | 3,297           | 53.8% | 0.0% | 0.0%  | 0.6%  | 0.0%     | 2.3%  | 0.0% | 0.0%          | 26.6%      | 0.0%       | 7.5%       | 0.2%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 8.7%  |
| S013                    | Inter-Mountain Basins Volcanic Rock and Cinder Land                  | 1,360           | 20.0% | 0.0% | 0.0%  | 25.8% | 0.0%     | 31.2% | 0.0% | 0.0%          | 3.6%       | 0.0%       | 8.5%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 10.7% |
| S014                    | Inter-Mountain Basins Wash   | 46              | 30.9% | 0.0% | 0.0%  | 0.0%  | 2.3%     | 1.3%  | 0.0% | 0.0%          | 14.6%      | 0.0%       | 2.6%       | 1.3%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.8% | 0.0%        | 0.0% | 45.3% |
| S003                    | Mediterranean California Alpine Bedrock and Scree                    | 23              | 1.1%  | 0.0% | 0.0%  | 74.0% | 24.4%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 0.5%  |
| S001                    | North American Alpine Ice Field                                      | 23              | 0.0%  | 0.0% | 0.0%  | 96.1% | 0.0%     | 2.3%  | 0.0% | 0.0%          | 0.0%       | 0.6%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 1.0%  |
| S018                    | North American Warm Desert Active and Stabilized Dune                | 2,728           | 26.1% | 0.4% | 8.2%  | 0.0%  | 47.5%    | 1.6%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 3.8%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 7.0%        | 0.0% | 5.3%  |
| S017                    | North American Warm Desert Badland                                   | 112             | 17.8% | 6.0% | 0.0%  | 0.0%  | 0.2%     | 59.3% | 0.0% | 0.0%          | 0.2%       | 2.1%       | 0.1%       | 6.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 7.7%  |
| S016                    | North American Warm Desert Bedrock Cliff and Outcrop                 | 3,568           | 45.3% | 0.3% | 16.0% | 9.2%  | 3.0%     | 6.8%  | 0.0% | 0.0%          | 5.3%       | 0.6%       | 4.8%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.3% | 0.0%        | 0.6% | 7.4%  |
| S021                    | North American Warm Desert Pavement                                  | 393             | 40.0% | 1.3% | 1.2%  | 0.3%  | 3.5%     | 18.4% | 0.0% | 0.0%          | 0.9%       | 0.2%       | 9.6%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.4% | 0.1%        | 0.0% | 22.1% |
| S022                    | North American Warm Desert Playa                                     | 1,115           | 25.3% | 0.1% | 14.2% | 0.8%  | 28.0%    | 14.5% | 0.1% | 0.0%          | 0.0%       | 0.5%       | 1.3%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.9%        | 0.0% | 12.5% |
| S019                    | North American Warm Desert Volcanic Rockland                         | 992             | 40.1% | 0.8% | 2.4%  | 1.4%  | 18.3%    | 9.9%  | 0.0% | 0.0%          | 0.1%       | 0.1%       | 8.8%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.2%       | 2.1% | 11.7%       | 0.0% | 4.0%  |
| S002                    | Rocky Mountain Alpine Bedrock and Scree                              | 3,863           | 3.7%  | 0.0% | 0.0%  | 84.4% | 0.0%     | 5.1%  | 0.0% | 0.0%          | 0.0%       | 0.4%       | 0.1%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.2% | 0.1%        | 0.0% | 5.5%  |
| S004                    | Rocky Mountain Alpine Fell-Field                                     | 761             | 3.7%  | 0.0% | 0.0%  | 84.8% | 0.0%     | 6.6%  | 0.0% | 0.0%          | 0.0%       | 0.4%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 0.0% | 4.2%  |
| S006                    | Rocky Mountain Cliff, Canyon and Massive Bedrock                     | 2,965           | 19.3% | 0.0% | 0.1%  | 50.5% | 0.2%     | 2.6%  | 0.0% | 0.0%          | 6.4%       | 0.1%       | 2.7%       | 1.4%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.2% | 0.2%        | 0.0% | 15.9% |
| S007                    | Sierra Nevada Cliff and Canyon                                       | 123             | 37.1% | 0.0% | 0.0%  | 32.7% | 7.4%     | 0.0%  | 0.0% | 0.0%          | 2.5%       | 0.2%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.1% | 0.2%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 0.0% | 19.6% |
| S008                    | Western Great Plains Cliff and Outcrop                               | 309             | 5.9%  | 0.0% | 0.0%  | 4.4%  | 1.0%     | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 13.5%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.1%        | 0.0% | 75.1% |
| <b>EVERGREEN FOREST</b> |  |                 |       |      |       |       |          |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |      |       |
| S039                    | Colorado Plateau Pinyon-Juniper Woodland                             | 97,855          | 29.9% | 0.0% | 0.0%  | 16.6% | 0.0%     | 2.7%  | 0.0% | 0.0%          | 24.9%      | 0.1%       | 6.8%       | 0.6%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.1%        | 0.0% | 18.1% |
| S040                    | Great Basin Pinyon-Juniper Woodland                                  | 50,776          | 64.9% | 0.0% | 0.7%  | 20.2% | 2.7%     | 1.2%  | 0.0% | 0.0%          | 0.6%       | 0.1%       | 1.6%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 7.8%  |
| S026                    | Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland     | 666             | 18.1% | 0.0% | 2.4%  | 69.4% | 0.4%     | 7.0%  | 0.0% | 0.0%          | 1.4%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.1%        | 0.0% | 1.2%  |
| S051                    | Madrean Encinal  | 4,358           | 14.3% | 0.0% | 0.2%  | 42.4% | 0.8%     | 1.7%  | 0.1% | 0.0%          | 2.3%       | 0.1%       | 14.9%      | 0.0%        | 0.0%        | 0.0%     | 0.1% | 0.0%   | 0.0% | 3.7%       | 0.6% | 0.1%        | 0.0% | 18.7% |
| S035                    | Madrean Pine-Oak Forest and Woodland                                 | 5,733           | 1.4%  | 0.0% | 0.0%  | 58.7% | 0.1%     | 0.4%  | 0.0% | 0.0%          | 30.9%      | 0.0%       | 2.1%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.1%       | 0.0% | 0.0%        | 0.0% | 6.2%  |
| S112                    | Madrean Pinyon-Juniper Woodland                                      | 21,918          | 6.8%  | 0.0% | 0.2%  | 42.1% | 2.7%     | 0.3%  | 0.0% | 0.0%          | 21.1%      | 0.0%       | 8.2%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.2%       | 0.1% | 0.1%        | 0.0% | 18.1% |
| S111                    | Madrean Upper Montane Conifer-Oak Forest and Woodland                | 795             | 0.4%  | 0.0% | 0.0%  | 71.3% | 0.5%     | 1.2%  | 0.0% | 0.0%          | 21.0%      | 0.0%       | 0.4%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.6%       | 0.0% | 0.0%        | 0.0% | 4.6%  |
| S033                    | Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland | 2               | 0.0%  | 0.0% | 0.0%  | 88.2% | 0.0%     | 0.0%  | 0.0% | 0.0%          | 0.0%       | 8.3%       | 0.0%       | 0.0%        | 0.0%        | 0.3%     | 0.0% | 0.5%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 2.8%  |

| Code                    | Land Cover Type   | Area in region  | BLM   | BOR  | FWS  | USFS  | DOD/D OE | NPS   | ARS  | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wildl | Other State | Reg. Gov | City | County | Aud  | Land Trust | TNC  | Priv-BioDiv | Priv  |
|-------------------------|---|-----------------|-------|------|------|-------|----------|-------|------|---------------|------------|------------|------------|-------------|-------------|----------|------|--------|------|------------|------|-------------|-------|
|                         |   | km <sup>2</sup> | %     | %    | %    | %     | %        | %     | %    | %             | %          | %          | %          | %           | %           | %        | %    | %      | %    | %          | %    | %           | %     |
| S123                    | Mediterranean California Ponderosa-Jeffrey Pine Forest and Woodland | 209             | 0.0%  | 0.0% | 0.0% | 69.7% | 0.0%     | 0.0%  | 0.0% | 0.0%          | 0.1%       | 8.8%       | 0.0%       | 0.0%        | 2.7%        | 0.3%     | 0.0% | 0.8%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 17.5% |
| S121                    | Mediterranean California Red Fir Forest and Woodland                | 106             | 0.0%  | 0.0% | 0.0% | 78.5% | 0.0%     | 0.0%  | 0.0% | 0.0%          | 0.0%       | 13.8%      | 0.0%       | 0.0%        | 0.3%        | 0.0%     | 0.0% | 0.6%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 6.8%  |
| S029                    | Northern Pacific Mesic Subalpine Parkland                           | 42              | 0.2%  | 0.0% | 0.0% | 96.1% | 0.0%     | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.1%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 3.5%  |
| S032                    | Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland  | 8,953           | 8.8%  | 0.0% | 0.5% | 62.5% | 0.0%     | 2.2%  | 0.0% | 0.0%          | 4.8%       | 0.2%       | 2.1%       | 1.1%        | 0.0%        | 0.0%     | 0.1% | 0.1%   | 0.0% | 0.0%       | 0.3% | 0.6%        | 17.0% |
| S125                    | Rocky Mountain Foothill Limber Pine-Juniper Woodland                | 6               | 0.4%  | 0.0% | 0.0% | 3.9%  | 0.0%     | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 7.6%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 87.3% |
| S031                    | Rocky Mountain Lodgepole Pine Forest                                | 8,764           | 3.4%  | 0.0% | 0.0% | 79.5% | 0.0%     | 2.9%  | 0.0% | 0.0%          | 0.2%       | 1.4%       | 0.6%       | 0.3%        | 0.0%        | 0.1%     | 0.0% | 0.2%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 11.2% |
| S034                    | Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland      | 7,295           | 10.4% | 0.0% | 0.4% | 57.5% | 0.0%     | 1.2%  | 0.0% | 0.0%          | 3.3%       | 0.2%       | 1.5%       | 1.5%        | 0.0%        | 0.0%     | 0.2% | 0.3%   | 0.0% | 0.0%       | 0.4% | 0.8%        | 22.1% |
| S028                    | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland   | 14,814          | 2.5%  | 0.0% | 0.0% | 86.4% | 0.1%     | 1.8%  | 0.0% | 0.0%          | 1.1%       | 0.4%       | 0.4%       | 0.2%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.2%        | 6.7%  |
| S030                    | Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland       | 10,359          | 3.5%  | 0.0% | 0.0% | 84.0% | 0.1%     | 1.9%  | 0.0% | 0.0%          | 1.1%       | 0.3%       | 0.4%       | 0.3%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.2%        | 8.0%  |
| S025                    | Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland   | 801             | 4.2%  | 0.0% | 0.0% | 64.3% | 0.0%     | 0.6%  | 0.0% | 0.0%          | 4.5%       | 0.0%       | 1.7%       | 2.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 2.4%        | 20.0% |
| S122                    | Sierra Nevada Subalpine Lodgepole Pine Forest and Woodland          | 20              | 0.8%  | 0.0% | 0.0% | 85.6% | 0.1%     | 0.0%  | 0.0% | 0.0%          | 0.0%       | 6.9%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.1%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 6.3%  |
| S038                    | Southern Rocky Mountain Pinyon-Juniper Woodland                     | 15,305          | 13.7% | 0.0% | 0.4% | 18.1% | 1.6%     | 0.7%  | 0.0% | 0.0%          | 5.4%       | 0.3%       | 7.3%       | 0.5%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.3% | 1.7%        | 50.0% |
| S036                    | Southern Rocky Mountain Ponderosa Pine Woodland                     | 50,221          | 2.8%  | 0.0% | 0.0% | 58.6% | 0.2%     | 1.1%  | 0.0% | 0.0%          | 13.5%      | 0.2%       | 1.6%       | 0.6%        | 0.0%        | 0.0%     | 0.1% | 0.2%   | 0.0% | 0.0%       | 0.1% | 2.3%        | 18.7% |
| <b>DECIDUOUS FOREST</b> |   |                 |       |      |      |       |          |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |
| S023                    | Rocky Mountain Aspen Forest and Woodland                            | 20,985          | 5.0%  | 0.0% | 0.1% | 62.2% | 0.0%     | 0.3%  | 0.0% | 0.0%          | 2.2%       | 0.3%       | 1.6%       | 0.9%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.2% | 0.2%        | 27.0% |
| S024                    | Rocky Mountain Bigtooth Maple Ravine Woodland                       | 888             | 1.0%  | 0.0% | 0.0% | 34.9% | 0.1%     | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.3%       | 1.1%       | 3.3%        | 0.0%        | 0.0%     | 0.0% | 0.1%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 59.0% |
| <b>MIXED FOREST</b>     |   |                 |       |      |      |       |          |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |
| S042                    | Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland       | 3,439           | 5.7%  | 0.0% | 0.0% | 71.7% | 0.0%     | 1.0%  | 0.0% | 0.0%          | 1.0%       | 0.0%       | 1.4%       | 0.4%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.5% | 0.3%        | 17.9% |
| <b>SHRUB/SCRUB</b>      |   |                 |       |      |      |       |          |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |
| S058                    | Apacherian-Chihuahuan Mesquite Upland Scrub                         | 31,685          | 23.2% | 0.1% | 0.9% | 12.1% | 1.2%     | 0.1%  | 1.1% | 0.0%          | 7.6%       | 0.1%       | 25.0%      | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.1%       | 0.1% | 0.2%        | 28.0% |
| S062                    | Chihuahuan Mixed Desert and Thorn Scrub                             | 27,409          | 41.4% | 0.3% | 0.7% | 1.3%  | 7.1%     | 0.2%  | 0.5% | 0.0%          | 1.5%       | 0.2%       | 22.9%      | 0.2%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.2%       | 0.1% | 1.8%        | 21.6% |
| S116                    | Chihuahuan Mixed Salt Desert Scrub                                  | 4,413           | 29.3% | 0.0% | 0.7% | 9.1%  | 12.0%    | 1.7%  | 0.2% | 0.0%          | 6.1%       | 0.1%       | 19.5%      | 0.5%        | 0.0%        | 0.0%     | 0.1% | 0.0%   | 0.0% | 0.2%       | 0.2% | 0.1%        | 20.0% |
| S068                    | Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub              | 5,726           | 39.1% | 0.0% | 0.0% | 0.0%  | 34.4%    | 1.4%  | 0.1% | 0.0%          | 0.1%       | 0.0%       | 12.2%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.2%        | 12.2% |
| S061                    | Chihuahuan Succulent Desert Scrub                                   | 187             | 32.8% | 0.0% | 0.2% | 7.9%  | 1.4%     | 2.0%  | 0.0% | 0.0%          | 6.4%       | 0.1%       | 28.1%      | 0.0%        | 0.0%        | 0.0%     | 0.1% | 0.1%   | 0.0% | 0.5%       | 0.1% | 0.1%        | 20.2% |
| S117                    | Coahuilan Chaparral   | 93              | 16.9% | 0.0% | 0.0% | 43.1% | 0.0%     | 30.0% | 0.0% | 0.0%          | 0.0%       | 0.0%       | 6.5%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 3.5%  |
| S059                    | Colorado Plateau Blackbrush-Mormon-tea Shrubland                    | 13,310          | 42.5% | 0.0% | 0.0% | 0.2%  | 0.0%     | 13.4% | 0.0% | 0.0%          | 36.0%      | 0.0%       | 5.6%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 2.1%  |
| S056                    | Colorado Plateau Mixed Low Sagebrush Shrubland                      | 2,401           | 42.5% | 0.0% | 0.0% | 0.8%  | 0.0%     | 0.1%  | 0.0% | 0.0%          | 11.0%      | 0.2%       | 13.5%      | 1.5%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 30.4% |
| S052                    | Colorado Plateau Pinyon-Juniper Shrubland                           | 11,535          | 70.7% | 0.0% | 0.0% | 1.4%  | 0.0%     | 6.1%  | 0.0% | 0.0%          | 6.7%       | 0.2%       | 6.5%       | 0.5%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 7.8%  |
| S053                    | Great Basin Semi-Desert Chaparral                                   | 163             | 5.9%  | 0.0% | 0.0% | 76.3% | 0.1%     | 0.1%  | 0.0% | 0.0%          | 0.8%       | 2.5%       | 0.0%       | 0.0%        | 0.8%        | 0.0%     | 0.0% | 0.1%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 13.3% |

| Code                        | Land Cover Type  | Area in region  | BLM   | BOR  | FWS   | USFS  | DOD/D OE | NPS   | ARS  | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wildl | Other State | Reg. Gov | City | County | Aud  | Land Trust | TNC  | Priv-BioDiv | Priv  |       |
|-----------------------------|--|-----------------|-------|------|-------|-------|----------|-------|------|---------------|------------|------------|------------|-------------|-------------|----------|------|--------|------|------------|------|-------------|-------|-------|
|                             |  | km <sup>2</sup> | %     | %    | %     | %     | %        | %     | %    | %             | %          | %          | %          | %           | %           | %        | %    | %      | %    | %          | %    | %           | %     | %     |
| S055                        | Great Basin Xeric Mixed Sagebrush Shrubland                    | 35,433          | 78.4% | 0.0% | 2.2%  | 5.7%  | 3.3%     | 0.1%  | 0.1% | 0.0%          | 0.6%       | 0.0%       | 0.8%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0%  | 8.7%  |
| S054                        | Inter-Mountain Basins Big Sagebrush Shrubland                  | 108,476         | 64.8% | 0.0% | 1.1%  | 2.8%  | 2.0%     | 0.6%  | 0.0% | 0.0%          | 4.6%       | 0.1%       | 2.7%       | 0.4%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0%  | 21.0% |
| S045                        | Inter-Mountain Basins Mat Saltbush Shrubland                   | 4,130           | 75.5% | 0.0% | 0.0%  | 0.2%  | 0.1%     | 2.6%  | 0.0% | 0.0%          | 0.8%       | 0.1%       | 10.1%      | 0.0%        | 0.1%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0%  | 10.5% |
| S065                        | Inter-Mountain Basins Mixed Salt Desert Scrub                  | 79,294          | 65.1% | 0.3% | 0.2%  | 0.9%  | 6.0%     | 0.5%  | 0.1% | 0.0%          | 11.0%      | 0.1%       | 3.0%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.1%        | 0.0%  | 12.4% |
| S050                        | Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland | 2,550           | 40.6% | 0.0% | 2.4%  | 45.4% | 0.0%     | 2.4%  | 0.0% | 0.0%          | 0.6%       | 0.0%       | 0.7%       | 0.3%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.1%        | 0.0%  | 7.5%  |
| S057                        | Mogollon Chaparral   | 11,515          | 19.2% | 0.0% | 0.2%  | 45.4% | 1.2%     | 1.3%  | 0.0% | 0.0%          | 8.8%       | 0.1%       | 11.5%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.2% | 0.1%        | 0.2%  | 11.8% |
| S060                        | Mojave Mid-Elevation Mixed Desert Scrub                        | 16,763          | 52.3% | 0.0% | 13.7% | 2.8%  | 9.6%     | 7.8%  | 0.0% | 0.0%          | 3.9%       | 0.1%       | 1.7%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0%  | 8.0%  |
| S043                        | Rocky Mountain Alpine Dwarf-Shrubland                          | 109             | 0.0%  | 0.0% | 0.0%  | 99.4% | 0.0%     | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0%  | 0.4%  |
| S046                        | Rocky Mountain Gambel Oak-Mixed Montane Shrubland              | 18,950          | 13.7% | 0.0% | 0.0%  | 29.1% | 0.4%     | 0.8%  | 0.0% | 0.0%          | 3.4%       | 0.5%       | 2.5%       | 2.3%        | 0.0%        | 0.0%     | 0.0% | 0.1%   | 0.0% | 0.0%       | 0.2% | 1.3%        | 45.6% |       |
| S047                        | Rocky Mountain Lower Montane-Foothill Shrubland                | 2,823           | 27.2% | 0.0% | 0.0%  | 8.1%  | 0.1%     | 1.4%  | 0.0% | 0.0%          | 1.0%       | 0.2%       | 4.6%       | 2.3%        | 0.0%        | 0.1%     | 0.5% | 1.3%   | 0.0% | 0.0%       | 0.4% | 0.0%        | 52.8% |       |
| S069                        | Sonora-Mojave Creosotebush-White Bursage Desert Scrub          | 58,763          | 40.8% | 0.5% | 8.7%  | 0.1%  | 14.8%    | 6.5%  | 0.0% | 0.0%          | 8.5%       | 0.4%       | 7.4%       | 0.1%        | 0.0%        | 0.1%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0%  | 12.0% |
| S070                        | Sonora-Mojave Mixed Salt Desert Scrub                          | 2,549           | 28.1% | 0.0% | 15.2% | 0.1%  | 13.0%    | 0.8%  | 0.0% | 0.0%          | 15.5%      | 0.2%       | 4.5%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0%  | 22.5% |
| S114                        | Sonora-Mojave Semi-Desert Chaparral                            | 89              | 11.9% | 0.0% | 6.0%  | 80.8% | 0.0%     | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.3%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0%  | 1.1%  |
| S129                        | Sonoran Mid-Elevation Desert Scrub                             | 5,393           | 45.5% | 0.0% | 0.4%  | 9.9%  | 0.1%     | 0.3%  | 0.1% | 0.0%          | 5.7%       | 0.0%       | 18.3%      | 0.0%        | 0.0%        | 0.1%     | 0.0% | 0.3%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0%  | 19.1% |
| S063                        | Sonoran Paloverde-Mixed Cacti Desert Scrub                     | 39,792          | 34.4% | 0.4% | 7.2%  | 6.8%  | 5.4%     | 2.5%  | 0.2% | 0.0%          | 18.6%      | 0.3%       | 14.4%      | 0.1%        | 0.0%        | 1.0%     | 0.3% | 0.3%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0%  | 8.0%  |
| S136                        | Southern Colorado Plateau Sand Shrubland                       | 7,021           | 7.1%  | 0.0% | 0.0%  | 0.0%  | 0.0%     | 1.0%  | 0.0% | 0.0%          | 84.9%      | 0.1%       | 2.7%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0%  | 4.2%  |
| S138                        | Western Great Plains Mesquite Woodland and Shrubland           | 1,797           | 0.3%  | 0.0% | 0.0%  | 0.2%  | 0.0%     | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.2%       | 12.2%      | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0%  | 86.9% |
| S048                        | Western Great Plains Sandhill Shrubland                        | 13,894          | 11.8% | 0.0% | 0.0%  | 1.3%  | 0.3%     | 0.1%  | 0.0% | 0.0%          | 0.0%       | 0.1%       | 15.0%      | 0.8%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 1.2%        | 0.0%  | 69.5% |
| S128                        | Wyoming Basins Low Sagebrush Shrubland                         | 47              | 77.0% | 0.0% | 0.0%  | 0.2%  | 0.0%     | 8.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 8.2%       | 0.8%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0%  | 5.8%  |
| <b>GRASSLAND/HERBACEOUS</b> |  |                 |       |      |       |       |          |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |       |
| S077                        | Apacherian-Chihuahuan Semi-Desert Grassland and Steppe         | 45,714          | 28.8% | 0.0% | 1.8%  | 4.9%  | 6.5%     | 0.4%  | 0.1% | 0.0%          | 2.0%       | 0.1%       | 20.3%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 1.9% | 0.5%        | 2.1%  | 30.5% |
| S087                        | Central Mixedgrass Prairie                                     | 120             | 0.0%  | 0.0% | 0.0%  | 0.0%  | 0.0%     | 0.0%  | 0.0% | 0.0%          | 0.0%       | 4.1%       | 9.6%       | 2.5%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0%  | 83.7% |
| S080                        | Chihuahuan Gypsophilous Grassland and Steppe                   | 804             | 7.6%  | 0.0% | 0.1%  | 0.1%  | 65.8%    | 18.7% | 0.0% | 0.0%          | 0.0%       | 0.0%       | 3.0%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 1.1%        | 3.5%  |       |
| S113                        | Chihuahuan Sandy Plains Semi-Desert Grassland                  | 986             | 26.0% | 0.1% | 0.8%  | 0.8%  | 14.2%    | 1.0%  | 2.3% | 0.0%          | 0.1%       | 0.1%       | 18.9%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.9% | 0.0%        | 9.5%  | 25.1% |
| S109                        | Chihuahuan-Sonoran Desert Bottomland and Swale Grassland       | <1              | 0.0%  | 0.0% | 0.0%  | 0.0%  | 0.0%     | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 2.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0%  | 98.0% |
| S078                        | Inter-Mountain Basins Big Sagebrush Steppe                     | 1,797           | 51.1% | 0.0% | 0.6%  | 1.1%  | 0.1%     | 0.0%  | 0.0% | 0.0%          | 1.6%       | 0.1%       | 1.6%       | 0.6%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0%  | 43.1% |
| S075                        | Inter-Mountain Basins Juniper Savanna                          | 5,590           | 11.4% | 0.0% | 0.4%  | 2.5%  | 0.0%     | 0.2%  | 0.0% | 0.0%          | 29.1%      | 0.0%       | 19.3%      | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.1%        | 36.7% |       |
| S071                        | Inter-Mountain Basins Montane Sagebrush Steppe                 | 40,652          | 32.3% | 0.0% | 1.1%  | 29.0% | 0.2%     | 0.3%  | 0.0% | 0.0%          | 2.2%       | 0.1%       | 3.5%       | 1.2%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 30.0% |       |
| S090                        | Inter-Mountain Basins Semi-Desert Grassland                    | 33,640          | 16.1% | 0.0% | 0.5%  | 3.0%  | 0.4%     | 0.9%  | 0.0% | 0.0%          | 34.7%      | 0.1%       | 11.7%      | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.1%        | 32.3% |       |
| S079                        | Inter-Mountain Basins Semi-Desert Shrub-Steppe                 | 47,618          | 31.5% | 0.0% | 1.3%  | 2.4%  | 2.9%     | 1.3%  | 0.1% | 0.0%          | 25.8%      | 0.0%       | 10.5%      | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.6% | 0.0%        | 23.3% |       |
| S115                        | Madrean Juniper Savanna  | 994             | 22.6% | 0.0% | 0.2%  | 23.4% | 0.9%     | 0.5%  | 0.0% | 0.0%          | 5.7%       | 0.0%       | 12.9%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.2%       | 0.1% | 0.1%        | 33.3% |       |

| Code                               | Land Cover Type  | Area in region  | BLM   | BOR  | FWS  | USFS  | DOD/D OE | NPS  | ARS  | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wildl | Other State | Reg. Gov | City | County | Aud  | Land Trust | TNC  | Priv-BioDiv | Priv  |
|------------------------------------|--|-----------------|-------|------|------|-------|----------|------|------|---------------|------------|------------|------------|-------------|-------------|----------|------|--------|------|------------|------|-------------|-------|
|                                    |  | km <sup>2</sup> | %     | %    | %    | %     | %        | %    | %    | %             | %          | %          | %          | %           | %           | %        | %    | %      | %    | %          | %    | %           | %     |
| S134                               | North Pacific Montane Grassland  | 27              | 9.1%  | 0.0% | 0.0% | 80.7% | 0.8%     | 0.0% | 0.0% | 0.0%          | 0.0%       | 2.1%       | 0.0%       | 0.0%        | 0.3%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.2% | 0.0%        | 6.7%  |
| S081                               | Rocky Mountain Dry Tundra  | 2,779           | 5.2%  | 0.0% | 0.0% | 83.7% | 0.0%     | 4.0% | 0.0% | 0.0%          | 0.0%       | 0.3%       | 0.1%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.4% | 0.3%        | 5.8%  |
| S083                               | Rocky Mountain Subalpine Mesic Meadow                                    | 2,177           | 2.0%  | 0.0% | 0.0% | 72.0% | 0.0%     | 0.4% | 0.0% | 0.0%          | 0.5%       | 0.2%       | 1.5%       | 0.4%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.3%        | 22.6% |
| S074                               | Southern Rocky Mountain Juniper Woodland and Savanna                     | 11,956          | 4.7%  | 0.0% | 0.2% | 4.3%  | 1.8%     | 0.2% | 0.0% | 0.0%          | 5.9%       | 0.1%       | 12.0%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.1%        | 70.5% |
| S085                               | Southern Rocky Mountain Montane-Subalpine Grassland                      | 10,293          | 11.8% | 0.0% | 0.0% | 34.3% | 0.0%     | 0.4% | 0.0% | 0.0%          | 2.3%       | 0.5%       | 5.2%       | 1.8%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.3% | 0.7%        | 42.3% |
| S086                               | Western Great Plains Foothill and Piedmont Grassland                     | 5,066           | 1.4%  | 0.0% | 0.2% | 3.2%  | 2.0%     | 0.1% | 0.0% | 0.1%          | 0.4%       | 0.3%       | 5.3%       | 0.6%        | 0.0%        | 0.1%     | 0.7% | 0.5%   | 0.0% | 0.0%       | 0.9% | 0.6%        | 83.6% |
| S089                               | Western Great Plains Sand Prairie  | 18              | 0.0%  | 0.0% | 0.0% | 0.0%  | 0.0%     | 0.0% | 0.0% | 0.0%          | 0.0%       | 0.0%       | 5.3%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 94.7% |
| S088                               | Western Great Plains Shortgrass Prairie                                  | 113,162         | 2.7%  | 0.0% | 0.0% | 2.4%  | 1.0%     | 0.0% | 0.0% | 0.0%          | 0.0%       | 0.0%       | 13.5%      | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.3% | 0.2%        | 79.4% |
| S132                               | Western Great Plains Tallgrass Prairie                                   | 1               | 0.0%  | 0.0% | 0.0% | 0.0%  | 0.0%     | 0.0% | 0.0% | 0.0%          | 0.0%       | 14.1%      | 0.9%       | 27.5%       | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 57.0% |
| <b>WOODY WETLAND</b>               |  |                 |       |      |      |       |          |      |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |
| S118                               | Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland   | 1,360           | 18.5% | 0.4% | 0.7% | 13.7% | 0.6%     | 0.1% | 0.0% | 0.0%          | 3.9%       | 0.6%       | 0.9%       | 2.4%        | 0.1%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 56.6% |
| S096                               | Inter-Mountain Basins Greasewood Flat                                    | 23,770          | 48.7% | 1.6% | 0.9% | 0.1%  | 3.6%     | 0.5% | 0.0% | 0.0%          | 12.3%      | 0.1%       | 4.3%       | 0.6%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.8% | 0.0%        | 25.7% |
| S094                               | North American Warm Desert Lower Montane Riparian Woodland and Shrubland | 426             | 15.0% | 0.0% | 0.7% | 24.7% | 1.1%     | 0.8% | 0.0% | 0.0%          | 8.2%       | 0.4%       | 9.7%       | 1.9%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 1.3%       | 0.4% | 3.6%        | 31.0% |
| S098                               | North American Warm Desert Riparian Mesquite Bosque                      | 832             | 9.9%  | 0.3% | 2.8% | 4.7%  | 0.3%     | 0.9% | 0.1% | 0.0%          | 47.5%      | 0.3%       | 11.1%      | 1.1%        | 0.0%        | 0.0%     | 0.0% | 0.3%   | 0.0% | 0.1%       | 0.7% | 0.0%        | 19.1% |
| S097                               | North American Warm Desert Riparian Woodland and Shrubland               | 422             | 19.2% | 1.2% | 5.5% | 11.3% | 1.8%     | 3.6% | 0.0% | 0.0%          | 13.5%      | 0.6%       | 9.2%       | 3.1%        | 0.0%        | 0.1%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.3% | 0.5%        | 25.8% |
| S020                               | North American Warm Desert Wash  | 652             | 44.3% | 2.5% | 1.6% | 1.7%  | 2.0%     | 2.5% | 0.1% | 0.0%          | 7.9%       | 0.6%       | 8.5%       | 0.4%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.1%       | 0.1% | 0.2%        | 27.0% |
| S093                               | Rocky Mountain Lower Montane Riparian Woodland and Shrubland             | 2,226           | 11.5% | 0.0% | 0.7% | 11.5% | 0.4%     | 1.9% | 0.0% | 0.0%          | 15.2%      | 1.0%       | 2.4%       | 1.8%        | 0.0%        | 0.0%     | 0.0% | 0.1%   | 0.0% | 0.0%       | 0.5% | 0.2%        | 52.1% |
| S091                               | Rocky Mountain Subalpine-Montane Riparian Shrubland                      | 3,224           | 3.3%  | 0.0% | 0.2% | 71.4% | 0.0%     | 2.1% | 0.0% | 0.0%          | 0.7%       | 0.6%       | 0.9%       | 0.8%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.3% | 0.2%        | 19.2% |
| S092                               | Rocky Mountain Subalpine-Montane Riparian Woodland                       | 292             | 9.7%  | 0.0% | 0.0% | 45.7% | 0.0%     | 1.5% | 0.0% | 0.0%          | 0.7%       | 1.7%       | 1.4%       | 1.2%        | 0.4%        | 0.1%     | 0.0% | 0.3%   | 0.0% | 0.0%       | 1.2% | 0.4%        | 35.5% |
| S120                               | Western Great Plains Floodplain  | 836             | 0.0%  | 0.0% | 0.1% | 0.0%  | 0.8%     | 0.0% | 0.0% | 0.0%          | 0.0%       | 0.6%       | 2.7%       | 3.0%        | 0.0%        | 0.0%     | 0.7% | 0.4%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 90.6% |
| S095                               | Western Great Plains Riparian Woodland and Shrubland                     | 1,713           | 2.5%  | 1.8% | 2.7% | 1.4%  | 1.0%     | 0.1% | 0.0% | 0.0%          | 10.9%      | 1.0%       | 3.3%       | 3.8%        | 0.0%        | 0.1%     | 1.0% | 0.4%   | 0.0% | 0.0%       | 0.2% | 1.4%        | 67.6% |
| <b>EMERGENT HERBACEOUS WETLAND</b> |  |                 |       |      |      |       |          |      |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |
| S105                               | Mediterranean California Subalpine-Montane Fen                           | 2               | 1.2%  | 0.0% | 0.0% | 98.8% | 0.0%     | 0.0% | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0%  |
| S100                               | North American Arid West Emergent Marsh                                  | 1,053           | 8.8%  | 4.3% | 9.6% | 0.9%  | 2.0%     | 0.1% | 0.0% | 0.0%          | 1.5%       | 1.2%       | 2.3%       | 9.8%        | 1.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.7% | 0.0%        | 40.4% |
| S102                               | Rocky Mountain Alpine-Montane Wet Meadow                                 | 1,956           | 2.6%  | 0.0% | 1.1% | 60.6% | 0.0%     | 0.5% | 0.0% | 0.0%          | 1.9%       | 0.2%       | 1.4%       | 0.9%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.4% | 1.1%        | 28.9% |
| S103                               | Temperate Pacific Subalpine-Montane Wet Meadow                           | 2               | 13.6% | 0.0% | 0.0% | 26.6% | 0.0%     | 0.0% | 0.0% | 0.0%          | 0.0%       | 19.3%      | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 39.9% |
| S108                               | Western Great Plains Saline Depression Wetland                           | 41              | 19.2% | 0.0% | 0.5% | 0.0%  | 0.0%     | 0.0% | 0.0% | 0.0%          | 0.0%       | 0.0%       | 10.5%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 19.8% |
| <b>ALTERED or DISTURBED</b>        |  |                 |       |      |      |       |          |      |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |
| D01                                | Disturbed, Non-specific  | 93              | 3.3%  | 0.0% | 0.0% | 0.0%  | 0.0%     | 0.0% | 0.0% | 0.0%          | 0.0%       | 0.1%       | 0.0%       | 5.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 90.7% |
| D14                                | Disturbed, Oil Well  | 46              | 12.8% | 0.0% | 0.0% | 2.1%  | 0.0%     | 0.0% | 0.0% | 0.0%          | 2.2%       | 0.0%       | 5.8%       | 0.9%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.5% | 0.0%        | 75.7% |

| Code  | Land Cover Type                                    | Area in region  | BLM   | BOR  | FWS   | USFS  | DOD/DOE | NPS  | ARS  | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wildl | Other State | Reg. Gov | City | County | Aud  | Land Trust | TNC  | Priv-BioDiv | Priv |       |
|---|--|-----------------|-------|------|-------|-------|---------|------|------|---------------|------------|------------|------------|-------------|-------------|----------|------|--------|------|------------|------|-------------|------|-------|
|   |  | km <sup>2</sup> | %     | %    | %     | %     | %       | %    | %    | %             | %          | %          | %          | %           | %           | %        | %    | %      | %    | %          | %    | %           | %    | %     |
| D09   | Invasive Annual and Biennial Forbland              | 2,638           | 45.1% | 0.2% | 0.4%  | 1.7%  | 1.1%    | 0.6% | 0.1% | 0.0%          | 2.4%       | 0.1%       | 4.0%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.2%        | 0.0% | 43.6% |
| D08   | Invasive Annual Grassland                          | 8,291           | 57.0% | 0.1% | 0.1%  | 0.7%  | 2.7%    | 0.3% | 0.0% | 0.0%          | 1.9%       | 0.6%       | 2.4%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 33.9% |
| D07   | Invasive Perennial Forbland                        | 1               | 0.0%  | 0.0% | 31.0% | 0.0%  | 0.0%    | 0.0% | 0.0% | 0.0%          | 0.0%       | 0.6%       | 1.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 67.4% |
| D06   | Invasive Perennial Grassland                       | 2,839           | 9.3%  | 0.0% | 1.1%  | 2.2%  | 0.7%    | 0.0% | 0.3% | 0.1%          | 1.3%       | 0.4%       | 2.1%       | 0.7%        | 0.0%        | 0.1%     | 1.1% | 0.6%   | 0.0% | 0.0%       | 0.1% | 0.1%        | 0.1% | 79.5% |
| D04   | Invasive Southwest Riparian Woodland and Shrubland | 1,609           | 18.5% | 1.5% | 2.8%  | 0.7%  | 0.3%    | 6.6% | 0.0% | 0.0%          | 18.9%      | 0.8%       | 3.4%       | 2.8%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.3% | 0.0%        | 0.0% | 40.4% |
| D02   | Recently Burned                                    | 2,033           | 29.1% | 0.0% | 1.1%  | 23.2% | 3.1%    | 5.5% | 0.0% | 0.0%          | 3.1%       | 0.0%       | 7.5%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 1.0%       | 0.0% | 0.6%        | 0.0% | 25.6% |
| D11   | Recently Chained Pinyon-Juniper Areas              | 689             | 54.8% | 0.0% | 0.0%  | 19.0% | 0.0%    | 0.2% | 0.0% | 0.0%          | 0.2%       | 0.0%       | 10.3%      | 1.7%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 13.7% |
| D10   | Recently Logged Areas                              | 836             | 2.4%  | 0.0% | 0.0%  | 90.6% | 0.0%    | 0.1% | 0.0% | 0.0%          | 0.2%       | 0.7%       | 0.2%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 5.5%  |
| D03   | Recently Mined or Quarried                         | 1,240           | 19.8% | 0.0% | 0.0%  | 1.6%  | 0.3%    | 0.0% | 0.0% | 0.0%          | 13.1%      | 0.0%       | 1.1%       | 0.1%        | 4.1%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 58.3% |
| <b>DEVELOPED and AGRICULTURE</b>  |  |                 |       |      |       |       |         |      |      |               |            |            |            |             |             |          |      |        |      |            |      |             |      |       |
| N80   | Agriculture  | 75,977          | 0.8%  | 0.1% | 0.2%  | 0.7%  | 0.1%    | 0.0% | 0.0% | 0.0%          | 2.0%       | 0.1%       | 2.3%       | 0.3%        | 0.0%        | 0.0%     | 0.1% | 0.1%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 0.0% | 93.0% |
| N22   | Developed, Medium - High Intensity                 | 7,540           | 2.2%  | 0.1% | 0.1%  | 1.0%  | 2.3%    | 0.0% | 0.0% | 0.0%          | 1.2%       | 0.1%       | 1.5%       | 0.1%        | 0.0%        | 0.1%     | 0.7% | 0.1%   | 0.0% | 0.0%       | 0.0% | 0.1%        | 0.0% | 90.2% |
| N21   | Developed, Open Space - Low Intensity              | 7,425           | 1.0%  | 0.1% | 0.0%  | 0.3%  | 3.6%    | 0.1% | 0.0% | 0.0%          | 1.2%       | 0.2%       | 1.1%       | 0.1%        | 0.2%        | 0.1%     | 0.8% | 0.4%   | 0.0% | 0.0%       | 0.0% | 0.1%        | 0.0% | 90.3% |
| <b>OTHER COVER TYPES</b>  |  |                 |       |      |       |       |         |      |      |               |            |            |            |             |             |          |      |        |      |            |      |             |      |       |
| N31   | Barren Lands, Non-specific                         | 1,421           | 18.0% | 0.2% | 0.8%  | 0.2%  | 3.9%    | 0.0% | 0.0% | 0.0%          | 56.5%      | 0.3%       | 4.2%       | 0.2%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 15.0% |
| N11   | Open Water   | 11,023          | 1.8%  | 1.2% | 0.4%  | 1.3%  | 0.2%    | 1.1% | 0.0% | 0.0%          | 1.6%       | 1.3%       | 0.5%       | 1.0%        | 2.2%        | 0.3%     | 0.1% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 0.0% | 7.7%  |
| <b>TOTAL</b>  |  | 1,386,073       | 30.5% | 0.1% | 1.3%  | 14.3% | 3.2%    | 1.7% | 0.1% | 0.0%          | 9.5%       | 0.2%       | 7.1%       | 0.4%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.1%       | 0.2% | 0.3%        | 0.0% | 30.2% |
| * For Land Stewardship headings: BLM = Bureau of Land Management, BOR = Bureau of Reclamation, FWS= U.S. Fish and Wildlife Service, USFS = U.S. Forest Service, DOD/DOE = Dept. of Defense/Dept. of Energy, NPS = U.S. National Park Service , ARS = Agricultural Research Service, Dept. of Com. = Dept. of Commerce, Nativ Amer = Native American Lands, Reg. Gov. = Regional Government, Aud = Audubon, TNC = The Nature Conservancy, Priv-BioDiv = Private Lands Managed for Biodiversity |  |                 |       |      |       |       |         |      |      |               |            |            |            |             |             |          |      |        |      |            |      |             |      |       |

**Appendix 5-2. Area and percent distribution of each land cover type represented within the four levels of GAP Management Status in the SWReGAP project area.**

| Code                    | Land Cover Type  | Area in region  | Status 1        |       | Status 2        |       | Status 3        |       | Status 4        |       | Status 1&2      |       |
|-------------------------|--|-----------------|-----------------|-------|-----------------|-------|-----------------|-------|-----------------|-------|-----------------|-------|
|                         |  | km <sup>2</sup> | km <sup>2</sup> | %     | km <sup>2</sup> | %     | km <sup>2</sup> | %     | km <sup>2</sup> | %     | km <sup>2</sup> | %     |
| <b>BARREN LANDS</b>     |  |                 |                 |       |                 |       |                 |       |                 |       |                 |       |
| S010                    | Colorado Plateau Mixed Bedrock Canyon and Tableland              | 24,321          | 1,887           | 7.8%  | 5,529           | 22.7% | 14,836          | 61.0% | 2,020           | 8.3%  | 7,416           | 30.5% |
| S012                    | Inter-Mountain Basins Active and Stabilized Dune                 | 3,103           | 100             | 3.2%  | 282             | 9.1%  | 1,938           | 62.4% | 777             | 25.0% | 383             | 12.3% |
| S009                    | Inter-Mountain Basins Cliff and Canyon                           | 2,889           | 48              | 1.7%  | 711             | 24.6% | 1,820           | 63.0% | 293             | 10.1% | 759             | 26.3% |
| S015                    | Inter-Mountain Basins Playa                                      | 17,586          | 625             | 3.6%  | 1,266           | 7.2%  | 12,759          | 72.6% | 2,483           | 14.1% | 1,891           | 10.8% |
| S011                    | Inter-Mountain Basins Shale Badland                              | 3,301           | 42              | 1.3%  | 348             | 10.5% | 2,347           | 71.1% | 559             | 16.9% | 390             | 11.8% |
| S013                    | Inter-Mountain Basins Volcanic Rock and Cinder Land              | 1,360           | 96              | 7.1%  | 423             | 31.1% | 573             | 42.1% | 267             | 19.6% | 519             | 38.2% |
| S014                    | Inter-Mountain Basins Wash                                       | 46              | 0               | 0.0%  | 2               | 4.4%  | 22              | 47.4% | 22              | 46.4% | 2               | 4.4%  |
| S003                    | Mediterranean California Alpine Bedrock and Scree                | 39              | 0               | 0.0%  | 17              | 42.3% | 7               | 16.7% | 0               | 0.3%  | 17              | 42.3% |
| S001                    | North American Alpine Ice Field                                  | 23              | 5               | 23.4% | 16              | 69.4% | 1               | 6.2%  | 0               | 1.0%  | 22              | 92.8% |
| S018                    | North American Warm Desert Active and Stabilized Dune            | 2,845           | 260             | 9.1%  | 267             | 9.4%  | 1,750           | 61.5% | 452             | 15.9% | 526             | 18.5% |
| S017                    | North American Warm Desert Badland                               | 113             | 3               | 2.7%  | 50              | 44.0% | 50              | 44.4% | 9               | 7.9%  | 53              | 46.7% |
| S016                    | North American Warm Desert Bedrock Cliff and Outcrop             | 3,635           | 435             | 12.0% | 1,210           | 33.3% | 1,443           | 39.7% | 477             | 13.1% | 1,645           | 45.3% |
| S021                    | North American Warm Desert Pavement                              | 399             | 26              | 6.5%  | 73              | 18.3% | 162             | 40.6% | 125             | 31.3% | 99              | 24.8% |
| S022                    | North American Warm Desert Playa                                 | 1,146           | 240             | 21.0% | 111             | 9.7%  | 577             | 50.3% | 166             | 14.5% | 352             | 30.7% |
| S019                    | North American Warm Desert Volcanic Rockland                     | 995             | 45              | 4.5%  | 303             | 30.4% | 393             | 39.5% | 252             | 25.3% | 347             | 34.9% |
| S002                    | Rocky Mountain Alpine Bedrock and Scree                          | 3,863           | 801             | 20.7% | 1,591           | 41.2% | 1,239           | 32.1% | 219             | 5.7%  | 2,392           | 61.9% |
| S004                    | Rocky Mountain Alpine Fell-Field                                 | 761             | 164             | 21.6% | 310             | 40.7% | 255             | 33.5% | 32              | 4.2%  | 474             | 62.3% |
| S006                    | Rocky Mountain Cliff, Canyon and Massive Bedrock                 | 2,971           | 252             | 8.5%  | 523             | 17.6% | 1,595           | 53.7% | 586             | 19.7% | 774             | 26.1% |
| S007                    | Sierra Nevada Cliff and Canyon                                   | 134             | 0               | 0.0%  | 6               | 4.5%  | 92              | 68.7% | 25              | 18.4% | 6               | 4.5%  |
| S008                    | Western Great Plains Cliff and Outcrop                           | 315             | 0               | 0.0%  | 3               | 0.9%  | 41              | 13.0% | 265             | 84.2% | 3               | 0.9%  |
| <b>EVERGREEN FOREST</b> |  |                 |                 |       |                 |       |                 |       |                 |       |                 |       |
| S039                    | Colorado Plateau Pinyon-Juniper Woodland                         | 97,894          | 2,470           | 2.5%  | 11,148          | 11.4% | 57,617          | 58.9% | 26,584          | 27.2% | 13,618          | 13.9% |
| S040                    | Great Basin Pinyon-Juniper Woodland                              | 51,234          | 1,127           | 2.2%  | 9,224           | 18.0% | 35,332          | 69.0% | 5,090           | 9.9%  | 10,351          | 20.2% |
| S026                    | Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland | 670             | 156             | 23.2% | 274             | 41.0% | 228             | 34.1% | 8               | 1.2%  | 430             | 64.2% |
| S051                    | Madrean Encinal  | 4,406           | 79              | 1.8%  | 616             | 14.0% | 2,196           | 49.8% | 1,466           | 33.3% | 695             | 15.8% |
| S035                    | Madrean Pine-Oak Forest and Woodland                             | 5,737           | 96              | 1.7%  | 863             | 15.0% | 4,297           | 74.9% | 478             | 8.3%  | 959             | 16.7% |
| S112                    | Madrean Pinyon-Juniper Woodland                                  | 21,930          | 165             | 0.8%  | 2,382           | 10.9% | 13,562          | 61.8% | 5,806           | 26.5% | 2,547           | 11.6% |

| Code                    | Land Cover Type  | Area in region  | Status 1        |       | Status 2        |       | Status 3        |       | Status 4        |       | Status 1&2      |       |
|-------------------------|--|-----------------|-----------------|-------|-----------------|-------|-----------------|-------|-----------------|-------|-----------------|-------|
|                         |  | km <sup>2</sup> | km <sup>2</sup> | %     | km <sup>2</sup> | %     | km <sup>2</sup> | %     | km <sup>2</sup> | %     | km <sup>2</sup> | %     |
| S111                    | Madrean Upper Montane Conifer-Oak Forest and Woodland                | 811             | 13              | 1.6%  | 150             | 18.5% | 592             | 73.1% | 40              | 4.9%  | 163             | 20.1% |
| S033                    | Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland | 2               | 0               | 0.0%  | 1               | 32.0% | 1               | 62.3% | 0               | 3.4%  | 1               | 32.0% |
| S123                    | Mediterranean California Ponderosa-Jeffrey Pine Forest and Woodland  | 236             | 0               | 0.0%  | 24              | 10.1% | 146             | 62.1% | 39              | 16.6% | 24              | 10.1% |
| S121                    | Mediterranean California Red Fir Forest and Woodland                 | 114             | 0               | 0.0%  | 24              | 20.6% | 74              | 64.8% | 8               | 6.8%  | 24              | 20.6% |
| S029                    | Northern Pacific Mesic Subalpine Parkland                            | 53              | 0               | 0.0%  | 25              | 47.0% | 16              | 29.9% | 1               | 2.8%  | 25              | 47.0% |
| S032                    | Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland   | 8,970           | 454             | 5.1%  | 1,619           | 18.0% | 5,055           | 56.4% | 1,821           | 20.3% | 2,073           | 23.1% |
| S125                    | Rocky Mountain Foothill Limber Pine-Juniper Woodland                 | 6               | 0               | 1.9%  | 0               | 1.3%  | 1               | 8.1%  | 5               | 81.7% | 0               | 3.1%  |
| S031                    | Rocky Mountain Lodgepole Pine Forest                                 | 8,876           | 434             | 4.9%  | 1,215           | 13.7% | 6,089           | 68.6% | 1,023           | 11.5% | 1,649           | 18.6% |
| S034                    | Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland       | 7,297           | 326             | 4.5%  | 1,136           | 15.6% | 4,037           | 55.3% | 1,795           | 24.6% | 1,462           | 20.0% |
| S028                    | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland    | 14,846          | 1,473           | 9.9%  | 3,467           | 23.4% | 8,798           | 59.3% | 1,059           | 7.1%  | 4,941           | 33.3% |
| S030                    | Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland        | 10,365          | 1,120           | 10.8% | 2,255           | 21.8% | 6,097           | 58.8% | 886             | 8.6%  | 3,375           | 32.6% |
| S025                    | Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland    | 802             | 13              | 1.6%  | 193             | 24.1% | 406             | 50.7% | 188             | 23.4% | 207             | 25.8% |
| S122                    | Sierra Nevada Subalpine Lodgepole Pine Forest and Woodland           | 21              | 0               | 0.0%  | 4               | 19.1% | 15              | 72.4% | 1               | 6.3%  | 4               | 19.1% |
| S038                    | Southern Rocky Mountain Pinyon-Juniper Woodland                      | 15,311          | 90              | 0.6%  | 950             | 6.2%  | 4,926           | 32.2% | 9,334           | 61.0% | 1,040           | 6.8%  |
| S036                    | Southern Rocky Mountain Ponderosa Pine Woodland                      | 50,241          | 1,494           | 3.0%  | 4,189           | 8.3%  | 32,837          | 65.4% | 11,686          | 23.3% | 5,683           | 11.3% |
| <b>DECIDUOUS FOREST</b> |  |                 |                 |       |                 |       |                 |       |                 |       |                 |       |
| S023                    | Rocky Mountain Aspen Forest and Woodland                             | 21,050          | 456             | 2.2%  | 2,219           | 10.5% | 12,395          | 58.9% | 5,909           | 28.1% | 2,675           | 12.7% |
| S024                    | Rocky Mountain Bigtooth Maple Ravine Woodland                        | 898             | 33              | 3.7%  | 69              | 7.7%  | 250             | 27.9% | 534             | 59.5% | 103             | 11.4% |
| <b>MIXED FOREST</b>     |  |                 |                 |       |                 |       |                 |       |                 |       |                 |       |
| S042                    | Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland        | 3,445           | 82              | 2.4%  | 308             | 8.9%  | 2,379           | 69.0% | 669             | 19.4% | 390             | 11.3% |
| <b>SHRUB/SCRUB</b>      |  |                 |                 |       |                 |       |                 |       |                 |       |                 |       |
| S058                    | Apacherian-Chihuahuan Mesquite Upland Scrub                          | 32,060          | 114             | 0.4%  | 1,557           | 4.9%  | 13,072          | 40.8% | 16,914          | 52.8% | 1,671           | 5.2%  |
| S062                    | Chihuahuan Mixed Desert and Thorn Scrub                              | 27,891          | 141             | 0.5%  | 1,219           | 4.4%  | 13,353          | 47.9% | 12,680          | 45.5% | 1,359           | 4.9%  |
| S116                    | Chihuahuan Mixed Salt Desert Scrub                                   | 4,448           | 99              | 2.2%  | 207             | 4.6%  | 2,353           | 52.9% | 1,746           | 39.3% | 306             | 6.9%  |
| S068                    | Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub               | 5,891           | 80              | 1.4%  | 59              | 1.0%  | 4,176           | 70.9% | 1,410           | 23.9% | 138             | 2.3%  |

| Code                        | Land Cover Type  | Area in region  | Status 1        |       | Status 2        |       | Status 3        |       | Status 4        |        | Status 1&2      |       |
|-----------------------------|--|-----------------|-----------------|-------|-----------------|-------|-----------------|-------|-----------------|--------|-----------------|-------|
|                             |  | km <sup>2</sup> | km <sup>2</sup> | %     | km <sup>2</sup> | %     | km <sup>2</sup> | %     | km <sup>2</sup> | %      | km <sup>2</sup> | %     |
| S061                        | Chihuahuan Succulent Desert Scrub                              | 189             | 4               | 2.2%  | 9               | 4.6%  | 84              | 44.5% | 90              | 47.6%  | 13              | 6.8%  |
| S117                        | Coahuilan Chaparral  | 96              | 27              | 27.8% | 12              | 13.0% | 45              | 47.2% | 9               | 9.7%   | 39              | 40.7% |
| S059                        | Colorado Plateau Blackbrush-Mormon-tea Shrubland               | 13,310          | 651             | 4.9%  | 2,018           | 15.2% | 9,567           | 71.9% | 1,061           | 8.0%   | 2,669           | 20.1% |
| S056                        | Colorado Plateau Mixed Low Sagebrush Shrubland                 | 2,401           | 2               | 0.1%  | 156             | 6.5%  | 1,174           | 48.9% | 1,069           | 44.5%  | 158             | 6.6%  |
| S052                        | Colorado Plateau Pinyon-Juniper Shrubland                      | 11,536          | 389             | 3.4%  | 3,790           | 32.9% | 5,652           | 49.0% | 1,702           | 14.8%  | 4,179           | 36.2% |
| S053                        | Great Basin Semi-Desert Chaparral                              | 169             | 1               | 0.3%  | 56              | 33.3% | 85              | 50.1% | 21              | 12.7%  | 57              | 33.7% |
| S055                        | Great Basin Xeric Mixed Sagebrush Shrubland                    | 35,631          | 672             | 1.9%  | 3,357           | 9.4%  | 27,902          | 78.3% | 3,496           | 9.8%   | 4,030           | 11.3% |
| S054                        | Inter-Mountain Basins Big Sagebrush Shrubland                  | 109,699         | 1,297           | 1.2%  | 6,256           | 5.7%  | 75,102          | 68.5% | 25,773          | 23.5%  | 7,553           | 6.9%  |
| S045                        | Inter-Mountain Basins Mat Saltbush Shrubland                   | 4,155           | 17              | 0.4%  | 254             | 6.1%  | 3,031           | 73.0% | 827             | 19.9%  | 271             | 6.5%  |
| S065                        | Inter-Mountain Basins Mixed Salt Desert Scrub                  | 79,498          | 594             | 0.7%  | 3,996           | 5.0%  | 61,601          | 77.5% | 13,009          | 16.4%  | 4,589           | 5.8%  |
| S050                        | Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland | 2,569           | 139             | 5.4%  | 587             | 22.9% | 1,616           | 62.9% | 209             | 8.1%   | 726             | 28.3% |
| S057                        | Mogollon Chaparral   | 11,518          | 284             | 2.5%  | 1,869           | 16.2% | 6,664           | 57.9% | 2,698           | 23.4%  | 2,153           | 18.7% |
| S060                        | Mojave Mid-Elevation Mixed Desert Scrub                        | 16,864          | 2,706           | 16.0% | 4,514           | 26.8% | 7,606           | 45.1% | 1,936           | 11.5%  | 7,220           | 42.8% |
| S043                        | Rocky Mountain Alpine Dwarf-Shrubland                          | 109             | 13              | 11.8% | 75              | 68.4% | 21              | 19.3% | 0               | 0.4%   | 88              | 80.2% |
| S046                        | Rocky Mountain Gambel Oak-Mixed Montane Shrubland              | 18,960          | 190             | 1.0%  | 1,212           | 6.4%  | 8,139           | 42.9% | 9,404           | 49.6%  | 1,402           | 7.4%  |
| S047                        | Rocky Mountain Lower Montane-Foothill Shrubland                | 2,872           | 38              | 1.3%  | 160             | 5.6%  | 1,006           | 35.0% | 1,616           | 56.3%  | 199             | 6.9%  |
| S069                        | Sonora-Mojave Creosotebush-White Bursage Desert Scrub          | 59,616          | 5,605           | 9.4%  | 10,585          | 17.8% | 29,651          | 49.7% | 12,883          | 21.6%  | 16,190          | 27.2% |
| S070                        | Sonora-Mojave Mixed Salt Desert Scrub                          | 2,571           | 172             | 6.7%  | 327             | 12.7% | 1,045           | 40.6% | 1,005           | 39.1%  | 499             | 19.4% |
| S114                        | Sonora-Mojave Semi-Desert Chaparral                            | 89              | 30              | 34.0% | 55              | 61.6% | 3               | 3.0%  | 1               | 1.4%   | 85              | 95.6% |
| S129                        | Sonoran Mid-Elevation Desert Scrub                             | 5,395           | 38              | 0.7%  | 1,202           | 22.3% | 2,110           | 39.1% | 2,043           | 37.9%  | 1,240           | 23.0% |
| S063                        | Sonoran Paloverde-Mixed Cacti Desert Scrub                     | 40,079          | 3,656           | 9.1%  | 5,122           | 12.8% | 20,783          | 51.9% | 10,212          | 25.5%  | 8,778           | 21.9% |
| S136                        | Southern Colorado Plateau Sand Shrubland                       | 7,021           | 55              | 0.8%  | 188             | 2.7%  | 6,281           | 89.5% | 496             | 7.1%   | 244             | 3.5%  |
| S138                        | Western Great Plains Mesquite Woodland and Shrubland           | 1,898           | 0               | 0.0%  | 3               | 0.2%  | 13              | 0.7%  | 1,780           | 93.8%  | 3               | 0.2%  |
| S048                        | Western Great Plains Sandhill Shrubland                        | 14,088          | 21              | 0.2%  | 346             | 2.5%  | 2,727           | 19.4% | 10,790          | 76.6%  | 368             | 2.6%  |
| S128                        | Wyoming Basins Low Sagebrush Shrubland                         | 54              | 4               | 6.8%  | 9               | 16.9% | 31              | 56.9% | 4               | 7.1%   | 13              | 23.7% |
| <b>GRASSLAND/HERBACEOUS</b> |  |                 |                 |       |                 |       |                 |       |                 |        |                 |       |
| S077                        | Apacherian-Chihuahuan Semi-Desert Grassland and Steppe         | 46,038          | 302             | 0.7%  | 2,987           | 6.5%  | 18,247          | 39.6% | 24,151          | 52.5%  | 3,289           | 7.1%  |
| S087                        | Central Mixedgrass Prairie                                     | 123             | 0               | 0.0%  | 3               | 2.7%  | 16              | 13.1% | 100             | 81.2%  | 3               | 2.7%  |
| S080                        | Chihuahuan Gypsophilous Grassland and Steppe                   | 805             | 150             | 18.7% | 3               | 0.4%  | 588             | 73.1% | 61              | 7.6%   | 154             | 19.1% |
| S113                        | Chihuahuan Sandy Plains Semi-Desert Grassland                  | 1,050           | 17              | 1.6%  | 27              | 2.6%  | 412             | 39.3% | 528             | 50.3%  | 44              | 4.2%  |
| S109                        | Chihuahuan-Sonoran Desert Bottomland and Swale Grassland       | 0               | 0               | 0.0%  | 0               | 0.0%  | 0               | 0.0%  | 0               | 100.0% | 0               | 0.0%  |
| S078                        | Inter-Mountain Basins Big Sagebrush Steppe                     | 1,851           | 10              | 0.6%  | 35              | 1.9%  | 940             | 50.8% | 812             | 43.9%  | 45              | 2.4%  |



| Code                               | Land Cover Type  | Area in region  | Status 1        |       | Status 2        |       | Status 3        |       | Status 4        |       | Status 1&2      |       |
|------------------------------------|--|-----------------|-----------------|-------|-----------------|-------|-----------------|-------|-----------------|-------|-----------------|-------|
|                                    |  | km <sup>2</sup> | km <sup>2</sup> | %     | km <sup>2</sup> | %     | km <sup>2</sup> | %     | km <sup>2</sup> | %     | km <sup>2</sup> | %     |
| S075                               | Inter-Mountain Basins Juniper Savanna                                    | 5,615           | 12              | 0.2%  | 135             | 2.4%  | 2,211           | 39.4% | 3,228           | 57.5% | 147             | 2.6%  |
| S071                               | Inter-Mountain Basins Montane Sagebrush Steppe                           | 41,190          | 593             | 1.4%  | 3,238           | 7.9%  | 23,505          | 57.1% | 13,305          | 32.3% | 3,831           | 9.3%  |
| S090                               | Inter-Mountain Basins Semi-Desert Grassland                              | 33,693          | 312             | 0.9%  | 1,207           | 3.6%  | 15,121          | 44.9% | 16,968          | 50.4% | 1,519           | 4.5%  |
| S079                               | Inter-Mountain Basins Semi-Desert Shrub-Steppe                           | 47,668          | 647             | 1.4%  | 2,806           | 5.9%  | 27,246          | 57.2% | 16,882          | 35.4% | 3,453           | 7.2%  |
| S115                               | Madrean Juniper Savanna  | 995             | 6               | 0.6%  | 48              | 4.8%  | 479             | 48.1% | 460             | 46.3% | 54              | 5.5%  |
| S134                               | North Pacific Montane Grassland  | 32              | 0               | 0.0%  | 4               | 11.4% | 22              | 68.3% | 2               | 5.7%  | 4               | 11.4% |
| S081                               | Rocky Mountain Dry Tundra  | 2,779           | 446             | 16.0% | 1,001           | 36.0% | 1,162           | 41.8% | 169             | 6.1%  | 1,447           | 52.1% |
| S083                               | Rocky Mountain Subalpine Mesic Meadow                                    | 2,178           | 71              | 3.3%  | 321             | 14.7% | 1,271           | 58.3% | 511             | 23.5% | 392             | 18.0% |
| S074                               | Southern Rocky Mountain Juniper Woodland and Savanna                     | 11,968          | 23              | 0.2%  | 156             | 1.3%  | 1,368           | 11.4% | 10,405          | 86.9% | 179             | 1.5%  |
| S085                               | Southern Rocky Mountain Montane-Subalpine Grassland                      | 10,346          | 104             | 1.0%  | 1,077           | 10.4% | 4,565           | 44.1% | 4,511           | 43.6% | 1,181           | 11.4% |
| S086                               | Western Great Plains Foothill and Piedmont Grassland                     | 5,096           | 7               | 0.1%  | 114             | 2.2%  | 551             | 10.8% | 4,391           | 86.2% | 121             | 2.4%  |
| S089                               | Western Great Plains Sand Prairie  | 18              | 0               | 0.0%  | 0               | 0.0%  | 1               | 5.3%  | 17              | 94.1% | 0               | 0.0%  |
| S088                               | Western Great Plains Shortgrass Prairie                                  | 114,340         | 48              | 0.0%  | 726             | 0.6%  | 12,012          | 10.5% | 100,220         | 87.7% | 774             | 0.7%  |
| S132                               | Western Great Plains Tallgrass Prairie                                   | 1               | 0               | 0.0%  | 0               | 25.8% | 0               | 14.1% | 0               | 53.4% | 0               | 25.8% |
| <b>WOODY WETLAND</b>               |  |                 |                 |       |                 |       |                 |       |                 |       |                 |       |
| S118                               | Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland   | 1,387           | 8               | 0.6%  | 91              | 6.6%  | 447             | 32.2% | 796             | 57.3% | 99              | 7.1%  |
| S096                               | Inter-Mountain Basins Greasewood Flat                                    | 23,842          | 598             | 2.5%  | 1,130           | 4.7%  | 14,753          | 61.9% | 7,124           | 29.9% | 1,728           | 7.2%  |
| S094                               | North American Warm Desert Lower Montane Riparian Woodland and Shrubland | 427             | 9               | 2.0%  | 67              | 15.6% | 153             | 35.9% | 192             | 44.9% | 75              | 17.7% |
| S098                               | North American Warm Desert Riparian Mesquite Bosque                      | 847             | 17              | 2.0%  | 62              | 7.3%  | 455             | 53.7% | 291             | 34.4% | 79              | 9.3%  |
| S097                               | North American Warm Desert Riparian Woodland and Shrubland               | 461             | 36              | 7.8%  | 48              | 10.4% | 125             | 27.1% | 195             | 42.3% | 84              | 18.2% |
| S020                               | North American Warm Desert Wash  | 657             | 19              | 2.9%  | 76              | 11.5% | 316             | 48.1% | 239             | 36.3% | 95              | 14.4% |
| S093                               | Rocky Mountain Lower Montane Riparian Woodland and Shrubland             | 2,236           | 39              | 1.7%  | 184             | 8.2%  | 679             | 30.4% | 1,308           | 58.5% | 223             | 10.0% |
| S091                               | Rocky Mountain Subalpine-Montane Riparian Shrubland                      | 3,240           | 340             | 10.5% | 783             | 24.2% | 1,449           | 44.7% | 643             | 19.8% | 1,124           | 34.7% |
| S092                               | Rocky Mountain Subalpine-Montane Riparian Woodland                       | 294             | 5               | 1.7%  | 46              | 15.8% | 134             | 45.7% | 106             | 36.1% | 51              | 17.5% |
| S120                               | Western Great Plains Floodplain  | 842             | 0               | 0.0%  | 31              | 3.7%  | 31              | 3.6%  | 766             | 91.0% | 31              | 3.7%  |
| S095                               | Western Great Plains Riparian Woodland and Shrubland                     | 1,720           | 2               | 0.1%  | 138             | 8.0%  | 121             | 7.0%  | 1,439           | 83.6% | 140             | 8.1%  |
| <b>EMERGENT HERBACEOUS WETLAND</b> |  |                 |                 |       |                 |       |                 |       |                 |       |                 |       |
| S105                               | Mediterranean California Subalpine-Montane Fen                           | 2               | 0               | 0.0%  | 1               | 45.8% | 1               | 50.7% | 0               | 0.0%  | 1               | 45.8% |
| S100                               | North American Arid West Emergent Marsh                                  | 1,074           | 59              | 5.5%  | 189             | 17.6% | 171             | 15.9% | 453             | 42.2% | 248             | 23.1% |
| S102                               | Rocky Mountain Alpine-Montane Wet Meadow                                 | 1,962           | 183             | 9.3%  | 439             | 22.4% | 719             | 36.7% | 604             | 30.8% | 622             | 31.7% |
| S103                               | Temperate Pacific Subalpine-Montane Wet Meadow                           | 3               | 0               | 0.0%  | 0               | 1.7%  | 1               | 40.2% | 1               | 28.0% | 0               | 1.7%  |

| Code                             | Land Cover Type                                    | Area in region  | Status 1        |       | Status 2        |      | Status 3        |       | Status 4        |       | Status 1&2      |       |
|----------------------------------|--|-----------------|-----------------|-------|-----------------|------|-----------------|-------|-----------------|-------|-----------------|-------|
|                                  |  | km <sup>2</sup> | km <sup>2</sup> | %     | km <sup>2</sup> | %    | km <sup>2</sup> | %     | km <sup>2</sup> | %     | km <sup>2</sup> | %     |
| S108                             | Western Great Plains Saline Depression Wetland     | 41              | 0               | 0.0%  | 0               | 0.5% | 8               | 19.1% | 12              | 30.2% | 0               | 0.5%  |
| <b>ALTERED or DISTURBED</b>      |  |                 |                 |       |                 |      |                 |       |                 |       |                 |       |
| D01                              | Disturbed, Non-specific                            | 93              | 0               | 0.0%  | 6               | 6.4% | 2               | 2.0%  | 84              | 90.7% | 6               | 6.4%  |
| D14                              | Disturbed, Oil Well                                | 52              | 0               | 0.0%  | 1               | 1.7% | 7               | 14.4% | 38              | 72.4% | 1               | 1.7%  |
| D09                              | Invasive Annual and Biennial Forbland              | 2,649           | 17              | 0.6%  | 69              | 2.6% | 1,311           | 49.5% | 1,236           | 46.7% | 86              | 3.2%  |
| D08                              | Invasive Annual Grassland                          | 8,347           | 21              | 0.2%  | 253             | 3.0% | 4,957           | 59.4% | 3,052           | 36.6% | 274             | 3.3%  |
| D07                              | Invasive Perennial Forbland                        | 1               | 0               | 31.0% | 0               | 0.0% | 0               | 1.6%  | 0               | 67.4% | 0               | 31.0% |
| D06                              | Invasive Perennial Grassland                       | 2,869           | 4               | 0.1%  | 46              | 1.6% | 438             | 15.3% | 2,346           | 81.8% | 49              | 1.7%  |
| D04                              | Invasive Southwest Riparian Woodland and Shrubland | 1,666           | 106             | 6.4%  | 161             | 9.7% | 518             | 31.1% | 777             | 46.6% | 267             | 16.0% |
| D02                              | Recently Burned                                    | 2,033           | 125             | 6.1%  | 180             | 8.9% | 1,029           | 50.6% | 699             | 34.4% | 305             | 15.0% |
| D11                              | Recently Chained Pinyon-Juniper Areas              | 689             | 1               | 0.2%  | 67              | 9.8% | 454             | 65.9% | 167             | 24.2% | 68              | 9.9%  |
| D10                              | Recently Logged Areas                              | 855             | 26              | 3.0%  | 29              | 3.3% | 734             | 85.9% | 46              | 5.4%  | 55              | 6.4%  |
| D03                              | Recently Mined or Quarried                         | 1,240           | 1               | 0.1%  | 6               | 0.5% | 480             | 38.7% | 733             | 59.1% | 7               | 0.5%  |
| <b>DEVELOPED and AGRICULTURE</b> |  |                 |                 |       |                 |      |                 |       |                 |       |                 |       |
| N80                              | Agriculture  | 77,813          | 59              | 0.1%  | 581             | 0.7% | 2,605           | 3.3%  | 72,632          | 93.3% | 639             | 0.8%  |
| N22                              | Developed, Medium - High Intensity                 | 7,600           | 3               | 0.0%  | 36              | 0.5% | 425             | 5.6%  | 7,066           | 93.0% | 38              | 0.5%  |
| N21                              | Developed, Open Space - Low Intensity              | 7,463           | 2               | 0.0%  | 17              | 0.2% | 366             | 4.9%  | 7,012           | 94.0% | 19              | 0.3%  |
| <b>OTHER COVER TYPES</b>         |  |                 |                 |       |                 |      |                 |       |                 |       |                 |       |
| N31                              | Barren Lands, Non-specific                         | 1,437           | 10              | 0.7%  | 55              | 3.8% | 1,070           | 74.5% | 275             | 19.1% | 65              | 4.5%  |
| N11                              | Open Water   | 11,220          | 102             | 0.9%  | 219             | 2.0% | 1,003           | 8.9%  | 972             | 8.7%  | 322             | 2.9%  |
|                                  | <b>TOTAL</b>                                       | 1,396,584       | 36,690          | 2.6%  | 123,493         | 8.8% | 688,818         | 49.3% | 526,365         | 37.7% | 160,183         | 11.5% |

## Appendix 5-3: Area (in square kilometers) of each land cover type summarized by land steward and GAP Management Status in the SWReGAP project area.

### BARREN LANDS

#### S010 Colorado Plateau Mixed Bedrock Canyon and Tableland

| Status | BLM  | BOR | FWS | USFS | DOD/DO E | NPS  | Nativ Amer | State Park | State Schl | State Wldlf | Other State | County | TNC | Priv-BioDiv | Private |
|--------|------|-----|-----|------|----------|------|------------|------------|------------|-------------|-------------|--------|-----|-------------|---------|
| 1      | 281  | 0   | 0   | 71   | 0        | 1536 | 0          | 0          | 0          | 0           | 0           | 0      | <1  | 0           | 0       |
| 2      | 4407 | 0   | 2   | 289  | 0        | 586  | 214        | <1         | 8          | 20          | 0           | 0      | <1  | 0           | 0       |
| 3      | 4624 | <1  | 0   | 381  | <1       | 2147 | 7651       | 18         | 3          | <1          | 3           | 0      | 5   | 0           | <1      |
| 4      | 0    | <1  | 0   | 0    | <1       | 0    | 252        | 0          | 970        | 0           | 0           | <1     | 0   | 4           | 793     |

#### S012 Inter-Mountain Basins Active and Stabilized Dune

| Status | BLM | BOR | FWS | USFS | DOD/DO E | NPS | Nativ Amer | State Park | State Schl | State Wldlf | Other State | County | TNC | Priv-BioDiv | Private |
|--------|-----|-----|-----|------|----------|-----|------------|------------|------------|-------------|-------------|--------|-----|-------------|---------|
| 1      | 4   | 0   | 1   | <1   | 0        | 95  | 0          | 0          | 0          | 0           | 0           | 0      | <1  | 0           | 0       |
| 2      | 160 | 1   | 85  | <1   | 0        | 7   | 9          | 0          | 1          | 6           | 0           | 0      | 13  | 0           | 0       |
| 3      | 917 | 1   | 0   | 16   | 328      | 150 | 522        | 4          | <1         | 0           | 0           | 0      | 0   | 0           | 0       |
| 4      | 0   | 0   | 0   | 0    | 0        | 0   | 89         | 0          | 144        | 0           | 0           | <1     | 0   | 2           | 542     |

#### S009 Inter-Mountain Basins Cliff and Canyon

| Status | BLM  | BOR | FWS | USFS | DOD/DO E | NPS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | TNC | Private |
|--------|------|-----|-----|------|----------|-----|-----|------------|------------|------------|-------------|-----|---------|
| 1      | 3    | 0   | 29  | 10   | 0        | 6   | 0   | 0          | 0          | 0          | 0           | <1  | 0       |
| 2      | 539  | <1  | <1  | 163  | 0        | 0   | 9   | 0          | <1         | 0          | <1          | <1  | 0       |
| 3      | 1454 | <1  | 15  | 241  | 61       | 0   | 0   | 46         | <1         | 1          | 0           | <1  | <1      |
| 4      | 0    | 0   | 0   | 0    | 9        | 0   | 0   | <1         | 0          | 20         | 0           | 0   | 263     |

#### S015 Inter-Mountain Basins Playa

| Status | BLM  | BOR | FWS | USFS | DOD/DO E | ARS | Nativ Amer | State Park | State Schl | State Wldlf | Other State | Reg. Gov | City | County | TNC | Private |
|--------|------|-----|-----|------|----------|-----|------------|------------|------------|-------------|-------------|----------|------|--------|-----|---------|
| 1      | 579  | 0   | 45  | 0    | 0        | 0   | 0          | 0          | 0          | 0           | 0           | 0        | 0    | 0      | <1  | 0       |
| 2      | 759  | 106 | 255 | <1   | 0        | 2   | 0          | 1          | 0          | 137         | 2           | 0        | 0    | 0      | 6   | 0       |
| 3      | 7273 | 45  | <1  | 7    | 5071     | 0   | 123        | 1          | 21         | <1          | 156         | 0        | 0    | 42     | 21  | 0       |
| 4      | 0    | 0   | 0   | 0    | <1       | 0   | <1         | 0          | 669        | 0           | 0           | <1       | <1   | <1     | 0   | 1812    |

#### S011 Inter-Mountain Basins Shale Badland

| Status | BLM  | BOR | FWS | USFS | DOD/DO E | NPS | Nativ Amer | State Park | State Schl | State Wldlf | Other State | City | County | TNC | Priv-BioDiv | Private |
|--------|------|-----|-----|------|----------|-----|------------|------------|------------|-------------|-------------|------|--------|-----|-------------|---------|
| 1      | 4    | 0   | 0   | <1   | 0        | 38  | 0          | 0          | 0          | 0           | 0           | 0    | 0      | 0   | 0           | 0       |
| 2      | 291  | 0   | 1   | 5    | 0        | 28  | 7          | <1         | 8          | 7           | 0           | 0    | 0      | 0   | 0           | 0       |
| 3      | 1480 | 0   | 0   | 15   | 1        | 11  | 833        | 1          | 4          | 0           | 2           | 0    | 0      | <1  | 0           | <1      |
| 4      | 0    | <1  | 0   | 0    | 0        | 0   | 38         | 0          | 234        | 0           | 0           | <1   | <1     | 0   | <1          | 286     |

#### S013 Inter-Mountain Basins Volcanic Rock and Cinder Land

| Status | BLM | FWS | USFS | DOD/DO E | NPS | Nativ Amer | State Schl | Priv-BioDiv | Private |
|--------|-----|-----|------|----------|-----|------------|------------|-------------|---------|
| 1      | 0   | 0   | 35   | 0        | 61  | 0          | 0          | 0           | 0       |
| 2      | 53  | <1  | 6    | 0        | 364 | 0          | 0          | 0           | 0       |
| 3      | 218 | 0   | 310  | <1       | 0   | 44         | 0          | 0           | 0       |
| 4      | 0   | 0   | 0    | 0        | 0   | 5          | 116        | <1          | 145     |

## S014 Inter-Mountain Basins Wash

| Status | BLM | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | City | TNC | Private |
|--------|-----|-------------|-----|---------------|---------------|---------------|----------------|------|-----|---------|
| 1      | <1  | 0           | 0   | 0             | 0             | 0             | 0              | 0    | 0   | 0       |
| 2      | <1  | 0           | <1  | <1            | 0             | <1            | <1             | 0    | <1  | 0       |
| 3      | 14  | <1          | 0   | 6             | <1            | <1            | 0              | 0    | <1  | 0       |
| 4      | 0   | <1          | 0   | <1            | 0             | <1            | 0              | <1   | 0   | 21      |

## S003 Mediterranean California Alpine Bedrock and Scree

| Status | BLM | USFS | DOD/DO<br>E | Private |
|--------|-----|------|-------------|---------|
| 1      | 0   | 0    | 0           | 0       |
| 2      | 0   | 17   | 0           | 0       |
| 3      | <1  | <1   | 6           | 0       |
| 4      | 0   | 0    | 0           | <1      |

## S001 North American Alpine Ice Field

| Status | USFS | NPS | State<br>Park | Private |
|--------|------|-----|---------------|---------|
| 1      | 5    | <1  | 0             | 0       |
| 2      | 16   | 0   | 0             | 0       |
| 3      | 1    | 0   | <1            | 0       |
| 4      | 0    | 0   | 0             | <1      |

## S018 North American Warm Desert Active and Stabilized Dune

| Status | BLM | BOR | FWS | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|-----|------|-------------|-----|---------------|---------------|---------------|----------------|-----|-----------------|---------|
| 1      | <1  | 0   | 216 | 0    | 0           | 43  | 0             | 0             | 0             | 0              | <1  | 0               | 0       |
| 2      | 62  | 0   | 7   | <1   | 198         | 0   | 0             | 0             | 0             | <1             | 0   | 0               | 0       |
| 3      | 650 | <1  | 0   | <1   | 1097        | 0   | <1            | 1             | 0             | 0              | <1  | 0               | 0       |
| 4      | 0   | 10  | 0   | 0    | 0           | 0   | <1            | 0             | 104           | 0              | 0   | 191             | 146     |

## S017 North American Warm Desert Badland

| Status | BLM | BOR | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | County | TNC | Private |
|--------|-----|-----|-------------|-----|---------------|---------------|---------------|----------------|--------|-----|---------|
| 1      | 0   | 0   | 0           | 3   | 0             | 0             | 0             | 0              | 0      | <1  | 0       |
| 2      | 8   | 0   | 0           | 35  | 0             | 0             | 0             | 7              | 0      | 0   | 0       |
| 3      | 12  | 7   | <1          | 28  | <1            | 2             | 0             | 0              | 0      | 0   | 0       |
| 4      | 0   | <1  | 0           | 0   | <1            | 0             | <1            | 0              | <1     | 0   | 9       |

## S016 North American Warm Desert Bedrock Cliff and Outcrop

| Status | BLM | BOR | FWS | USFS | DOD/DO<br>E | NPS | ARS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | City | County | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|-----|------|-------------|-----|-----|---------------|---------------|---------------|----------------|------|--------|---------------|-----|-----------------|---------|
| 1      | 24  | 0   | 312 | 11   | 0           | 88  | 0   | 0             | 0             | 0             | 0              | 0    | 0      | 0             | <1  | 0               | 0       |
| 2      | 751 | 0   | 261 | 96   | 20          | 68  | 0   | 0             | <1            | <1            | 5              | 0    | 0      | 9             | <1  | 0               | 0       |
| 3      | 841 | 10  | 0   | 223  | 85          | 87  | <1  | 173           | 22            | <1            | <1             | 0    | 0      | 1             | <1  | 0               | 0       |
| 4      | 0   | <1  | 0   | 0    | 2           | 0   | 0   | 15            | 0             | 171           | 0              | <1   | <1     | 0             | 0   | 22              | 266     |

S021 North American Warm Desert Pavement

| Status | BLM | BOR | FWS | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | City | County | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|-----|------|-------------|-----|---------------|---------------|---------------|----------------|------|--------|---------------|-----|-----------------|---------|
| 1      | 1   | 0   | 4   | 0    | 0           | 21  | 0             | 0             | 0             | 0              | 0    | 0      | 0             | <1  | 0               | 0       |
| 2      | 36  | 0   | <1  | <1   | 0           | 34  | 0             | 0             | 0             | <1             | 0    | 0      | 1             | <1  | 0               | 0       |
| 3      | 119 | 5   | 0   | 1    | 14          | 18  | 4             | <1            | 0             | 0              | 0    | 0      | <1            | <1  | 0               | <1      |
| 4      | 0   | 0   | 0   | 0    | 0           | 0   | 0             | 0             | 38            | 0              | <1   | <1     | 0             | 0   | <1              | 87      |

S022 North American Warm Desert Playa

| Status | BLM | BOR | FWS | USFS | DOD/DO<br>E | NPS | ARS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Reg.<br>Gov | City | County | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|-----|------|-------------|-----|-----|---------------|---------------|---------------|----------------|-------------|------|--------|-----|-----------------|---------|
| 1      | 17  | 0   | 62  | <1   | 0           | 162 | 0   | 0             | 0             | 0             | 0              | 0           | 0    | 0      | <1  | 0               | 0       |
| 2      | 11  | 0   | 96  | 4    | 0           | <1  | 0   | 0             | 0             | 0             | <1             | 0           | 0    | 0      | 0   | 0               | 0       |
| 3      | 254 | <1  | 0   | 5    | 311         | <1  | <1  | <1            | 5             | 0             | 0              | 0           | 0    | 0      | 0   | 0               | 0       |
| 4      | 0   | 0   | 0   | 0    | <1          | 0   | 0   | <1            | 0             | 15            | 0              | <1          | <1   | <1     | 0   | 10              | 140     |

S019 North American Warm Desert Volcanic Rockland

| Status | BLM | BOR | FWS | USFS | DOD/DO<br>E | NPS | ARS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | City | County | Aud | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|-----|------|-------------|-----|-----|---------------|---------------|---------------|----------------|------|--------|-----|---------------|-----|-----------------|---------|
| 1      | 15  | 0   | 21  | 0    | 0           | 8   | 0   | 0             | 0             | 0             | 0              | 0    | 0      | <1  | 0             | 0   | 0               | 0       |
| 2      | 254 | 0   | 3   | 3    | 0           | 41  | 0   | 0             | <1            | <1            | <1             | 0    | 0      | 0   | <1            | <1  | 0               | 0       |
| 3      | 129 | <1  | 0   | 10   | 182         | 48  | <1  | <1            | <1            | <1            | 0              | 0    | 0      | 0   | 2             | 20  | 0               | 0       |
| 4      | 0   | 8   | 0   | 0    | 0           | 0   | 0   | 0             | 0             | 87            | 0              | <1   | <1     | 0   | 0             | 0   | 116             | 39      |

S002 Rocky Mountain Alpine Bedrock and Scree

| Status | BLM | FWS | USFS | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | County | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|------|-----|---------------|---------------|---------------|----------------|--------|-----|-----------------|---------|
| 1      | 8   | 0   | 611  | 181 | 0             | 0             | 0             | 0              | 0      | 1   | 0               | 0       |
| 2      | 88  | 0   | 1484 | 15  | 0             | 0             | 1             | 2              | 0      | <1  | 0               | 0       |
| 3      | 48  | <1  | 1165 | 0   | 2             | 16            | <1            | 0              | 0      | 7   | 0               | <1      |
| 4      | 0   | 0   | 0    | 0   | 0             | 0             | 4             | 0              | <1     | 0   | 4               | 211     |

S004 Rocky Mountain Alpine Fell-Field

| Status | BLM | FWS | USFS | NPS | State<br>Park | State<br>Schl | State<br>Wldlf | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|------|-----|---------------|---------------|----------------|-----|-----------------|---------|
| 1      | 1   | 0   | 115  | 48  | 0             | 0             | 0              | <1  | 0               | 0       |
| 2      | 12  | 0   | 294  | 3   | 0             | <1            | <1             | 0   | 0               | 0       |
| 3      | 15  | <1  | 236  | 0   | 3             | <1            | <1             | <1  | 0               | 0       |
| 4      | 0   | 0   | 0    | 0   | 0             | 0             | 0              | 0   | <1              | 32      |

S006 Rocky Mountain Cliff, Canyon and Massive Bedrock

| Status | BLM | FWS | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Other<br>State | City | County | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|------|-------------|-----|---------------|---------------|---------------|----------------|----------------|------|--------|-----|-----------------|---------|
| 1      | 3   | <1  | 187  | 0           | 62  | 0             | 0             | 0             | 0              | 0              | 0    | 0      | <1  | 0               | 0       |
| 2      | 118 | 3   | 350  | 0           | 10  | 0             | 0             | 1             | 40             | 0              | 0    | 0      | <1  | 0               | 0       |
| 3      | 452 | <1  | 960  | 7           | 5   | 157           | 3             | 3             | <1             | <1             | 0    | 0      | 6   | 0               | <1      |
| 4      | 0   | 0   | 0    | 0           | 0   | 32            | 0             | 76            | 0              | 0              | <1   | <1     | 0   | 6               | 472     |

S007 Sierra Nevada Cliff and Canyon

| Status | BLM | BOR | USFS | DOD/DO<br>E | Nativ<br>Amer | State<br>Park | State<br>Schl | Other<br>State | Reg.<br>Gov | City | County | TNC | Private |
|--------|-----|-----|------|-------------|---------------|---------------|---------------|----------------|-------------|------|--------|-----|---------|
| 1      | 0   | 0   | 0    | 0           | 0             | 0             | 0             | 0              | 0           | 0    | 0      | 0   | 0       |
| 2      | 2   | 0   | 4    | 0           | 0             | 0             | 0             | 0              | 0           | 0    | 0      | <1  | 0       |
| 3      | 43  | <1  | 36   | 9           | 3             | <1            | 0             | 0              | 0           | 0    | 0      | <1  | 0       |
| 4      | 0   | 0   | 0    | 0           | <1            | 0             | <1            | <1             | <1          | <1   | <1     | <1  | 24      |

S008 Western Great Plains Cliff and Outcrop

| Status | BLM | BOR | FWS | USFS | DOD/DO<br>E | NPS | ARS | State<br>Park | State<br>Schl | State<br>Wldlf | Reg.<br>Gov | City | County | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|-----|------|-------------|-----|-----|---------------|---------------|----------------|-------------|------|--------|-----|-----------------|---------|
| 1      | 0   | 0   | 0   | <1   | 0           | <1  | 0   | 0             | 0             | 0              | 0           | 0    | 0      | <1  | 0               | 0       |
| 2      | 2   | 0   | <1  | <1   | 0           | <1  | <1  | 0             | <1            | <1             | 0           | 0    | 0      | 0   | 0               | 0       |
| 3      | 16  | <1  | <1  | 13   | 3           | 0   | 0   | <1            | 6             | 0              | 0           | 0    | 0      | <1  | 0               | 3       |
| 4      | 0   | 0   | 0   | 0    | 0           | 0   | 0   | 0             | 36            | 0              | <1          | <1   | <1     | 0   | <1              | 229     |

EVERGREEN FOREST

S039 Colorado Plateau Pinyon-Juniper Woodland

| Status | BLM   | BOR | FWS | USFS  | DOD/DO<br>E | NPS  | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Other<br>State | City | County | TNC | Priv-<br>BioDiv | Private |
|--------|-------|-----|-----|-------|-------------|------|---------------|---------------|---------------|----------------|----------------|------|--------|-----|-----------------|---------|
| 1      | 163   | 0   | 0   | 287   | 0           | 2015 | 0             | 0             | 0             | 0              | 0              | 0    | 0      | 5   | 0               | 0       |
| 2      | 8632  | 0   | 21  | 981   | 0           | 464  | 406           | 0             | 51            | 591            | 0              | 0    | 0      | 3   | 0               | 0       |
| 3      | 20453 | <1  | <1  | 14987 | 46          | 172  | 21704         | 101           | 95            | <1             | <1             | 0    | 0      | 54  | 0               | 3       |
| 4      | 0     | 1   | 0   | 0     | <1          | 0    | 2240          | 0             | 6505          | 4              | 0              | <1   | 2      | 0   | 135             | 17698   |

S040 Great Basin Pinyon-Juniper Woodland

| Status | BLM   | BOR | FWS | USFS | DOD/DO<br>E | NPS | ARS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Other<br>State | Reg.<br>Gov | City | County | TNC | Private |   |
|--------|-------|-----|-----|------|-------------|-----|-----|---------------|---------------|---------------|----------------|----------------|-------------|------|--------|-----|---------|---|
| 1      | 18    | 0   | 359 | 116  | 0           | 634 | 0   | 0             | 0             | 0             | 0              | 0              | 0           | 0    | 0      | 0   | <1      | 0 |
| 2      | 7620  | 0   | 14  | 1486 | 0           | <1  | 24  | 0             | 10            | 32            | 38             | 0              | 0           | 0    | 0      | 0   | <1      | 0 |
| 3      | 25326 | <1  | <1  | 8657 | 1064        | 0   | 0   | 261           | 22            | 0             | <1             | 1              | 0           | 0    | <1     | <1  | <1      |   |
| 4      | 0     | 0   | 0   | 0    | 330         | 0   | 0   | 26            | 0             | 773           | 0              | <1             | 1           | <1   | 2      | 0   | 3956    |   |

S026 Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland

| Status | BLM | FWS | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Wldlf | TNC | Private |
|--------|-----|-----|------|-------------|-----|---------------|----------------|-----|---------|
| 1      | <1  | 16  | 93   | 0           | 47  | 0             | 0              | 0   | 0       |
| 2      | 71  | 0   | 203  | 0           | 0   | 0             | <1             | <1  | 0       |
| 3      | 50  | 0   | 167  | 3           | 0   | 9             | 0              | 0   | <1      |
| 4      | 0   | 0   | 0    | 0           | 0   | 0             | 0              | 0   | 8       |

S051 Madrean Encinal

| Status | BLM | FWS | USFS | DOD/DO<br>E | NPS | ARS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | City | County | Aud | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|------|-------------|-----|-----|---------------|---------------|---------------|----------------|------|--------|-----|---------------|-----|-----------------|---------|
| 1      | 7   | 2   | 3    | 0           | 65  | 0   | 0             | 0             | 0             | 0              | 0    | 0      | <1  | 0             | 3   | 0               | 0       |
| 2      | 244 | 6   | 196  | 0           | 6   | 0   | 0             | 3             | <1            | 1              | 0    | 0      | 0   | 147           | 14  | 0               | 0       |
| 3      | 372 | 0   | 1651 | 33          | 2   | 4   | 101           | 2             | 6             | 0              | 0    | 0      | 0   | 14            | 12  | 0               | <1      |
| 4      | 0   | 0   | 0    | 0           | 0   | 0   | 0             | 0             | 644           | <1             | 4    | <1     | 0   | 0             | 0   | 2               | 815     |

## S035 Madrean Pine-Oak Forest and Woodland

| Status | BLM | FWS | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wildf | City | Aud | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|------|-------------|-----|---------------|---------------|---------------|----------------|------|-----|---------------|-----|-----------------|---------|
| 1      | <1  | 0   | 76   | 0           | 20  | 0             | 0             | 0             | 0              | 0    | 0   | 0             | <1  | 0               | 0       |
| 2      | 33  | <1  | 826  | 0           | <1  | 0             | 0             | 0             | <1             | 0    | <1  | 3             | <1  | 0               | 0       |
| 3      | 49  | 0   | 2467 | 7           | 0   | 1773          | <1            | 0             | <1             | 0    | 0   | <1            | <1  | 0               | <1      |
| 4      | 0   | 0   | 0    | 0           | 0   | <1            | 0             | 123           | 0              | <1   | 0   | 0             | 0   | <1              | 354     |

## S112 Madrean Pinyon-Juniper Woodland

| Status | BLM  | BOR | FWS | USFS | DOD/DO<br>E | NPS | ARS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wildf | Reg.<br>Gov | City | County | Aud | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |
|--------|------|-----|-----|------|-------------|-----|-----|---------------|---------------|---------------|----------------|-------------|------|--------|-----|---------------|-----|-----------------|---------|
| 1      | 8    | 0   | 4   | 89   | 0           | 61  | 0   | 0             | 0             | 0             | 0              | 0           | 0    | 0      | <1  | 0             | 4   | 0               | 0       |
| 2      | 368  | 0   | 50  | 1898 | 0           | 5   | 0   | 0             | <1            | <1            | 6              | 0           | 0    | 0      | 0   | 49            | 6   | 0               | 0       |
| 3      | 1107 | 0   | 0   | 7248 | 581         | <1  | 4   | 4591          | 1             | <1            | 0              | 0           | 0    | 0      | 0   | 3             | 20  | 0               | 5       |
| 4      | 0    | <1  | 0   | 0    | 0           | 0   | 0   | 24            | 0             | 1800          | <1             | 1           | <1   | <1     | 0   | 0             | 0   | 17              | 3964    |

## S111 Madrean Upper Montane Conifer-Oak Forest and Woodland

| Status | BLM | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Schl | Land<br>Trust | Private |
|--------|-----|------|-------------|-----|---------------|---------------|---------------|---------|
| 1      | 0   | 3    | 0           | 9   | 0             | 0             | 0             | 0       |
| 2      | 2   | 143  | 0           | <1  | 0             | 0             | 5             | 0       |
| 3      | 1   | 420  | 4           | 0   | 167           | 0             | 0             | 0       |
| 4      | 0   | 0    | 0           | 0   | <1            | 3             | 0             | 37      |

## S033 Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland

| Status | USFS | State<br>Park | Reg. Gov | County | Private |
|--------|------|---------------|----------|--------|---------|
| 1      | 0    | 0             | 0        | 0      | 0       |
| 2      | <1   | 0             | 0        | 0      | 0       |
| 3      | <1   | <1            | 0        | 0      | 0       |
| 4      | 0    | 0             | <1       | <1     | <1      |

## S123 Mediterranean California Ponderosa-Jeffrey Pine Forest and Woodland

| Status | BLM | USFS | Nativ<br>Amer | State<br>Park | Other<br>State | Reg.<br>Gov | County | TNC | Private |
|--------|-----|------|---------------|---------------|----------------|-------------|--------|-----|---------|
| 1      | 0   | 0    | 0             | 0             | 0              | 0           | 0      | 0   | 0       |
| 2      | 0   | 24   | 0             | 0             | 0              | 0           | 0      | 0   | 0       |
| 3      | <1  | 122  | 0             | 18            | 6              | 0           | 0      | <1  | 0       |
| 4      | 0   | 0    | <1            | 0             | 0              | <1          | 2      | 0   | 37      |

## S121 Mediterranean California Red Fir Forest and Woodland

| Status | USFS | State<br>Park | Other<br>State | Reg. Gov | County | Private |
|--------|------|---------------|----------------|----------|--------|---------|
| 1      | 0    | 0             | 0              | 0        | 0      | 0       |
| 2      | 24   | 0             | 0              | 0        | 0      | 0       |
| 3      | 59   | 15            | <1             | 0        | 0      | 0       |
| 4      | 0    | 0             | 0              | <1       | <1     | 7       |

## S029 Northern Pacific Mesic Subalpine Parkland

| Status | BLM | USFS | State Park | Other State | Private |
|--------|-----|------|------------|-------------|---------|
| 1      | 0   | 0    | 0          | 0           | 0       |
| 2      | 0   | 25   | 0          | 0           | 0       |
| 3      | <1  | 16   | <1         | <1          | 0       |
| 4      | 0   | 0    | 0          | 0           | 1       |

## S032 Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland

| Status | BLM | FWS | USFS | DOD/DO E | NPS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | Other State | Reg. Gov | City | County | Aud | Land Trust | TNC | Priv-BioDiv | Private |
|--------|-----|-----|------|----------|-----|-----|------------|------------|------------|-------------|-------------|----------|------|--------|-----|------------|-----|-------------|---------|
| 1      | 1   | 43  | 234  | 0        | 175 | 0   | 0          | 0          | 0          | 0           | 0           | 0        | 0    | 0      | 0   | 0          | <1  | 0           | 0       |
| 2      | 244 | <1  | 1247 | 0        | 19  | <1  | <1         | <1         | 13         | 94          | 0           | 0        | 0    | 0      | <1  | 0          | 1   | 0           | 0       |
| 3      | 541 | <1  | 4111 | 2        | 4   | 0   | 311        | 13         | 18         | <1          | <1          | 0        | 0    | <1     | 0   | <1         | 23  | 0           | 32      |
| 4      | 0   | 0   | 0    | 0        | 0   | 0   | 115        | 0          | 154        | 0           | 0           | <1       | 7    | 5      | 0   | 0          | 0   | 50          | 1489    |

## S125 Rocky Mountain Foothill Limber Pine-Juniper Woodland

| Status | BLM | USFS | State Park | State Schl | State Wldlf | Private |
|--------|-----|------|------------|------------|-------------|---------|
| 1      | 0   | <1   | 0          | 0          | 0           | 0       |
| 2      | 0   | 0    | 0          | <1         | <1          | 0       |
| 3      | <1  | <1   | <1         | <1         | 0           | 0       |
| 4      | 0   | 0    | 0          | 0          | 0           | 5       |

## S031 Rocky Mountain Lodgepole Pine Forest

| Status | BLM | FWS | USFS | DOD/DO E | NPS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | Other State | Reg. Gov | City | County | Land Trust | TNC | Priv-BioDiv | Private |
|--------|-----|-----|------|----------|-----|-----|------------|------------|------------|-------------|-------------|----------|------|--------|------------|-----|-------------|---------|
| 1      | 0   | 0   | 187  | 0        | 248 | 0   | 0          | 0          | 0          | 0           | 0           | 0        | 0    | 0      | 0          | 0   | 0           | 0       |
| 2      | 24  | <1  | 1153 | 0        | 2   | 0   | 0          | 9          | 27         | 0           | 0           | 0        | 0    | 0      | 0          | 0   | 0           | 0       |
| 3      | 276 | 3   | 5630 | <1       | <1  | 22  | 124        | 27         | <1         | 2           | 0           | 0        | <1   | <1     | 7          | 0   | 0           |         |
| 4      | 0   | 0   | 0    | 0        | 0   | 0   | 0          | 18         | 0          | 0           | 8           | 1        | 14   | 0      | 0          | 4   | 977         |         |

## S034 Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland

| Status | BLM | FWS | USFS | DOD/DO E | NPS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | Other State | Reg. Gov | City | County | Aud | Land Trust | TNC | Priv-BioDiv | Private |
|--------|-----|-----|------|----------|-----|-----|------------|------------|------------|-------------|-------------|----------|------|--------|-----|------------|-----|-------------|---------|
| 1      | 3   | 25  | 233  | 0        | 65  | 0   | 0          | 0          | 0          | 0           | 0           | 0        | 0    | 0      | 0   | 0          | <1  | 0           | 0       |
| 2      | 208 | <1  | 787  | 0        | 13  | <1  | <1         | 2          | 16         | 109         | 0           | 0        | 0    | 0      | <1  | 0          | 1   | 0           | 0       |
| 3      | 550 | 0   | 3176 | 3        | 10  | 0   | 184        | 14         | 27         | <1          | <1          | 0        | 0    | <1     | 0   | <1         | 30  | 0           | 46      |
| 4      | 0   | 0   | 0    | 0        | 0   | 0   | 58         | 0          | 70         | 0           | 0           | <1       | 17   | 21     | 0   | 0          | 0   | 60          | 1565    |

## S028 Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland

| Status | BLM | BOR | FWS | USFS | DOD/DO E | NPS | Nativ Amer | State Park | State Schl | State Wldlf | Other State | Reg. Gov | City | County | Land Trust | TNC | Priv-BioDiv | Private |
|--------|-----|-----|-----|------|----------|-----|------------|------------|------------|-------------|-------------|----------|------|--------|------------|-----|-------------|---------|
| 1      | <1  | 0   | 0   | 1227 | 0        | 244 | 0          | 0          | 0          | 0           | 0           | 0        | 0    | 0      | 0          | <1  | 0           | 0       |
| 2      | 120 | 0   | 1   | 3286 | 0        | 15  | 0          | 0          | 11         | 34          | 0           | 0        | 0    | 0      | 0          | <1  | 0           | 0       |
| 3      | 254 | <1  | 2   | 8285 | 10       | <1  | 128        | 65         | 12         | <1          | <1          | 0        | 0    | 0      | <1         | 11  | 0           | 31      |
| 4      | 0   | 0   | 0   | 0    | 0        | 0   | 38         | 0          | 32         | 0           | 0           | <1       | <1   | <1     | 0          | 0   | 27          | 960     |



## S030 Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland

| Status | BLM | BOR | FWS | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Other<br>State | Reg.<br>Gov | City | County | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|-----|------|-------------|-----|---------------|---------------|---------------|----------------|----------------|-------------|------|--------|---------------|-----|-----------------|---------|
| 1      | <1  | 0   | 0   | 938  | 0           | 183 | 0             | 0             | 0             | 0              | 0              | 0           | 0    | 0      | 0             | <1  | 0               | 0       |
| 2      | 126 | 0   | <1  | 2078 | 0           | 14  | 0             | 0             | 6             | 31             | 0              | 0           | 0    | 0      | 0             | <1  | 0               | 0       |
| 3      | 232 | <1  | 3   | 5686 | 6           | <1  | 95            | 32            | 15            | <1             | <1             | 0           | 0    | 0      | <1            | 13  | 0               | 16      |
| 4      | 0   | 0   | 0   | 0    | 0           | 0   | 24            | 0             | 23            | 0              | 0              | <1          | <1   | 1      | 0             | 0   | 24              | 810     |

## S025 Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland

| Status | BLM | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |
|--------|-----|------|-------------|-----|---------------|---------------|---------------|----------------|---------------|-----|-----------------|---------|
| 1      | 0   | 13   | 0           | <1  | 0             | 0             | 0             | 0              | 0             | <1  | 0               | 0       |
| 2      | 10  | 158  | 0           | 4   | 0             | 0             | 4             | 17             | 0             | <1  | 0               | 0       |
| 3      | 23  | 344  | <1          | 0   | 26            | <1            | 7             | 0              | <1            | <1  | 0               | 5       |
| 4      | 0   | 0    | 0           | 0   | 11            | 0             | 3             | 0              | 0             | 0   | 19              | 155     |

## S122 Sierra Nevada Subalpine Lodgepole Pine Forest and Woodland

| Status | BLM | USFS | DOD/DO<br>E | State<br>Park | County | Private |
|--------|-----|------|-------------|---------------|--------|---------|
| 1      | 0   | 0    | 0           | 0             | 0      | 0       |
| 2      | <1  | 4    | 0           | 0             | 0      | 0       |
| 3      | <1  | 14   | <1          | 1             | 0      | 0       |
| 4      | 0   | 0    | 0           | 0             | <1     | 1       |

## S038 Southern Rocky Mountain Pinyon-Juniper Woodland

| Status | BLM  | BOR | FWS | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | City | County | Aud | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |
|--------|------|-----|-----|------|-------------|-----|---------------|---------------|---------------|----------------|------|--------|-----|---------------|-----|-----------------|---------|
| 1      | <1   | 0   | 3   | 10   | 0           | 77  | 0             | 0             | 0             | 0              | 0    | 0      | 0   | 0             | <1  | 0               | 0       |
| 2      | 435  | 0   | 57  | 307  | 0           | 29  | <1            | <1            | 30            | 78             | 0    | 0      | <1  | <1            | 11  | 0               | 0       |
| 3      | 1663 | <1  | 0   | 2455 | 239         | <1  | 251           | 39            | 196           | 2              | 0    | 0      | 0   | <1            | 40  | 0               | 41      |
| 4      | 0    | <1  | 0   | 0    | 0           | 0   | 571           | 0             | 894           | 0              | 3    | 2      | 0   | 0             | 0   | 254             | 7611    |

## S036 Southern Rocky Mountain Ponderosa Pine Woodland

| Status | BLM | FWS | USFS  | DOD/DO<br>E | NPS | Dept.<br>of<br>Com. | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Other<br>State | Reg.<br>Gov | City | County | Aud | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |   |
|--------|-----|-----|-------|-------------|-----|---------------------|---------------|---------------|---------------|----------------|----------------|-------------|------|--------|-----|---------------|-----|-----------------|---------|---|
| 1      | 1   | 2   | 982   | 0           | 508 | 0                   | 0             | 0             | 0             | 0              | 0              | 0           | 0    | 0      | 0   | 0             | 0   | <1              | 0       | 0 |
| 2      | 518 | 4   | 3276  | 0           | 25  | 0                   | 7             | 5             | 33            | 317            | 0              | 0           | 0    | 0      | <1  | 0             | 5   | 0               | 0       |   |
| 3      | 863 | 1   | 25155 | 115         | 4   | 0                   | 6163          | 78            | 139           | 2              | <1             | 0           | 0    | 1      | 0   | <1            | 52  | 0               | 261     |   |
| 4      | 0   | 0   | 0     | <1          | 0   | <1                  | 625           | 0             | 632           | <1             | 0              | 3           | 50   | 86     | 0   | 0             | 0   | 1153            | 9137    |   |

## DECIDUOUS FOREST

## S023 Rocky Mountain Aspen Forest and Woodland

| Status | BLM | FWS | USFS  | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Other<br>State | Reg.<br>Gov | City | County | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|-------|-------------|-----|---------------|---------------|---------------|----------------|----------------|-------------|------|--------|---------------|-----|-----------------|---------|
| 1      | <1  | 27  | 395   | 0           | 33  | 0             | 0             | 0             | 0              | 0              | 0           | 0    | 0      | 0             | <1  | 0               | 0       |
| 2      | 200 | 1   | 1754  | 0           | 30  | <1            | 0             | 53            | 180            | 0              | 0           | 0    | 0      | <1            | 1   | 0               | 0       |
| 3      | 854 | <1  | 10902 | 5           | 2   | 428           | 63            | 90            | <1             | <1             | 0           | 0    | 0      | <1            | 36  | 0               | 17      |
| 4      | 0   | 0   | 0     | 0           | 0   | 29            | 0             | 198           | 0              | 0              | <1          | <1   | <1     | 0             | 0   | 32              | 5647    |

S024 Rocky Mountain Bigtooth Maple Ravine Woodland

| Status | BLM | USFS | DOD/DO E | NPS | Nativ Amer | State Park | State Schl | State Wldlf | City | County | TNC | Private |
|--------|-----|------|----------|-----|------------|------------|------------|-------------|------|--------|-----|---------|
| 1      | 0   | 33   | 0        | <1  | 0          | 0          | 0          | 0           | 0    | 0      | 0   | 0       |
| 2      | <1  | 40   | 0        | <1  | 0          | 0          | 0          | 30          | 0    | 0      | 0   | 0       |
| 3      | 9   | 237  | <1       | 0   | <1         | 3          | 0          | <1          | 0    | 0      | <1  | 0       |
| 4      | 0   | 0    | <1       | 0   | 0          | 0          | 10         | 0           | <1   | <1     | 0   | 524     |

MIXED FOREST

S042 Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland

| Status | BLM | FWS | USFS | NPS | Nativ Amer | State Park | State Schl | State Wldlf | Reg. Gov | City | County | Land Trust | TNC | Priv-BioDiv | Private |
|--------|-----|-----|------|-----|------------|------------|------------|-------------|----------|------|--------|------------|-----|-------------|---------|
| 1      | <1  | 0   | 61   | 20  | 0          | 0          | 0          | 0           | 0        | 0    | 0      | 0          | 0   | 0           | 0       |
| 2      | 49  | <1  | 227  | 14  | 0          | 0          | 5          | 13          | 0        | 0    | 0      | 0          | <1  | 0           | 0       |
| 3      | 147 | 0   | 2179 | <1  | 26         | 1          | 6          | <1          | 0        | 0    | 0      | <1         | 16  | 0           | 3       |
| 4      | 0   | 0   | 0    | 0   | 8          | 0          | 38         | 0           | <1       | <1   | <1     | 0          | 0   | 11          | 611     |

SHRUB/SCRUB

S058 Apacherian-Chihuahuan Mesquite Upland Scrub

| Status | BLM  | BOR | FWS | USFS | DOD/DO E | NPS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | Reg. Gov | City | County | Aud | Land Trust | TNC | Priv-BioDiv | Private |
|--------|------|-----|-----|------|----------|-----|-----|------------|------------|------------|-------------|----------|------|--------|-----|------------|-----|-------------|---------|
| 1      | 23   | 0   | 43  | 23   | 0        | 22  | 0   | 0          | 0          | 0          | 0           | 0        | 0    | 0      | 1   | 0          | 2   | 0           | 0       |
| 2      | 561  | 0   | 239 | 644  | <1       | 8   | 0   | 0          | 10         | 8          | 45          | 0        | 0    | 0      | 0   | 15         | 27  | 0           | 0       |
| 3      | 6754 | 31  | 1   | 3153 | 357      | <1  | 338 | 2351       | 19         | 31         | <1          | 0        | 0    | <1     | 0   | 18         | 18  | 0           | 0       |
| 4      | 0    | 1   | 0   | 0    | 24       | 0   | 0   | 62         | 0          | 7872       | <1          | 1        | 10   | 9      | 0   | 0          | 0   | 63          | 8869    |

S062 Chihuahuan Mixed Desert and Thorn Scrub

| Status | BLM   | BOR | FWS | USFS | DOD/DO E | NPS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | City | County | Aud | Land Trust | TNC | Priv-BioDiv | Private |
|--------|-------|-----|-----|------|----------|-----|-----|------------|------------|------------|-------------|------|--------|-----|------------|-----|-------------|---------|
| 1      | 33    | 0   | 56  | <1   | 0        | 49  | 0   | 0          | 0          | 0          | 0           | 0    | 0      | 1   | 0          | <1  | 0           | 0       |
| 2      | 960   | 0   | 142 | 24   | 0        | 3   | 0   | 0          | 2          | 2          | 54          | 0    | 0      | 0   | 12         | 19  | 0           | 0       |
| 3      | 10349 | 71  | <1  | 322  | 1944     | <1  | 124 | 407        | 64         | 15         | 0           | 0    | 0      | 0   | 43         | 12  | 0           | 0       |
| 4      | 0     | 3   | 0   | 0    | 5        | 0   | 0   | <1         | 0          | 6265       | <1          | 2    | 4      | 0   | 0          | 0   | 485         | 5913    |

S116 Chihuahuan Mixed Salt Desert Scrub

| Status | BLM  | BOR | FWS | USFS | DOD/DO E | NPS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | City | County | Aud | Land Trust | TNC | Priv-BioDiv | Private |
|--------|------|-----|-----|------|----------|-----|-----|------------|------------|------------|-------------|------|--------|-----|------------|-----|-------------|---------|
| 1      | 21   | 0   | 2   | 1    | 0        | 75  | 0   | 0          | 0          | 0          | 0           | 0    | 0      | <1  | 0          | <1  | 0           | 0       |
| 2      | 93   | 0   | 28  | 52   | 0        | <1  | 0   | 0          | 2          | <1         | 20          | 0    | 0      | 0   | 2          | 9   | 0           | 0       |
| 3      | 1180 | <1  | <1  | 349  | 528      | <1  | 7   | 270        | 3          | 7          | 0           | 0    | 0      | 0   | 5          | 2   | 0           | 0       |
| 4      | 0    | <1  | 0   | 0    | <1       | 0   | 0   | <1         | 0          | 852        | <1          | 4    | 1      | 0   | 0          | 0   | 3           | 885     |

S068 Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub

| Status | BLM  | BOR | FWS | USFS | DOD/DO E | NPS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | City | County | Land Trust | TNC | Priv-BioDiv | Private |
|--------|------|-----|-----|------|----------|-----|-----|------------|------------|------------|-------------|------|--------|------------|-----|-------------|---------|
| 1      | <1   | 0   | <1  | 0    | 0        | 78  | 0   | 0          | 0          | 0          | 0           | 0    | 0      | 0          | <1  | 0           | 0       |
| 2      | 51   | 0   | 1   | <1   | 0        | 0   | 0   | 0          | <1         | 0          | <1          | 0    | 0      | <1         | 6   | 0           | 0       |
| 3      | 2188 | 3   | 0   | 1    | 1968     | 0   | 7   | 6          | 1          | <1         | 0           | 0    | 0      | 1          | <1  | 0           | 0       |
| 4      | 0    | 0   | 0   | 0    | <1       | 0   | 0   | 0          | 0          | 700        | 0           | <1   | <1     | 0          | 0   | 12          | 697     |

## S061 Chihuahuan Succulent Desert Scrub

| Status | BLM | BOR | FWS | USFS | DOD/DO<br>E | NPS | ARS | Nativ<br>Amer | State<br>Park | State<br>Schl | City | County | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|-----|------|-------------|-----|-----|---------------|---------------|---------------|------|--------|---------------|-----|-----------------|---------|
| 1      | <1  | 0   | <1  | <1   | 0           | 3   | 0   | 0             | 0             | 0             | 0    | 0      | 0             | <1  | 0               | 0       |
| 2      | 5   | 0   | <1  | 2    | 0           | <1  | 0   | 0             | 0             | 0             | 0    | 0      | <1            | <1  | 0               | 0       |
| 3      | 55  | <1  | 0   | 12   | 3           | <1  | <1  | 12            | <1            | 1             | 0    | 0      | <1            | <1  | 0               | 0       |
| 4      | 0   | 0   | 0   | 0    | 0           | 0   | 0   | <1            | 0             | 52            | <1   | <1     | 0             | 0   | <1              | 38      |

## S117 Coahuilan Chaparral

| Status | BLM | USFS | NPS | State Schl | Private |
|--------|-----|------|-----|------------|---------|
| 1      | <1  | <1   | 27  | 0          | 0       |
| 2      | 6   | 5    | 1   | 0          | 0       |
| 3      | 10  | 35   | 0   | 0          | 0       |
| 4      | 0   | 0    | 0   | 6          | 3       |

## S059 Colorado Plateau Blackbrush-Mormon-tea Shrubland

| Status | BLM  | BOR | USFS | DOD/DO<br>E | NPS  | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wildf | Other<br>State | County | TNC | Private |
|--------|------|-----|------|-------------|------|---------------|---------------|---------------|----------------|----------------|--------|-----|---------|
| 1      | 28   | 0   | 15   | 0           | 608  | 0             | 0             | 0             | 0              | 0              | 0      | <1  | 0       |
| 2      | 1849 | 0   | <1   | 0           | 32   | 124           | <1            | 7             | 3              | 0              | 0      | 3   | 0       |
| 3      | 3777 | 0   | 10   | <1          | 1147 | 4626          | 5             | <1            | <1             | 3              | 0      | <1  | 0       |
| 4      | 0    | <1  | 0    | 0           | 0    | 44            | 0             | 735           | 0              | 0              | <1     | 0   | 281     |

## S056 Colorado Plateau Mixed Low Sagebrush Shrubland

| Status | BLM | FWS | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wildf | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|------|-------------|-----|---------------|---------------|---------------|----------------|-----|-----------------|---------|
| 1      | <1  | 0   | 0    | 0           | 2   | 0             | 0             | 0             | 0              | <1  | 0               | 0       |
| 2      | 120 | <1  | <1   | 0           | <1  | <1            | 0             | <1            | 35             | 0   | 0               | 0       |
| 3      | 900 | 0   | 20   | <1          | 0   | 246           | 6             | <1            | 0              | <1  | 0               | 0       |
| 4      | 0   | 0   | 0    | 0           | 0   | 18            | 0             | 322           | 0              | 0   | <1              | 729     |

## S052 Colorado Plateau Pinyon-Juniper Shrubland

| Status | BLM  | BOR | FWS | USFS | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wildf | Other<br>State | TNC | Private |
|--------|------|-----|-----|------|-----|---------------|---------------|---------------|----------------|----------------|-----|---------|
| 1      | 96   | 0   | 0   | 6    | 287 | 0             | 0             | 0             | 0              | 0              | <1  | 0       |
| 2      | 3584 | 0   | 2   | 14   | 132 | <1            | <1            | <1            | 53             | 0              | 4   | 0       |
| 3      | 4475 | 0   | <1  | 139  | 289 | 726           | 18            | 2             | 0              | <1             | 3   | 0       |
| 4      | 0    | <1  | 0   | 0    | 0   | 50            | 0             | 747           | 0              | 0              | 0   | 905     |

## S053 Great Basin Semi-Desert Chaparral

| Status | BLM | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | Other<br>State | Reg.<br>Gov | County | Private |
|--------|-----|------|-------------|-----|---------------|---------------|----------------|-------------|--------|---------|
| 1      | 0   | <1   | 0           | <1  | 0             | 0             | 0              | 0           | 0      | 0       |
| 2      | 1   | 55   | 0           | 0   | 0             | 0             | 0              | 0           | 0      | 0       |
| 3      | 9   | 68   | <1          | 0   | 1             | 4             | 1              | 0           | 0      | <1      |
| 4      | 0   | 0    | 0           | 0   | 0             | 0             | 0              | <1          | <1     | 21      |

S055 Great Basin Xeric Mixed Sagebrush Shrubland

| Status | BLM   | BOR | FWS | USFS | DOD/DO<br>E | NPS | ARS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Other<br>State | Reg.<br>Gov | City | County | TNC | Private |    |
|--------|-------|-----|-----|------|-------------|-----|-----|---------------|---------------|---------------|----------------|----------------|-------------|------|--------|-----|---------|----|
| 1      | 3     | 0   | 617 | 2    | 0           | 49  | 0   | 0             | 0             | 0             | 0              | 0              | 0           | 0    | 0      | 0   | <1      | 0  |
| 2      | 3058  | 0   | 151 | 95   | 0           | <1  | 45  | 0             | <1            | 0             | 7              | 0              | 0           | 0    | 0      | 0   | <1      | 0  |
| 3      | 24707 | <1  | 5   | 1912 | 1052        | 0   | 0   | 216           | 9             | 0             | 0              | 0              | 0           | 0    | 0      | 0   | <1      | <1 |
| 4      | 0     | 0   | 0   | 0    | 118         | 0   | 0   | 10            | 0             | 296           | 0              | <1             | <1          | <1   | 1      | 0   | 3070    |    |

S054 Inter-Mountain Basins Big Sagebrush Shrubland

| Status | BLM   | BOR | FWS | USFS | DOD/DO<br>E | NPS | ARS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Other<br>State | Reg.<br>Gov | City | County | TNC | Priv-<br>BioDiv | Private |
|--------|-------|-----|-----|------|-------------|-----|-----|---------------|---------------|---------------|----------------|----------------|-------------|------|--------|-----|-----------------|---------|
| 1      | 34    | 0   | 815 | 36   | 0           | 412 | 0   | 0             | 0             | 0             | 0              | 0              | 0           | 0    | 0      | <1  | 0               | 0       |
| 2      | 5279  | <1  | 219 | 68   | 0           | 89  | 4   | 66            | 10            | 72            | 443            | <1             | 0           | 0    | 0      | 8   | 0               | 0       |
| 3      | 64977 | 20  | 143 | 2940 | 1827        | 104 | 0   | 4485          | 62            | 521           | 2              | <1             | 0           | 0    | 0      | 25  | 0               | 0       |
| 4      | 0     | <1  | 0   | 0    | 307         | 0   | 0   | 400           | 0             | 2291          | <1             | 2              | 6           | 2    | 13     | 0   | 1               | 22753   |

S045 Inter-Mountain Basins Mat Saltbush Shrubland

| Status | BLM  | BOR | FWS | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Other<br>State | TNC | Private |
|--------|------|-----|-----|------|-------------|-----|---------------|---------------|---------------|----------------|----------------|-----|---------|
| 1      | 4    | 0   | 0   | <1   | 0           | 13  | 0             | 0             | 0             | 0              | 0              | 0   | 0       |
| 2      | 237  | 0   | <1  | <1   | 0           | 15  | 0             | <1            | <1            | 2              | 0              | 0   | 0       |
| 3      | 2878 | 0   | 0   | 7    | 5           | 79  | 27            | 2             | 26            | <1             | 6              | <1  | 0       |
| 4      | 0    | <1  | 0   | 0    | 0           | 0   | 6             | 0             | 389           | 0              | 0              | 0   | 432     |

S065 Inter-Mountain Basins Mixed Salt Desert Scrub

| Status | BLM   | BOR | FWS | USFS | DOD/DO<br>E | NPS | ARS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Other<br>State | Reg.<br>Gov | City | County | TNC | Priv-<br>BioDiv | Private |
|--------|-------|-----|-----|------|-------------|-----|-----|---------------|---------------|---------------|----------------|----------------|-------------|------|--------|-----|-----------------|---------|
| 1      | 330   | 0   | 56  | 3    | 0           | 205 | 0   | 0             | 0             | 0             | <1             | 0              | 0           | 0    | 0      | <1  | 0               | 0       |
| 2      | 3579  | 87  | 59  | 4    | 0           | 41  | 79  | 51            | 1             | 20            | 73             | 0              | 0           | 0    | 0      | 2   | 0               | 0       |
| 3      | 47694 | 124 | 21  | 725  | 4745        | 150 | 0   | 7927          | 80            | 58            | <1             | 6              | 0           | 0    | 4      | 64  | 0               | <1      |
| 4      | 0     | <1  | 0   | 0    | 40          | 0   | 0   | 765           | 0             | 2332          | 0              | <1             | <1          | <1   | 2      | 0   | 9               | 9860    |

S050 Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland

| Status | BLM | FWS | USFS | DOD/DO<br>E | NPS | ARS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Reg.<br>Gov | County | TNC | Private |
|--------|-----|-----|------|-------------|-----|-----|---------------|---------------|---------------|----------------|-------------|--------|-----|---------|
| 1      | 4   | 60  | 14   | 0           | 61  | 0   | 0             | 0             | 0             | 0              | 0           | 0      | <1  | 0       |
| 2      | 280 | 0   | 297  | 0           | 0   | <1  | 0             | 0             | 0             | 8              | 0           | 0      | 2   | 0       |
| 3      | 752 | 0   | 847  | <1          | 0   | 0   | 16            | <1            | 0             | 0              | 0           | 0      | <1  | <1      |
| 4      | 0   | 0   | 0    | 0           | 0   | 0   | 0             | 0             | 18            | 0              | <1          | <1     | 0   | 191     |

S057 Mogollon Chaparral

| Status | BLM  | BOR | FWS | USFS | DOD/DO<br>E | NPS | ARS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Reg.<br>Gov | City | County | Aud | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |
|--------|------|-----|-----|------|-------------|-----|-----|---------------|---------------|---------------|----------------|-------------|------|--------|-----|---------------|-----|-----------------|---------|
| 1      | 3    | 0   | 2   | 134  | 0           | 143 | 0   | 0             | 0             | 0             | 0              | 0           | 0    | 0      | <1  | 0             | 2   | 0               | 0       |
| 2      | 467  | 0   | 23  | 1343 | 0           | 3   | 0   | 0             | <1            | <1            | 3              | 0           | 0    | 0      | 0   | 22            | 7   | 0               | 0       |
| 3      | 1747 | 0   | 0   | 3747 | 136         | <1  | 2   | 1017          | 11            | <1            | 0              | 0           | 0    | 0      | 0   | 2             | <1  | 0               | <1      |
| 4      | 0    | <1  | 0   | 0    | 0           | 0   | 0   | 1             | 0             | 1322          | <1             | <1          | <1   | 2      | 0   | 0             | 0   | 18              | 1355    |

S060 Mojave Mid-Elevation Mixed Desert Scrub

| Status | BLM  | BOR | FWS  | USFS | DOD/DO<br>E | NPS  | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | County | TNC | Private |
|--------|------|-----|------|------|-------------|------|---------------|---------------|---------------|----------------|--------|-----|---------|
| 1      | 23   | 0   | 1329 | 60   | 0           | 1291 | 0             | 0             | 0             | 0              | 0      | 3   | 0       |
| 2      | 3143 | 0   | 962  | 394  | 0           | 4    | 0             | 0             | 11            | <1             | 0      | 0   | 0       |
| 3      | 5608 | <1  | 0    | 16   | 1368        | 10   | 589           | 14            | 0             | <1             | 0      | <1  | 0       |
| 4      | 0    | 0   | 0    | 0    | 249         | 0    | 72            | 0             | 280           | <1             | <1     | 0   | 1336    |

S043 Rocky Mountain Alpine Dwarf-Shrubland

| Status | USFS | Nativ<br>Amer | State Schl | Private |
|--------|------|---------------|------------|---------|
| 1      | 13   | 0             | 0          | 0       |
| 2      | 75   | 0             | 0          | 0       |
| 3      | 21   | <1            | 0          | 0       |
| 4      | 0    | 0             | <1         | <1      |

S046 Rocky Mountain Gambel Oak-Mixed Montane Shrubland

| Status | BLM  | BOR | FWS | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Reg.<br>Gov | City | County | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |
|--------|------|-----|-----|------|-------------|-----|---------------|---------------|---------------|----------------|-------------|------|--------|---------------|-----|-----------------|---------|
| 1      | 5    | 0   | <1  | 84   | 0           | 100 | 0             | 0             | 0             | 0              | 0           | 0    | 0      | 0             | <1  | 0               | 0       |
| 2      | 388  | 0   | 3   | 293  | 0           | 29  | 7             | 18            | 43            | 428            | 0           | 0    | 0      | 0             | 3   | 0               | 0       |
| 3      | 2205 | <1  | <1  | 5132 | 69          | 21  | 460           | 82            | 104           | <1             | 0           | 0    | 0      | <1            | 38  | 0               | 27      |
| 4      | 0    | <1  | 0   | 0    | <1          | 0   | 185           | 0             | 335           | <1             | <1          | 6    | 12     | 0             | 0   | 249             | 8617    |

S047 Rocky Mountain Lower Montane-Foothill Shrubland

| Status | BLM | BOR | FWS | USFS | DOD/DO<br>E | NPS | Dept.<br>of<br>Com. | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Reg.<br>Gov | City | County | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|-----|------|-------------|-----|---------------------|---------------|---------------|---------------|----------------|-------------|------|--------|-----|-----------------|---------|
| 1      | <1  | 0   | <1  | 3    | 0           | 35  | 0                   | 0             | 0             | 0             | 0              | 0           | 0    | 0      | <1  | 0               | 0       |
| 2      | 71  | 0   | <1  | 13   | 0           | 1   | 0                   | <1            | <1            | 7             | 63             | 0           | 0    | 0      | 4   | 0               | 0       |
| 3      | 696 | <1  | <1  | 212  | 3           | 2   | 0                   | 24            | 6             | 55            | <1             | 0           | 0    | <1     | 8   | 0               | <1      |
| 4      | 0   | <1  | 0   | 0    | <1          | 0   | <1                  | 4             | 0             | 69            | 0              | 2           | 15   | 35     | 0   | <1              | 1490    |

S069 Sonora-Mojave Creosotebush-White Bursage Desert Scrub

| Status | BLM   | BOR | FWS  | USFS | DOD/DO<br>E | NPS  | ARS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Other<br>State | Reg.<br>Gov | City | County | TNC | Private |    |
|--------|-------|-----|------|------|-------------|------|-----|---------------|---------------|---------------|----------------|----------------|-------------|------|--------|-----|---------|----|
| 1      | 165   | 0   | 3922 | <1   | 0           | 1513 | 0   | 0             | 0             | 0             | 0              | 0              | 0           | 0    | 0      | 0   | 4       | 0  |
| 2      | 7584  | 0   | 1183 | 7    | 796         | 887  | 0   | 0             | 0             | 63            | 64             | 0              | 0           | 0    | 0      | 0   | <1      | 0  |
| 3      | 16213 | 101 | 0    | 56   | 7714        | 1400 | 4   | 3901          | 252           | 0             | 4              | 0              | 0           | 0    | 0      | <1  | 2       | <1 |
| 4      | 0     | 205 | 0    | 0    | 185         | 0    | 0   | 1076          | 0             | 4284          | <1             | <1             | 53          | 12   | 12     | 0   | 7057    |    |

S070 Sonora-Mojave Mixed Salt Desert Scrub

| Status | BLM | BOR | FWS | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Reg.<br>Gov | City | County | TNC | Private |
|--------|-----|-----|-----|------|-------------|-----|---------------|---------------|---------------|----------------|-------------|------|--------|-----|---------|
| 1      | 13  | 0   | 141 | 0    | 0           | 18  | 0             | 0             | 0             | 0              | 0           | 0    | 0      | <1  | 0       |
| 2      | 77  | 0   | 246 | 1    | <1          | <1  | 0             | 0             | <1            | 1              | 0           | 0    | 0      | 0   | 0       |
| 3      | 626 | <1  | 0   | <1   | 294         | 2   | 117           | 5             | 0             | 0              | 0           | 0    | 0      | 0   | 0       |
| 4      | 0   | <1  | 0   | 0    | 38          | 0   | 277           | 0             | 115           | 0              | <1          | <1   | <1     | 0   | 574     |

## S114 Sonora-Mojave Semi-Desert Chaparral

| Status | BLM | FWS | USFS | State Schl | Private |
|--------|-----|-----|------|------------|---------|
| 1      | 0   | 5   | 25   | 0          | 0       |
| 2      | 8   | 0   | 47   | 0          | 0       |
| 3      | 3   | 0   | <1   | 0          | 0       |
| 4      | 0   | 0   | 0    | <1         | 1       |

## S129 Sonoran Mid-Elevation Desert Scrub

| Status | BLM  | BOR | USFS | DOD/DO E | NPS | FWS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | Reg. Gov | City | County | Land Trust | TNC | Private |
|--------|------|-----|------|----------|-----|-----|-----|------------|------------|------------|-------------|----------|------|--------|------------|-----|---------|
| 1      | 1    | 0   | 2    | 0        | 14  | 21  | 0   | 0          | 0          | 0          | 0           | 0        | 0    | 0      | 0          | 0   | 0       |
| 2      | 1031 | 0   | 166  | <1       | <1  | 2   | 0   | 0          | 0          | 1          | <1          | 0        | 0    | 0      | <1         | 1   | 0       |
| 3      | 1424 | 0   | 367  | 6        | <1  | 0   | 5   | 302        | 2          | 0          | 2           | 0        | 0    | 0      | 0          | <1  | 0       |
| 4      | 0    | <1  | 0    | 0        | 0   | 0   | 0   | 5          | 0          | 985        | 0           | 5        | <1   | 17     | 0          | 0   | 1030    |

## S063 Sonoran Paloverde-Mixed Cacti Desert Scrub

| Status | BLM  | BOR | FWS  | USFS | DOD/DO E | NPS  | ARS | Nativ Amer | State Park | State Schl | State Wldlf | Reg. Gov | City | County | Land Trust | TNC | Private |
|--------|------|-----|------|------|----------|------|-----|------------|------------|------------|-------------|----------|------|--------|------------|-----|---------|
| 1      | 15   | 0   | 2621 | 7    | 0        | 1010 | 0   | 0          | 0          | 0          | 0           | 0        | 0    | 0      | 0          | 2   | 0       |
| 2      | 3807 | 0   | 248  | 644  | 224      | <1   | 0   | 0          | <1         | 172        | 21          | 0        | 0    | 0      | 1          | 4   | 0       |
| 3      | 9850 | 0   | 0    | 2056 | 1944     | 0    | 93  | 6717       | 101        | 6          | 9           | 0        | 0    | 1      | <1         | 4   | 0       |
| 4      | 0    | 159 | 0    | 0    | 0        | 0    | 0   | 691        | 0          | 5544       | <1          | 390      | 106  | 135    | 0          | 0   | 3187    |

## S136 Southern Colorado Plateau Sand Shrubland

| Status | BLM | USFS | NPS | Nativ Amer | State Park | State Schl | State Wldlf | Other State | County | TNC | Private |
|--------|-----|------|-----|------------|------------|------------|-------------|-------------|--------|-----|---------|
| 1      | <1  | 0    | 55  | 0          | 0          | 0          | 0           | 0           | 0      | 0   | 0       |
| 2      | 157 | <1   | 1   | 9          | 0          | 20         | <1          | 0           | 0      | <1  | 0       |
| 3      | 339 | 1    | 16  | 5918       | 6          | 0          | 0           | <1          | 0      | 0   | 0       |
| 4      | 0   | 0    | 0   | 31         | 0          | 170        | <1          | 0           | <1     | 0   | 295     |

## S138 Western Great Plains Mesquite Woodland and Shrubland

| Status | BLM | BOR | FWS | USFS | DOD/DO E | State Park | State Schl | State Wldlf | TNC | Priv-BioDiv | Private |
|--------|-----|-----|-----|------|----------|------------|------------|-------------|-----|-------------|---------|
| 1      | 0   | 0   | 0   | 0    | 0        | 0          | 0          | 0           | <1  | 0           | 0       |
| 2      | <1  | 0   | <1  | 0    | 0        | 0          | <1         | 2           | <1  | 0           | 0       |
| 3      | 5   | 0   | 0   | 3    | <1       | 3          | <1         | 0           | 0   | 0           | 0       |
| 4      | 0   | <1  | 0   | 0    | 0        | 0          | 218        | 0           | 0   | <1          | 1562    |

## S048 Western Great Plains Sandhill Shrubland

| Status | BLM  | BOR | FWS | USFS | DOD/DO E | NPS | State Park | State Schl | State Wldlf | Reg. Gov | City | County | TNC | Private |
|--------|------|-----|-----|------|----------|-----|------------|------------|-------------|----------|------|--------|-----|---------|
| 1      | 2    | 0   | <1  | <1   | 0        | 0   | 0          | 0          | 0           | 0        | 0    | 0      | 18  | 0       |
| 2      | 16   | 0   | <1  | 12   | 0        | <1  | <1         | 69         | 105         | 0        | 0    | 0      | 146 | 0       |
| 3      | 1622 | <1  | <1  | 166  | 15       | 9   | 11         | 903        | <1          | 0        | 0    | 0      | <1  | <1      |
| 4      | 0    | <1  | 0   | 0    | 20       | 0   | 0          | 1111       | 0           | <1       | <1   | <1     | 0   | 9659    |

S128 Wyoming Basins Low Sagebrush Shrubland

| Status | BLM | USFS | NPS | State Schl | State Wldlf | Private |
|--------|-----|------|-----|------------|-------------|---------|
| 1      | 0   | 0    | 4   | 0          | 0           | 0       |
| 2      | 9   | 0    | 0   | 0          | <1          | 0       |
| 3      | 28  | <1   | <1  | 3          | 0           | 0       |
| 4      | 0   | 0    | 0   | 1          | 0           | 3       |

GRASSLAND/HERBACEOUS

S077 Apacherian-Chihuahuan Semi-Desert Grassland and Steppe

| Status | BLM   | BOR | FWS | USFS | DOD/DO E | NPS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | City | County | Aud | Land Trust | TNC | Priv-BioDiv | Private |
|--------|-------|-----|-----|------|----------|-----|-----|------------|------------|------------|-------------|------|--------|-----|------------|-----|-------------|---------|
| 1      | 85    | 0   | 64  | 2    | 0        | 149 | 0   | 0          | 0          | 0          | 0           | 0    | 0      | 1   | 0          | <1  | 0           | 0       |
| 2      | 1291  | 0   | 754 | 115  | 0        | 18  | 0   | 0          | 11         | 11         | 11          | 0    | 0      | 0   | 631        | 146 | 0           | 0       |
| 3      | 11795 | 9   | <1  | 2122 | 2962     | <1  | 44  | 931        | 36         | 33         | 0           | 0    | 0      | 0   | 232        | 80  | 0           | <1      |
| 4      | 0     | <1  | 0   | 0    | <1       | 0   | 0   | 1          | 0          | 9245       | <1          | 5    | 3      | 0   | 0          | 0   | 946         | 13951   |

S087 Central Mixedgrass Prairie

| Status | USFS | State Park | State Schl | State Wldlf | TNC | Private |
|--------|------|------------|------------|-------------|-----|---------|
| 1      | 0    | 0          | 0          | 0           | 0   | 0       |
| 2      | <1   | 0          | <1         | 3           | <1  | 0       |
| 3      | 0    | 5          | 11         | 0           | 0   | 0       |
| 4      | 0    | 0          | 0          | 0           | 0   | 100     |

S080 Chihuahuan Gypsophilous Grassland and Steppe

| Status | BLM | BOR | FWS | USFS | DOD/DO E | NPS | State Park | State Schl | State Wldlf | Priv-BioDiv | Private |
|--------|-----|-----|-----|------|----------|-----|------------|------------|-------------|-------------|---------|
| 1      | <1  | 0   | <1  | 0    | 0        | 150 | 0          | 0          | 0           | 0           | 0       |
| 2      | 2   | 0   | <1  | 0    | 0        | 0   | 0          | 0          | <1          | 0           | 0       |
| 3      | 58  | <1  | 0   | <1   | 529      | 0   | <1         | 0          | 0           | 0           | <1      |
| 4      | 0   | 0   | 0   | 0    | 0        | 0   | 0          | 24         | 0           | 9           | 28      |

S113 Chihuahuan Sandy Plains Semi-Desert Grassland

| Status | BLM | BOR | FWS | USFS | DOD/DO E | NPS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | Land Trust | TNC | Priv-BioDiv | Private |
|--------|-----|-----|-----|------|----------|-----|-----|------------|------------|------------|-------------|------------|-----|-------------|---------|
| 1      | <1  | 0   | 7   | 0    | 0        | 9   | 0   | 0          | 0          | 0          | 0           | 0          | 0   | 0           | 0       |
| 2      | 18  | 0   | <1  | <1   | 0        | <1  | 0   | 0          | 0          | 0          | <1          | 8          | <1  | 0           | 0       |
| 3      | 237 | <1  | 0   | 7    | 140      | <1  | 23  | 1          | 1          | 0          | 0           | 2          | <1  | 0           | 0       |
| 4      | 0   | <1  | 0   | 0    | <1       | 0   | 0   | <1         | 0          | 186        | 0           | 0          | 0   | 94          | 248     |

S109 Chihuahuan-Sonoran Desert Bottomland and Swale Grassland

| Status | State Schl | Private |
|--------|------------|---------|
| 1      | 0          | 0       |
| 2      | 0          | 0       |
| 3      | 0          | 0       |
| 4      | <1         | <1      |

## S078 Inter-Mountain Basins Big Sagebrush Steppe

| Status | BLM | FWS | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | County | TNC | Private |
|--------|-----|-----|------|-------------|-----|---------------|---------------|---------------|----------------|--------|-----|---------|
| 1      | <1  | 10  | <1   | 0           | <1  | 0             | 0             | 0             | 0              | 0      | 0   | 0       |
| 2      | 27  | 0   | <1   | 0           | 0   | 0             | 0             | 0             | 8              | 0      | 0   | 0       |
| 3      | 891 | <1  | 19   | <1          | 0   | 23            | 2             | 0             | 3              | 0      | <1  | 0       |
| 4      | 0   | 0   | 0    | 2           | 0   | 7             | 0             | 29            | 0              | <1     | 0   | 775     |

## S075 Inter-Mountain Basins Juniper Savanna

| Status | BLM | FWS | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | County | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|------|-------------|-----|---------------|---------------|---------------|----------------|--------|-----|-----------------|---------|
| 1      | <1  | <1  | <1   | 0           | 11  | 0             | 0             | 0             | 0              | 0      | 0   | 0               | 0       |
| 2      | 91  | 22  | <1   | 0           | 2   | 0             | 0             | 14            | 5              | 0      | 0   | 0               | 0       |
| 3      | 548 | 0   | 141  | 1           | <1  | 1500          | 1             | 19            | 0              | 0      | <1  | 0               | 0       |
| 4      | 0   | 0   | 0    | 0           | 0   | 128           | 0             | 1045          | <1             | <1     | 0   | 4               | 2051    |

## S071 Inter-Mountain Basins Montane Sagebrush Steppe

| Status | BLM   | BOR | FWS | USFS  | DOD/DO<br>E | NPS | ARS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Other<br>State | Reg.<br>Gov | City | County | TNC | Priv-<br>BioDiv | Private |
|--------|-------|-----|-----|-------|-------------|-----|-----|---------------|---------------|---------------|----------------|----------------|-------------|------|--------|-----|-----------------|---------|
| 1      | 5     | 0   | 414 | 101   | 0           | 72  | 0   | 0             | 0             | 0             | 0              | 0              | 0           | 0    | 0      | <1  | 0               | 0       |
| 2      | 1360  | 0   | 26  | 1240  | 0           | 13  | <1  | 0             | <1            | 99            | 494            | 0              | 0           | 0    | 0      | 7   | 0               | 0       |
| 3      | 11757 | <1  | 0   | 10447 | 62          | 23  | 0   | 849           | 56            | 263           | 2              | <1             | 0           | 0    | 0      | 40  | 0               | 3       |
| 4      | 0     | 0   | 0   | 0     | 4           | 0   | 0   | 51            | 0             | 1065          | 0              | <1             | <1          | <1   | 1      | 0   | <1              | 12185   |

## S090 Inter-Mountain Basins Semi-Desert Grassland

| Status | BLM  | BOR | FWS | USFS | DOD/DO<br>E | NPS | ARS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Other<br>State | Reg.<br>Gov | City | County | TNC | Priv-<br>BioDiv | Private |
|--------|------|-----|-----|------|-------------|-----|-----|---------------|---------------|---------------|----------------|----------------|-------------|------|--------|-----|-----------------|---------|
| 1      | 13   | 0   | 70  | 1    | 0           | 228 | 0   | 0             | 0             | 0             | 0              | 0              | 0           | 0    | 0      | <1  | 0               | 0       |
| 2      | 861  | <1  | 103 | 36   | 0           | 64  | 3   | 21            | 15            | 54            | 46             | 0              | 0           | 0    | 0      | 5   | 0               | 0       |
| 3      | 4528 | 12  | <1  | 956  | 123         | 18  | 0   | 9417          | 15            | 28            | 0              | 3              | 0           | 0    | 0      | 20  | 0               | <1      |
| 4      | 0    | 0   | 0   | 0    | <1          | 0   | 0   | 2218          | 0             | 3848          | 0              | <1             | <1          | <1   | 3      | 0   | 46              | 10852   |

## S079 Inter-Mountain Basins Semi-Desert Shrub-Steppe

| Status | BLM   | BOR | FWS | USFS | DOD/DO<br>E | NPS | ARS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Other<br>State | Reg.<br>Gov | City | County | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |       |
|--------|-------|-----|-----|------|-------------|-----|-----|---------------|---------------|---------------|----------------|----------------|-------------|------|--------|---------------|-----|-----------------|---------|-------|
| 1      | 20    | 0   | 122 | 8    | 0           | 494 | 0   | 0             | 0             | 0             | 0              | 0              | 0           | 0    | 0      | 0             | 0   | 3               | 0       | 0     |
| 2      | 1849  | 0   | 478 | 29   | 0           | 94  | 46  | 51            | 3             | 47            | 51             | 0              | 0           | 0    | 0      | 0             | 158 | 0               | 0       |       |
| 3      | 13113 | <1  | <1  | 1093 | 1268        | 54  | 1   | 11419         | 12            | 151           | <1             | <1             | 0           | 0    | 0      | 2             | 130 | 0               | <1      |       |
| 4      | 0     | <1  | 0   | 0    | 131         | 0   | 0   | 834           | 0             | 4803          | <1             | 0              | <1          | <1   | 2      | 0             | 0   | 0               | 7       | 11106 |

## S115 Madrean Juniper Savanna

| Status | BLM | BOR | FWS | USFS | DOD/DO<br>E | NPS | ARS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Reg.<br>Gov | City | County | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|-----|------|-------------|-----|-----|---------------|---------------|---------------|----------------|-------------|------|--------|---------------|-----|-----------------|---------|
| 1      | <1  | 0   | 0   | <1   | 0           | 5   | 0   | 0             | 0             | 0             | 0              | 0           | 0    | 0      | 0             | <1  | 0               | 0       |
| 2      | 26  | 0   | 2   | 18   | 0           | <1  | 0   | 0             | <1            | 0             | <1             | 0           | 0    | 0      | 1             | <1  | 0               | 0       |
| 3      | 198 | <1  | 0   | 214  | 9           | <1  | <1  | 56            | <1            | <1            | 0              | 0           | 0    | 0      | <1            | <1  | 0               | <1      |
| 4      | 0   | <1  | 0   | 0    | 0           | 0   | 0   | <1            | 0             | 128           | 0              | <1          | <1   | <1     | 0             | 0   | 1               | 330     |



## S134 North Pacific Montane Grassland

| Status | BLM | USFS | DOD/DO<br>E | State<br>Park | Other<br>State | TNC | Private |
|--------|-----|------|-------------|---------------|----------------|-----|---------|
| 1      | 0   | 0    | 0           | 0             | 0              | 0   | 0       |
| 2      | <1  | 3    | 0           | 0             | 0              | <1  | 0       |
| 3      | 2   | 19   | <1          | <1            | <1             | 0   | 0       |
| 4      | 0   | 0    | 0           | 0             | 0              | 0   | 2       |

## S081 Rocky Mountain Dry Tundra

| Status | BLM | FWS | USFS | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|------|-----|---------------|---------------|---------------|----------------|-----|-----------------|---------|
| 1      | 4   | 0   | 341  | 100 | 0             | 0             | 0             | 0              | <1  | 0               | 0       |
| 2      | 76  | 0   | 910  | 11  | 0             | 0             | 1             | 3              | <1  | 0               | 0       |
| 3      | 65  | <1  | 1076 | 0   | <1            | 9             | <1            | 0              | 10  | 0               | 0       |
| 4      | 0   | 0   | 0    | 0   | 0             | 0             | <1            | 0              | 0   | 8               | 160     |

## S083 Rocky Mountain Subalpine Mesic Meadow

| Status | BLM | FWS | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Reg.<br>Gov | City | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|------|-------------|-----|---------------|---------------|---------------|----------------|-------------|------|---------------|-----|-----------------|---------|
| 1      | <1  | 0   | 66   | 0           | 4   | 0             | 0             | 0             | 0              | 0           | 0    | 0             | <1  | 0               | 0       |
| 2      | 12  | <1  | 292  | 0           | 4   | 0             | 0             | 4             | 8              | 0           | 0    | 0             | <1  | 0               | 0       |
| 3      | 30  | <1  | 1208 | <1          | <1  | 11            | 4             | 15            | <1             | 0           | 0    | <1            | 2   | 0               | <1      |
| 4      | 0   | 0   | 0    | 0           | 0   | <1            | 0             | 13            | 0              | <1          | <1   | 0             | 0   | 6               | 492     |

## S074 Southern Rocky Mountain Juniper Woodland and Savanna

| Status | BLM | BOR | FWS | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | City | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|-----|------|-------------|-----|---------------|---------------|---------------|----------------|------|-----|-----------------|---------|
| 1      | <1  | 0   | 0   | 5    | 0           | 18  | 0             | 0             | 0             | 0              | 0    | 0   | 0               | 0       |
| 2      | 93  | 0   | 24  | 19   | 0           | 11  | 0             | 0             | 1             | 5              | 0    | 2   | 0               | 0       |
| 3      | 474 | <1  | 0   | 490  | 211         | 0   | 5             | 7             | 166           | 0              | 0    | 13  | 0               | <1      |
| 4      | 0   | <1  | 0   | 0    | 0           | 0   | 703           | 0             | 1268          | 0              | <1   | 0   | 9               | 8425    |

## S085 Southern Rocky Mountain Montane-Subalpine Grassland

| Status | BLM | BOR | FWS | USFS | DOD/DO<br>E | NPS | ARS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Other<br>State | Reg.<br>Gov | City | County | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|-----|------|-------------|-----|-----|---------------|---------------|---------------|----------------|----------------|-------------|------|--------|---------------|-----|-----------------|---------|
| 1      | <1  | 0   | <1  | 71   | 0           | 30  | 0   | 0             | 0             | 0             | 0              | 0              | 0           | 0    | 0      | 0             | 3   | 0               | 0       |
| 2      | 238 | 0   | <1  | 548  | 0           | 8   | 1   | <1            | 1             | 90            | 187            | 0              | 0           | 0    | 0      | 0             | 1   | 0               | 0       |
| 3      | 980 | <1  | 0   | 2906 | 4           | <1  | 0   | 217           | 45            | 375           | 2              | <1             | 0           | 0    | 0      | 1             | 27  | 0               | 6       |
| 4      | 0   | <1  | 0   | 0    | 0           | 0   | 0   | 25            | 0             | 70            | 0              | 0              | <1          | <1   | 2      | 0             | 0   | 69              | 4347    |

## S086 Western Great Plains Foothill and Piedmont Grassland

| Status | BLM | FWS | USFS | DOD/DO<br>E | NPS | ARS | Dept.<br>of<br>Com. | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Reg.<br>Gov | City | County | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|------|-------------|-----|-----|---------------------|---------------|---------------|---------------|----------------|-------------|------|--------|-----|-----------------|---------|
| 1      | 0   | 0   | <1   | 0           | 7   | 0   | 0                   | 0             | 0             | 0             | 0              | 0           | 0    | 0      | 0   | 0               | 0       |
| 2      | 9   | 1   | 7    | 0           | <1  | <1  | 0                   | 0             | 1             | 37            | 31             | 0           | 0    | 0      | 25  | 0               | 0       |
| 3      | 59  | 10  | 155  | 97          | 0   | 0   | 0                   | 1             | 14            | 192           | <1             | 0           | 0    | 0      | 19  | 0               | 3       |
| 4      | 0   | 0   | 0    | 4           | 0   | 0   | 4                   | 16            | 0             | 41            | 0              | 4           | 37   | 23     | 0   | 30              | 4231    |

## S089 Western Great Plains Sand Prairie

| Status | State Schl | Private |
|--------|------------|---------|
| 1      | 0          | 0       |
| 2      | 0          | 0       |
| 3      | 1          | 0       |
| 4      | 0          | 17      |

## S088 Western Great Plains Shortgrass Prairie

| Status | BLM  | BOR | FWS | USFS | DOD/DO E | NPS | ARS | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wldlf | Reg. Gov | City | County | TNC | Priv-BioDiv | Private |
|--------|------|-----|-----|------|----------|-----|-----|---------------|------------|------------|------------|-------------|----------|------|--------|-----|-------------|---------|
| 1      | 25   | 0   | <1  | 10   | 0        | <1  | 0   | 0             | 0          | 0          | 0          | 0           | 0        | 0    | 0      | 12  | 0           | 0       |
| 2      | 16   | 0   | 31  | 64   | 0        | 7   | 51  | 0             | 0          | 7          | 299        | 142         | 0        | 0    | 0      | 110 | 0           | 0       |
| 3      | 2994 | 16  | <1  | 2645 | 1050     | 29  | 0   | 0             | 8          | 44         | 4963       | <1          | 0        | 0    | 0      | 210 | 0           | 53      |
| 4      | 0    | 4   | 0   | 0    | 90       | 0   | 0   | <1            | <1         | 0          | 10056      | 0           | 1        | 6    | 5      | 0   | 281         | 89777   |

## S132 Western Great Plains Tallgrass Prairie

| Status | State Park | State Schl | State Wldlf | Private |
|--------|------------|------------|-------------|---------|
| 1      | 0          | 0          | 0           | 0       |
| 2      | 0          | 0          | <1          | 0       |
| 3      | <1         | <1         | 0           | 0       |
| 4      | 0          | 0          | 0           | <1      |

## WOODY WETLAND

## S118 Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland

| Status | BLM | BOR | FWS | USFS | DOD/DO E | NPS | Nativ Amer | State Park | State Schl | State Wldlf | Other State | Reg. Gov | City | County | TNC | Private |
|--------|-----|-----|-----|------|----------|-----|------------|------------|------------|-------------|-------------|----------|------|--------|-----|---------|
| 1      | <1  | 0   | 6   | <1   | 0        | 1   | 0          | 0          | 0          | 0           | 0           | 0        | 0    | 0      | <1  | 0       |
| 2      | 42  | 0   | 3   | 11   | 0        | <1  | 0          | 2          | 0          | 32          | 0           | 0        | 0    | 0      | 1   | 0       |
| 3      | 209 | 6   | <1  | 176  | 6        | 0   | 43         | 7          | 0          | <1          | 0           | 0        | 0    | 0      | <1  | <1      |
| 4      | 0   | 0   | 0   | 0    | 2        | 0   | 10         | 0          | 12         | 0           | <1          | <1       | <1   | <1     | 0   | 770     |

## S096 Inter-Mountain Basins Greasewood Flat

| Status | BLM   | BOR | FWS | USFS | DOD/DO E | NPS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | Other State | Reg. Gov | City | County | Land Trust | TNC | Priv-BioDiv | Private |
|--------|-------|-----|-----|------|----------|-----|-----|------------|------------|------------|-------------|-------------|----------|------|--------|------------|-----|-------------|---------|
| 1      | 425   | 0   | 113 | <1   | 0        | 49  | 0   | 0          | 0          | 0          | <1          | 0           | 0        | 0    | 0      | 0          | 10  | 0           | 0       |
| 2      | 538   | 142 | 65  | <1   | 0        | 20  | 8   | 19         | 7          | 7          | 144         | <1          | 0        | 0    | 0      | 0          | 178 | 0           | 0       |
| 3      | 10609 | 243 | 36  | 16   | 832      | 43  | 0   | 2796       | 19         | 138        | <1          | 9           | 0        | 0    | 4      | <1         | 9   | 0           | 0       |
| 4      | 0     | <1  | 0   | 0    | 15       | 0   | 0   | 104        | 0          | 888        | 0           | <1          | <1       | <1   | <1     | 0          | 0   | <1          | 6114    |

## S094 North American Warm Desert Lower Montane Riparian Woodland and Shrubland

| Status | BLM | BOR | FWS | USFS | DOD/DO E | NPS | Nativ Amer | State Park | State Schl | State Wldlf | Reg. Gov | City | County | Land Trust | TNC | Priv-BioDiv | Private |
|--------|-----|-----|-----|------|----------|-----|------------|------------|------------|-------------|----------|------|--------|------------|-----|-------------|---------|
| 1      | <1  | 0   | 3   | 3    | 0        | 2   | 0          | 0          | 0          | 0           | 0        | 0    | 0      | 0          | <1  | 0           | 0       |
| 2      | 23  | 0   | <1  | 28   | 0        | 2   | 0          | 0          | <1         | 8           | 0        | 0    | 0      | 6          | 1   | 0           | 0       |
| 3      | 41  | <1  | 0   | 74   | 4        | 0   | 32         | 2          | 0          | 0           | 0        | 0    | <1     | <1         | <1  | 0           | 0       |
| 4      | 0   | 0   | 0   | 0    | <1       | 0   | 3          | 0          | 41         | <1          | <1       | <1   | <1     | 0          | 0   | 15          | 132     |

S098 North American Warm Desert Riparian Mesquite Bosque

| Status | BLM | BOR | FWS | USFS | DOD/DO E | NPS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | Reg. Gov | City | County | Land Trust | TNC | Private |
|--------|-----|-----|-----|------|----------|-----|-----|------------|------------|------------|-------------|----------|------|--------|------------|-----|---------|
| 1      | 3   | 0   | 10  | <1   | 0        | 3   | 0   | 0          | 0          | 0          | 0           | 0        | 0    | 0      | 0          | <1  | 0       |
| 2      | 21  | 0   | 13  | 8    | <1       | 4   | 0   | 0          | <1         | <1         | 9           | 0        | 0    | 0      | <1         | 4   | 0       |
| 3      | 58  | <1  | 0   | 30   | 2        | 0   | 1   | 359        | 2          | 1          | <1          | 0        | 0    | <1     | <1         | <1  | 0       |
| 4      | 0   | 2   | 0   | 0    | 0        | 0   | 0   | 36         | 0          | 91         | <1          | <1       | <1   | 3      | 0          | 0   | 159     |

S097 North American Warm Desert Riparian Woodland and Shrubland

| Status | BLM | BOR | FWS | USFS | DOD/DO E | NPS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | Reg. Gov | City | County | Land Trust | TNC | Priv-BioDiv | Private |
|--------|-----|-----|-----|------|----------|-----|-----|------------|------------|------------|-------------|----------|------|--------|------------|-----|-------------|---------|
| 1      | <1  | 0   | 22  | 1    | 0        | 12  | 0   | 0          | 0          | 0          | 0           | 0        | 0    | 0      | 0          | <1  | 0           | 0       |
| 2      | 17  | 0   | <1  | 16   | <1       | <1  | 0   | 0          | 0          | <1         | 13          | 0        | 0    | 0      | <1         | <1  | 0           | 0       |
| 3      | 64  | <1  | <1  | 31   | 8        | 3   | <1  | 16         | 3          | <1         | <1          | 0        | 0    | <1     | <1         | <1  | 0           | 0       |
| 4      | 0   | 4   | 0   | 0    | <1       | 0   | 0   | 41         | 0          | 38         | <1          | <1       | <1   | <1     | 0          | 0   | 2           | 109     |

S020 North American Warm Desert Wash

| Status | BLM | BOR | FWS | USFS | DOD/DO E | NPS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | Reg. Gov | City | County | Land Trust | TNC | Priv-BioDiv | Private |
|--------|-----|-----|-----|------|----------|-----|-----|------------|------------|------------|-------------|----------|------|--------|------------|-----|-------------|---------|
| 1      | <1  | 0   | 8   | <1   | 0        | 10  | 0   | 0          | 0          | 0          | 0           | 0        | 0    | 0      | 0          | <1  | 0           | 0       |
| 2      | 67  | 0   | 3   | <1   | 0        | 3   | 0   | 0          | <1         | <1         | 2           | 0        | 0    | 0      | <1         | <1  | 0           | 0       |
| 3      | 221 | 16  | <1  | 11   | 13       | 3   | <1  | 46         | 4          | <1         | <1          | 0        | 0    | 0      | <1         | <1  | 0           | 0       |
| 4      | 0   | <1  | 0   | 0    | <1       | 0   | 0   | 6          | 0          | 55         | 0           | <1       | <1   | <1     | 0          | 0   | 1           | 176     |

S093 Rocky Mountain Lower Montane Riparian Woodland and Shrubland

| Status | BLM | BOR | FWS | USFS | DOD/DO E | NPS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | Other State | City | County | Aud | TNC | Priv-BioDiv | Private |
|--------|-----|-----|-----|------|----------|-----|-----|------------|------------|------------|-------------|-------------|------|--------|-----|-----|-------------|---------|
| 1      | 7   | 0   | 1   | 3    | 0        | 27  | 0   | 0          | 0          | 0          | 0           | 0           | 0    | 0      | 0   | 1   | 0           | 0       |
| 2      | 82  | 0   | 13  | 24   | 0        | 6   | 13  | <1         | 1          | 40         | 0           | 0           | 0    | 0      | <1  | 5   | 0           | 0       |
| 3      | 167 | <1  | <1  | 230  | 10       | 9   | 232 | 20         | 3          | <1         | <1          | 0           | 0    | 0      | 5   | 0   | 2           |         |
| 4      | 0   | <1  | 0   | 0    | 0        | 0   | 94  | 0          | 49         | <1         | 0           | <1          | 2    | 0      | 0   | 5   | 1157        |         |

S091 Rocky Mountain Subalpine-Montane Riparian Shrubland

| Status | BLM | FWS | USFS | DOD/DO E | NPS | Nativ Amer | State Park | State Schl | State Wldlf | Other State | Reg. Gov | City | County | Land Trust | TNC | Priv-BioDiv | Private |
|--------|-----|-----|------|----------|-----|------------|------------|------------|-------------|-------------|----------|------|--------|------------|-----|-------------|---------|
| 1      | 1   | 4   | 274  | 0        | 60  | 0          | 0          | 0          | 0           | 0           | 0        | 0    | 0      | 0          | 1   | 0           | 0       |
| 2      | 27  | 2   | 718  | 0        | 6   | 0          | 0          | 6          | 24          | 0           | 0        | 0    | 0      | 0          | <1  | 0           | 0       |
| 3      | 78  | 1   | 1310 | <1       | <1  | 20         | 19         | 13         | <1          | 1           | 0        | 0    | 0      | <1         | 8   | 0           | <1      |
| 4      | 0   | 0   | 0    | 0        | 0   | 2          | 0          | 12         | 0           | 0           | 1        | <1   | 1      | 0          | 0   | 7           | 619     |

S092 Rocky Mountain Subalpine-Montane Riparian Woodland

| Status | BLM | FWS | USFS | DOD/DO E | NPS | Nativ Amer | State Park | State Schl | State Wldlf | Other State | Reg. Gov | City | County | Land Trust | TNC | Priv-BioDiv | Private |
|--------|-----|-----|------|----------|-----|------------|------------|------------|-------------|-------------|----------|------|--------|------------|-----|-------------|---------|
| 1      | <1  | 0   | 1    | 0        | 4   | 0          | 0          | 0          | 0           | 0           | 0        | 0    | 0      | 0          | 0   | 0           | 0       |
| 2      | 5   | <1  | 35   | 0        | <1  | 0          | <1         | 1          | 4           | 0           | 0        | 0    | 0      | 0          | <1  | 0           | 0       |
| 3      | 23  | 0   | 97   | <1       | 0   | 2          | 5          | 3          | <1          | 1           | 0        | 0    | 0      | <1         | 3   | 0           | <1      |
| 4      | 0   | 0   | 0    | 0        | 0   | <1         | 0          | <1         | 0           | 0           | <1       | <1   | <1     | 0          | 0   | 1           | 103     |

S120 Western Great Plains Floodplain

| Status | BLM | FWS | USFS | DOD/DO<br>E | NPS | ARS | State<br>Park | State<br>Schl | State<br>Wildf | Reg.<br>Gov | City | County | TNC | Private |
|--------|-----|-----|------|-------------|-----|-----|---------------|---------------|----------------|-------------|------|--------|-----|---------|
| 1      | 0   | 0   | <1   | 0           | 0   | 0   | 0             | 0             | 0              | 0           | 0    | 0      | 0   | 0       |
| 2      | 0   | 0   | 0    | 0           | <1  | <1  | <1            | 5             | 25             | 0           | 0    | 0      | <1  | 0       |
| 3      | <1  | <1  | <1   | 7           | <1  | 0   | 5             | 17            | <1             | 0           | 0    | 0      | <1  | 0       |
| 4      | 0   | 0   | 0    | <1          | 0   | 0   | 0             | 0             | 0              | <1          | 6    | 3      | 0   | 757     |

S095 Western Great Plains Riparian Woodland and Shrubland

| Status | BLM | BOR | FWS | USFS | DOD/DO<br>E | NPS | ARS | Dept.<br>of<br>Com. | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wildf | Reg.<br>Gov | City | County | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|-----|------|-------------|-----|-----|---------------------|---------------|---------------|---------------|----------------|-------------|------|--------|-----|-----------------|---------|
| 1      | <1  | 0   | <1  | <1   | 0           | 1   | 0   | 0                   | 0             | 0             | 0             | 0              | 0           | 0    | 0      | 0   | 0               | 0       |
| 2      | 14  | 0   | 44  | 6    | 0           | <1  | <1  | 0                   | 0             | <1            | 6             | 65             | 0           | 0    | 0      | 4   | 0               | 0       |
| 3      | 29  | 30  | 3   | 18   | 16          | <1  | 0   | 0                   | <1            | 16            | 8             | <1             | 0           | 0    | 0      | <1  | 0               | <1      |
| 4      | 0   | <1  | 0   | 0    | 1           | 0   | 0   | <1                  | 187           | 0             | 44            | 0              | 1           | 16   | 7      | 0   | 25              | 1158    |

EMERGENT HERBACEOUS WETLAND

S105 Mediterranean California Subalpine-Montane Fen

| Status | BLM | USFS | Private |
|--------|-----|------|---------|
| 1      | 0   | 0    | 0       |
| 2      | 0   | 1    | 0       |
| 3      | <1  | 1    | 0       |
| 4      | 0   | 0    | <1      |

S100 North American Arid West Emergent Marsh

| Status | BLM | BOR | FWS | USFS | DOD/DO<br>E | NPS | ARS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wildf | Other<br>State | Reg.<br>Gov | City | County | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|-----|------|-------------|-----|-----|---------------|---------------|---------------|----------------|----------------|-------------|------|--------|---------------|-----|-----------------|---------|
| 1      | <1  | 0   | 57  | <1   | 0           | <1  | 0   | 0             | 0             | 0             | 0              | 0              | 0           | 0    | 0      | 0             | <1  | 0               | 0       |
| 2      | 11  | 15  | 44  | 3    | 0           | <1  | 0   | 0             | 10            | <1            | 104            | 2              | 0           | 0    | 0      | 0             | 1   | 0               | 0       |
| 3      | 81  | 31  | <1  | 6    | 20          | <1  | <1  | 14            | 3             | <1            | <1             | 8              | 0           | 0    | 0      | <1            | 6   | 0               | <1      |
| 4      | 0   | <1  | 0   | 0    | <1          | 0   | 0   | 2             | 0             | 23            | <1             | <1             | <1          | <1   | <1     | 0             | 0   | <1              | 426     |

S102 Rocky Mountain Alpine-Montane Wet Meadow

| Status | BLM | FWS | USFS | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wildf | Reg.<br>Gov | City | County | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|------|-----|---------------|---------------|---------------|----------------|-------------|------|--------|---------------|-----|-----------------|---------|
| 1      | <1  | 17  | 164  | 2   | 0             | 0             | 0             | 0              | 0           | 0    | 0      | 0             | <1  | 0               | 0       |
| 2      | 15  | 3   | 389  | 8   | 0             | <1            | 3             | 17             | 0           | 0    | 0      | 0             | 3   | 0               | 0       |
| 3      | 36  | <1  | 632  | <1  | 33            | 3             | 11            | <1             | 0           | 0    | 0      | <1            | 4   | 0               | <1      |
| 4      | 0   | 0   | 0    | 0   | 4             | 0             | 14            | <1             | <1          | <1   | <1     | 0             | 0   | 21              | 565     |

S103 Temperate Pacific Subalpine-Montane Wet Meadow

| Status | BLM | USFS | State<br>Park | Private |
|--------|-----|------|---------------|---------|
| 1      | 0   | 0    | 0             | 0       |
| 2      | 0   | <1   | 0             | 0       |
| 3      | <1  | <1   | <1            | 0       |
| 4      | 0   | 0    | 0             | 1       |

S108 Western Great Plains Saline Depression Wetland

| Status | BLM | FWS | State Park | State Schl | Private |
|--------|-----|-----|------------|------------|---------|
| 1      | 0   | 0   | 0          | 0          | 0       |
| 2      | <1  | <1  | 0          | 0          | 0       |
| 3      | 8   | 0   | <1         | 0          | 0       |
| 4      | 0   | 0   | 0          | 4          | 8       |

ALTERED or DISTURBED

D01 Disturbed, Non-specific

| Status | BLM | NPS | State Park | State Wldlf | Private |
|--------|-----|-----|------------|-------------|---------|
| 1      | 0   | <1  | 0          | 0           | 0       |
| 2      | 1   | 0   | 0          | 5           | 0       |
| 3      | 2   | 0   | <1         | 0           | 0       |
| 4      | 0   | 0   | 0          | 0           | 84      |

D14 Disturbed, Oil Well

| Status | BLM | USFS | NPS | Nativ Amer | State Park | State Schl | State Wldlf | TNC | Private |
|--------|-----|------|-----|------------|------------|------------|-------------|-----|---------|
| 1      | 0   | 0    | 0   | 0          | 0          | 0          | 0           | 0   | 0       |
| 2      | <1  | 0    | 0   | 0          | 0          | 0          | <1          | 0   | 0       |
| 3      | 5   | 1    | <1  | <1         | <1         | 0          | 0           | <1  | 0       |
| 4      | 0   | 0    | 0   | <1         | 0          | 3          | 0           | 0   | 35      |

D09 Invasive Annual and Biennial Forbland

| Status | BLM  | BOR | FWS | USFS | DOD/DO E | NPS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | Other State | Reg. Gov | City | County | Land Trust | TNC | Private |
|--------|------|-----|-----|------|----------|-----|-----|------------|------------|------------|-------------|-------------|----------|------|--------|------------|-----|---------|
| 1      | <1   | 0   | 7   | <1   | 0        | 9   | 0   | 0          | 0          | 0          | 0           | 0           | 0        | 0    | 0      | 0          | <1  | 0       |
| 2      | 44   | 2   | 3   | 2    | 0        | 3   | 3   | 2          | 1          | <1         | 3           | <1          | 0        | 0    | 0      | 0          | 5   | 0       |
| 3      | 1145 | 2   | <1  | 42   | 27       | 5   | 0   | 53         | <1         | 34         | <1          | <1          | 0        | 0    | 0      | <1         | 1   | 0       |
| 4      | 0    | 0   | 0   | 0    | 3        | 0   | 0   | 10         | 0          | 72         | 0           | <1          | <1       | <1   | <1     | 0          | 0   | 1150    |

D08 Invasive Annual Grassland

| Status | BLM  | BOR | FWS | USFS | DOD/DO E | NPS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | Other State | Reg. Gov | City | County | TNC | Private |
|--------|------|-----|-----|------|----------|-----|-----|------------|------------|------------|-------------|-------------|----------|------|--------|-----|---------|
| 1      | 2    | 0   | 2   | <1   | 0        | 17  | 0   | 0          | 0          | 0          | 0           | 0           | 0        | 0    | 0      | <1  | 0       |
| 2      | 187  | <1  | 7   | 1    | 0        | 3   | <1  | <1         | 42         | 1          | 11          | 0           | 0        | 0    | 0      | <1  | 0       |
| 3      | 4541 | 7   | <1  | 57   | 208      | 8   | 0   | 117        | 4          | 11         | <1          | <1          | 0        | 0    | 0      | 1   | <1      |
| 4      | 0    | 0   | 0   | 0    | 17       | 0   | 0   | 40         | 0          | 186        | 0           | <1          | <1       | <1   | 2      | 0   | 2807    |

D07 Invasive Perennial Forbland

| Status | FWS | State Park | State Schl | Private |
|--------|-----|------------|------------|---------|
| 1      | <1  | 0          | 0          | 0       |
| 2      | 0   | 0          | 0          | 0       |
| 3      | 0   | <1         | <1         | 0       |
| 4      | 0   | 0          | 0          | <1      |

## D06 Invasive Perennial Grassland

| Status | BLM | FWS | USFS | DOD/DO<br>E | NPS | ARS | Dept.<br>of<br>Com. | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Other<br>State | Reg.<br>Gov | City | County | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|------|-------------|-----|-----|---------------------|---------------|---------------|---------------|----------------|----------------|-------------|------|--------|-----|-----------------|---------|
| 1      | 0   | <1  | 3    | 0           | <1  | 0   | 0                   | 0             | 0             | 0             | 0              | 0              | 0           | 0    | 0      | 0   | 0               | 0       |
| 2      | 6   | <1  | 4    | 0           | <1  | 8   | 0                   | 0             | 1             | 5             | 21             | 0              | 0           | 0    | 0      | <1  | 0               | 0       |
| 3      | 259 | 32  | 55   | 12          | <1  | 0   | 0                   | 37            | 11            | 31            | <1             | <1             | 0           | 0    | 0      | 2   | 0               | 0       |
| 4      | 0   | 0   | 0    | 8           | 0   | 0   | 2                   | <1            | 0             | 26            | 0              | 0              | 4           | 31   | 18     | 0   | 1               | 2256    |

## D04 Invasive Southwest Riparian Woodland and Shrubland

| Status | BLM | BOR | FWS | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Other<br>State | Reg.<br>Gov | City | County | Land<br>Trust | TNC | Private |
|--------|-----|-----|-----|------|-------------|-----|---------------|---------------|---------------|----------------|----------------|-------------|------|--------|---------------|-----|---------|
| 1      | 2   | 0   | 39  | <1   | 0           | 62  | 0             | 0             | 0             | 2              | 0              | 0           | 0    | 0      | 0             | 2   | 0       |
| 2      | 85  | 12  | 6   | <1   | <1          | 8   | 4             | <1            | 1             | 43             | 0              | 0           | 0    | 0      | <1            | 1   | 0       |
| 3      | 212 | 7   | 0   | 11   | 4           | 37  | 219           | 13            | 12            | <1             | <1             | 0           | 0    | 0      | 0             | 1   | 0       |
| 4      | 0   | 5   | 0   | 0    | <1          | 0   | 81            | 0             | 41            | 0              | 0              | <1          | <1   | <1     | 0             | 0   | 649     |

## D02 Recently Burned

| Status | BLM | FWS | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Other<br>State | City | Land<br>Trust | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|------|-------------|-----|---------------|---------------|---------------|----------------|----------------|------|---------------|-----|-----------------|---------|
| 1      | 0   | 0   | 12   | 0           | 112 | 0             | 0             | 0             | 0              | 0              | 0    | 0             | 0   | 0               | 0       |
| 2      | 46  | 22  | 68   | 0           | 0   | 24            | 0             | 1             | <1             | 0              | 0    | 18            | <1  | 0               | 0       |
| 3      | 545 | 0   | 392  | 63          | <1  | 20            | <1            | 4             | 0              | <1             | 0    | 2             | <1  | 0               | 1       |
| 4      | 0   | 0   | 0    | <1          | 0   | 19            | 0             | 148           | 0              | 0              | <1   | 0             | 0   | 13              | 519     |

## D11 Recently Chained Pinyon-Juniper Areas

| Status | BLM | USFS | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | TNC | Priv-<br>BioDiv | Private |
|--------|-----|------|-----|---------------|---------------|---------------|----------------|-----|-----------------|---------|
| 1      | <1  | <1   | 1   | 0             | 0             | 0             | 0              | 0   | 0               | 0       |
| 2      | 54  | 1    | <1  | 0             | 0             | 12            | <1             | <1  | 0               | 0       |
| 3      | 324 | 129  | <1  | <1            | <1            | <1            | 0              | <1  | 0               | 0       |
| 4      | 0   | 0    | 0   | 1             | 0             | 71            | 0              | 0   | <1              | 95      |

## D10 Recently Logged Areas

| Status | BLM | FWS | USFS | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Other<br>State | County | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|------|-----|---------------|---------------|---------------|----------------|----------------|--------|-----|-----------------|---------|
| 1      | 0   | 0   | 25   | 1   | 0             | 0             | 0             | 0              | 0              | 0      | 0   | 0               | 0       |
| 2      | 1   | <1  | 26   | <1  | 0             | 0             | <1            | <1             | 0              | 0      | 0   | 0               | 0       |
| 3      | 19  | 0   | 706  | <1  | 2             | 6             | 1             | 0              | <1             | 0      | <1  | 0               | 0       |
| 4      | 0   | 0   | 0    | 0   | 0             | 0             | <1            | 0              | 0              | <1     | 0   | <1              | 46      |

## D03 Recently Mined or Quarried

| Status | BLM | FWS | USFS | DOD/DO<br>E | NPS | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wldlf | Other<br>State | City | County | TNC | Priv-<br>BioDiv | Private |
|--------|-----|-----|------|-------------|-----|---------------|---------------|---------------|----------------|----------------|------|--------|-----|-----------------|---------|
| 1      | 0   | 0   | <1   | 0           | <1  | 0             | 0             | 0             | 0              | 0              | 0    | 0      | 0   | 0               | 0       |
| 2      | 3   | <1  | 1    | 0           | 0   | <1            | 0             | <1            | <1             | 0              | 0    | 0      | <1  | 0               | 0       |
| 3      | 242 | <1  | 18   | 3           | 0   | 162           | <1            | 4             | 0              | 51             | 0    | 0      | <1  | 0               | 0       |
| 4      | 0   | 0   | 0    | <1          | 0   | <1            | 0             | 9             | 0              | 0              | <1   | <1     | 0   | <1              | 723     |

DEVELOPED and AGRICULTURE

N80

Agriculture

| Status | BLM | BOR | FWS | USFS | DOD/DO E | NPS | ARS | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wldlf | Other State | Reg. Gov | City | County | Land Trust | TNC | Priv-BioDiv | Private |
|--------|-----|-----|-----|------|----------|-----|-----|---------------|------------|------------|------------|-------------|-------------|----------|------|--------|------------|-----|-------------|---------|
| 1      | <1  | 0   | 46  | 5    | 0        | 7   | 0   | 0             | 0          | 0          | 0          | 0           | 0           | 0        | 0    | 0      | 0          | <1  | 0           | 0       |
| 2      | 153 | 1   | 47  | 26   | 0        | 2   | 8   | 0             | <1         | <1         | 47         | 241         | <1          | 0        | 0    | 0      | 0          | 54  | 0           | 0       |
| 3      | 427 | 11  | 32  | 499  | 61       | 15  | 0   | 0             | 588        | 53         | 879        | 2           | 3           | 0        | 0    | 0      | 2          | 34  | 0           | 3       |
| 4      | 0   | 29  | 0   | 0    | 9        | 0   | 0   | <1            | 926        | 0          | 836        | <1          | 2           | 10       | 44   | 97     | 0          | 0   | 4           | 70674   |

N22

Developed, Medium - High Intensity

| Status | BLM | BOR | FWS | USFS | DOD/DO E | NPS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | Other State | Reg. Gov | City | County | Aud | Land Trust | TNC | Priv-BioDiv | Private |
|--------|-----|-----|-----|------|----------|-----|-----|------------|------------|------------|-------------|-------------|----------|------|--------|-----|------------|-----|-------------|---------|
| 1      | <1  | 0   | <1  | <1   | 0        | 2   | 0   | 0          | 0          | 0          | <1          | 0           | 0        | 0    | 0      | 0   | 0          | <1  | 0           | 0       |
| 2      | 24  | <1  | 2   | 3    | <1       | <1  | 0   | 0          | 0          | <1         | 6           | 0           | 0        | 0    | 0      | <1  | <1         | <1  | 0           | 0       |
| 3      | 143 | <1  | 3   | 71   | 141      | <1  | <1  | 44         | 8          | 12         | <1          | <1          | 0        | 0    | 0      | 0   | <1         | <1  | 0           | 0       |
| 4      | 0   | 4   | 0   | 0    | 33       | 0   | 0   | 49         | <1         | 105        | <1          | <1          | 5        | 55   | 11     | 0   | 0          | 0   | 6           | 6798    |

N21

Developed, Open Space - Low Intensity

| Status | BLM | BOR | FWS | USFS | DOD/DO E | NPS | ARS | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wldlf | Other State | Reg. Gov | City | County | Aud | Land Trust | TNC | Priv-BioDiv | Private |   |
|--------|-----|-----|-----|------|----------|-----|-----|---------------|------------|------------|------------|-------------|-------------|----------|------|--------|-----|------------|-----|-------------|---------|---|
| 1      | <1  | 0   | <1  | <1   | 0        | 2   | 0   | 0             | 0          | 0          | 0          | 0           | 0           | 0        | 0    | 0      | 0   | 0          | 0   | <1          | 0       | 0 |
| 2      | 2   | 0   | <1  | 1    | 0        | 4   | <1  | 0             | 0          | <1         | <1         | 8           | 0           | 0        | 0    | 0      | <1  | <1         | <1  | 0           | 0       |   |
| 3      | 73  | 1   | <1  | 23   | 189      | 4   | <1  | 0             | 46         | 11         | 4          | <1          | 15          | 0        | 0    | 0      | 0   | <1         | <1  | 0           | 0       |   |
| 4      | 0   | 4   | 0   | 0    | 82       | 0   | 0   | <1            | 45         | 0          | 82         | <1          | <1          | 5        | 56   | 27     | 0   | 0          | 0   | 4           | 6708    |   |

OTHER COVER TYPES

N31

Barren Lands, Non-specific

| Status | BLM | BOR | FWS | USFS | DOD/DO E | NPS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | Other State | Reg. Gov | City | County | TNC | Private |
|--------|-----|-----|-----|------|----------|-----|-----|------------|------------|------------|-------------|-------------|----------|------|--------|-----|---------|
| 1      | <1  | 0   | 10  | 0    | 0        | <1  | 0   | 0          | 0          | 0          | 0           | 0           | 0        | 0    | 0      | 0   | 0       |
| 2      | 35  | 1   | <1  | <1   | 6        | <1  | <1  | 0          | 9          | 2          | 0           | 0           | 0        | 0    | 0      | 0   | 0       |
| 3      | 220 | 1   | <1  | 3    | 49       | <1  | 791 | 4          | <1         | <1         | 0           | 0           | 0        | <1   | <1     | 0   | 0       |
| 4      | 0   | <1  | 0   | 0    | <1       | 0   | 11  | 0          | 50         | 0          | <1          | <1          | <1       | <1   | <1     | 0   | 213     |

N11

Open Water

| Status | BLM | BOR | FWS | USFS | DOD/DO E | NPS | ARS | Nativ Amer | State Park | State Schl | State Wldlf | Other State | Reg. Gov | City | County | Land Trust | TNC | Priv-BioDiv | Private |
|--------|-----|-----|-----|------|----------|-----|-----|------------|------------|------------|-------------|-------------|----------|------|--------|------------|-----|-------------|---------|
| 1      | <1  | 0   | 16  | 10   | 0        | 75  | 0   | 0          | 0          | 0          | <1          | 0           | 0        | 0    | 0      | 0          | <1  | 0           | 0       |
| 2      | 29  | 7   | 33  | 25   | 0        | 6   | <1  | 2          | <1         | 3          | 109         | 1           | 0        | 0    | 0      | <1         | 5   | 0           | 0       |
| 3      | 168 | 123 | 1   | 114  | 26       | 46  | 0   | 139        | 139        | 14         | <1          | 235         | 0        | 0    | 0      | <1         | 3   | 0           | <1      |
| 4      | 0   | 2   | 0   | 0    | <1       | 0   | 0   | 36         | 0          | 41         | <1          | <1          | 28       | 6    | 3      | 0          | 0   | 3           | 855     |

### Appendix 5-4. Percent distribution of each land cover type among 22 land stewards in the state of Arizona.

| Code                    | Land Cover Type  | Area in AZ      | BLM   | BOR  | FWS   | USFS   | DOD/DOE | NPS   | ARS  | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wildl | Other State | Reg. Gov | City | County | Aud  | Land Trust | TNC  | Priv-BioDi v | Priv |       |
|-------------------------|--|-----------------|-------|------|-------|--------|---------|-------|------|---------------|------------|------------|------------|-------------|-------------|----------|------|--------|------|------------|------|--------------|------|-------|
|                         |  | km <sup>2</sup> | %     | %    | %     | %      | %       | %     | %    | %             | %          | %          | %          | %           | %           | %        | %    | %      | %    | %          | %    | %            | %    | %     |
| <b>BARREN LANDS</b>     |  |                 |       |      |       |        |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |              |      |       |
| S010                    | Colorado Plateau Mixed Bedrock Canyon and Tableland                | 6,973           | 6.8%  | 0.0% | 0.0%  | 5.3%   | 0.0%    | 11.7% | 0.0% | 0.0%          | 72.7%      | 0.0%       | 1.2%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 2.1%  |
| S012                    | Inter-Mountain Basins Active and Stabilized Dune                   | 352             | 4.0%  | 0.0% | 0.0%  | 0.0%   | 0.0%    | 8.4%  | 0.0% | 0.0%          | 85.1%      | 0.0%       | 0.3%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 1.8%  |
| S015                    | Inter-Mountain Basins Playa  | 14              | 0.0%  | 0.0% | 0.0%  | 30.4%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 8.1%       | 0.0%       | 0.9%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 6.9%  |
| S011                    | Inter-Mountain Basins Shale Badland                                | 730             | 7.7%  | 0.0% | 0.0%  | 0.0%   | 0.0%    | 3.9%  | 0.0% | 0.0%          | 70.3%      | 0.0%       | 5.8%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 12.0% |
| S013                    | Inter-Mountain Basins Volcanic Rock and Cinder Land                | 573             | 11.4% | 0.0% | 0.0%  | 38.0%  | 0.0%    | 10.1% | 0.0% | 0.0%          | 7.5%       | 0.0%       | 16.1%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 17.0% |
| S014                    | Inter-Mountain Basins Wash   | 4               | 0.0%  | 0.0% | 0.0%  | 0.0%   | 0.0%    | 14.3% | 0.0% | 0.0%          | 82.0%      | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 0.6%  |
| S018                    | North American Warm Desert Active and Stabilized Dune              | 1,017           | 0.1%  | 1.0% | 20.5% | 0.0%   | 76.6%   | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 1.1%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 0.7%  |
| S017                    | North American Warm Desert Badland                                 | 34              | 12.8% | 0.0% | 0.0%  | 0.0%   | 0.0%    | 84.1% | 0.0% | 0.0%          | 0.2%       | 0.0%       | 0.4%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 1.5%  |
| S016                    | North American Warm Desert Bedrock Cliff and Outcrop               | 761             | 25.2% | 0.0% | 5.3%  | 24.4%  | 9.8%    | 15.0% | 0.0% | 0.0%          | 4.9%       | 0.1%       | 9.6%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.0%         | 0.0% | 5.4%  |
| S021                    | North American Warm Desert Pavement                                | 45              | 15.8% | 0.0% | 0.5%  | 2.4%   | 0.1%    | 40.3% | 0.0% | 0.0%          | 0.0%       | 0.0%       | 23.1%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.4%       | 0.0% | 0.0%         | 0.0% | 17.3% |
| S022                    | North American Warm Desert Playa                                   | 48              | 52.1% | 0.0% | 0.0%  | 0.0%   | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.3%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 47.6% |
| S019                    | North American Warm Desert Volcanic Rockland                       | 205             | 36.7% | 4.0% | 11.0% | 6.5%   | 0.1%    | 23.9% | 0.0% | 0.0%          | 0.4%       | 0.1%       | 11.3%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.3%       | 0.1% | 0.0%         | 0.0% | 5.9%  |
| S002                    | Rocky Mountain Alpine Bedrock and Scree                            | 5               | 0.0%  | 0.0% | 0.0%  | 100.0% | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 0.0%  |
| S006                    | Rocky Mountain Cliff, Canyon and Massive Bedrock                   | 92              | 0.0%  | 0.0% | 0.0%  | 13.0%  | 0.0%    | 0.1%  | 0.0% | 0.0%          | 82.9%      | 0.0%       | 2.0%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 1.2%  |
| <b>EVERGREEN FOREST</b> |  |                 |       |      |       |        |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |              |      |       |
| S039                    | Colorado Plateau Pinyon-Juniper Woodland                           | 32,495          | 7.2%  | 0.0% | 0.0%  | 18.0%  | 0.0%    | 4.3%  | 0.0% | 0.0%          | 45.3%      | 0.0%       | 9.4%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 15.7% |
| S040                    | Great Basin Pinyon-Juniper Woodland                                | 3,414           | 82.8% | 0.0% | 0.0%  | 0.0%   | 0.0%    | 10.6% | 0.0% | 0.0%          | 1.6%       | 0.0%       | 1.9%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 3.1%  |
| S051                    | Madrean Encinal  | 3,008           | 8.3%  | 0.0% | 0.3%  | 51.8%  | 0.9%    | 2.0%  | 0.1% | 0.0%          | 3.4%       | 0.2%       | 16.8%      | 0.0%        | 0.0%        | 0.0%     | 0.1% | 0.0%   | 0.0% | 0.1%       | 0.5% | 0.0%         | 0.0% | 15.5% |
| S035                    | Madrean Pine-Oak Forest and Woodland                               | 4,008           | 1.3%  | 0.0% | 0.0%  | 64.3%  | 0.1%    | 0.5%  | 0.0% | 0.0%          | 28.4%      | 0.0%       | 2.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 3.3%  |
| S112                    | Madrean Pinyon-Juniper Woodland                                    | 13,163          | 4.3%  | 0.0% | 0.0%  | 48.3%  | 0.3%    | 0.5%  | 0.0% | 0.0%          | 30.6%      | 0.0%       | 7.4%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.0%         | 0.0% | 8.5%  |
| S111                    | Madrean Upper Montane Conifer-Oak Forest and Woodland              | 123             | 1.1%  | 0.0% | 0.0%  | 87.9%  | 3.0%    | 7.6%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.1%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 0.4%  |
| S032                    | Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland | 1,030           | 0.5%  | 0.0% | 0.0%  | 67.7%  | 0.0%    | 13.4% | 0.0% | 0.0%          | 18.0%      | 0.0%       | 0.1%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 0.2%  |
| S034                    | Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland     | 439             | 0.3%  | 0.0% | 0.0%  | 71.5%  | 0.1%    | 2.7%  | 0.0% | 0.0%          | 25.1%      | 0.0%       | 0.1%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 0.2%  |
| S028                    | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland  | 223             | 0.0%  | 0.0% | 0.0%  | 58.9%  | 0.0%    | 11.3% | 0.0% | 0.0%          | 29.6%      | 0.0%       | 0.1%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 0.0%  |
| S030                    | Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland      | 120             | 0.0%  | 0.0% | 0.0%  | 45.6%  | 0.0%    | 1.8%  | 0.0% | 0.0%          | 52.6%      | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 0.0%  |
| S025                    | Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland  | 2               | 0.0%  | 0.0% | 0.0%  | 94.6%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 5.4%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 0.0%  |



| Code                        | Land Cover Type  | Area in AZ      | BLM   | BOR  | FWS  | USFS  | DOD/DOE | NPS    | ARS  | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wildl | Other State | Reg. Gov | City | County | Aud  | Land Trust | TNC  | Priv-BioDi v | Priv |       |
|-----------------------------|--|-----------------|-------|------|------|-------|---------|--------|------|---------------|------------|------------|------------|-------------|-------------|----------|------|--------|------|------------|------|--------------|------|-------|
|                             |  | km <sup>2</sup> | %     | %    | %    | %     | %       | %      | %    | %             | %          | %          | %          | %           | %           | %        | %    | %      | %    | %          | %    | %            | %    | %     |
| S038                        | Southern Rocky Mountain Pinyon-Juniper Woodland        | 1               | 40.6% | 0.0% | 0.0% | 30.7% | 0.0%    | 1.9%   | 0.0% | 0.0%          | 0.0%       | 0.0%       | 13.9%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 12.9% |
| S036                        | Southern Rocky Mountain Ponderosa Pine Woodland        | 16,240          | 0.8%  | 0.0% | 0.0% | 64.7% | 0.3%    | 2.1%   | 0.0% | 0.0%          | 26.7%      | 0.0%       | 1.3%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 4.0%  |
| <b>DECIDUOUS FOREST</b>     |  |                 |       |      |      |       |         |        |      |               |            |            |            |             |             |          |      |        |      |            |      |              |      |       |
| S023                        | Rocky Mountain Aspen Forest and Woodland               | 443             | 0.0%  | 0.0% | 0.0% | 56.0% | 0.0%    | 2.9%   | 0.0% | 0.0%          | 39.8%      | 0.0%       | 0.1%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.1%         | 0.0% | 0.7%  |
| <b>SHRUB/SCRUB</b>          |  |                 |       |      |      |       |         |        |      |               |            |            |            |             |             |          |      |        |      |            |      |              |      |       |
| S058                        | Apacherian-Chihuahuan Mesquite Upland Scrub            | 16,547          | 13.4% | 0.0% | 1.2% | 22.8% | 0.5%    | 0.1%   | 0.5% | 0.0%          | 14.3%      | 0.1%       | 27.9%      | 0.0%        | 0.0%        | 0.0%     | 0.1% | 0.1%   | 0.0% | 0.1%       | 0.2% | 0.0%         | 0.0% | 18.7% |
| S062                        | Chihuahuan Mixed Desert and Thorn Scrub                | 6,319           | 19.7% | 0.0% | 0.3% | 3.9%  | 1.2%    | 0.2%   | 0.2% | 0.0%          | 6.4%       | 0.1%       | 43.5%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.1%   | 0.0% | 0.4%       | 0.2% | 0.0%         | 0.0% | 23.8% |
| S116                        | Chihuahuan Mixed Salt Desert Scrub                     | 2,816           | 32.5% | 0.0% | 0.3% | 14.1% | 0.5%    | 0.7%   | 0.2% | 0.0%          | 9.6%       | 0.1%       | 25.1%      | 0.0%        | 0.0%        | 0.0%     | 0.1% | 0.0%   | 0.0% | 0.1%       | 0.3% | 0.0%         | 0.0% | 16.3% |
| S068                        | Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub | 187             | 37.2% | 0.0% | 0.0% | 0.5%  | 0.2%    | 0.0%   | 0.0% | 0.0%          | 3.0%       | 0.0%       | 38.7%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.1%   | 0.0% | 0.1%       | 0.0% | 0.0%         | 0.0% | 20.0% |
| S061                        | Chihuahuan Succulent Desert Scrub                      | 109             | 25.3% | 0.0% | 0.3% | 12.1% | 0.7%    | 1.5%   | 0.0% | 0.0%          | 11.0%      | 0.0%       | 34.5%      | 0.0%        | 0.0%        | 0.0%     | 0.2% | 0.2%   | 0.0% | 0.2%       | 0.1% | 0.0%         | 0.0% | 13.7% |
| S059                        | Colorado Plateau Blackbrush-Mormon-tea Shrubland       | 4,036           | 14.0% | 0.0% | 0.0% | 0.5%  | 0.0%    | 6.0%   | 0.0% | 0.0%          | 74.0%      | 0.0%       | 2.2%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 3.1%  |
| S056                        | Colorado Plateau Mixed Low Sagebrush Shrubland         | 489             | 3.5%  | 0.0% | 0.0% | 0.0%  | 0.0%    | 0.1%   | 0.0% | 0.0%          | 7.4%       | 0.0%       | 32.8%      | 0.8%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 55.5% |
| S052                        | Colorado Plateau Pinyon-Juniper Shrubland              | 353             | 48.7% | 0.0% | 0.0% | 4.1%  | 0.0%    | 0.5%   | 0.0% | 0.0%          | 40.9%      | 0.0%       | 4.2%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 1.6%  |
| S053                        | Great Basin Semi-Desert Chaparral                      | <1              | 0.0%  | 0.0% | 0.0% | 0.0%  | 0.0%    | 100.0% | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 0.0%  |
| S054                        | Inter-Mountain Basins Big Sagebrush Shrubland          | 5,200           | 32.1% | 0.0% | 0.0% | 5.3%  | 0.0%    | 3.8%   | 0.0% | 0.0%          | 46.7%      | 0.0%       | 5.7%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.0%         | 0.0% | 6.3%  |
| S045                        | Inter-Mountain Basins Mat Saltbush Shrubland           | 75              | 90.9% | 0.0% | 0.0% | 0.0%  | 0.0%    | 1.9%   | 0.0% | 0.0%          | 1.1%       | 0.0%       | 5.8%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 0.3%  |
| S065                        | Inter-Mountain Basins Mixed Salt Desert Scrub          | 7,005           | 19.4% | 0.0% | 0.0% | 0.8%  | 0.0%    | 1.4%   | 0.0% | 0.0%          | 56.2%      | 0.1%       | 8.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.0%         | 0.0% | 13.9% |
| S057                        | Mogollon Chaparral                                     | 9,637           | 15.5% | 0.0% | 0.0% | 48.8% | 0.1%    | 0.8%   | 0.0% | 0.0%          | 10.4%      | 0.1%       | 13.0%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.0%         | 0.0% | 11.2% |
| S060                        | Mojave Mid-Elevation Mixed Desert Scrub                | 5,416           | 41.3% | 0.0% | 0.0% | 0.8%  | 0.0%    | 20.9%  | 0.0% | 0.0%          | 10.9%      | 0.0%       | 3.9%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 22.3% |
| S046                        | Rocky Mountain Gambel Oak-Mixed Montane Shrubland      | 128             | 4.0%  | 0.0% | 0.0% | 51.5% | 0.0%    | 12.9%  | 0.0% | 0.0%          | 29.2%      | 0.0%       | 1.3%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 1.1%  |
| S069                        | Sonora-Mojave Creosotebush-White Bursage Desert Scrub  | 38,922          | 29.9% | 0.5% | 8.1% | 0.1%  | 19.1%   | 5.6%   | 0.0% | 0.0%          | 12.1%      | 0.2%       | 10.8%      | 0.1%        | 0.0%        | 0.1%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 13.1% |
| S070                        | Sonora-Mojave Mixed Salt Desert Scrub                  | 1,011           | 6.7%  | 0.0% | 0.6% | 0.0%  | 1.8%    | 0.7%   | 0.0% | 0.0%          | 38.8%      | 0.2%       | 11.2%      | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 39.7% |
| S129                        | Sonoran Mid-Elevation Desert Scrub                     | 5,391           | 45.5% | 0.0% | 0.4% | 9.9%  | 0.1%    | 0.3%   | 0.1% | 0.0%          | 5.7%       | 0.0%       | 18.3%      | 0.0%        | 0.0%        | 0.1%     | 0.0% | 0.3%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 19.1% |
| S063                        | Sonoran Paloverde-Mixed Cacti Desert Scrub             | 39,791          | 34.4% | 0.4% | 7.2% | 6.8%  | 5.4%    | 2.5%   | 0.2% | 0.0%          | 18.6%      | 0.3%       | 14.4%      | 0.1%        | 0.0%        | 1.0%     | 0.3% | 0.3%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 8.0%  |
| S136                        | Southern Colorado Plateau Sand Shrubland               | 6,073           | 2.9%  | 0.0% | 0.0% | 0.0%  | 0.0%    | 0.8%   | 0.0% | 0.0%          | 89.3%      | 0.0%       | 2.2%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%         | 0.0% | 4.7%  |
| <b>GRASSLAND/HERBACEOUS</b> |  |                 |       |      |      |       |         |        |      |               |            |            |            |             |             |          |      |        |      |            |      |              |      |       |
| S077                        | Apacherian-Chihuahuan Semi-Desert Grassland and Steppe | 11,354          | 7.7%  | 0.0% | 1.3% | 10.6% | 1.4%    | 0.3%   | 0.1% | 0.0%          | 7.5%       | 0.1%       | 30.2%      | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.9%       | 0.6% | 0.0%         | 0.0% | 39.1% |



| Code   | Land Cover Type                       | Area in AZ      | BLM   | BOR  | FWS  | USFS  | DOD/DOE | NPS  | ARS  | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wildl | Other State | Reg. Gov | City | County | Aud  | Land Trust | TNC  | Priv-BioDiv | Priv  |
|--|---------------------------------------|-----------------|-------|------|------|-------|---------|------|------|---------------|------------|------------|------------|-------------|-------------|----------|------|--------|------|------------|------|-------------|-------|
|  |                                       | km <sup>2</sup> | %     | %    | %    | %     | %       | %    | %    | %             | %          | %          | %          | %           | %           | %        | %    | %      | %    | %          | %    | %           | %     |
| N21  | Developed, Open Space - Low Intensity | 1,711           | 0.5%  | 0.3% | 0.0% | 0.5%  | 4.4%    | 0.3% | 0.0% | 0.0%          | 2.7%       | 0.1%       | 1.9%       | 0.0%        | 0.0%        | 0.3%     | 0.2% | 0.2%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 88.7% |
| <b>OTHER COVER TYPES</b>   |                                       |                 |       |      |      |       |         |      |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |
| N31  | Barren Lands, Non-specific            | 1,119           | 9.6%  | 0.1% | 0.7% | 0.0%  | 4.7%    | 0.0% | 0.0% | 0.0%          | 66.9%      | 0.3%       | 5.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 12.6% |
| N11  | Open Water                            | 701             | 1.2%  | 0.2% | 0.8% | 2.3%  | 0.0%    | 8.9% | 0.0% | 0.0%          | 5.4%       | 0.4%       | 0.8%       | 1.0%        | 0.0%        | 3.9%     | 0.1% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 6.3%  |
|  | <b>TOTAL</b>                          | 295,347         | 17.0% | 0.1% | 2.3% | 15.3% | 3.8%    | 3.2% | 0.1% | 0.0%          | 27.5%      | 0.1%       | 12.6%      | 0.1%        | 0.0%        | 0.2%     | 0.1% | 0.1%   | 0.0% | 0.1%       | 0.1% | 0.0%        | 17.2% |
| <p>* For Land Stewardship headings: BLM = Bureau of Land Management, BOR = Bureau of Reclamation, FWS= U.S. Fish and Wildlife Service, USFS = U.S. Forest Service, DOD/DOE = Dept. of Defense/Dept. of Energy, NPS = U.S. National Park Service , ARS = Agricultural Research Service, Dept. of Com. = Dept. of Commerce, Nativ Amer = Native American Lands, Reg. Gov. = Regional Government, Aud = Audubon, TNC = The Nature Conservancy, Priv-BioDiv = Private Lands Managed for Biodiversity</p> |                                       |                 |       |      |      |       |         |      |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |

**Appendix 5-5. Area and percent distribution of each land cover type represented within the four levels of GAP Management Status in the state of Arizona.**

| Code                    | Land Cover Type  | Area in AZ      |                 | Status 1 |                 | Status 2 |                 | Status 3 |                 | Status 4 |                 | Status 1&2 |  |
|-------------------------|--|-----------------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|------------|--|
|                         |  | km <sup>2</sup> | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %          |  |
| <b>BARREN LANDS</b>     |  |                 |                 |          |                 |          |                 |          |                 |          |                 |            |  |
| S010                    | Colorado Plateau Mixed Bedrock Canyon and Tableland                | 6,965           | 761             | 10.9%    | 698             | 10.0%    | 5,275           | 75.7%    | 231             | 3.3%     | 1,459           | 20.9%      |  |
| S012                    | Inter-Mountain Basins Active and Stabilized Dune                   | 350             | 0               | 0.0%     | 19              | 5.6%     | 324             | 92.5%    | 7               | 1.9%     | 19              | 5.6%       |  |
| S015                    | Inter-Mountain Basins Playa  | 7               | 0               | 0.0%     | 0               | 0.0%     | 6               | 83.2%    | 1               | 16.8%    | 0               | 0.0%       |  |
| S011                    | Inter-Mountain Basins Shale Badland                                | 729             | 28              | 3.9%     | 13              | 1.8%     | 561             | 77.0%    | 126             | 17.2%    | 42              | 5.7%       |  |
| S013                    | Inter-Mountain Basins Volcanic Rock and Cinder Land                | 573             | 93              | 16.2%    | 6               | 1.0%     | 282             | 49.3%    | 192             | 33.5%    | 98              | 17.2%      |  |
| S014                    | Inter-Mountain Basins Wash   | 4               | 0               | 0.0%     | 1               | 14.9%    | 3               | 84.4%    | 0               | 0.7%     | 1               | 14.9%      |  |
| S018                    | North American Warm Desert Active and Stabilized Dune              | 1,017           | 203             | 19.9%    | 204             | 20.0%    | 582             | 57.2%    | 29              | 2.8%     | 406             | 40.0%      |  |
| S017                    | North American Warm Desert Badland                                 | 34              | 0               | 1.1%     | 4               | 11.4%    | 29              | 85.4%    | 1               | 2.2%     | 4               | 12.5%      |  |
| S016                    | North American Warm Desert Bedrock Cliff and Outcrop               | 760             | 68              | 9.0%     | 233             | 30.6%    | 345             | 45.4%    | 114             | 15.0%    | 301             | 39.6%      |  |
| S021                    | North American Warm Desert Pavement                                | 45              | 1               | 1.1%     | 5               | 11.0%    | 21              | 47.5%    | 18              | 40.4%    | 5               | 12.1%      |  |
| S022                    | North American Warm Desert Playa                                   | 48              | 0               | 0.0%     | 0               | 0.3%     | 25              | 51.9%    | 23              | 47.8%    | 0               | 0.3%       |  |
| S019                    | North American Warm Desert Volcanic Rockland                       | 205             | 23              | 11.3%    | 9               | 4.2%     | 130             | 63.4%    | 43              | 21.1%    | 32              | 15.5%      |  |
| S002                    | Rocky Mountain Alpine Bedrock and Scree                            | 5               | 0               | 0.0%     | 5               | 95.9%    | 0               | 4.1%     | 0               | 0.0%     | 5               | 95.9%      |  |
| S006                    | Rocky Mountain Cliff, Canyon and Massive Bedrock                   | 91              | 1               | 0.7%     | 4               | 4.4%     | 84              | 91.7%    | 3               | 3.2%     | 5               | 5.1%       |  |
| <b>EVERGREEN FOREST</b> |  |                 |                 |          |                 |          |                 |          |                 |          |                 |            |  |
| S039                    | Colorado Plateau Pinyon-Juniper Woodland                           | 32,482          | 1,218           | 3.7%     | 1,506           | 4.6%     | 21,563          | 66.4%    | 8,195           | 25.2%    | 2,724           | 8.4%       |  |
| S040                    | Great Basin Pinyon-Juniper Woodland                                | 3,414           | 363             | 10.6%    | 2,051           | 60.1%    | 862             | 25.2%    | 138             | 4.1%     | 2,414           | 70.7%      |  |
| S051                    | Madrean Encinal  | 3,008           | 64              | 2.1%     | 293             | 9.7%     | 1,680           | 55.8%    | 972             | 32.3%    | 357             | 11.9%      |  |
| S035                    | Madrean Pine-Oak Forest and Woodland                               | 4,008           | 81              | 2.0%     | 715             | 17.8%    | 2,999           | 74.8%    | 213             | 5.3%     | 796             | 19.9%      |  |
| S112                    | Madrean Pinyon-Juniper Woodland                                    | 13,161          | 113             | 0.9%     | 1,730           | 13.1%    | 9,218           | 70.0%    | 2,101           | 16.0%    | 1,842           | 14.0%      |  |
| S111                    | Madrean Upper Montane Conifer-Oak Forest and Woodland              | 123             | 9               | 7.6%     | 87              | 70.7%    | 26              | 21.2%    | 1               | 0.5%     | 96              | 78.3%      |  |
| S032                    | Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland | 1,029           | 153             | 14.9%    | 72              | 7.0%     | 803             | 78.0%    | 2               | 0.2%     | 225             | 21.8%      |  |
| S034                    | Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland     | 439             | 27              | 6.0%     | 47              | 10.7%    | 364             | 82.9%    | 1               | 0.3%     | 74              | 16.8%      |  |
| S028                    | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland  | 223             | 33              | 14.9%    | 22              | 10.1%    | 167             | 74.9%    | 0               | 0.1%     | 56              | 24.9%      |  |
| S030                    | Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland      | 120             | 13              | 11.0%    | 10              | 8.3%     | 97              | 80.7%    | 0               | 0.1%     | 23              | 19.2%      |  |

| Code | Land Cover Type   | Area in AZ      |                 | Status 1 |                 | Status 2 |                 | Status 3 |                 | Status 4 |                 | Status 1&2 |  |
|------|---|-----------------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|------------|--|
|      |   | km <sup>2</sup> | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %          |  |
| S025 | Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland | 2               | 0               | 3.0%     | 1               | 73.2%    | 0               | 23.8%    | 0               | 0.0%     | 2               | 76.2%      |  |
| S038 | Southern Rocky Mountain Pinyon-Juniper Woodland                   | 1               | 0               | 0.0%     | 0               | 4.3%     | 1               | 68.8%    | 0               | 26.8%    | 0               | 4.3%       |  |
| S036 | Southern Rocky Mountain Ponderosa Pine Woodland                   | 16,233          | 422             | 2.6%     | 907             | 5.6%     | 14,018          | 86.4%    | 887             | 5.5%     | 1,328           | 8.2%       |  |

**DECIDUOUS FOREST**

|      |  |     |    |      |    |       |     |       |   |      |    |       |
|------|--|-----|----|------|----|-------|-----|-------|---|------|----|-------|
| S023 | Rocky Mountain Aspen Forest and Woodland | 442 | 21 | 4.8% | 72 | 16.3% | 345 | 78.1% | 4 | 0.8% | 93 | 21.1% |
|------|--|-----|----|------|----|-------|-----|-------|---|------|----|-------|

**SHRUB/SCRUB**

|      |  |        |       |        |       |       |        |       |        |       |       |        |
|------|--|--------|-------|--------|-------|-------|--------|-------|--------|-------|-------|--------|
| S058 | Apacherian-Chihuahuan Mesquite Upland Scrub            | 16,539 | 63    | 0.4%   | 1,306 | 7.9%  | 7,463  | 45.1% | 7,707  | 46.6% | 1,369 | 8.3%   |
| S062 | Chihuahuan Mixed Desert and Thorn Scrub                | 6,318  | 26    | 0.4%   | 189   | 3.0%  | 1,861  | 29.5% | 4,241  | 67.1% | 215   | 3.4%   |
| S116 | Chihuahuan Mixed Salt Desert Scrub                     | 2,814  | 39    | 1.4%   | 114   | 4.0%  | 1,497  | 53.2% | 1,165  | 41.4% | 153   | 5.4%   |
| S068 | Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub | 187    | 0     | 0.0%   | 2     | 0.9%  | 76     | 40.3% | 110    | 58.8% | 2     | 0.9%   |
| S061 | Chihuahuan Succulent Desert Scrub                      | 109    | 2     | 2.1%   | 4     | 3.7%  | 51     | 46.4% | 52     | 47.9% | 6     | 5.7%   |
| S059 | Colorado Plateau Blackbrush-Mormon-tea Shrubland       | 4,033  | 208   | 5.2%   | 375   | 9.3%  | 3,236  | 80.3% | 214    | 5.3%  | 583   | 14.4%  |
| S056 | Colorado Plateau Mixed Low Sagebrush Shrubland         | 489    | 0     | 0.1%   | 5     | 1.0%  | 52     | 10.7% | 431    | 88.3% | 5     | 1.1%   |
| S052 | Colorado Plateau Pinyon-Juniper Shrubland              | 353    | 6     | 1.7%   | 17    | 4.7%  | 310    | 87.8% | 20     | 5.8%  | 23    | 6.4%   |
| S053 | Great Basin Semi-Desert Chaparral                      | 0      | 0     | 100.0% | 0     | 0.0%  | 0      | 0.0%  | 0      | 0.0%  | 0     | 100.0% |
| S054 | Inter-Mountain Basins Big Sagebrush Shrubland          | 5,199  | 213   | 4.1%   | 355   | 6.8%  | 4,017  | 77.3% | 613    | 11.8% | 568   | 10.9%  |
| S045 | Inter-Mountain Basins Mat Saltbush Shrubland           | 75     | 0     | 0.0%   | 0     | 0.1%  | 70     | 93.8% | 5      | 6.1%  | 0     | 0.1%   |
| S065 | Inter-Mountain Basins Mixed Salt Desert Scrub          | 6,995  | 84    | 1.2%   | 85    | 1.2%  | 5,286  | 75.6% | 1,540  | 22.0% | 169   | 2.4%   |
| S057 | Mogollon Chaparral                                     | 9,636  | 195   | 2.0%   | 1,488 | 15.4% | 5,619  | 58.3% | 2,335  | 24.2% | 1,683 | 17.5%  |
| S060 | Mojave Mid-Elevation Mixed Desert Scrub                | 5,416  | 1,178 | 21.7%  | 1,001 | 18.5% | 1,829  | 33.8% | 1,408  | 26.0% | 2,179 | 40.2%  |
| S046 | Rocky Mountain Gambel Oak-Mixed Montane Shrubland      | 128    | 20    | 15.8%  | 10    | 7.8%  | 95     | 74.1% | 3      | 2.3%  | 30    | 23.6%  |
| S069 | Sonora-Mojave Creosotebush-White Bursage Desert Scrub  | 38,909 | 3,913 | 10.1%  | 4,022 | 10.3% | 20,416 | 52.5% | 10,558 | 27.1% | 7,935 | 20.4%  |
| S070 | Sonora-Mojave Mixed Salt Desert Scrub                  | 1,011  | 12    | 1.2%   | 19    | 1.9%  | 187    | 18.5% | 793    | 78.5% | 31    | 3.1%   |
| S129 | Sonoran Mid-Elevation Desert Scrub                     | 5,390  | 38    | 0.7%   | 1,201 | 22.3% | 2,109  | 39.1% | 2,042  | 37.9% | 1,239 | 23.0%  |
| S063 | Sonoran Paloverde-Mixed Cacti Desert Scrub             | 39,773 | 3,656 | 9.2%   | 5,122 | 12.9% | 20,783 | 52.3% | 10,212 | 25.7% | 8,778 | 22.1%  |
| S136 | Southern Colorado Plateau Sand Shrubland               | 6,073  | 49    | 0.8%   | 139   | 2.3%  | 5,473  | 90.1% | 412    | 6.8%  | 188   | 3.1%   |

**GRASSLAND/HERBACEOUS**

|      |  |        |    |      |     |      |       |       |       |       |     |      |
|------|--|--------|----|------|-----|------|-------|-------|-------|-------|-----|------|
| S077 | Apacherian-Chihuahuan Semi-Desert Grassland and Steppe | 11,346 | 44 | 0.4% | 552 | 4.9% | 2,915 | 25.7% | 7,834 | 69.1% | 596 | 5.3% |
| S113 | Chihuahuan Sandy Plains Semi-Desert Grassland          | 16     | 0  | 0.2% | 0   | 2.5% | 3     | 22.2% | 12    | 75.0% | 0   | 2.7% |
| S075 | Inter-Mountain Basins Juniper Savanna                  | 3,998  | 11 | 0.3% | 46  | 1.2% | 1,434 | 35.9% | 2,507 | 62.7% | 57  | 1.4% |

| Code | Land Cover Type                                     | Area in AZ      |                 | Status 1 |                 | Status 2 |                 | Status 3 |                 | Status 4 |                 | Status 1&2 |  |
|------|---|-----------------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|------------|--|
|      |   | km <sup>2</sup> | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %          |  |
| S071 | Inter-Mountain Basins Montane Sagebrush Steppe      | 1               | 0               | 0.0%     | 0               | 26.9%    | 1               | 71.4%    | 0               | 1.7%     | 0               | 26.9%      |  |
| S090 | Inter-Mountain Basins Semi-Desert Grassland         | 11,245          | 198             | 1.8%     | 101             | 0.9%     | 5,075           | 45.1%    | 5,872           | 52.2%    | 298             | 2.7%       |  |
| S079 | Inter-Mountain Basins Semi-Desert Shrub-Steppe      | 15,465          | 264             | 1.7%     | 296             | 1.9%     | 8,814           | 57.0%    | 6,091           | 39.4%    | 560             | 3.6%       |  |
| S115 | Madrean Juniper Savanna                             | 336             | 1               | 0.3%     | 22              | 6.5%     | 220             | 65.5%    | 93              | 27.6%    | 23              | 6.8%       |  |
| S083 | Rocky Mountain Subalpine Mesic Meadow               | 0               | 0               | 0.0%     | 0               | 0.0%     | 0               | 100.0%   | 0               | 0.0%     | 0               | 0.0%       |  |
| S085 | Southern Rocky Mountain Montane-Subalpine Grassland | 563             | 11              | 2.0%     | 11              | 1.9%     | 482             | 85.6%    | 59              | 10.5%    | 22              | 3.9%       |  |

**WOODY WETLAND**

|      |  |       |    |      |    |       |       |        |     |       |    |       |
|------|--|-------|----|------|----|-------|-------|--------|-----|-------|----|-------|
| S096 | Inter-Mountain Basins Greasewood Flat                                    | 1,235 | 3  | 0.2% | 10 | 0.8%  | 1,115 | 90.3%  | 107 | 8.7%  | 13 | 1.0%  |
| S094 | North American Warm Desert Lower Montane Riparian Woodland and Shrubland | 180   | 4  | 2.0% | 29 | 16.2% | 82    | 45.4%  | 65  | 36.3% | 33 | 18.3% |
| S098 | North American Warm Desert Riparian Mesquite Bosque                      | 795   | 14 | 1.8% | 54 | 6.8%  | 443   | 55.8%  | 282 | 35.5% | 69 | 8.6%  |
| S097 | North American Warm Desert Riparian Woodland and Shrubland               | 269   | 25 | 9.2% | 37 | 13.9% | 76    | 28.3%  | 131 | 48.6% | 62 | 23.1% |
| S020 | North American Warm Desert Wash  | 152   | 9  | 6.1% | 22 | 14.3% | 35    | 23.3%  | 85  | 56.2% | 31 | 20.5% |
| S093 | Rocky Mountain Lower Montane Riparian Woodland and Shrubland             | 24    | 0  | 0.4% | 0  | 1.6%  | 18    | 76.4%  | 5   | 21.6% | 0  | 2.0%  |
| S091 | Rocky Mountain Subalpine-Montane Riparian Shrubland                      | 0     | 0  | 0.0% | 0  | 0.0%  | 0     | 100.0% | 0   | 0.0%  | 0  | 0.0%  |

**EMERGENT HERBACEOUS WETLAND**

|      |  |    |   |       |   |      |   |       |    |       |   |       |
|------|--|----|---|-------|---|------|---|-------|----|-------|---|-------|
| S100 | North American Arid West Emergent Marsh  | 24 | 6 | 25.1% | 2 | 6.5% | 3 | 13.8% | 13 | 54.6% | 8 | 31.6% |
| S102 | Rocky Mountain Alpine-Montane Wet Meadow | 0  | 0 | 0.0%  | 0 | 0.0% | 0 | 96.8% | 0  | 3.2%  | 0 | 0.0%  |

**ALTERED or DISTURBED**

|     |  |     |    |       |    |       |     |       |     |       |    |       |
|-----|--|-----|----|-------|----|-------|-----|-------|-----|-------|----|-------|
| D09 | Invasive Annual and Biennial Forbland              | 127 | 5  | 4.0%  | 5  | 3.6%  | 73  | 57.6% | 44  | 34.8% | 10 | 7.5%  |
| D08 | Invasive Annual Grassland                          | 72  | 0  | 0.3%  | 1  | 1.4%  | 53  | 73.7% | 18  | 24.7% | 1  | 1.7%  |
| D06 | Invasive Perennial Grassland                       | 13  | 0  | 0.0%  | 0  | 0.0%  | 12  | 94.5% | 1   | 5.5%  | 0  | 0.0%  |
| D04 | Invasive Southwest Riparian Woodland and Shrubland | 473 | 60 | 12.7% | 20 | 4.2%  | 195 | 41.2% | 199 | 42.0% | 80 | 16.9% |
| D02 | Recently Burned                                    | 168 | 21 | 12.4% | 71 | 42.1% | 75  | 44.9% | 1   | 0.6%  | 91 | 54.5% |
| D03 | Recently Mined or Quarried                         | 467 | 0  | 0.0%  | 0  | 0.1%  | 121 | 26.0% | 345 | 73.9% | 0  | 0.1%  |

**DEVELOPED and AGRICULTURE**

|     |                                       |       |   |      |    |      |     |      |       |       |    |      |
|-----|---------------------------------------|-------|---|------|----|------|-----|------|-------|-------|----|------|
| N80 | Agriculture                           | 5,629 | 8 | 0.1% | 14 | 0.2% | 99  | 1.8% | 5,509 | 97.9% | 21 | 0.4% |
| N22 | Developed, Medium - High Intensity    | 4,046 | 1 | 0.0% | 11 | 0.3% | 180 | 4.4% | 3,854 | 95.3% | 12 | 0.3% |
| N21 | Developed, Open Space - Low Intensity | 1,710 | 1 | 0.0% | 3  | 0.2% | 127 | 7.4% | 1,580 | 92.4% | 3  | 0.2% |

**OTHER COVER TYPES**

|     |                            |       |   |      |    |      |     |       |     |       |    |      |
|-----|----------------------------|-------|---|------|----|------|-----|-------|-----|-------|----|------|
| N31 | Barren Lands, Non-specific | 1,118 | 8 | 0.7% | 41 | 3.7% | 870 | 77.8% | 200 | 17.8% | 49 | 4.4% |
|-----|----------------------------|-------|---|------|----|------|-----|-------|-----|-------|----|------|

| Code | Land Cover Type | Area in AZ      | Status 1        |       | Status 2        |      | Status 3        |       | Status 4        |       | Status 1&2      |       |
|------|-----------------|-----------------|-----------------|-------|-----------------|------|-----------------|-------|-----------------|-------|-----------------|-------|
|      |                 | km <sup>2</sup> | km <sup>2</sup> | %     | km <sup>2</sup> | %    | km <sup>2</sup> | %     | km <sup>2</sup> | %     | km <sup>2</sup> | %     |
| N11  | Open Water      | 220             | 44              | 20.0% | 10              | 4.7% | 71              | 32.4% | 94              | 43.0% | 54              | 24.7% |
|      | <b>TOTAL</b>    | 284,218         | 14,135          | 5.0%  | 25,524          | 9.0% | 162,831         | 57.3% | 92,165          | 32.4% | 39,659          | 13.5% |

### Appendix 5-6. Percent distribution of each land cover type among 22 land stewards in the state of Colorado.

| Code                    | Land Cover Type  | Area in CO      | BLM   | BOR  | FWS  | USFS  | DOD/DOE | NPS   | ARS  | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wildl | Other State | Reg. Gov | City | County | Aud  | Land Trust | TNC   | Priv-BioDiv | Priv |        |
|-------------------------|--|-----------------|-------|------|------|-------|---------|-------|------|---------------|------------|------------|------------|-------------|-------------|----------|------|--------|------|------------|-------|-------------|------|--------|
|                         |  | km <sup>2</sup> | %     | %    | %    | %     | %       | %     | %    | %             | %          | %          | %          | %           | %           | %        | %    | %      | %    | %          | %     | %           | %    | %      |
| <b>BARREN LANDS</b>     |  |                 |       |      |      |       |         |       |      |               |            |            |            |             |             |          |      |        |      |            |       |             |      |        |
| S010                    | Colorado Plateau Mixed Bedrock Canyon and Tableland                | 675             | 55.6% | 0.0% | 0.0% | 1.3%  | 0.0%    | 7.4%  | 0.0% | 0.0%          | 20.8%      | 0.1%       | 0.4%       | 0.3%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0%  | 0.0%        | 0.0% | 14.0%  |
| S012                    | Inter-Mountain Basins Active and Stabilized Dune                   | 130             | 4.8%  | 0.0% | 0.7% | 0.1%  | 0.0%    | 70.6% | 0.0% | 0.0%          | 0.1%       | 1.3%       | 0.8%       | 0.3%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 10.0% | 0.0%        | 0.0% | 11.0%  |
| S009                    | Inter-Mountain Basins Cliff and Canyon                             | 4               | 65.5% | 0.0% | 0.0% | 0.0%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 31.7%      | 1.7%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0%  | 0.0%        | 0.0% | 1.1%   |
| S015                    | Inter-Mountain Basins Playa  | 46              | 1.4%  | 0.0% | 5.3% | 0.0%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 44.7%      | 0.6%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 9.4%  | 0.0%        | 0.0% | 33.7%  |
| S011                    | Inter-Mountain Basins Shale Badland                                | 258             | 63.1% | 0.0% | 0.1% | 0.8%  | 0.0%    | 0.8%  | 0.0% | 0.0%          | 11.2%      | 0.0%       | 1.6%       | 0.6%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0%  | 0.0%        | 0.0% | 21.7%  |
| S014                    | Inter-Mountain Basins Wash   | 20              | 0.0%  | 0.0% | 0.0% | 0.0%  | 5.2%    | 0.0%  | 0.0% | 0.0%          | 1.8%       | 0.0%       | 5.8%       | 0.0%        | 0.0%        | 0.0%     | 0.1% | 0.0%   | 0.0% | 0.0%       | 1.7%  | 0.0%        | 0.0% | 85.2%  |
| S001                    | North American Alpine Ice Field                                    | 2               | 0.0%  | 0.0% | 0.0% | 55.8% | 0.0%    | 26.1% | 0.0% | 0.0%          | 0.0%       | 6.4%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0%  | 0.0%        | 0.0% | 11.2%  |
| S018                    | North American Warm Desert Active and Stabilized Dune              | <1              | 0.0%  | 0.0% | 0.0% | 0.0%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0%  | 0.0%        | 0.0% | 100.0% |
| S016                    | North American Warm Desert Bedrock Cliff and Outcrop               | <1              | 0.0%  | 0.0% | 0.0% | 27.0% | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 6.2%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0%  | 0.0%        | 0.0% | 66.8%  |
| S022                    | North American Warm Desert Playa                                   | <1              | 0.0%  | 0.0% | 0.0% | 0.0%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0%  | 0.0%        | 0.0% | 100.0% |
| S002                    | Rocky Mountain Alpine Bedrock and Scree                            | 2,888           | 4.4%  | 0.0% | 0.0% | 81.8% | 0.0%    | 6.1%  | 0.0% | 0.0%          | 0.0%       | 0.5%       | 0.1%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.3%  | 0.0%        | 0.0% | 6.4%   |
| S004                    | Rocky Mountain Alpine Fell-Field                                   | 584             | 4.8%  | 0.0% | 0.0% | 80.3% | 0.0%    | 8.6%  | 0.0% | 0.0%          | 0.0%       | 0.6%       | 0.1%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.2%  | 0.0%        | 0.0% | 5.5%   |
| S006                    | Rocky Mountain Cliff, Canyon and Massive Bedrock                   | 989             | 21.3% | 0.0% | 0.0% | 52.3% | 0.0%    | 1.2%  | 0.0% | 0.0%          | 0.0%       | 0.2%       | 0.4%       | 0.4%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1%  | 0.0%        | 0.0% | 23.1%  |
| S008                    | Western Great Plains Cliff and Outcrop                             | 88              | 0.2%  | 0.0% | 0.0% | 12.3% | 3.3%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 6.9%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.1%   | 0.0% | 0.0%       | 0.0%  | 0.0%        | 0.0% | 76.9%  |
| <b>EVERGREEN FOREST</b> |  |                 |       |      |      |       |         |       |      |               |            |            |            |             |             |          |      |        |      |            |       |             |      |        |
| S039                    | Colorado Plateau Pinyon-Juniper Woodland                           | 15,136          | 61.4% | 0.0% | 0.0% | 4.8%  | 0.0%    | 3.5%  | 0.0% | 0.0%          | 8.6%       | 0.1%       | 0.7%       | 1.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0%  | 0.0%        | 0.0% | 19.6%  |
| S035                    | Madrean Pine-Oak Forest and Woodland                               | <1              | 0.0%  | 0.0% | 0.0% | 0.0%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0%  | 0.0%        | 0.0% | 100.0% |
| S112                    | Madrean Pinyon-Juniper Woodland                                    | <1              | 0.0%  | 0.0% | 0.0% | 0.0%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 12.7%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0%  | 0.0%        | 0.0% | 87.3%  |
| S032                    | Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland | 3,152           | 13.0% | 0.0% | 0.0% | 55.4% | 0.0%    | 1.1%  | 0.0% | 0.0%          | 0.5%       | 0.4%       | 1.0%       | 1.2%        | 0.0%        | 0.0%     | 0.2% | 0.2%   | 0.0% | 0.0%       | 0.7%  | 0.0%        | 0.0% | 26.4%  |
| S125                    | Rocky Mountain Foothill Limber Pine-Juniper Woodland               | 6               | 0.4%  | 0.0% | 0.0% | 3.9%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 7.6%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0%  | 0.0%        | 0.0% | 87.3%  |
| S031                    | Rocky Mountain Lodgepole Pine Forest                               | 6,940           | 4.2%  | 0.0% | 0.0% | 76.0% | 0.0%    | 3.6%  | 0.0% | 0.0%          | 0.0%       | 1.8%       | 0.5%       | 0.4%        | 0.0%        | 0.1%     | 0.0% | 0.2%   | 0.0% | 0.0%       | 0.1%  | 0.0%        | 0.0% | 13.0%  |
| S034                    | Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland     | 3,603           | 13.4% | 0.0% | 0.0% | 50.5% | 0.0%    | 1.3%  | 0.0% | 0.0%          | 0.5%       | 0.3%       | 1.2%       | 1.4%        | 0.0%        | 0.0%     | 0.5% | 0.6%   | 0.0% | 0.0%       | 0.8%  | 0.1%        | 0.0% | 29.4%  |
| S028                    | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland  | 10,189          | 3.1%  | 0.0% | 0.0% | 88.4% | 0.0%    | 2.1%  | 0.0% | 0.0%          | 0.0%       | 0.6%       | 0.2%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1%  | 0.0%        | 0.0% | 5.2%   |
| S030                    | Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland      | 8,151           | 3.9%  | 0.0% | 0.0% | 86.4% | 0.0%    | 2.2%  | 0.0% | 0.0%          | 0.0%       | 0.4%       | 0.3%       | 0.2%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.2%  | 0.0%        | 0.0% | 6.4%   |
| S025                    | Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland  | 369             | 5.6%  | 0.0% | 0.0% | 64.0% | 0.0%    | 1.3%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 2.8%       | 2.9%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.2%  | 0.2%        | 0.0% | 22.9%  |
| S038                    | Southern Rocky Mountain Pinyon-Juniper Woodland                    | 4,836           | 23.5% | 0.0% | 0.1% | 9.0%  | 2.6%    | 0.5%  | 0.0% | 0.0%          | 0.0%       | 0.4%       | 4.7%       | 0.8%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.6%  | 0.1%        | 0.0% | 57.6%  |
| S036                    | Southern Rocky Mountain Ponderosa Pine Woodland                    | 10,792          | 6.7%  | 0.0% | 0.0% | 39.2% | 0.3%    | 0.8%  | 0.0% | 0.0%          | 3.0%       | 0.5%       | 1.6%       | 1.8%        | 0.0%        | 0.0%     | 0.4% | 0.8%   | 0.0% | 0.0%       | 0.3%  | 0.7%        | 0.0% | 43.8%  |



| Code                        | Land Cover Type  | Area in CO      | BLM   | BOR  | FWS  | USFS  | DOD/DOE | NPS   | ARS  | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wildl | Other State | Reg. Gov | City | County | Aud  | Land Trust | TNC  | Priv-BioDiv | Priv   |
|-----------------------------|--|-----------------|-------|------|------|-------|---------|-------|------|---------------|------------|------------|------------|-------------|-------------|----------|------|--------|------|------------|------|-------------|--------|
|                             |  | km <sup>2</sup> | %     | %    | %    | %     | %       | %     | %    | %             | %          | %          | %          | %           | %           | %        | %    | %      | %    | %          | %    | %           | %      |
| <b>DECIDUOUS FOREST</b>     |  |                 |       |      |      |       |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |        |
| S023                        | Rocky Mountain Aspen Forest and Woodland                       | 11,436          | 5.9%  | 0.0% | 0.0% | 64.1% | 0.0%    | 0.3%  | 0.0% | 0.0%          | 0.0%       | 0.3%       | 1.2%       | 0.8%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.2% | 0.0%        | 27.0%  |
| <b>MIXED FOREST</b>         |  |                 |       |      |      |       |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |        |
| S042                        | Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland  | 1,951           | 6.0%  | 0.0% | 0.0% | 70.1% | 0.0%    | 0.8%  | 0.0% | 0.0%          | 0.0%       | 0.1%       | 0.6%       | 0.4%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.8% | 0.1%        | 21.2%  |
| <b>SHRUB/SCRUB</b>          |  |                 |       |      |      |       |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |        |
| S062                        | Chihuahuan Mixed Desert and Thorn Scrub                        | 9               | 0.1%  | 0.0% | 0.0% | 9.0%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 7.5%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 83.4%  |
| S059                        | Colorado Plateau Blackbrush-Mormon-tea Shrubland               | 97              | 51.6% | 0.0% | 0.0% | 0.0%  | 0.0%    | 0.1%  | 0.0% | 0.0%          | 41.6%      | 0.0%       | 0.1%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 6.6%   |
| S056                        | Colorado Plateau Mixed Low Sagebrush Shrubland                 | 66              | 54.9% | 0.0% | 0.0% | 0.1%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.4%       | 0.0%       | 1.2%       | 4.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 39.3%  |
| S052                        | Colorado Plateau Pinyon-Juniper Shrubland                      | 1,765           | 81.6% | 0.0% | 0.1% | 0.1%  | 0.0%    | 2.2%  | 0.0% | 0.0%          | 2.8%       | 0.0%       | 0.1%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 12.9%  |
| S054                        | Inter-Mountain Basins Big Sagebrush Shrubland                  | 13,383          | 49.8% | 0.0% | 0.4% | 0.6%  | 0.0%    | 1.4%  | 0.0% | 0.0%          | 1.7%       | 0.0%       | 4.3%       | 1.4%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 40.2%  |
| S045                        | Inter-Mountain Basins Mat Saltbush Shrubland                   | 1,019           | 75.7% | 0.0% | 0.0% | 0.0%  | 0.0%    | 0.1%  | 0.0% | 0.0%          | 0.6%       | 0.1%       | 2.6%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 21.0%  |
| S065                        | Inter-Mountain Basins Mixed Salt Desert Scrub                  | 2,324           | 48.6% | 0.0% | 0.1% | 0.3%  | 0.8%    | 0.1%  | 0.0% | 0.0%          | 16.8%      | 0.3%       | 2.6%       | 0.4%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 2.3% | 0.0%        | 27.6%  |
| S050                        | Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland | 1               | 86.7% | 0.0% | 0.0% | 0.0%  | 0.0%    | 10.6% | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 2.7%   |
| S046                        | Rocky Mountain Gambel Oak-Mixed Montane Shrubland              | 10,229          | 17.8% | 0.0% | 0.0% | 23.3% | 0.3%    | 0.8%  | 0.0% | 0.0%          | 1.8%       | 0.4%       | 1.4%       | 1.9%        | 0.0%        | 0.0%     | 0.1% | 0.1%   | 0.0% | 0.0%       | 0.2% | 0.4%        | 51.5%  |
| S047                        | Rocky Mountain Lower Montane-Foothill Shrubland                | 2,305           | 27.8% | 0.0% | 0.0% | 7.2%  | 0.0%    | 1.5%  | 0.0% | 0.0%          | 0.2%       | 0.3%       | 2.7%       | 2.7%        | 0.0%        | 0.1%     | 0.7% | 1.5%   | 0.0% | 0.0%       | 0.5% | 0.0%        | 54.8%  |
| S136                        | Southern Colorado Plateau Sand Shrubland                       | 13              | 1.6%  | 0.0% | 0.0% | 0.0%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 98.0%      | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.4%   |
| S138                        | Western Great Plains Mesquite Woodland and Shrubland           | 10              | 0.0%  | 0.0% | 0.0% | 8.5%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 7.7%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 83.6%  |
| S048                        | Western Great Plains Sandhill Shrubland                        | 8,682           | 0.4%  | 0.0% | 0.0% | 2.0%  | 0.2%    | 0.1%  | 0.0% | 0.0%          | 0.0%       | 0.1%       | 11.2%      | 0.7%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 1.4% | 0.0%        | 83.9%  |
| S128                        | Wyoming Basins Low Sagebrush Shrubland                         | 43              | 79.6% | 0.0% | 0.0% | 0.2%  | 0.0%    | 8.2%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 6.4%       | 0.9%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 4.6%   |
| <b>GRASSLAND/HERBACEOUS</b> |  |                 |       |      |      |       |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |        |
| S087                        | Central Mixedgrass Prairie                                     | 120             | 0.0%  | 0.0% | 0.0% | 0.0%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 4.1%       | 9.6%       | 2.5%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 83.7%  |
| S080                        | Chihuahuan Gypsophilous Grassland and Steppe                   | <1              | 0.0%  | 0.0% | 0.0% | 0.0%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 100.0% |
| S075                        | Inter-Mountain Basins Juniper Savanna                          | 281             | 74.8% | 0.0% | 0.0% | 0.0%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 7.6%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 17.5%  |
| S071                        | Inter-Mountain Basins Montane Sagebrush Steppe                 | 8,504           | 25.3% | 0.0% | 0.3% | 18.0% | 0.0%    | 0.8%  | 0.0% | 0.0%          | 0.0%       | 0.3%       | 4.3%       | 2.4%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.2% | 0.0%        | 48.5%  |
| S090                        | Inter-Mountain Basins Semi-Desert Grassland                    | 863             | 38.7% | 0.0% | 0.1% | 1.0%  | 0.0%    | 0.6%  | 0.0% | 0.0%          | 5.0%       | 0.0%       | 3.4%       | 0.9%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.2% | 0.0%        | 50.1%  |
| S079                        | Inter-Mountain Basins Semi-Desert Shrub-Steppe                 | 3,354           | 25.9% | 0.0% | 0.5% | 1.1%  | 0.6%    | 4.5%  | 0.0% | 0.0%          | 2.3%       | 0.0%       | 4.6%       | 0.3%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.1%       | 5.2% | 0.0%        | 54.7%  |
| S115                        | Madrean Juniper Savanna  | 1               | 0.0%  | 0.0% | 0.0% | 7.4%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 6.3%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 86.3%  |
| S081                        | Rocky Mountain Dry Tundra                                      | 2,447           | 5.9%  | 0.0% | 0.0% | 82.4% | 0.0%    | 4.5%  | 0.0% | 0.0%          | 0.0%       | 0.4%       | 0.1%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.5% | 0.1%        | 6.0%   |
| S083                        | Rocky Mountain Subalpine Mesic Meadow                          | 1,507           | 2.2%  | 0.0% | 0.0% | 72.6% | 0.0%    | 0.5%  | 0.0% | 0.0%          | 0.0%       | 0.1%       | 1.3%       | 0.3%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.2% | 0.1%        | 22.7%  |



| Code   | Land Cover Type | Area in CO      | BLM   | BOR  | FWS  | USFS  | DOD/DOE | NPS  | ARS  | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wildl | Other State | Reg. Gov | City | County | Aud  | Land Trust | TNC  | Priv-BioDiv | Priv  |
|--|-----------------|-----------------|-------|------|------|-------|---------|------|------|---------------|------------|------------|------------|-------------|-------------|----------|------|--------|------|------------|------|-------------|-------|
|  |                 | km <sup>2</sup> | %     | %    | %    | %     | %       | %    | %    | %             | %          | %          | %          | %           | %           | %        | %    | %      | %    | %          | %    | %           | %     |
| N11  | Open Water      | 1,316           | 2.8%  | 0.0% | 0.6% | 4.9%  | 0.1%    | 1.1% | 0.0% | 0.0%          | 0.4%       | 5.4%       | 1.3%       | 2.1%        | 0.0%        | 0.0%     | 0.4% | 0.2%   | 0.0% | 0.0%       | 0.3% | 0.0%        | 26.3% |
|  | <b>TOTAL</b>    | 269,735         | 12.5% | 0.0% | 0.1% | 21.7% | 0.7%    | 1.0% | 0.0% | 0.0%          | 1.1%       | 0.3%       | 4.0%       | 0.8%        | 0.0%        | 0.0%     | 0.1% | 0.1%   | 0.0% | 0.0%       | 0.5% | 0.1%        | 56.6% |
| <p>* For Land Stewardship headings: BLM = Bureau of Land Management, BOR = Bureau of Reclamation, FWS= U.S. Fish and Wildlife Service, USFS = U.S. Forest Service, DOD/DOE = Dept. of Defense/Dept. of Energy, NPS = U.S. National Park Service , ARS = Agricultural Research Service, Dept. of Com. = Dept. of Commerce, Nativ Amer = Native American Lands, Reg. Gov. = Regional Government, Aud = Audubon, TNC = The Nature Conservancy, Priv-BioDiv = Private Lands Managed for Biodiversity</p> |                 |                 |       |      |      |       |         |      |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |

**Appendix 5-7. Area and percent distribution of each land cover type represented within the four levels of GAP Management Status in the state of Colorado.**

| Code                    | Land Cover Type  | Area in CO      |                 | Status 1 |                 | Status 2 |                 | Status 3 |                 | Status 4 |                 | Status 1&2 |  |
|-------------------------|--|-----------------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|------------|--|
|                         |  | km <sup>2</sup> | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %          |  |
| <b>BARREN LANDS</b>     |  |                 |                 |          |                 |          |                 |          |                 |          |                 |            |  |
| S010                    | Colorado Plateau Mixed Bedrock Canyon and Tableland                | 674             | 52              | 7.7%     | 202             | 29.9%    | 229             | 34.0%    | 192             | 28.4%    | 253             | 37.6%      |  |
| S012                    | Inter-Mountain Basins Active and Stabilized Dune                   | 129             | 93              | 71.5%    | 18              | 14.0%    | 4               | 3.3%     | 14              | 11.1%    | 111             | 85.5%      |  |
| S009                    | Inter-Mountain Basins Cliff and Canyon                             | 4               | 0               | 0.0%     | 0               | 8.5%     | 4               | 90.5%    | 0               | 1.1%     | 0               | 8.5%       |  |
| S015                    | Inter-Mountain Basins Playa  | 44              | 3               | 5.8%     | 5               | 10.5%    | 21              | 48.2%    | 16              | 35.5%    | 7               | 16.3%      |  |
| S011                    | Inter-Mountain Basins Shale Badland                                | 258             | 3               | 1.2%     | 30              | 11.7%    | 144             | 55.9%    | 80              | 31.2%    | 33              | 12.9%      |  |
| S014                    | Inter-Mountain Basins Wash   | 20              | 0               | 0.0%     | 1               | 3.9%     | 1               | 7.3%     | 18              | 88.7%    | 1               | 3.9%       |  |
| S001                    | North American Alpine Ice Field                                    | 2               | 1               | 29.6%    | 1               | 49.1%    | 0               | 10.0%    | 0               | 11.3%    | 2               | 78.8%      |  |
| S018                    | North American Warm Desert Active and Stabilized Dune              | 0               | 0               | 0.0%     | 0               | 0.0%     | 0               | 0.0%     | 0               | 100.0%   | 0               | 0.0%       |  |
| S016                    | North American Warm Desert Bedrock Cliff and Outcrop               | 0               | 0               | 0.0%     | 0               | 0.0%     | 0               | 33.2%    | 0               | 66.8%    | 0               | 0.0%       |  |
| S022                    | North American Warm Desert Playa                                   | 0               | 0               | 0.0%     | 0               | 0.0%     | 0               | 0.0%     | 0               | 100.0%   | 0               | 0.0%       |  |
| S002                    | Rocky Mountain Alpine Bedrock and Scree                            | 2,878           | 668             | 23.2%    | 1,066           | 37.0%    | 958             | 33.3%    | 185             | 6.4%     | 1,734           | 60.3%      |  |
| S004                    | Rocky Mountain Alpine Fell-Field                                   | 584             | 140             | 24.0%    | 214             | 36.7%    | 198             | 33.9%    | 32              | 5.5%     | 354             | 60.7%      |  |
| S006                    | Rocky Mountain Cliff, Canyon and Massive Bedrock                   | 981             | 123             | 12.6%    | 174             | 17.8%    | 455             | 46.4%    | 229             | 23.3%    | 298             | 30.3%      |  |
| S008                    | Western Great Plains Cliff and Outcrop                             | 88              | 0               | 0.0%     | 1               | 0.6%     | 19              | 22.2%    | 68              | 77.2%    | 1               | 0.7%       |  |
| <b>EVERGREEN FOREST</b> |  |                 |                 |          |                 |          |                 |          |                 |          |                 |            |  |
| S039                    | Colorado Plateau Pinyon-Juniper Woodland                           | 15,134          | 561             | 3.7%     | 2,452           | 16.2%    | 8,237           | 54.4%    | 3,883           | 25.7%    | 3,014           | 19.9%      |  |
| S035                    | Madrean Pine-Oak Forest and Woodland                               | 0               | 0               | 0.0%     | 0               | 0.0%     | 0               | 0.0%     | 0               | 100.0%   | 0               | 0.0%       |  |
| S112                    | Madrean Pinyon-Juniper Woodland                                    | 0               | 0               | 0.0%     | 0               | 0.0%     | 0               | 12.7%    | 0               | 87.3%    | 0               | 0.0%       |  |
| S032                    | Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland | 3,150           | 101             | 3.2%     | 323             | 10.3%    | 1,866           | 59.2%    | 859             | 27.3%    | 425             | 13.5%      |  |
| S125                    | Rocky Mountain Foothill Limber Pine-Juniper Woodland               | 6               | 0               | 2.0%     | 0               | 1.4%     | 1               | 8.7%     | 5               | 87.9%    | 0               | 3.4%       |  |
| S031                    | Rocky Mountain Lodgepole Pine Forest                               | 6,939           | 376             | 5.4%     | 926             | 13.3%    | 4,709           | 67.9%    | 927             | 13.4%    | 1,302           | 18.8%      |  |
| S034                    | Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland     | 3,603           | 99              | 2.8%     | 376             | 10.4%    | 2,011           | 55.8%    | 1,116           | 31.0%    | 475             | 13.2%      |  |
| S028                    | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland  | 10,179          | 1,264           | 12.4%    | 2,298           | 22.6%    | 6,083           | 59.8%    | 534             | 5.2%     | 3,563           | 35.0%      |  |
| S030                    | Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland      | 8,150           | 1,036           | 12.7%    | 1,753           | 21.5%    | 4,834           | 59.3%    | 527             | 6.5%     | 2,789           | 34.2%      |  |

| Code | Land Cover Type   | Area in CO      |                 | Status 1 |                 | Status 2 |                 | Status 3 |                 | Status 4 |                 | Status 1&2 |  |
|------|---|-----------------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|------------|--|
|      |   | km <sup>2</sup> | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %          |  |
| S025 | Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland | 369             | 8               | 2.3%     | 48              | 12.9%    | 228             | 61.7%    | 85              | 23.1%    | 56              | 15.2%      |  |
| S038 | Southern Rocky Mountain Pinyon-Juniper Woodland                   | 4,834           | 28              | 0.6%     | 358             | 7.4%     | 1,652           | 34.2%    | 2,795           | 57.8%    | 386             | 8.0%       |  |
| S036 | Southern Rocky Mountain Ponderosa Pine Woodland                   | 10,790          | 132             | 1.2%     | 697             | 6.5%     | 4,705           | 43.6%    | 5,256           | 48.7%    | 829             | 7.7%       |  |

**DECIDUOUS FOREST**

|      |  |        |     |      |       |      |       |       |       |       |       |       |
|------|--|--------|-----|------|-------|------|-------|-------|-------|-------|-------|-------|
| S023 | Rocky Mountain Aspen Forest and Woodland | 11,432 | 258 | 2.3% | 1,079 | 9.4% | 7,003 | 61.3% | 3,092 | 27.0% | 1,337 | 11.7% |
|------|--|--------|-----|------|-------|------|-------|-------|-------|-------|-------|-------|

**MIXED FOREST**

|      |   |       |    |      |     |      |       |       |     |       |     |       |
|------|---|-------|----|------|-----|------|-------|-------|-----|-------|-----|-------|
| S042 | Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland | 1,951 | 57 | 2.9% | 167 | 8.5% | 1,312 | 67.3% | 415 | 21.3% | 224 | 11.5% |
|------|---|-------|----|------|-----|------|-------|-------|-----|-------|-----|-------|

**SHRUB/SCRUB**

|      |  |        |     |       |     |       |       |       |       |       |       |       |
|------|--|--------|-----|-------|-----|-------|-------|-------|-------|-------|-------|-------|
| S062 | Chihuahuan Mixed Desert and Thorn Scrub                        | 9      | 0   | 0.0%  | 0   | 0.1%  | 2     | 16.5% | 8     | 83.4% | 0     | 0.1%  |
| S059 | Colorado Plateau Blackbrush-Mormon-tea Shrubland               | 97     | 0   | 0.2%  | 36  | 36.8% | 17    | 17.2% | 45    | 45.9% | 36    | 37.0% |
| S056 | Colorado Plateau Mixed Low Sagebrush Shrubland                 | 66     | 0   | 0.0%  | 8   | 11.5% | 32    | 49.0% | 26    | 39.6% | 8     | 11.5% |
| S052 | Colorado Plateau Pinyon-Juniper Shrubland                      | 1,764  | 39  | 2.2%  | 510 | 28.9% | 937   | 53.1% | 278   | 15.7% | 549   | 31.1% |
| S054 | Inter-Mountain Basins Big Sagebrush Shrubland                  | 13,378 | 136 | 1.0%  | 888 | 6.6%  | 6,806 | 50.9% | 5,548 | 41.5% | 1,024 | 7.7%  |
| S045 | Inter-Mountain Basins Mat Saltbush Shrubland                   | 1,019  | 2   | 0.2%  | 70  | 6.9%  | 727   | 71.4% | 219   | 21.5% | 72    | 7.1%  |
| S065 | Inter-Mountain Basins Mixed Salt Desert Scrub                  | 2,324  | 5   | 0.2%  | 264 | 11.4% | 1,066 | 45.9% | 989   | 42.6% | 269   | 11.6% |
| S050 | Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland | 1      | 0   | 10.6% | 0   | 13.8% | 1     | 72.9% | 0     | 2.7%  | 0     | 24.4% |
| S046 | Rocky Mountain Gambel Oak-Mixed Montane Shrubland              | 10,226 | 67  | 0.7%  | 551 | 5.4%  | 4,105 | 40.1% | 5,504 | 53.8% | 618   | 6.0%  |
| S047 | Rocky Mountain Lower Montane-Foothill Shrubland                | 2,303  | 35  | 1.5%  | 141 | 6.1%  | 808   | 35.1% | 1,319 | 57.3% | 176   | 7.6%  |
| S136 | Southern Colorado Plateau Sand Shrubland                       | 13     | 0   | 0.0%  | 0   | 2.3%  | 0     | 0.0%  | 13    | 97.7% | 0     | 2.3%  |
| S138 | Western Great Plains Mesquite Woodland and Shrubland           | 10     | 0   | 0.0%  | 0   | 2.8%  | 1     | 13.5% | 8     | 83.7% | 0     | 2.8%  |
| S048 | Western Great Plains Sandhill Shrubland                        | 8,679  | 0   | 0.0%  | 258 | 3.0%  | 1,128 | 13.0% | 7,292 | 84.0% | 259   | 3.0%  |
| S128 | Wyoming Basins Low Sagebrush Shrubland                         | 43     | 3   | 8.0%  | 8   | 18.4% | 30    | 69.0% | 2     | 4.6%  | 11    | 26.4% |

**GRASSLAND/HERBACEOUS**

|      |  |       |     |       |     |       |       |       |       |        |       |       |
|------|--|-------|-----|-------|-----|-------|-------|-------|-------|--------|-------|-------|
| S087 | Central Mixedgrass Prairie                     | 120   | 0   | 0.0%  | 3   | 2.7%  | 16    | 13.5% | 100   | 83.7%  | 3     | 2.7%  |
| S080 | Chihuahuan Gypsophilous Grassland and Steppe   | 0     | 0   | 0.0%  | 0   | 0.0%  | 0     | 0.0%  | 0     | 100.0% | 0     | 0.0%  |
| S075 | Inter-Mountain Basins Juniper Savanna          | 281   | 0   | 0.0%  | 7   | 2.3%  | 226   | 80.2% | 49    | 17.5%  | 7     | 2.3%  |
| S071 | Inter-Mountain Basins Montane Sagebrush Steppe | 8,498 | 48  | 0.6%  | 625 | 7.4%  | 3,701 | 43.6% | 4,124 | 48.5%  | 673   | 7.9%  |
| S090 | Inter-Mountain Basins Semi-Desert Grassland    | 862   | 6   | 0.7%  | 63  | 7.3%  | 333   | 38.6% | 460   | 53.4%  | 69    | 8.0%  |
| S079 | Inter-Mountain Basins Semi-Desert Shrub-Steppe | 3,350 | 171 | 5.1%  | 369 | 11.0% | 915   | 27.3% | 1,895 | 56.6%  | 540   | 16.1% |
| S115 | Madrean Juniper Savanna                        | 1     | 0   | 0.0%  | 0   | 0.0%  | 0     | 13.7% | 1     | 86.3%  | 0     | 0.0%  |
| S081 | Rocky Mountain Dry Tundra                      | 2,446 | 418 | 17.1% | 910 | 37.2% | 968   | 39.6% | 149   | 6.1%   | 1,328 | 54.3% |

| Code | Land Cover Type                                      | Area in CO      |                 | Status 1 |                 | Status 2 |                 | Status 3 |                 | Status 4 |                 | Status 1&2 |  |
|------|--|-----------------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|------------|--|
|      |  | km <sup>2</sup> | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %          |  |
| S083 | Rocky Mountain Subalpine Mesic Meadow                | 1,504           | 57              | 3.8%     | 194             | 12.9%    | 911             | 60.5%    | 343             | 22.8%    | 251             | 16.7%      |  |
| S074 | Southern Rocky Mountain Juniper Woodland and Savanna | 2,149           | 0               | 0.0%     | 6               | 0.3%     | 396             | 18.4%    | 1,747           | 81.3%    | 6               | 0.3%       |  |
| S085 | Southern Rocky Mountain Montane-Subalpine Grassland  | 7,245           | 80              | 1.1%     | 607             | 8.4%     | 3,130           | 43.2%    | 3,429           | 47.3%    | 687             | 9.5%       |  |
| S086 | Western Great Plains Foothill and Piedmont Grassland | 4,362           | 0               | 0.0%     | 102             | 2.3%     | 405             | 9.3%     | 3,854           | 88.4%    | 102             | 2.3%       |  |
| S089 | Western Great Plains Sand Prairie                    | 18              | 0               | 0.0%     | 0               | 0.0%     | 1               | 5.3%     | 17              | 94.7%    | 0               | 0.0%       |  |
| S088 | Western Great Plains Shortgrass Prairie              | 45,615          | 10              | 0.0%     | 625             | 1.4%     | 8,185           | 17.9%    | 36,796          | 80.7%    | 634             | 1.4%       |  |
| S132 | Western Great Plains Tallgrass Prairie               | 1               | 0               | 0.0%     | 0               | 27.7%    | 0               | 15.1%    | 0               | 57.3%    | 0               | 27.7%      |  |

**WOODY WETLAND**

|      |  |       |     |       |     |       |       |       |       |       |       |       |
|------|--|-------|-----|-------|-----|-------|-------|-------|-------|-------|-------|-------|
| S096 | Inter-Mountain Basins Greasewood Flat                        | 2,276 | 44  | 1.9%  | 294 | 12.9% | 526   | 23.1% | 1,412 | 62.1% | 337   | 14.8% |
| S020 | North American Warm Desert Wash                              | 1     | 0   | 0.0%  | 0   | 0.7%  | 0     | 14.9% | 1     | 84.4% | 0     | 0.7%  |
| S093 | Rocky Mountain Lower Montane Riparian Woodland and Shrubland | 566   | 5   | 1.0%  | 48  | 8.5%  | 78    | 13.7% | 434   | 76.8% | 54    | 9.5%  |
| S091 | Rocky Mountain Subalpine-Montane Riparian Shrubland          | 2,812 | 335 | 11.9% | 738 | 26.3% | 1,252 | 44.5% | 487   | 17.3% | 1,073 | 38.1% |
| S092 | Rocky Mountain Subalpine-Montane Riparian Woodland           | 215   | 3   | 1.3%  | 22  | 10.1% | 95    | 44.4% | 95    | 44.2% | 24    | 11.4% |
| S120 | Western Great Plains Floodplain                              | 828   | 0   | 0.0%  | 31  | 3.8%  | 31    | 3.7%  | 766   | 92.6% | 31    | 3.8%  |
| S095 | Western Great Plains Riparian Woodland and Shrubland         | 849   | 0   | 0.0%  | 61  | 7.2%  | 40    | 4.7%  | 747   | 88.1% | 61    | 7.2%  |

**EMERGENT HERBACEOUS WETLAND**

|      |  |       |     |       |     |       |     |       |     |       |     |       |
|------|--|-------|-----|-------|-----|-------|-----|-------|-----|-------|-----|-------|
| S100 | North American Arid West Emergent Marsh  | 44    | 10  | 21.7% | 10  | 22.8% | 1   | 2.5%  | 23  | 53.0% | 19  | 44.5% |
| S102 | Rocky Mountain Alpine-Montane Wet Meadow | 1,327 | 160 | 12.1% | 328 | 24.7% | 445 | 33.5% | 394 | 29.7% | 488 | 36.8% |

**ALTERED or DISTURBED**

|     |  |       |    |       |    |       |     |       |       |       |     |       |
|-----|--|-------|----|-------|----|-------|-----|-------|-------|-------|-----|-------|
| D01 | Disturbed, Non-specific                            | 2     | 0  | 0.5%  | 1  | 49.9% | 1   | 49.2% | 0     | 0.4%  | 1   | 50.4% |
| D14 | Disturbed, Oil Well                                | 0     | 0  | 0.0%  | 0  | 14.8% | 0   | 19.2% | 0     | 66.0% | 0   | 14.8% |
| D09 | Invasive Annual and Biennial Forbland              | 633   | 6  | 1.0%  | 14 | 2.1%  | 122 | 19.3% | 491   | 77.6% | 20  | 3.2%  |
| D08 | Invasive Annual Grassland                          | 372   | 6  | 1.6%  | 15 | 4.1%  | 127 | 34.1% | 224   | 60.2% | 21  | 5.7%  |
| D07 | Invasive Perennial Forbland                        | 1     | 0  | 31.0% | 0  | 0.0%  | 0   | 1.6%  | 0     | 67.4% | 0   | 31.0% |
| D06 | Invasive Perennial Grassland                       | 2,079 | 1  | 0.1%  | 24 | 1.1%  | 134 | 6.5%  | 1,920 | 92.3% | 25  | 1.2%  |
| D04 | Invasive Southwest Riparian Woodland and Shrubland | 486   | 1  | 0.3%  | 25 | 5.2%  | 38  | 7.8%  | 421   | 86.7% | 27  | 5.5%  |
| D02 | Recently Burned                                    | 313   | 89 | 28.4% | 50 | 16.1% | 147 | 47.0% | 27    | 8.5%  | 139 | 44.5% |
| D11 | Recently Chained Pinyon-Juniper Areas              | 231   | 1  | 0.4%  | 18 | 7.9%  | 165 | 71.5% | 46    | 20.1% | 19  | 8.4%  |
| D10 | Recently Logged Areas                              | 540   | 26 | 4.8%  | 26 | 4.9%  | 458 | 84.8% | 30    | 5.6%  | 52  | 9.6%  |
| D03 | Recently Mined or Quarried                         | 87    | 1  | 0.7%  | 3  | 4.0%  | 20  | 22.9% | 63    | 72.3% | 4   | 4.7%  |

**DEVELOPED and AGRICULTURE**

|     |             |        |    |      |     |      |       |      |        |       |     |      |
|-----|-------------|--------|----|------|-----|------|-------|------|--------|-------|-----|------|
| N80 | Agriculture | 52,820 | 40 | 0.1% | 478 | 0.9% | 1,700 | 3.2% | 50,602 | 95.8% | 518 | 1.0% |
|-----|-------------|--------|----|------|-----|------|-------|------|--------|-------|-----|------|

| Code                     | Land Cover Type                       | Area in CO      |                 | Status 1 |                 | Status 2 |                 | Status 3 |                 | Status 4 |                 | Status 1&2 |  |
|--------------------------|---------------------------------------|-----------------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|------------|--|
|                          |                                       | km <sup>2</sup> | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %          |  |
| N22                      | Developed, Medium - High Intensity    | 1,068           | 1               | 0.1%     | 8               | 0.7%     | 53              | 5.0%     | 1,006           | 94.2%    | 8               | 0.8%       |  |
| N21                      | Developed, Open Space - Low Intensity | 2,010           | 0               | 0.0%     | 3               | 0.1%     | 22              | 1.1%     | 1,985           | 98.8%    | 3               | 0.1%       |  |
| <b>OTHER COVER TYPES</b> |                                       |                 |                 |          |                 |          |                 |          |                 |          |                 |            |  |
| N31                      | Barren Lands, Non-specific            | 10              | 0               | 0.0%     | 2               | 21.5%    | 2               | 20.7%    | 6               | 57.8%    | 2               | 21.5%      |  |
| N11                      | Open Water                            | 607             | 24              | 4.0%     | 58              | 9.6%     | 164             | 27.0%    | 361             | 59.4%    | 82              | 13.5%      |  |
|                          | <b>TOTAL</b>                          | 268,761         | 6,837           | 2.5%     | 20,692          | 7.7%     | 85,144          | 31.7%    | 156,088         | 58.1%    | 27,529          | 10.2%      |  |

### Appendix 5-8. Percent distribution of each land cover type among 22 land stewards in the state of New Mexico.

| Code                    | Land Cover Type  | Area in NM      | BLM   | BOR  | FWS   | USFS  | DOD/D OE | NPS   | ARS  | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wildl | Other State | Reg. Gov | City | County | Aud  | Land Trust | TNC  | Priv-BioDiv | Priv  |
|-------------------------|--|-----------------|-------|------|-------|-------|----------|-------|------|---------------|------------|------------|------------|-------------|-------------|----------|------|--------|------|------------|------|-------------|-------|
|                         |  | km <sup>2</sup> | %     | %    | %     | %     | %        | %     | %    | %             | %          | %          | %          | %           | %           | %        | %    | %      | %    | %          | %    | %           | %     |
| <b>BARREN LANDS</b>     |  |                 |       |      |       |       |          |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |
| S010                    | Colorado Plateau Mixed Bedrock Canyon and Tableland                | 2,466           | 20.5% | 0.0% | 0.0%  | 3.5%  | 0.0%     | 0.4%  | 0.0% | 0.0%          | 59.5%      | 0.0%       | 3.7%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.2%        | 12.2% |
| S012                    | Inter-Mountain Basins Active and Stabilized Dune                   | 735             | 8.4%  | 0.0% | 11.5% | 2.1%  | 0.6%     | 0.0%  | 0.0% | 0.0%          | 12.5%      | 0.0%       | 3.8%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.3%        | 60.8% |
| S015                    | Inter-Mountain Basins Playa  | 2               | 31.9% | 0.0% | 0.0%  | 0.0%  | 0.0%     | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 68.1% |
| S011                    | Inter-Mountain Basins Shale Badland                                | 481             | 42.0% | 0.0% | 0.0%  | 2.8%  | 0.0%     | 1.7%  | 0.0% | 0.0%          | 38.3%      | 0.0%       | 6.0%       | 0.8%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 8.2%  |
| S013                    | Inter-Mountain Basins Volcanic Rock and Cinder Land                | 470             | 12.5% | 0.0% | 0.0%  | 0.9%  | 0.0%     | 77.4% | 0.0% | 0.0%          | 1.4%       | 0.0%       | 0.6%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 7.1%  |
| S014                    | Inter-Mountain Basins Wash   | 3               | 2.3%  | 0.0% | 0.0%  | 0.0%  | 0.0%     | 0.0%  | 0.0% | 0.0%          | 79.5%      | 0.0%       | 0.5%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 12.4% |
| S018                    | North American Warm Desert Active and Stabilized Dune              | 1,695           | 41.2% | 0.0% | 0.7%  | 0.1%  | 30.4%    | 2.6%  | 0.0% | 0.0%          | 0.0%       | 0.1%       | 5.5%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 11.3%       | 8.2%  |
| S016                    | North American Warm Desert Bedrock Cliff and Outcrop               | 838             | 32.9% | 0.0% | 0.2%  | 12.2% | 0.4%     | 0.3%  | 0.0% | 0.0%          | 16.7%      | 0.0%       | 11.0%      | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 1.2%       | 0.1% | 2.7%        | 22.1% |
| S021                    | North American Warm Desert Pavement                                | 180             | 53.2% | 0.0% | 0.1%  | 0.0%  | 4.6%     | 8.8%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 15.1%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.8%       | 0.2% | 0.1%        | 13.4% |
| S022                    | North American Warm Desert Playa                                   | 535             | 8.9%  | 0.1% | 0.5%  | 1.6%  | 43.5%    | 30.2% | 0.1% | 0.0%          | 0.0%       | 0.1%       | 2.7%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 1.8%        | 6.7%  |
| S019                    | North American Warm Desert Volcanic Rockland                       | 700             | 42.5% | 0.0% | 0.0%  | 0.1%  | 25.4%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 9.2%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.3%       | 2.9% | 16.6%       | 3.0%  |
| S002                    | Rocky Mountain Alpine Bedrock and Scree                            | 7               | 0.0%  | 0.0% | 0.0%  | 5.3%  | 0.0%     | 0.0%  | 0.0% | 0.0%          | 0.5%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 55.3%       | 38.9% |
| S004                    | Rocky Mountain Alpine Fell-Field                                   | <1              | 0.0%  | 0.0% | 0.0%  | 36.2% | 0.0%     | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 28.2%       | 35.6% |
| S006                    | Rocky Mountain Cliff, Canyon and Massive Bedrock                   | 417             | 26.7% | 0.0% | 0.7%  | 30.6% | 1.7%     | 0.7%  | 0.0% | 0.0%          | 10.6%      | 0.0%       | 4.2%       | 2.5%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 1.4%        | 20.6% |
| S008                    | Western Great Plains Cliff and Outcrop                             | 221             | 8.1%  | 0.0% | 0.0%  | 1.3%  | 0.0%     | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 16.1%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.1%        | 74.3% |
| <b>EVERGREEN FOREST</b> |  |                 |       |      |       |       |          |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |
| S039                    | Colorado Plateau Pinyon-Juniper Woodland                           | 27,864          | 20.4% | 0.0% | 0.1%  | 19.4% | 0.2%     | 0.3%  | 0.0% | 0.0%          | 25.6%      | 0.2%       | 7.3%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.5%        | 25.9% |
| S051                    | Madrean Encinal  | 1,350           | 27.7% | 0.0% | 0.0%  | 21.5% | 0.4%     | 1.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 10.6%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 11.7%      | 1.0% | 0.2%        | 25.9% |
| S035                    | Madrean Pine-Oak Forest and Woodland                               | 1,725           | 1.7%  | 0.0% | 0.0%  | 45.8% | 0.2%     | 0.0%  | 0.0% | 0.0%          | 36.8%      | 0.0%       | 2.4%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.2%       | 0.0% | 0.0%        | 12.9% |
| S112                    | Madrean Pinyon-Juniper Woodland                                    | 8,754           | 10.5% | 0.0% | 0.6%  | 32.9% | 6.2%     | 0.1%  | 0.0% | 0.0%          | 6.7%       | 0.0%       | 9.5%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.6%       | 0.3% | 0.2%        | 32.5% |
| S111                    | Madrean Upper Montane Conifer-Oak Forest and Woodland              | 672             | 0.3%  | 0.0% | 0.0%  | 68.3% | 0.1%     | 0.0%  | 0.0% | 0.0%          | 24.8%      | 0.0%       | 0.4%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.7%       | 0.0% | 0.0%        | 5.4%  |
| S032                    | Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland | 2,864           | 0.3%  | 0.0% | 0.0%  | 77.1% | 0.0%     | 0.4%  | 0.0% | 0.0%          | 4.7%       | 0.1%       | 0.9%       | 1.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 1.7%        | 13.6% |
| S031                    | Rocky Mountain Lodgepole Pine Forest                               | 7               | 0.0%  | 0.0% | 0.0%  | 29.6% | 0.0%     | 0.0%  | 0.0% | 0.0%          | 0.5%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 50.7%       | 19.2% |
| S034                    | Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland     | 1,610           | 0.5%  | 0.0% | 0.0%  | 73.6% | 0.1%     | 0.2%  | 0.0% | 0.0%          | 3.7%       | 0.1%       | 0.4%       | 1.7%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 3.6%        | 15.9% |
| S028                    | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland  | 982             | 0.2%  | 0.0% | 0.1%  | 59.6% | 0.4%     | 0.1%  | 0.0% | 0.0%          | 8.7%       | 0.0%       | 0.5%       | 1.7%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 2.5%        | 26.0% |
| S030                    | Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland      | 640             | 0.0%  | 0.0% | 0.0%  | 68.5% | 0.0%     | 0.0%  | 0.0% | 0.0%          | 6.5%       | 0.0%       | 0.2%       | 1.6%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 3.6%        | 19.5% |
| S025                    | Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland  | 376             | 3.2%  | 0.0% | 0.0%  | 61.8% | 0.0%     | 0.0%  | 0.0% | 0.0%          | 9.6%       | 0.0%       | 0.7%       | 1.6%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 4.9%        | 18.0% |



| Code                        | Land Cover Type   | Area in         | BLM   | BOR  | FWS  | USFS  | DOD/OE | NPS   | ARS  | Dept. of | Nativ | State | State | State | Other | Reg. | City | County | Aud  | Land | TNC  | Priv- | Priv  |       |
|-----------------------------|---|-----------------|-------|------|------|-------|--------|-------|------|----------|-------|-------|-------|-------|-------|------|------|--------|------|------|------|-------|-------|-------|
|                             |   | km <sup>2</sup> | %     | %    | %    | %     | %      | %     | %    | %        | %     | %     | %     | %     | %     | %    | %    | %      | %    | %    | %    | %     | %     | %     |
| S038                        | Southern Rocky Mountain Pinyon-Juniper Woodland               | 10,468          | 9.2%  | 0.0% | 0.5% | 22.3% | 1.1%   | 0.8%  | 0.0% | 0.0%     | 7.8%  | 0.2%  | 8.5%  | 0.4%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.0% | 0.2%  | 2.4%  | 46.5% |
| S036                        | Southern Rocky Mountain Ponderosa Pine Woodland               | 21,163          | 1.6%  | 0.0% | 0.0% | 62.2% | 0.2%   | 0.2%  | 0.0% | 0.0%     | 9.9%  | 0.1%  | 1.8%  | 0.6%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.0% | 0.1%  | 5.1%  | 18.2% |
| <b>DECIDUOUS FOREST</b>     |   |                 |       |      |      |       |        |       |      |          |       |       |       |       |       |      |      |        |      |      |      |       |       |       |
| S023                        | Rocky Mountain Aspen Forest and Woodland                      | 1,483           | 0.1%  | 0.0% | 0.0% | 68.8% | 0.0%   | 0.0%  | 0.0% | 0.0%     | 7.9%  | 0.0%  | 0.6%  | 1.0%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.0% | 0.0%  | 2.0%  | 19.4% |
| S024                        | Rocky Mountain Bigtooth Maple Ravine Woodland                 | <1              | 0.0%  | 0.0% | 0.0% | 67.8% | 0.0%   | 32.2% | 0.0% | 0.0%     | 0.0%  | 0.0%  | 0.0%  | 0.0%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.0% | 0.0%  | 0.0%  | 0.0%  |
| <b>MIXED FOREST</b>         |   |                 |       |      |      |       |        |       |      |          |       |       |       |       |       |      |      |        |      |      |      |       |       |       |
| S042                        | Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland | 182             | 0.1%  | 0.0% | 0.0% | 61.6% | 0.0%   | 0.3%  | 0.0% | 0.0%     | 7.2%  | 0.0%  | 0.1%  | 1.9%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.0% | 0.0%  | 5.3%  | 23.5% |
| <b>SHRUB/SCRUB</b>          |   |                 |       |      |      |       |        |       |      |          |       |       |       |       |       |      |      |        |      |      |      |       |       |       |
| S058                        | Apacherian-Chihuahuan Mesquite Upland Scrub                   | 15,137          | 33.8% | 0.2% | 0.5% | 0.3%  | 2.0%   | 0.1%  | 1.7% | 0.0%     | 0.4%  | 0.1%  | 21.7% | 0.3%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.1% | 0.1%  | 0.4%  | 38.1% |
| S062                        | Chihuahuan Mixed Desert and Thorn Scrub                       | 21,080          | 47.9% | 0.4% | 0.9% | 0.5%  | 8.9%   | 0.2%  | 0.5% | 0.0%     | 0.0%  | 0.3%  | 16.8% | 0.2%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.1% | 0.1%  | 2.3%  | 20.9% |
| S116                        | Chihuahuan Mixed Salt Desert Scrub                            | 1,597           | 23.8% | 0.0% | 1.4% | 0.3%  | 32.2%  | 3.5%  | 0.1% | 0.0%     | 0.0%  | 0.2%  | 9.5%  | 1.2%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.3% | 0.1%  | 0.2%  | 26.7% |
| S068                        | Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub        | 5,538           | 39.2% | 0.0% | 0.0% | 0.0%  | 35.5%  | 1.4%  | 0.1% | 0.0%     | 0.0%  | 0.0%  | 11.3% | 0.0%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.0% | 0.1%  | 0.2%  | 11.9% |
| S061                        | Chihuahuan Succulent Desert Scrub                             | 78              | 43.3% | 0.0% | 0.1% | 2.0%  | 2.3%   | 2.7%  | 0.0% | 0.0%     | 0.0%  | 0.1%  | 19.1% | 0.0%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.8% | 0.0%  | 0.2%  | 29.2% |
| S117                        | Coahuilan Chaparral   | 93              | 16.9% | 0.0% | 0.0% | 43.1% | 0.0%   | 30.0% | 0.0% | 0.0%     | 0.0%  | 0.0%  | 6.5%  | 0.0%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.0% | 0.0%  | 0.0%  | 3.5%  |
| S059                        | Colorado Plateau Blackbrush-Mormon-tea Shrubland              | 141             | 13.2% | 0.0% | 0.0% | 0.0%  | 0.0%   | 0.0%  | 0.0% | 0.0%     | 65.9% | 0.0%  | 2.7%  | 0.7%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.0% | 0.0%  | 0.0%  | 17.6% |
| S056                        | Colorado Plateau Mixed Low Sagebrush Shrubland                | 329             | 33.7% | 0.0% | 0.0% | 0.3%  | 0.0%   | 0.1%  | 0.0% | 0.0%     | 19.8% | 0.0%  | 7.4%  | 0.1%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.0% | 0.0%  | 0.0%  | 38.5% |
| S054                        | Inter-Mountain Basins Big Sagebrush Shrubland                 | 3,934           | 23.9% | 0.0% | 0.0% | 6.6%  | 0.0%   | 0.2%  | 0.0% | 0.0%     | 26.4% | 0.4%  | 6.1%  | 0.9%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.0% | 0.0%  | 0.0%  | 35.2% |
| S065                        | Inter-Mountain Basins Mixed Salt Desert Scrub                 | 3,791           | 12.2% | 0.0% | 0.5% | 1.1%  | 0.2%   | 0.1%  | 0.0% | 0.0%     | 51.8% | 0.0%  | 7.9%  | 0.0%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.0% | 0.0%  | 0.2%  | 25.5% |
| S057                        | Mogollon Chaparral  | 870             | 14.9% | 0.0% | 2.6% | 32.1% | 14.3%  | 0.4%  | 0.0% | 0.0%     | 1.9%  | 0.0%  | 6.3%  | 0.2%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 2.7% | 0.3%  | 2.0%  | 22.3% |
| S046                        | Rocky Mountain Gambel Oak-Mixed Montane Shrubland             | 1,888           | 1.7%  | 0.0% | 0.0% | 19.3% | 0.2%   | 0.2%  | 0.0% | 0.0%     | 15.4% | 0.6%  | 5.4%  | 1.7%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.0% | 0.0%  | 10.9% | 44.4% |
| S047                        | Rocky Mountain Lower Montane-Foothill Shrubland               | 266             | 9.0%  | 0.1% | 0.1% | 1.3%  | 1.0%   | 0.0%  | 0.0% | 0.0%     | 0.2%  | 0.1%  | 15.2% | 0.0%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.0% | 0.0%  | 0.1%  | 72.8% |
| S069                        | Sonora-Mojave Creosotebush-White Bursage Desert Scrub         | <1              | 10.5% | 0.0% | 0.0% | 0.0%  | 0.0%   | 0.0%  | 0.0% | 0.0%     | 0.0%  | 0.0%  | 0.0%  | 0.0%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.0% | 0.0%  | 0.0%  | 89.5% |
| S129                        | Sonoran Mid-Elevation Desert Scrub                            | 2               | 47.2% | 0.0% | 0.0% | 8.1%  | 0.0%   | 0.0%  | 0.0% | 0.0%     | 0.0%  | 0.0%  | 15.5% | 0.0%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.0% | 0.0%  | 0.0%  | 29.2% |
| S063                        | Sonoran Paloverde-Mixed Cacti Desert Scrub                    | <1              | 68.1% | 0.0% | 0.0% | 2.5%  | 0.0%   | 0.0%  | 0.0% | 0.0%     | 0.0%  | 0.0%  | 4.0%  | 0.0%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.0% | 0.0%  | 0.0%  | 25.5% |
| S136                        | Southern Colorado Plateau Sand Shrubland                      | 79              | 4.9%  | 0.0% | 0.0% | 0.0%  | 0.0%   | 0.0%  | 0.0% | 0.0%     | 84.4% | 0.0%  | 2.0%  | 0.0%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.0% | 0.0%  | 0.0%  | 8.6%  |
| S138                        | Western Great Plains Mesquite Woodland and Shrubland          | 1,787           | 0.3%  | 0.0% | 0.0% | 0.1%  | 0.0%   | 0.0%  | 0.0% | 0.0%     | 0.0%  | 0.2%  | 12.2% | 0.1%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.0% | 0.0%  | 0.0%  | 87.0% |
| S048                        | Western Great Plains Sandhill Shrubland                       | 5,212           | 30.9% | 0.0% | 0.0% | 0.1%  | 0.3%   | 0.0%  | 0.0% | 0.0%     | 0.0%  | 0.0%  | 21.3% | 0.9%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 0.0% | 0.8%  | 0.0%  | 45.6% |
| <b>GRASSLAND/HERBACEOUS</b> |   |                 |       |      |      |       |        |       |      |          |       |       |       |       |       |      |      |        |      |      |      |       |       |       |
| S077                        | Apacherian-Chihuahuan Semi-Desert Grassland and Steppe        | 34,357          | 35.8% | 0.0% | 1.9% | 3.0%  | 8.2%   | 0.4%  | 0.1% | 0.0%     | 0.2%  | 0.1%  | 17.1% | 0.0%  | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0% | 0.0% | 2.2% | 0.4%  | 2.8%  | 27.7% |



| Code  | Land Cover Type                                    | Area in NM      | BLM   | BOR   | FWS  | USFS  | DOD/DOE | NPS  | ARS  | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wildl | Other State | Reg. Gov | City | County | Aud  | Land Trust | TNC  | Priv-BioDiv | Priv  |
|---|--|-----------------|-------|-------|------|-------|---------|------|------|---------------|------------|------------|------------|-------------|-------------|----------|------|--------|------|------------|------|-------------|-------|
|   |  | km <sup>2</sup> | %     | %     | %    | %     | %       | %    | %    | %             | %          | %          | %          | %           | %           | %        | %    | %      | %    | %          | %    | %           | %     |
| <b>ALTERED or DISTURBED</b>   |  |                 |       |       |      |       |         |      |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |
| D09   | Invasive Annual and Biennial Forbland              | 48              | 12.5% | 0.0%  | 0.0% | 0.1%  | 0.0%    | 0.0% | 0.0% | 0.0%          | 3.0%       | 0.0%       | 4.3%       | 1.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 78.6% |
| D06   | Invasive Perennial Grassland                       | 30              | 4.4%  | 0.0%  | 0.0% | 2.4%  | 0.0%    | 0.0% | 0.0% | 0.0%          | 83.2%      | 0.0%       | 0.1%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 4.9%        | 2.9%  |
| D04   | Invasive Southwest Riparian Woodland and Shrubland | 27              | 5.4%  | 0.0%  | 0.0% | 0.0%  | 0.0%    | 0.0% | 0.0% | 0.0%          | 58.1%      | 0.0%       | 1.1%       | 0.4%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 34.3% |
| D02   | Recently Burned                                    | 806             | 1.1%  | 0.0%  | 0.0% | 26.5% | 0.4%    | 0.4% | 0.0% | 0.0%          | 2.4%       | 0.0%       | 17.4%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 2.5%       | 0.0% | 1.6%        | 47.8% |
| D11   | Recently Chained Pinyon-Juniper Areas              | <1              | 0.0%  | 0.0%  | 0.0% | 10.3% | 0.0%    | 0.0% | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 1.0%        | 88.6% |
| D10   | Recently Logged Areas                              | 8               | 0.8%  | 0.0%  | 0.0% | 70.3% | 0.0%    | 0.0% | 0.0% | 0.0%          | 0.9%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 1.0%        | 26.3% |
| D03   | Recently Mined or Quarried                         | 182             | 5.2%  | 0.0%  | 0.0% | 0.3%  | 0.0%    | 0.0% | 0.0% | 0.0%          | 35.2%      | 0.0%       | 1.2%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 55.6% |
| <b>DEVELOPED and AGRICULTURE</b>  |  |                 |       |       |      |       |         |      |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |
| N80   | Agriculture  | 6,025           | 0.2%  | 0.0%  | 0.2% | 0.2%  | 0.0%    | 0.0% | 0.0% | 0.0%          | 6.5%       | 0.0%       | 3.9%       | 0.2%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.1%        | 88.7% |
| N22   | Developed, Medium - High Intensity                 | 1,108           | 1.8%  | 0.0%  | 0.2% | 0.1%  | 3.0%    | 0.0% | 0.0% | 0.0%          | 2.2%       | 0.1%       | 1.7%       | 0.0%        | 0.0%        | 0.0%     | 0.3% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.6%        | 89.9% |
| N21   | Developed, Open Space - Low Intensity              | 977             | 0.7%  | 0.0%  | 0.0% | 0.2%  | 4.3%    | 0.1% | 0.0% | 0.0%          | 3.5%       | 0.0%       | 1.4%       | 0.0%        | 0.0%        | 0.0%     | 0.4% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.4%        | 88.6% |
| <b>OTHER COVER TYPES</b>  |  |                 |       |       |      |       |         |      |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |
| N31   | Barren Lands, Non-specific                         | 54              | 4.0%  | 0.0%  | 0.0% | 0.0%  | 0.0%    | 0.3% | 0.0% | 0.0%          | 86.0%      | 0.0%       | 1.7%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 7.9%  |
| N11   | Open Water   | 792             | 4.9%  | 14.0% | 1.3% | 0.8%  | 2.7%    | 0.1% | 0.0% | 0.0%          | 4.8%       | 2.3%       | 1.5%       | 2.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.4%        | 20.2% |
|   | <b>TOTAL</b>                                       | 314,870         | 17.3% | 0.1%  | 0.5% | 12.0% | 3.3%    | 0.5% | 0.1% | 0.0%          | 10.4%      | 0.1%       | 11.4%      | 0.2%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.4%       | 0.1% | 1.4%        | 42.0% |
| * For Land Stewardship headings: BLM = Bureau of Land Management, BOR = Bureau of Reclamation, FWS= U.S. Fish and Wildlife Service, USFS = U.S. Forest Service, DOD/DOE = Dept. of Defense/Dept. of Energy, NPS = U.S. National Park Service , ARS = Agricultural Research Service, Dept. of Com. = Dept. of Commerce, Nativ Amer = Native American Lands, Reg. Gov. = Regional Government, Aud = Audubon, TNC = The Nature Conservancy, Priv-BioDiv = Private Lands Managed for Biodiversity |  |                 |       |       |      |       |         |      |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |

**Appendix 5-9. Area and percent distribution of each land cover type represented within the four levels of GAP Management Status in the state of New Mexico.**

| Code                    | Land Cover Type  | Area in NM      |                 | Status 1 |                 | Status 2 |                 | Status 3 |                 | Status 4 |                 | Status 1&2 |  |
|-------------------------|--|-----------------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|------------|--|
|                         |  | km <sup>2</sup> | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %          |  |
| <b>BARREN LANDS</b>     |  |                 |                 |          |                 |          |                 |          |                 |          |                 |            |  |
| S010                    | Colorado Plateau Mixed Bedrock Canyon and Tableland                | 2,465           | 11              | 0.4%     | 214             | 8.7%     | 1,694           | 68.7%    | 546             | 22.1%    | 225             | 9.1%       |  |
| S012                    | Inter-Mountain Basins Active and Stabilized Dune                   | 735             | 0               | 0.0%     | 89              | 12.1%    | 80              | 10.8%    | 566             | 77.0%    | 89              | 12.1%      |  |
| S015                    | Inter-Mountain Basins Playa  | 2               | 0               | 0.0%     | 0               | 0.0%     | 1               | 31.9%    | 1               | 68.1%    | 0               | 0.0%       |  |
| S011                    | Inter-Mountain Basins Shale Badland                                | 481             | 1               | 0.2%     | 78              | 16.3%    | 322             | 67.0%    | 80              | 16.5%    | 79              | 16.5%      |  |
| S013                    | Inter-Mountain Basins Volcanic Rock and Cinder Land                | 470             | 0               | 0.0%     | 414             | 88.1%    | 17              | 3.6%     | 39              | 8.3%     | 414             | 88.1%      |  |
| S014                    | Inter-Mountain Basins Wash   | 3               | 0               | 0.0%     | 0               | 1.1%     | 2               | 85.3%    | 0               | 13.6%    | 0               | 1.1%       |  |
| S018                    | North American Warm Desert Active and Stabilized Dune              | 1,695           | 54              | 3.2%     | 59              | 3.5%     | 1,160           | 68.4%    | 422             | 24.9%    | 113             | 6.7%       |  |
| S016                    | North American Warm Desert Bedrock Cliff and Outcrop               | 838             | 3               | 0.4%     | 58              | 6.9%     | 469             | 56.0%    | 308             | 36.7%    | 61              | 7.3%       |  |
| S021                    | North American Warm Desert Pavement                                | 173             | 16              | 9.1%     | 16              | 9.1%     | 90              | 52.1%    | 51              | 29.7%    | 32              | 18.2%      |  |
| S022                    | North American Warm Desert Playa                                   | 515             | 162             | 31.4%    | 9               | 1.8%     | 284             | 55.2%    | 60              | 11.7%    | 171             | 33.2%      |  |
| S019                    | North American Warm Desert Volcanic Rockland                       | 700             | 14              | 2.0%     | 250             | 35.7%    | 235             | 33.5%    | 202             | 28.8%    | 264             | 37.6%      |  |
| S002                    | Rocky Mountain Alpine Bedrock and Scree                            | 7               | 0               | 0.0%     | 0               | 0.0%     | 0               | 5.9%     | 6               | 94.1%    | 0               | 0.0%       |  |
| S004                    | Rocky Mountain Alpine Fell-Field                                   | 0               | 0               | 0.0%     | 0               | 0.0%     | 0               | 36.2%    | 0               | 63.8%    | 0               | 0.0%       |  |
| S006                    | Rocky Mountain Cliff, Canyon and Massive Bedrock                   | 417             | 13              | 3.1%     | 64              | 15.4%    | 199             | 47.8%    | 141             | 33.8%    | 77              | 18.4%      |  |
| S008                    | Western Great Plains Cliff and Outcrop                             | 221             | 0               | 0.0%     | 2               | 1.0%     | 22              | 9.8%     | 198             | 89.2%    | 2               | 1.0%       |  |
| <b>EVERGREEN FOREST</b> |  |                 |                 |          |                 |          |                 |          |                 |          |                 |            |  |
| S039                    | Colorado Plateau Pinyon-Juniper Woodland                           | 27,849          | 156             | 0.6%     | 2,195           | 7.9%     | 14,896          | 53.5%    | 10,602          | 38.1%    | 2,351           | 8.4%       |  |
| S051                    | Madrean Encinal  | 1,350           | 15              | 1.1%     | 324             | 24.0%    | 516             | 38.2%    | 495             | 36.7%    | 339             | 25.1%      |  |
| S035                    | Madrean Pine-Oak Forest and Woodland                               | 1,725           | 15              | 0.9%     | 148             | 8.6%     | 1,297           | 75.2%    | 265             | 15.3%    | 163             | 9.5%       |  |
| S112                    | Madrean Pinyon-Juniper Woodland                                    | 8,754           | 52              | 0.6%     | 653             | 7.5%     | 4,346           | 49.6%    | 3,703           | 42.3%    | 705             | 8.1%       |  |
| S111                    | Madrean Upper Montane Conifer-Oak Forest and Woodland              | 672             | 3               | 0.5%     | 63              | 9.4%     | 566             | 84.3%    | 39              | 5.8%     | 66              | 9.9%       |  |
| S032                    | Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland | 2,864           | 65              | 2.3%     | 902             | 31.5%    | 1,365           | 47.7%    | 532             | 18.6%    | 967             | 33.8%      |  |
| S031                    | Rocky Mountain Lodgepole Pine Forest                               | 7               | 0               | 0.0%     | 1               | 8.2%     | 2               | 22.0%    | 5               | 69.8%    | 1               | 8.2%       |  |
| S034                    | Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland     | 1,610           | 90              | 5.6%     | 424             | 26.4%    | 780             | 48.5%    | 315             | 19.6%    | 514             | 31.9%      |  |

| Code | Land Cover Type   | Area in NM      |                 | Status 1 |                 | Status 2 |                 | Status 3 |                 | Status 4 |                 | Status 1&2 |  |
|------|---|-----------------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|------------|--|
|      |   | km <sup>2</sup> | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %          |  |
|      |   |                 |                 |          |                 |          |                 |          |                 |          |                 |            |  |
| S028 | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland | 982             | 5               | 0.5%     | 354             | 36.1%    | 330             | 33.6%    | 292             | 29.8%    | 359             | 36.6%      |  |
| S030 | Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland     | 640             | 18              | 2.9%     | 257             | 40.2%    | 207             | 32.4%    | 158             | 24.6%    | 275             | 43.0%      |  |
| S025 | Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland | 376             | 0               | 0.0%     | 129             | 34.4%    | 152             | 40.5%    | 95              | 25.1%    | 129             | 34.4%      |  |
| S038 | Southern Rocky Mountain Pinyon-Juniper Woodland                   | 10,465          | 62              | 0.6%     | 592             | 5.7%     | 3,273           | 31.3%    | 6,539           | 62.5%    | 654             | 6.2%       |  |
| S036 | Southern Rocky Mountain Ponderosa Pine Woodland                   | 21,160          | 869             | 4.1%     | 2,428           | 11.5%    | 12,520          | 59.2%    | 5,342           | 25.2%    | 3,297           | 15.6%      |  |

**DECIDUOUS FOREST**

|      |   |       |    |       |     |       |     |       |     |       |     |       |
|------|---|-------|----|-------|-----|-------|-----|-------|-----|-------|-----|-------|
| S023 | Rocky Mountain Aspen Forest and Woodland      | 1,483 | 99 | 6.7%  | 422 | 28.5% | 618 | 41.7% | 343 | 23.1% | 522 | 35.2% |
| S024 | Rocky Mountain Bigtooth Maple Ravine Woodland | 0     | 0  | 32.2% | 0   | 30.4% | 0   | 37.4% | 0   | 0.0%  | 0   | 62.6% |

**MIXED FOREST**

|      |   |     |   |      |    |       |    |       |    |       |    |       |
|------|---|-----|---|------|----|-------|----|-------|----|-------|----|-------|
| S042 | Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland | 182 | 1 | 0.3% | 32 | 17.8% | 91 | 50.2% | 58 | 31.7% | 33 | 18.1% |
|------|---|-----|---|------|----|-------|----|-------|----|-------|----|-------|

**SHRUB/SCRUB**

|      |  |        |     |       |       |       |        |       |       |       |       |       |
|------|--|--------|-----|-------|-------|-------|--------|-------|-------|-------|-------|-------|
| S058 | Apacherian-Chihuahuan Mesquite Upland Scrub            | 15,120 | 51  | 0.3%  | 251   | 1.7%  | 5,608  | 37.1% | 9,210 | 60.9% | 302   | 2.0%  |
| S062 | Chihuahuan Mixed Desert and Thorn Scrub                | 21,066 | 115 | 0.5%  | 1,029 | 4.9%  | 11,491 | 54.5% | 8,431 | 40.0% | 1,144 | 5.4%  |
| S116 | Chihuahuan Mixed Salt Desert Scrub                     | 1,590  | 60  | 3.8%  | 93    | 5.8%  | 856    | 53.8% | 581   | 36.5% | 153   | 9.6%  |
| S068 | Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub | 5,537  | 80  | 1.4%  | 57    | 1.0%  | 4,101  | 74.1% | 1,300 | 23.5% | 136   | 2.5%  |
| S061 | Chihuahuan Succulent Desert Scrub                      | 78     | 2   | 2.4%  | 5     | 6.0%  | 33     | 43.0% | 38    | 48.5% | 7     | 8.5%  |
| S117 | Coahuilan Chaparral                                    | 93     | 27  | 28.4% | 12    | 13.3% | 45     | 48.3% | 9     | 10.0% | 39    | 41.7% |
| S059 | Colorado Plateau Blackbrush-Mormon-tea Shrubland       | 141    | 0   | 0.1%  | 5     | 3.7%  | 106    | 75.0% | 30    | 21.3% | 5     | 3.8%  |
| S056 | Colorado Plateau Mixed Low Sagebrush Shrubland         | 329    | 0   | 0.0%  | 42    | 12.7% | 118    | 36.0% | 168   | 51.2% | 42    | 12.8% |
| S054 | Inter-Mountain Basins Big Sagebrush Shrubland          | 3,929  | 1   | 0.0%  | 116   | 3.0%  | 2,027  | 51.6% | 1,785 | 45.4% | 118   | 3.0%  |
| S065 | Inter-Mountain Basins Mixed Salt Desert Scrub          | 3,777  | 1   | 0.0%  | 160   | 4.2%  | 1,957  | 51.8% | 1,660 | 43.9% | 161   | 4.3%  |
| S057 | Mogollon Chaparral                                     | 870    | 18  | 2.1%  | 132   | 15.1% | 454    | 52.2% | 266   | 30.6% | 150   | 17.2% |
| S046 | Rocky Mountain Gambel Oak-Mixed Montane Shrubland      | 1,888  | 12  | 0.7%  | 135   | 7.1%  | 615    | 32.6% | 1,126 | 59.6% | 147   | 7.8%  |
| S047 | Rocky Mountain Lower Montane-Foothill Shrubland        | 266    | 0   | 0.0%  | 4     | 1.6%  | 27     | 10.3% | 234   | 88.1% | 4     | 1.7%  |
| S069 | Sonora-Mojave Creosotebush-White Bursage Desert Scrub  | 0      | 0   | 0.0%  | 0     | 0.0%  | 0      | 10.5% | 0     | 89.5% | 0     | 0.0%  |
| S129 | Sonoran Mid-Elevation Desert Scrub                     | 2      | 0   | 0.0%  | 0     | 10.7% | 1      | 44.7% | 1     | 44.6% | 0     | 10.7% |
| S063 | Sonoran Paloverde-Mixed Cacti Desert Scrub             | 0      | 0   | 0.0%  | 0     | 66.3% | 0      | 4.2%  | 0     | 29.5% | 0     | 66.3% |
| S136 | Southern Colorado Plateau Sand Shrubland               | 79     | 0   | 0.0%  | 1     | 1.2%  | 67     | 84.7% | 11    | 14.1% | 1     | 1.2%  |
| S138 | Western Great Plains Mesquite Woodland and Shrubland   | 1,787  | 0   | 0.0%  | 3     | 0.2%  | 12     | 0.7%  | 1,772 | 99.2% | 3     | 0.2%  |

| Code                               | Land Cover Type  | Area in         | Status 1        |       | Status 2        |       | Status 3        |       | Status 4        |        | Status 1&2      |       |
|------------------------------------|--|-----------------|-----------------|-------|-----------------|-------|-----------------|-------|-----------------|--------|-----------------|-------|
|                                    |  | km <sup>2</sup> | km <sup>2</sup> | %     | km <sup>2</sup> | %     | km <sup>2</sup> | %     | km <sup>2</sup> | %      | km <sup>2</sup> | %     |
| S048                               | Western Great Plains Sandhill Shrubland                                  | 5,208           | 21              | 0.4%  | 88              | 1.7%  | 1,600           | 30.7% | 3,499           | 67.2%  | 109             | 2.1%  |
| <b>GRASSLAND/HERBACEOUS</b>        |  |                 |                 |       |                 |       |                 |       |                 |        |                 |       |
| S077                               | Apacherian-Chihuahuan Semi-Desert Grassland and Steppe                   | 34,343          | 258             | 0.8%  | 2,436           | 7.1%  | 15,331          | 44.6% | 16,318          | 47.5%  | 2,694           | 7.8%  |
| S080                               | Chihuahuan Gypsophilous Grassland and Steppe                             | 803             | 150             | 18.7% | 3               | 0.4%  | 588             | 73.3% | 61              | 7.6%   | 154             | 19.1% |
| S113                               | Chihuahuan Sandy Plains Semi-Desert Grassland                            | 969             | 17              | 1.7%  | 27              | 2.8%  | 409             | 42.2% | 517             | 53.3%  | 44              | 4.5%  |
| S109                               | Chihuahuan-Sonoran Desert Bottomland and Swale Grassland                 | 0               | 0               | 0.0%  | 0               | 0.0%  | 0               | 0.0%  | 0               | 100.0% | 0               | 0.0%  |
| S075                               | Inter-Mountain Basins Juniper Savanna                                    | 1,297           | 0               | 0.0%  | 82              | 6.3%  | 543             | 41.8% | 673             | 51.8%  | 82              | 6.3%  |
| S071                               | Inter-Mountain Basins Montane Sagebrush Steppe                           | 282             | 1               | 0.5%  | 23              | 8.1%  | 75              | 26.7% | 183             | 64.7%  | 24              | 8.6%  |
| S090                               | Inter-Mountain Basins Semi-Desert Grassland                              | 16,390          | 11              | 0.1%  | 652             | 4.0%  | 7,154           | 43.6% | 8,573           | 52.3%  | 663             | 4.0%  |
| S079                               | Inter-Mountain Basins Semi-Desert Shrub-Steppe                           | 14,466          | 8               | 0.1%  | 566             | 3.9%  | 6,822           | 47.2% | 7,071           | 48.9%  | 574             | 4.0%  |
| S115                               | Madrean Juniper Savanna  | 657             | 5               | 0.8%  | 26              | 4.0%  | 259             | 39.4% | 367             | 55.8%  | 32              | 4.8%  |
| S081                               | Rocky Mountain Dry Tundra  | 19              | 0               | 0.0%  | 0               | 0.0%  | 1               | 4.1%  | 18              | 95.9%  | 0               | 0.0%  |
| S083                               | Rocky Mountain Subalpine Mesic Meadow                                    | 147             | 0               | 0.0%  | 27              | 18.3% | 51              | 34.4% | 70              | 47.3%  | 27              | 18.3% |
| S074                               | Southern Rocky Mountain Juniper Woodland and Savanna                     | 9,803           | 23              | 0.2%  | 150             | 1.5%  | 971             | 9.9%  | 8,659           | 88.3%  | 173             | 1.8%  |
| S085                               | Southern Rocky Mountain Montane-Subalpine Grassland                      | 1,855           | 5               | 0.2%  | 426             | 22.9% | 689             | 37.2% | 735             | 39.6%  | 430             | 23.2% |
| S086                               | Western Great Plains Foothill and Piedmont Grassland                     | 701             | 7               | 1.0%  | 12              | 1.6%  | 146             | 20.8% | 537             | 76.6%  | 18              | 2.6%  |
| S088                               | Western Great Plains Shortgrass Prairie                                  | 67,399          | 38              | 0.1%  | 102             | 0.2%  | 3,830           | 5.7%  | 63,429          | 94.1%  | 140             | 0.2%  |
| <b>WOODY WETLAND</b>               |  |                 |                 |       |                 |       |                 |       |                 |        |                 |       |
| S096                               | Inter-Mountain Basins Greasewood Flat                                    | 2,264           | 5               | 0.2%  | 91              | 4.0%  | 1,494           | 66.0% | 674             | 29.7%  | 97              | 4.3%  |
| S094                               | North American Warm Desert Lower Montane Riparian Woodland and Shrubland | 191             | 1               | 0.6%  | 29              | 15.5% | 60              | 31.4% | 100             | 52.5%  | 31              | 16.1% |
| S098                               | North American Warm Desert Riparian Mesquite Bosque                      | 3               | 0               | 0.0%  | 1               | 20.9% | 1               | 30.7% | 1               | 48.4%  | 1               | 20.9% |
| S097                               | North American Warm Desert Riparian Woodland and Shrubland               | 122             | 11              | 8.9%  | 10              | 8.0%  | 46              | 37.5% | 56              | 45.7%  | 21              | 16.8% |
| S020                               | North American Warm Desert Wash  | 197             | 3               | 1.3%  | 8               | 3.8%  | 55              | 27.9% | 132             | 67.0%  | 10              | 5.1%  |
| S093                               | Rocky Mountain Lower Montane Riparian Woodland and Shrubland             | 783             | 3               | 0.3%  | 41              | 5.2%  | 288             | 36.7% | 452             | 57.7%  | 43              | 5.5%  |
| S091                               | Rocky Mountain Subalpine-Montane Riparian Shrubland                      | 103             | 0               | 0.0%  | 15              | 14.9% | 38              | 37.2% | 49              | 48.0%  | 15              | 14.9% |
| S092                               | Rocky Mountain Subalpine-Montane Riparian Woodland                       | 5               | 0               | 0.0%  | 1               | 10.0% | 0               | 6.4%  | 4               | 83.6%  | 1               | 10.0% |
| S095                               | Western Great Plains Riparian Woodland and Shrubland                     | 851             | 2               | 0.2%  | 77              | 9.0%  | 81              | 9.5%  | 691             | 81.3%  | 78              | 9.2%  |
| <b>EMERGENT HERBACEOUS WETLAND</b> |  |                 |                 |       |                 |       |                 |       |                 |        |                 |       |
| S100                               | North American Arid West Emergent Marsh                                  | 85              | 0               | 0.4%  | 3               | 3.4%  | 27              | 32.1% | 54              | 64.1%  | 3               | 3.8%  |
| S102                               | Rocky Mountain Alpine-Montane Wet Meadow                                 | 136             | 0               | 0.0%  | 11              | 7.8%  | 43              | 31.4% | 83              | 60.8%  | 11              | 7.8%  |
| S108                               | Western Great Plains Saline Depression Wetland                           | 20              | 0               | 0.0%  | 0               | 1.0%  | 8               | 38.4% | 12              | 60.6%  | 0               | 1.0%  |

| Code                             | Land Cover Type                                    | Area in | Status 1        |                 | Status 2 |                 | Status 3 |                 | Status 4 |                 | Status 1&2 |                 |
|----------------------------------|--|---------|-----------------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|------------|-----------------|
|                                  |  | NM      | km <sup>2</sup> | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %          | km <sup>2</sup> |
| <b>ALTERED or DISTURBED</b>      |  |         |                 |                 |          |                 |          |                 |          |                 |            |                 |
| D09                              | Invasive Annual and Biennial Forbland              | 48      | 0               | 0.0%            | 3        | 6.5%            | 5        | 10.0%           | 40       | 83.5%           | 3          | 6.5%            |
| D06                              | Invasive Perennial Grassland                       | 29      | 0               | 0.0%            | 0        | 0.1%            | 27       | 91.8%           | 2        | 8.1%            | 0          | 0.1%            |
| D04                              | Invasive Southwest Riparian Woodland and Shrubland | 27      | 0               | 0.0%            | 1        | 3.4%            | 17       | 61.2%           | 10       | 35.4%           | 1          | 3.4%            |
| D02                              | Recently Burned                                    | 806     | 13              | 1.6%            | 32       | 4.0%            | 211      | 26.2%           | 549      | 68.2%           | 45         | 5.6%            |
| D11                              | Recently Chained Pinyon-Juniper Areas              | 0       | 0               | 0.0%            | 0        | 0.0%            | 0        | 10.3%           | 0        | 89.7%           | 0          | 0.0%            |
| D10                              | Recently Logged Areas                              | 8       | 0               | 0.0%            | 0        | 2.6%            | 5        | 70.0%           | 2        | 27.5%           | 0          | 2.6%            |
| D03                              | Recently Mined or Quarried                         | 177     | 0               | 0.0%            | 0        | 0.0%            | 74       | 41.7%           | 103      | 58.3%           | 0          | 0.0%            |
| <b>DEVELOPED and AGRICULTURE</b> |  |         |                 |                 |          |                 |          |                 |          |                 |            |                 |
| N80                              | Agriculture  | 6,026   | 0               | 0.0%            | 25       | 0.4%            | 343      | 5.7%            | 5,658    | 93.9%           | 25         | 0.4%            |
| N22                              | Developed, Medium - High Intensity                 | 1,107   | 0               | 0.0%            | 3        | 0.3%            | 61       | 5.6%            | 1,043    | 94.1%           | 3          | 0.3%            |
| N21                              | Developed, Open Space - Low Intensity              | 975     | 0               | 0.0%            | 3        | 0.3%            | 59       | 6.0%            | 913      | 93.6%           | 3          | 0.3%            |
| <b>OTHER COVER TYPES</b>         |  |         |                 |                 |          |                 |          |                 |          |                 |            |                 |
| N31                              | Barren Lands, Non-specific                         | 54      | 0               | 0.0%            | 1        | 1.5%            | 48       | 88.8%           | 5        | 9.7%            | 1          | 1.5%            |
| N11                              | Open Water   | 438     | 2               | 0.4%            | 34       | 7.9%            | 211      | 48.2%           | 191      | 43.5%           | 36         | 8.3%            |
|                                  | <b>TOTAL</b>                                       | 314,189 | 2,678           | 0.9%            | 17,230   | 5.5%            | 114,723  | 36.5%           | 179,559  | 57.1%           | 19,908     | 6.3%            |

### Appendix 5-10. Percent distribution of each land cover type among 22 land stewards in the state of Nevada.

| Code                    | Land Cover Type  | Area in NV      | BLM   | BOR  | FWS   | USFS  | DOD/DOE | NPS   | ARS  | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wildl | Other State | Reg. Gov | City | County | Aud  | Land Trust | TNC  | Priv-BioDiv | Priv |       |
|-------------------------|--|-----------------|-------|------|-------|-------|---------|-------|------|---------------|------------|------------|------------|-------------|-------------|----------|------|--------|------|------------|------|-------------|------|-------|
|                         |  | km <sup>2</sup> | %     | %    | %     | %     | %       | %     | %    | %             | %          | %          | %          | %           | %           | %        | %    | %      | %    | %          | %    | %           | %    | %     |
| <b>BARREN LANDS</b>     |  |                 |       |      |       |       |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |      |       |
| S010                    | Colorado Plateau Mixed Bedrock Canyon and Tableland                  | 2               | 98.0% | 0.0% | 0.0%  | 0.0%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 2.0%  |
| S012                    | Inter-Mountain Basins Active and Stabilized Dune                     | 79              | 46.1% | 3.2% | 0.6%  | 0.2%  | 18.9%   | 0.0%  | 0.0% | 0.0%          | 11.5%      | 0.3%       | 0.0%       | 0.2%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 18.7% |
| S009                    | Inter-Mountain Basins Cliff and Canyon                               | 2,487           | 70.0% | 0.0% | 1.7%  | 15.6% | 2.6%    | 0.2%  | 0.0% | 0.0%          | 1.8%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 7.9%  |
| S015                    | Inter-Mountain Basins Playa  | 6,234           | 75.5% | 2.4% | 2.6%  | 0.0%  | 5.5%    | 0.0%  | 0.0% | 0.0%          | 1.9%       | 0.0%       | 0.3%       | 0.5%        | 0.0%        | 0.0%     | 0.0% | 0.7%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 8.1%  |
| S014                    | Inter-Mountain Basins Wash   | 18              | 79.1% | 0.0% | 0.0%  | 0.0%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.2%       | 0.1%       | 0.0%       | 3.2%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.1%        | 0.0% | 17.2% |
| S003                    | Mediterranean California Alpine Bedrock and Scree                    | 23              | 1.1%  | 0.0% | 0.0%  | 74.0% | 24.4%   | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 0.5%  |
| S018                    | North American Warm Desert Active and Stabilized Dune                | 16              | 73.9% | 0.0% | 17.5% | 0.0%  | 3.2%    | 0.0%  | 0.0% | 0.0%          | 5.1%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 0.0%  |
| S017                    | North American Warm Desert Badland                                   | 78              | 20.0% | 8.6% | 0.0%  | 0.0%  | 0.3%    | 48.6% | 0.0% | 0.0%          | 0.2%       | 2.9%       | 0.0%       | 8.6%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 10.4% |
| S016                    | North American Warm Desert Bedrock Cliff and Outcrop                 | 1,842           | 57.6% | 0.5% | 28.8% | 1.5%  | 1.6%    | 6.9%  | 0.0% | 0.0%          | 0.2%       | 0.9%       | 0.0%       | 0.2%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 1.8%  |
| S021                    | North American Warm Desert Pavement                                  | 168             | 32.3% | 3.0% | 2.7%  | 0.0%  | 3.2%    | 22.9% | 0.0% | 0.0%          | 2.2%       | 0.5%       | 0.0%       | 0.2%        | 0.0%        | 0.0%     | 0.0% | 0.1%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 32.8% |
| S022                    | North American Warm Desert Playa                                     | 527             | 39.6% | 0.0% | 29.5% | 0.0%  | 15.0%   | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.8%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.1% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 0.0% | 14.6% |
| S019                    | North American Warm Desert Volcanic Rockland                         | 78              | 30.9% | 0.0% | 2.2%  | 0.0%  | 4.5%    | 62.3% | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 0.0%  |
| S002                    | Rocky Mountain Alpine Bedrock and Scree                              | 148             | 1.7%  | 0.0% | 0.0%  | 84.0% | 0.0%    | 12.8% | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 1.5%  |
| S007                    | Sierra Nevada Cliff and Canyon                                       | 123             | 37.1% | 0.0% | 0.0%  | 32.7% | 7.4%    | 0.0%  | 0.0% | 0.0%          | 2.5%       | 0.2%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.1% | 0.2%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 0.0% | 19.6% |
| <b>EVERGREEN FOREST</b> |  |                 |       |      |       |       |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |      |       |
| S040                    | Great Basin Pinyon-Juniper Woodland                                  | 36,376          | 63.7% | 0.0% | 1.0%  | 24.6% | 3.6%    | 0.4%  | 0.0% | 0.0%          | 0.5%       | 0.1%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 6.0%  |
| S026                    | Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland     | 635             | 15.7% | 0.0% | 2.5%  | 72.9% | 0.4%    | 7.4%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 1.1%  |
| S033                    | Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland | 2               | 0.0%  | 0.0% | 0.0%  | 88.2% | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 8.3%       | 0.0%       | 0.0%        | 0.0%        | 0.3%     | 0.0% | 0.5%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 2.8%  |
| S123                    | Mediterranean California Ponderosa-Jeffrey Pine Forest and Woodland  | 209             | 0.0%  | 0.0% | 0.0%  | 69.7% | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.1%       | 8.8%       | 0.0%       | 0.0%        | 2.7%        | 0.3%     | 0.0% | 0.8%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 17.5% |
| S121                    | Mediterranean California Red Fir Forest and Woodland                 | 105             | 0.0%  | 0.0% | 0.0%  | 78.5% | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 13.8%      | 0.0%       | 0.0%        | 0.3%        | 0.0%     | 0.0% | 0.6%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 6.8%  |
| S029                    | Northern Pacific Mesic Subalpine Parkland                            | 42              | 0.2%  | 0.0% | 0.0%  | 96.1% | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.1%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 3.5%  |
| S032                    | Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland   | 196             | 15.6% | 0.0% | 21.7% | 56.6% | 0.2%    | 2.3%  | 0.0% | 0.0%          | 0.3%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.1%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 3.2%  |
| S034                    | Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland       | 216             | 19.5% | 0.0% | 11.6% | 58.5% | 0.1%    | 7.8%  | 0.0% | 0.0%          | 0.1%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 2.2%  |
| S028                    | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland    | 190             | 7.2%  | 0.0% | 0.0%  | 82.8% | 3.2%    | 5.1%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 1.7%  |
| S030                    | Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland        | 175             | 7.2%  | 0.0% | 0.0%  | 81.4% | 3.3%    | 4.9%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 3.1%  |
| S025                    | Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland    | 14              | 5.5%  | 0.0% | 0.0%  | 88.2% | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 6.3%  |
| S122                    | Sierra Nevada Subalpine Lodgepole Pine Forest and Woodland           | 20              | 0.8%  | 0.0% | 0.0%  | 85.6% | 0.1%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 6.9%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.1%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 6.3%  |



| Code                        | Land Cover Type  | Area in NV      | BLM    | BOR  | FWS   | USFS  | DOD/<br>DOE | NPS   | ARS  | Dept. of<br>Com. | Nativ<br>Amer | State<br>Park | State<br>Schl | State<br>Wildl | Other<br>State | Reg.<br>Gov | City | County | Aud  | Land<br>Trust | TNC  | Priv-<br>BioDiv | Priv  |
|-----------------------------|--|-----------------|--------|------|-------|-------|-------------|-------|------|------------------|---------------|---------------|---------------|----------------|----------------|-------------|------|--------|------|---------------|------|-----------------|-------|
|                             |  | km <sup>2</sup> | %      | %    | %     | %     | %           | %     | %    | %                | %             | %             | %             | %              | %              | %           | %    | %      | %    | %             | %    | %               | %     |
| S036                        | Southern Rocky Mountain Ponderosa Pine Woodland                          | 7               | 91.7%  | 0.0% | 0.0%  | 4.6%  | 0.0%        | 3.6%  | 0.0% | 0.0%             | 0.0%          | 0.0%          | 0.0%          | 0.0%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 0.0%  |
| <b>DECIDUOUS FOREST</b>     |  |                 |        |      |       |       |             |       |      |                  |               |               |               |                |                |             |      |        |      |               |      |                 |       |
| S023                        | Rocky Mountain Aspen Forest and Woodland                                 | 1,289           | 19.4%  | 0.0% | 2.1%  | 62.3% | 0.0%        | 0.8%  | 0.0% | 0.0%             | 2.4%          | 0.0%          | 0.0%          | 0.0%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 12.9% |
| S024                        | Rocky Mountain Bigtooth Maple Ravine Woodland                            | 1               | 9.9%   | 0.0% | 0.0%  | 0.0%  | 0.0%        | 1.0%  | 0.0% | 0.0%             | 0.0%          | 0.0%          | 0.0%          | 0.0%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 89.1% |
| <b>MIXED FOREST</b>         |  |                 |        |      |       |       |             |       |      |                  |               |               |               |                |                |             |      |        |      |               |      |                 |       |
| S042                        | Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland            | 84              | 21.8%  | 0.0% | 0.0%  | 54.9% | 0.0%        | 21.9% | 0.0% | 0.0%             | 0.0%          | 0.0%          | 0.0%          | 0.0%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 1.4%  |
| <b>SHRUB/SCRUB</b>          |  |                 |        |      |       |       |             |       |      |                  |               |               |               |                |                |             |      |        |      |               |      |                 |       |
| S059                        | Colorado Plateau Blackbrush-Mormon-tea Shrubland                         | 4               | 100.0% | 0.0% | 0.0%  | 0.0%  | 0.0%        | 0.0%  | 0.0% | 0.0%             | 0.0%          | 0.0%          | 0.0%          | 0.0%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 0.0%  |
| S053                        | Great Basin Semi-Desert Chaparral  | 162             | 5.9%   | 0.0% | 0.0%  | 76.4% | 0.1%        | 0.0%  | 0.0% | 0.0%             | 0.8%          | 2.5%          | 0.0%          | 0.0%           | 0.8%           | 0.0%        | 0.0% | 0.1%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 13.3% |
| S055                        | Great Basin Xeric Mixed Sagebrush Shrubland                              | 31,798          | 78.6%  | 0.0% | 2.4%  | 6.2%  | 3.5%        | 0.2%  | 0.0% | 0.0%             | 0.7%          | 0.0%          | 0.0%          | 0.0%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 8.4%  |
| S054                        | Inter-Mountain Basins Big Sagebrush Shrubland                            | 66,018          | 76.1%  | 0.0% | 1.7%  | 2.8%  | 3.0%        | 0.0%  | 0.0% | 0.0%             | 1.1%          | 0.0%          | 0.0%          | 0.0%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 15.1% |
| S065                        | Inter-Mountain Basins Mixed Salt Desert Scrub                            | 50,646          | 76.0%  | 0.4% | 0.2%  | 1.2%  | 8.3%        | 0.0%  | 0.0% | 0.0%             | 3.6%          | 0.1%          | 0.0%          | 0.1%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 10.0% |
| S050                        | Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland           | 1,924           | 45.6%  | 0.0% | 3.1%  | 44.0% | 0.0%        | 3.1%  | 0.0% | 0.0%             | 0.1%          | 0.0%          | 0.0%          | 0.0%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 4.0%  |
| S057                        | Mogollon Chaparral   | 425             | 98.5%  | 0.0% | 0.0%  | 0.0%  | 0.0%        | 0.0%  | 0.0% | 0.0%             | 0.0%          | 1.1%          | 0.0%          | 0.0%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 0.4%  |
| S060                        | Mojave Mid-Elevation Mixed Desert Scrub                                  | 10,520          | 56.6%  | 0.0% | 21.8% | 3.9%  | 15.4%       | 1.7%  | 0.0% | 0.0%             | 0.0%          | 0.0%          | 0.0%          | 0.0%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 0.6%  |
| S046                        | Rocky Mountain Gambel Oak-Mixed Montane Shrubland                        | 108             | 97.9%  | 0.0% | 0.0%  | 0.1%  | 0.0%        | 0.1%  | 0.0% | 0.0%             | 0.0%          | 0.4%          | 0.0%          | 0.0%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 1.4%  |
| S069                        | Sonora-Mojave Creosotebush-White Bursage Desert Scrub                    | 19,031          | 62.6%  | 0.5% | 10.2% | 0.0%  | 6.5%        | 8.4%  | 0.0% | 0.0%             | 1.4%          | 0.8%          | 0.0%          | 0.1%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 9.3%  |
| S070                        | Sonora-Mojave Mixed Salt Desert Scrub                                    | 1,528           | 42.3%  | 0.0% | 24.9% | 0.1%  | 20.6%       | 0.8%  | 0.0% | 0.0%             | 0.2%          | 0.2%          | 0.0%          | 0.0%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 10.9% |
| S114                        | Sonora-Mojave Semi-Desert Chaparral                                      | 86              | 9.2%   | 0.0% | 6.2%  | 83.5% | 0.0%        | 0.0%  | 0.0% | 0.0%             | 0.0%          | 0.0%          | 0.0%          | 0.0%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 1.2%  |
| <b>GRASSLAND/HERBACEOUS</b> |  |                 |        |      |       |       |             |       |      |                  |               |               |               |                |                |             |      |        |      |               |      |                 |       |
| S078                        | Inter-Mountain Basins Big Sagebrush Steppe                               | 1,275           | 61.3%  | 0.0% | 0.8%  | 1.0%  | 0.2%        | 0.0%  | 0.0% | 0.0%             | 2.2%          | 0.0%          | 0.0%          | 0.0%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 34.5% |
| S075                        | Inter-Mountain Basins Juniper Savanna                                    | 1               | 58.8%  | 0.0% | 32.0% | 0.0%  | 0.0%        | 0.0%  | 0.0% | 0.0%             | 0.0%          | 0.0%          | 0.0%          | 0.0%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 9.2%  |
| S071                        | Inter-Mountain Basins Montane Sagebrush Steppe                           | 17,816          | 49.6%  | 0.0% | 2.3%  | 30.3% | 0.3%        | 0.2%  | 0.0% | 0.0%             | 0.7%          | 0.0%          | 0.0%          | 0.0%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 16.6% |
| S090                        | Inter-Mountain Basins Semi-Desert Grassland                              | 3,113           | 42.8%  | 0.4% | 2.2%  | 5.4%  | 0.2%        | 0.0%  | 0.0% | 0.0%             | 2.0%          | 0.1%          | 0.0%          | 0.5%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 45.9% |
| S079                        | Inter-Mountain Basins Semi-Desert Shrub-Steppe                           | 5,974           | 63.8%  | 0.0% | 9.2%  | 1.6%  | 21.1%       | 1.0%  | 0.0% | 0.0%             | 0.6%          | 0.0%          | 0.0%          | 0.1%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 2.6%  |
| S134                        | North Pacific Montane Grassland  | 27              | 9.1%   | 0.0% | 0.0%  | 80.7% | 0.8%        | 0.0%  | 0.0% | 0.0%             | 0.0%          | 2.1%          | 0.0%          | 0.0%           | 0.3%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.2% | 0.0%            | 6.7%  |
| S081                        | Rocky Mountain Dry Tundra  | 20              | 1.3%   | 0.0% | 0.0%  | 89.5% | 0.0%        | 6.8%  | 0.0% | 0.0%             | 0.0%          | 0.0%          | 0.0%          | 0.0%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 2.3%  |
| S083                        | Rocky Mountain Subalpine Mesic Meadow                                    | 24              | 1.3%   | 0.0% | 0.0%  | 87.6% | 0.0%        | 0.0%  | 0.0% | 0.0%             | 3.3%          | 0.0%          | 0.0%          | 0.0%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 7.7%  |
| S085                        | Southern Rocky Mountain Montane-Subalpine Grassland                      | 2               | 90.5%  | 0.0% | 0.0%  | 9.5%  | 0.0%        | 0.0%  | 0.0% | 0.0%             | 0.0%          | 0.0%          | 0.1%          | 0.0%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 0.0%  |
| <b>WOODY WETLAND</b>        |  |                 |        |      |       |       |             |       |      |                  |               |               |               |                |                |             |      |        |      |               |      |                 |       |
| S118                        | Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland   | 1,068           | 17.6%  | 0.6% | 0.8%  | 13.4% | 0.3%        | 0.1%  | 0.0% | 0.0%             | 4.5%          | 0.6%          | 0.0%          | 1.9%           | 0.1%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.1% | 0.0%            | 59.1% |
| S096                        | Inter-Mountain Basins Greasewood Flat                                    | 10,673          | 66.3%  | 3.6% | 1.6%  | 0.1%  | 1.5%        | 0.0%  | 0.0% | 0.0%             | 1.7%          | 0.1%          | 0.0%          | 0.6%           | 0.0%           | 0.0%        | 0.0% | 0.0%   | 0.0% | 0.0%          | 0.0% | 0.0%            | 23.2% |
| S094                        | North American Warm Desert Lower Montane Riparian Woodland and Shrubland | 32              | 20.3%  | 0.0% | 8.6%  | 6.6%  | 4.2%        | 0.6%  | 0.0% | 0.0%             | 0.0%          | 1.4%          | 0.0%          | 3.2%           | 0.0%           | 0.0%        | 0.0% | 0.2%   | 0.0% | 0.0%          | 1.2% | 0.0%            | 49.2% |
| S098                        | North American Warm Desert Riparian Mesquite Bosque                      | 25              | 53.6%  | 0.5% | 8.3%  | 0.0%  | 0.0%        | 17.2% | 0.0% | 0.0%             | 0.1%          | 0.9%          | 0.0%          | 0.2%           | 0.0%           | 0.0%        | 0.1% | 0.0%   | 0.0% | 0.0%          | 0.1% | 0.0%            | 19.0% |

| Code  | Land Cover Type  | Area in NV      | BLM   | BOR   | FWS  | USFS  | DOD/DOE | NPS   | ARS  | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wildl | Other State | Reg. Gov | City | County | Aud  | Land Trust | TNC  | Priv-BioDiv | Priv  |
|---|--|-----------------|-------|-------|------|-------|---------|-------|------|---------------|------------|------------|------------|-------------|-------------|----------|------|--------|------|------------|------|-------------|-------|
|   |  | km <sup>3</sup> | %     | %     | %    | %     | %       | %     | %    | %             | %          | %          | %          | %           | %           | %        | %    | %      | %    | %          | %    | %           | %     |
| S097  | North American Warm Desert Riparian Woodland and Shrubland | 5               | 0.8%  | 0.0%  | 0.0% | 0.0%  | 0.0%    | 13.9% | 0.0% | 0.0%          | 66.3%      | 0.7%       | 0.0%       | 4.4%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 12.9% |
| S020  | North American Warm Desert Wash                            | 288             | 72.5% | 5.2%  | 2.2% | 0.0%  | 0.4%    | 1.1%  | 0.0% | 0.0%          | 12.2%      | 1.3%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 5.0%  |
| S091  | Rocky Mountain Subalpine-Montane Riparian Shrubland        | 3               | 2.9%  | 0.0%  | 0.0% | 88.7% | 2.5%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 1.4%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 4.4%  |
| S092  | Rocky Mountain Subalpine-Montane Riparian Woodland         | 68              | 5.4%  | 0.0%  | 0.0% | 76.1% | 0.1%    | 3.1%  | 0.0% | 0.0%          | 0.0%       | 4.4%       | 0.0%       | 0.0%        | 1.8%        | 0.0%     | 0.0% | 0.1%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 8.9%  |
| <b>EMERGENT HERBACEOUS WETLAND</b>  |  |                 |       |       |      |       |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |
| S105  | Mediterranean California Subalpine-Montane Fen             | 2               | 1.2%  | 0.0%  | 0.0% | 98.8% | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0%  |
| S100  | North American Arid West Emergent Marsh                    | 409             | 10.6% | 10.9% | 9.8% | 0.9%  | 0.8%    | 0.2%  | 0.0% | 0.0%          | 2.3%       | 0.6%       | 0.0%       | 2.3%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.2% | 0.0%        | 37.4% |
| S102  | Rocky Mountain Alpine-Montane Wet Meadow                   | 10              | 49.4% | 0.0%  | 7.1% | 22.1% | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 16.8% |
| S103  | Temperate Pacific Subalpine-Montane Wet Meadow             | 2               | 13.6% | 0.0%  | 0.0% | 26.6% | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 19.3%      | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 39.9% |
| <b>ALTERED or DISTURBED</b>   |  |                 |       |       |      |       |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |
| D09   | Invasive Annual and Biennial Forbland                      | 1,134           | 65.1% | 0.4%  | 0.6% | 0.5%  | 1.0%    | 0.0%  | 0.0% | 0.0%          | 0.7%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 31.3% |
| D08   | Invasive Annual Grassland                                  | 4,611           | 67.2% | 0.2%  | 0.1% | 0.8%  | 0.7%    | 0.0%  | 0.0% | 0.0%          | 0.9%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 30.0% |
| D06   | Invasive Perennial Grassland                               | 187             | 75.1% | 0.0%  | 0.0% | 1.9%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.1%       | 0.0%       | 0.0%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 22.7% |
| D04   | Invasive Southwest Riparian Woodland and Shrubland         | 149             | 12.8% | 13.1% | 1.3% | 0.0%  | 0.2%    | 2.7%  | 0.0% | 0.0%          | 6.9%       | 0.6%       | 0.0%       | 8.7%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 38.1% |
| D02   | Recently Burned  | 574             | 81.9% | 0.0%  | 0.0% | 2.7%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 15.4% |
| D03   | Recently Mined or Quarried                                 | 322             | 56.1% | 0.0%  | 0.0% | 1.1%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 41.8% |
| <b>DEVELOPED and AGRICULTURE</b>  |  |                 |       |       |      |       |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |
| N80   | Agriculture  | 2,223           | 3.2%  | 0.5%  | 0.9% | 0.1%  | 0.4%    | 0.0%  | 0.0% | 0.0%          | 2.7%       | 0.1%       | 0.0%       | 0.3%        | 0.1%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 91.4% |
| N22   | Developed, Medium - High Intensity                         | 210             | 18.4% | 0.3%  | 0.0% | 0.0%  | 2.0%    | 0.0%  | 0.0% | 0.0%          | 1.3%       | 0.0%       | 0.1%       | 0.0%        | 0.0%        | 0.1%     | 0.4% | 0.4%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 76.8% |
| N21   | Developed, Open Space - Low Intensity                      | 726             | 0.9%  | 0.2%  | 0.0% | 0.2%  | 0.8%    | 0.0%  | 0.0% | 0.0%          | 0.5%       | 0.1%       | 0.1%       | 0.0%        | 0.0%        | 0.1%     | 1.0% | 1.4%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 94.6% |
| <b>OTHER COVER TYPES</b>  |  |                 |       |       |      |       |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |
| N31   | Barren Lands, Non-specific                                 | 195             | 57.9% | 1.3%  | 1.6% | 1.1%  | 1.5%    | 0.0%  | 0.0% | 0.0%          | 0.6%       | 0.0%       | 0.1%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.1%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 31.3% |
| N11   | Open Water   | 1,481           | 0.7%  | 1.3%  | 0.3% | 0.1%  | 0.0%    | 0.3%  | 0.0% | 0.0%          | 3.0%       | 0.5%       | 0.0%       | 0.4%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 2.0%  |
| <b>TOTAL</b>  |  | 286,281         | 67.2% | 0.4%  | 3.3% | 8.2%  | 4.8%    | 0.9%  | 0.0% | 0.0%          | 1.4%       | 0.1%       | 0.0%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 12.7% |
| * For Land Stewardship headings: BLM = Bureau of Land Management, BOR = Bureau of Reclamation, FWS= U.S. Fish and Wildlife Service, USFS = U.S. Forest Service, DOD/DOE = Dept. of Defense/Dept. of Energy, NPS = U.S. National Park Service , ARS = Agricultural Research Service, Dept. of Com. = Dept. of Commerce, Nativ Amer = Native American Lands, Reg. Gov. = Regional Government, Aud = Audubon, TNC = The Nature Conservancy, Priv-BioDiv = Private Lands Managed for Biodiversity |  |                 |       |       |      |       |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |

**Appendix 5-11. Area and percent distribution of each land cover type represented within the four levels of GAP Management Status in the state of Nevada.**

| Code                    | Land Cover Type  | Area in NV      |                 | Status 1 |                 | Status 2 |                 | Status 3 |                 | Status 4 |                 | Status 1&2 |  |
|-------------------------|--|-----------------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|------------|--|
|                         |  | km <sup>2</sup> | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %          |  |
| <b>BARREN LANDS</b>     |  |                 |                 |          |                 |          |                 |          |                 |          |                 |            |  |
| S010                    | Colorado Plateau Mixed Bedrock Canyon and Tableland                  | 2               | 0               | 0.0%     | 2               | 96.1%    | 0               | 1.8%     | 0               | 2.1%     | 2               | 96.1%      |  |
| S012                    | Inter-Mountain Basins Active and Stabilized Dune                     | 79              | 1               | 0.6%     | 3               | 3.5%     | 61              | 77.1%    | 15              | 18.8%    | 3               | 4.1%       |  |
| S009                    | Inter-Mountain Basins Cliff and Canyon                               | 2,486           | 41              | 1.7%     | 601             | 24.2%    | 1,638           | 65.9%    | 207             | 8.3%     | 642             | 25.8%      |  |
| S015                    | Inter-Mountain Basins Playa  | 6,082           | 589             | 9.7%     | 886             | 14.6%    | 4,079           | 67.1%    | 528             | 8.7%     | 1,475           | 24.3%      |  |
| S014                    | Inter-Mountain Basins Wash   | 18              | 0               | 0.0%     | 1               | 3.4%     | 14              | 79.4%    | 3               | 17.2%    | 1               | 3.4%       |  |
| S003                    | Mediterranean California Alpine Bedrock and Scree                    | 23              | 0               | 0.0%     | 17              | 71.3%    | 7               | 28.2%    | 0               | 0.5%     | 17              | 71.3%      |  |
| S018                    | North American Warm Desert Active and Stabilized Dune                | 16              | 3               | 17.5%    | 5               | 27.9%    | 8               | 49.5%    | 1               | 5.1%     | 7               | 45.4%      |  |
| S017                    | North American Warm Desert Badland                                   | 78              | 3               | 3.5%     | 46              | 58.6%    | 21              | 27.3%    | 8               | 10.6%    | 48              | 62.1%      |  |
| S016                    | North American Warm Desert Bedrock Cliff and Outcrop                 | 1,842           | 364             | 19.8%    | 869             | 47.2%    | 573             | 31.1%    | 36              | 1.9%     | 1,233           | 67.0%      |  |
| S021                    | North American Warm Desert Pavement                                  | 168             | 10              | 5.8%     | 52              | 31.2%    | 51              | 30.2%    | 55              | 32.8%    | 62              | 36.9%      |  |
| S022                    | North American Warm Desert Playa                                     | 526             | 79              | 14.9%    | 102             | 19.3%    | 267             | 50.8%    | 78              | 14.9%    | 180             | 34.3%      |  |
| S019                    | North American Warm Desert Volcanic Rockland                         | 78              | 8               | 9.7%     | 44              | 56.3%    | 27              | 34.0%    | 0               | 0.0%     | 52              | 65.9%      |  |
| S002                    | Rocky Mountain Alpine Bedrock and Scree                              | 148             | 41              | 28.0%    | 56              | 37.8%    | 49              | 32.9%    | 2               | 1.2%     | 97              | 65.8%      |  |
| S007                    | Sierra Nevada Cliff and Canyon                                       | 123             | 0               | 0.0%     | 6               | 4.9%     | 92              | 75.0%    | 25              | 20.1%    | 6               | 4.9%       |  |
| <b>EVERGREEN FOREST</b> |  |                 |                 |          |                 |          |                 |          |                 |          |                 |            |  |
| S040                    | Great Basin Pinyon-Juniper Woodland                                  | 36,374          | 620             | 1.7%     | 5,869           | 16.1%    | 27,350          | 75.2%    | 2,535           | 7.0%     | 6,489           | 17.8%      |  |
| S026                    | Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland     | 635             | 156             | 24.5%    | 254             | 40.0%    | 218             | 34.4%    | 7               | 1.1%     | 409             | 64.5%      |  |
| S033                    | Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland | 2               | 0               | 0.0%     | 1               | 32.7%    | 1               | 63.8%    | 0               | 3.5%     | 1               | 32.7%      |  |
| S123                    | Mediterranean California Ponderosa-Jeffrey Pine Forest and Woodland  | 209             | 0               | 0.0%     | 24              | 11.4%    | 146             | 69.9%    | 39              | 18.7%    | 24              | 11.4%      |  |
| S121                    | Mediterranean California Red Fir Forest and Woodland                 | 106             | 0               | 0.0%     | 24              | 22.4%    | 74              | 70.3%    | 8               | 7.4%     | 24              | 22.4%      |  |
| S029                    | Northern Pacific Mesic Subalpine Parkland                            | 42              | 0               | 0.0%     | 25              | 59.0%    | 16              | 37.5%    | 1               | 3.5%     | 25              | 59.0%      |  |
| S032                    | Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland   | 196             | 88              | 45.0%    | 52              | 26.7%    | 49              | 25.1%    | 6               | 3.2%     | 140             | 71.7%      |  |
| S034                    | Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland       | 216             | 63              | 29.3%    | 64              | 29.6%    | 84              | 38.9%    | 5               | 2.3%     | 127             | 58.8%      |  |
| S028                    | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland    | 190             | 20              | 10.6%    | 77              | 40.4%    | 90              | 47.5%    | 3               | 1.5%     | 97              | 51.0%      |  |

| Code | Land Cover Type   | Area in NV      |                 | Status 1 |                 | Status 2 |                 | Status 3 |                 | Status 4 |                 | Status 1&2 |  |
|------|---|-----------------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|------------|--|
|      |   | km <sup>2</sup> | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %          |  |
| S030 | Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland     | 175             | 13              | 7.7%     | 58              | 33.0%    | 98              | 56.3%    | 5               | 3.0%     | 71              | 40.7%      |  |
| S025 | Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland | 14              | 1               | 4.3%     | 6               | 39.0%    | 7               | 52.2%    | 1               | 4.5%     | 6               | 43.3%      |  |
| S122 | Sierra Nevada Subalpine Lodgepole Pine Forest and Woodland        | 20              | 0               | 0.0%     | 4               | 19.5%    | 15              | 74.0%    | 1               | 6.4%     | 4               | 19.5%      |  |
| S036 | Southern Rocky Mountain Ponderosa Pine Woodland                   | 7               | 0               | 3.6%     | 6               | 93.3%    | 0               | 3.1%     | 0               | 0.0%     | 7               | 96.9%      |  |

#### DECIDUOUS FOREST

|      |   |       |    |      |     |       |     |       |     |       |     |       |
|------|---|-------|----|------|-----|-------|-----|-------|-----|-------|-----|-------|
| S023 | Rocky Mountain Aspen Forest and Woodland      | 1,289 | 38 | 3.0% | 326 | 25.3% | 764 | 59.3% | 161 | 12.5% | 364 | 28.3% |
| S024 | Rocky Mountain Bigtooth Maple Ravine Woodland | 1     | 0  | 1.0% | 0   | 0.0%  | 0   | 9.9%  | 0   | 89.1% | 0   | 1.0%  |

#### MIXED FOREST

|      |   |    |    |       |    |       |    |       |   |      |    |       |
|------|---|----|----|-------|----|-------|----|-------|---|------|----|-------|
| S042 | Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland | 84 | 19 | 22.2% | 25 | 30.3% | 39 | 46.1% | 1 | 1.4% | 44 | 52.5% |
|------|---|----|----|-------|----|-------|----|-------|---|------|----|-------|

#### SHRUB/SCRUB

|      |  |        |       |       |       |       |        |       |        |       |       |       |
|------|--|--------|-------|-------|-------|-------|--------|-------|--------|-------|-------|-------|
| S059 | Colorado Plateau Blackbrush-Mormon-tea Shrubland               | 4      | 0     | 0.0%  | 3     | 89.6% | 0      | 10.4% | 0      | 0.0%  | 3     | 89.6% |
| S053 | Great Basin Semi-Desert Chaparral                              | 162    | 0     | 0.2%  | 56    | 34.6% | 84     | 52.0% | 21     | 13.2% | 57    | 34.8% |
| S055 | Great Basin Xeric Mixed Sagebrush Shrubland                    | 31,792 | 672   | 2.1%  | 3,052 | 9.6%  | 25,283 | 79.5% | 2,785  | 8.8%  | 3,724 | 11.7% |
| S054 | Inter-Mountain Basins Big Sagebrush Shrubland                  | 65,988 | 842   | 1.3%  | 3,324 | 5.0%  | 51,509 | 78.1% | 10,314 | 15.6% | 4,165 | 6.3%  |
| S065 | Inter-Mountain Basins Mixed Salt Desert Scrub                  | 50,604 | 373   | 0.7%  | 2,717 | 5.4%  | 42,401 | 83.8% | 5,113  | 10.1% | 3,090 | 6.1%  |
| S050 | Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland | 1,924  | 124   | 6.4%  | 502   | 26.1% | 1,221  | 63.4% | 77     | 4.0%  | 626   | 32.5% |
| S057 | Mogollon Chaparral   | 425    | 0     | 0.0%  | 133   | 31.3% | 291    | 68.4% | 2      | 0.4%  | 133   | 31.3% |
| S060 | Mojave Mid-Elevation Mixed Desert Scrub                        | 10,521 | 1,524 | 14.5% | 3,428 | 32.6% | 5,254  | 49.9% | 315    | 3.0%  | 4,952 | 47.1% |
| S046 | Rocky Mountain Gambel Oak-Mixed Montane Shrubland              | 108    | 0     | 0.1%  | 38    | 35.6% | 68     | 62.8% | 2      | 1.4%  | 39    | 35.8% |
| S069 | Sonora-Mojave Creosotebush-White Bursage Desert Scrub          | 19,013 | 1,691 | 8.9%  | 6,346 | 33.4% | 9,003  | 47.4% | 1,974  | 10.4% | 8,036 | 42.3% |
| S070 | Sonora-Mojave Mixed Salt Desert Scrub                          | 1,528  | 160   | 10.5% | 307   | 20.1% | 856    | 56.0% | 205    | 13.4% | 467   | 30.6% |
| S114 | Sonora-Mojave Semi-Desert Chaparral                            | 86     | 30    | 35.2% | 55    | 63.6% | 0      | 0.1%  | 1      | 1.1%  | 85    | 98.8% |

#### GRASSLAND/HERBACEOUS

|      |  |        |     |       |       |       |        |       |       |       |       |       |
|------|--|--------|-----|-------|-------|-------|--------|-------|-------|-------|-------|-------|
| S078 | Inter-Mountain Basins Big Sagebrush Steppe     | 1,274  | 10  | 0.8%  | 26    | 2.1%  | 789    | 61.9% | 448   | 35.2% | 37    | 2.9%  |
| S075 | Inter-Mountain Basins Juniper Savanna          | 1      | 0   | 32.0% | 0     | 3.4%  | 1      | 55.4% | 0     | 9.2%  | 0     | 35.4% |
| S071 | Inter-Mountain Basins Montane Sagebrush Steppe | 17,813 | 466 | 2.6%  | 1,877 | 10.5% | 12,509 | 70.2% | 2,960 | 16.6% | 2,344 | 13.2% |
| S090 | Inter-Mountain Basins Semi-Desert Grassland    | 3,101  | 68  | 2.2%  | 127   | 4.1%  | 1,457  | 47.0% | 1,449 | 46.7% | 195   | 6.3%  |
| S079 | Inter-Mountain Basins Semi-Desert Shrub-Steppe | 5,973  | 167 | 2.8%  | 863   | 14.5% | 4,660  | 78.0% | 283   | 4.7%  | 1,030 | 17.2% |
| S134 | North Pacific Montane Grassland                | 27     | 0   | 0.0%  | 4     | 13.3% | 22     | 80.0% | 2     | 6.7%  | 4     | 13.3% |

| Code | Land Cover Type                                     | Area in NV      |                 | Status 1 |                 | Status 2 |                 | Status 3 |                 | Status 4 |                 | Status 1&2 |  |
|------|---|-----------------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|------------|--|
|      |   | km <sup>2</sup> | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %          |  |
| S081 | Rocky Mountain Dry Tundra                           | 20              | 7               | 34.4%    | 7               | 35.7%    | 5               | 27.6%    | 0               | 2.3%     | 14              | 70.1%      |  |
| S083 | Rocky Mountain Subalpine Mesic Meadow               | 24              | 2               | 8.0%     | 12              | 51.2%    | 8               | 33.0%    | 2               | 7.8%     | 14              | 59.2%      |  |
| S085 | Southern Rocky Mountain Montane-Subalpine Grassland | 2               | 0               | 0.0%     | 0               | 6.7%     | 2               | 93.3%    | 0               | 0.0%     | 0               | 6.7%       |  |

**WOODY WETLAND**

|      |  |        |     |       |     |       |       |       |       |       |       |       |
|------|--|--------|-----|-------|-----|-------|-------|-------|-------|-------|-------|-------|
| S118 | Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland   | 1,059  | 8   | 0.7%  | 64  | 6.1%  | 345   | 32.6% | 642   | 60.6% | 72    | 6.8%  |
| S096 | Inter-Mountain Basins Greasewood Flat                                    | 10,550 | 500 | 4.7%  | 511 | 4.8%  | 7,043 | 66.8% | 2,496 | 23.7% | 1,011 | 9.6%  |
| S094 | North American Warm Desert Lower Montane Riparian Woodland and Shrubland | 30     | 4   | 13.0% | 4   | 13.9% | 6     | 20.4% | 16    | 52.6% | 8     | 26.9% |
| S098 | North American Warm Desert Riparian Mesquite Bosque                      | 25     | 3   | 10.5% | 7   | 27.2% | 11    | 43.3% | 5     | 19.1% | 9     | 37.6% |
| S097 | North American Warm Desert Riparian Woodland and Shrubland               | 5      | 0   | 0.0%  | 1   | 18.1% | 0     | 1.7%  | 4     | 80.2% | 1     | 18.1% |
| S020 | North American Warm Desert Wash  | 288    | 7   | 2.4%  | 46  | 15.9% | 221   | 76.5% | 15    | 5.1%  | 53    | 18.3% |
| S091 | Rocky Mountain Subalpine-Montane Riparian Shrubland                      | 3      | 0   | 0.0%  | 1   | 30.2% | 2     | 65.4% | 0     | 4.4%  | 1     | 30.2% |
| S092 | Rocky Mountain Subalpine-Montane Riparian Woodland                       | 67     | 2   | 3.2%  | 23  | 34.1% | 36    | 53.8% | 6     | 8.9%  | 25    | 37.3% |

**EMERGENT HERBACEOUS WETLAND**

|      |  |     |    |       |    |       |    |       |     |       |    |       |
|------|--|-----|----|-------|----|-------|----|-------|-----|-------|----|-------|
| S105 | Mediterranean California Subalpine-Montane Fen | 2   | 0  | 0.0%  | 1  | 47.4% | 1  | 52.5% | 0   | 0.0%  | 1  | 47.4% |
| S100 | North American Arid West Emergent Marsh        | 311 | 30 | 9.7%  | 42 | 13.5% | 85 | 27.2% | 154 | 49.6% | 72 | 23.2% |
| S102 | Rocky Mountain Alpine-Montane Wet Meadow       | 10  | 2  | 21.0% | 3  | 26.9% | 3  | 34.4% | 2   | 17.7% | 5  | 47.9% |
| S103 | Temperate Pacific Subalpine-Montane Wet Meadow | 2   | 0  | 0.0%  | 0  | 2.4%  | 1  | 57.6% | 1   | 40.1% | 0  | 2.4%  |

**ALTERED or DISTURBED**

|     |  |       |   |      |     |       |       |       |       |       |     |       |
|-----|--|-------|---|------|-----|-------|-------|-------|-------|-------|-----|-------|
| D09 | Invasive Annual and Biennial Forbland              | 1,131 | 4 | 0.4% | 23  | 2.1%  | 744   | 65.8% | 359   | 31.8% | 27  | 2.4%  |
| D08 | Invasive Annual Grassland                          | 4,610 | 3 | 0.1% | 115 | 2.5%  | 3,096 | 67.2% | 1,396 | 30.3% | 118 | 2.6%  |
| D06 | Invasive Perennial Grassland                       | 187   | 0 | 0.0% | 3   | 1.5%  | 142   | 75.7% | 43    | 22.8% | 3   | 1.5%  |
| D04 | Invasive Southwest Riparian Woodland and Shrubland | 126   | 2 | 1.3% | 36  | 28.3% | 26    | 20.5% | 63    | 50.0% | 37  | 29.6% |
| D02 | Recently Burned                                    | 574   | 2 | 0.4% | 26  | 4.6%  | 457   | 79.7% | 88    | 15.4% | 28  | 4.9%  |
| D03 | Recently Mined or Quarried                         | 319   | 0 | 0.0% | 0   | 0.0%  | 184   | 57.8% | 134   | 42.2% | 0   | 0.0%  |

**DEVELOPED and AGRICULTURE**

|     |                                       |       |   |      |    |      |     |       |       |       |    |      |
|-----|---------------------------------------|-------|---|------|----|------|-----|-------|-------|-------|----|------|
| N80 | Agriculture                           | 2,222 | 8 | 0.4% | 24 | 1.1% | 145 | 6.5%  | 2,044 | 92.0% | 33 | 1.5% |
| N22 | Developed, Medium - High Intensity    | 210   | 0 | 0.0% | 5  | 2.5% | 41  | 19.3% | 164   | 78.2% | 5  | 2.5% |
| N21 | Developed, Open Space - Low Intensity | 724   | 0 | 0.0% | 0  | 0.0% | 15  | 2.1%  | 709   | 97.9% | 0  | 0.0% |

**OTHER COVER TYPES**

|     |                            |     |   |      |    |       |     |       |    |       |    |       |
|-----|----------------------------|-----|---|------|----|-------|-----|-------|----|-------|----|-------|
| N31 | Barren Lands, Non-specific | 186 | 2 | 1.2% | 11 | 5.8%  | 111 | 59.7% | 62 | 33.4% | 13 | 7.0%  |
| N11 | Open Water                 | 129 | 5 | 3.9% | 19 | 14.8% | 74  | 57.3% | 31 | 24.0% | 24 | 18.7% |

| Code | Land Cover Type | Area in NV      |                 | Status 1 |                 | Status 2 |                 | Status 3 |                 | Status 4 |                 | Status 1&2 |  |
|------|-----------------|-----------------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|------------|--|
|      |                 | km <sup>2</sup> | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %          |  |
|      | <b>TOTAL</b>    | 284,387         | 8,876           | 3.1%     | 33,342          | 11.7%    | 204,049         | 71.8%    | 38,120          | 13.4%    | 42,218          | 14.8%      |  |

### Appendix 5-12. Percent distribution of each land cover type among 22 land stewards in the state of Utah.

| Code                    | Land Cover Type  | Area in UT      | BLM   | BOR  | FWS  | USFS   | DOD/DOE | NPS   | ARS  | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wildl | Other State | Reg. Gov | City | County | Aud  | Land Trust | TNC  | Priv-BioDiv | Priv  |
|-------------------------|--|-----------------|-------|------|------|--------|---------|-------|------|---------------|------------|------------|------------|-------------|-------------|----------|------|--------|------|------------|------|-------------|-------|
|                         |  | km <sup>2</sup> | %     | %    | %    | %      | %       | %     | %    | %             | %          | %          | %          | %           | %           | %        | %    | %      | %    | %          | %    | %           | %     |
| <b>BARREN LANDS</b>     |  |                 |       |      |      |        |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |
| S010                    | Colorado Plateau Mixed Bedrock Canyon and Tableland                | 14,197          | 56.1% | 0.0% | 0.0% | 1.9%   | 0.0%    | 23.9% | 0.0% | 0.0%          | 10.2%      | 0.1%       | 5.7%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 1.8%  |
| S012                    | Inter-Mountain Basins Active and Stabilized Dune                   | 1,808           | 53.2% | 0.0% | 0.0% | 0.0%   | 17.1%   | 7.2%  | 0.0% | 0.0%          | 12.2%      | 0.1%       | 6.4%       | 0.3%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 3.3%  |
| S009                    | Inter-Mountain Basins Cliff and Canyon                             | 382             | 66.3% | 0.0% | 0.0% | 7.1%   | 1.3%    | 0.0%  | 2.4% | 0.0%          | 0.3%       | 0.0%       | 5.2%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 17.3% |
| S015                    | Inter-Mountain Basins Playa  | 11,284          | 34.6% | 0.0% | 1.2% | 0.0%   | 41.9%   | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 5.8%       | 0.9%        | 1.4%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.2% | 0.0%        | 11.4% |
| S011                    | Inter-Mountain Basins Shale Badland                                | 1,828           | 74.0% | 0.0% | 0.1% | 0.3%   | 0.1%    | 2.0%  | 0.0% | 0.0%          | 8.3%       | 0.1%       | 9.4%       | 0.1%        | 0.1%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 5.6%  |
| S013                    | Inter-Mountain Basins Volcanic Rock and Cinder Land                | 317             | 46.5% | 0.0% | 0.0% | 40.8%  | 0.0%    | 1.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 6.7%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 4.7%  |
| S014                    | Inter-Mountain Basins Wash   | 1               | 0.0%  | 0.0% | 0.0% | 0.0%   | 0.0%    | 0.0%  | 0.0% | 0.0%          | 88.8%      | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 7.5%  |
| S001                    | North American Alpine Ice Field                                    | 21              | 0.0%  | 0.0% | 0.0% | 100.0% | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0%  |
| S016                    | North American Warm Desert Bedrock Cliff and Outcrop               | 127             | 68.7% | 0.0% | 0.0% | 11.2%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 6.0%       | 4.2%       | 4.6%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.2% | 0.0%        | 5.0%  |
| S022                    | North American Warm Desert Playa                                   | 6               | 13.7% | 0.0% | 0.0% | 0.2%   | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.8%       | 3.8%       | 3.7%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 1.1% | 0.0%        | 76.6% |
| S019                    | North American Warm Desert Volcanic Rockland                       | 8               | 7.1%  | 0.0% | 0.0% | 0.0%   | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 12.0%      | 0.1%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 80.8% |
| S002                    | Rocky Mountain Alpine Bedrock and Scree                            | 815             | 1.9%  | 0.0% | 0.0% | 94.3%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.2%       | 0.0%       | 0.5%       | 0.2%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 2.6%  |
| S004                    | Rocky Mountain Alpine Fell-Field                                   | 177             | 0.0%  | 0.0% | 0.0% | 100.0% | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0%  |
| S006                    | Rocky Mountain Cliff, Canyon and Massive Bedrock                   | 1,467           | 17.1% | 0.0% | 0.0% | 57.2%  | 0.0%    | 4.2%  | 0.0% | 0.0%          | 4.7%       | 0.1%       | 3.8%       | 1.7%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.3% | 0.0%        | 10.7% |
| <b>EVERGREEN FOREST</b> |  |                 |       |      |      |        |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |
| S039                    | Colorado Plateau Pinyon-Juniper Woodland                           | 22,362          | 53.3% | 0.0% | 0.0% | 19.0%  | 0.0%    | 2.9%  | 0.0% | 0.0%          | 5.4%       | 0.1%       | 6.6%       | 1.7%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 10.8% |
| S040                    | Great Basin Pinyon-Juniper Woodland                                | 10,982          | 63.5% | 0.0% | 0.0% | 11.8%  | 0.8%    | 1.0%  | 0.2% | 0.0%          | 0.5%       | 0.1%       | 6.7%       | 0.3%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 15.1% |
| S026                    | Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland   | 32              | 66.0% | 0.0% | 0.0% | 0.1%   | 0.0%    | 0.0%  | 0.0% | 0.0%          | 28.9%      | 0.0%       | 0.0%       | 0.2%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 2.4% | 0.0%        | 2.4%  |
| S032                    | Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland | 1,710           | 19.2% | 0.0% | 0.0% | 48.5%  | 0.0%    | 0.6%  | 0.0% | 0.0%          | 5.3%       | 0.0%       | 7.5%       | 1.6%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 17.2% |
| S031                    | Rocky Mountain Lodgepole Pine Forest                               | 1,816           | 0.5%  | 0.0% | 0.0% | 93.2%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 1.2%       | 0.0%       | 1.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 4.0%  |
| S034                    | Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland     | 1,427           | 15.6% | 0.0% | 0.0% | 52.3%  | 0.0%    | 0.7%  | 0.0% | 0.0%          | 3.9%       | 0.1%       | 4.4%       | 2.2%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 20.7% |
| S028                    | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland  | 3,230           | 1.4%  | 0.0% | 0.0% | 90.4%  | 0.0%    | 0.4%  | 0.0% | 0.0%          | 0.4%       | 0.0%       | 0.8%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 6.3%  |
| S030                    | Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland      | 1,273           | 2.5%  | 0.0% | 0.0% | 79.9%  | 0.0%    | 0.2%  | 0.0% | 0.0%          | 1.1%       | 0.1%       | 1.7%       | 0.6%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 13.8% |
| S025                    | Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland  | 39              | 0.0%  | 0.0% | 0.0% | 80.6%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.2%       | 0.8%       | 1.2%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 17.3% |
| S036                    | Southern Rocky Mountain Ponderosa Pine Woodland                    | 2,019           | 9.1%  | 0.0% | 0.0% | 74.8%  | 0.0%    | 3.6%  | 0.0% | 0.0%          | 2.2%       | 0.0%       | 2.1%       | 0.3%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 7.9%  |
| <b>DECIDUOUS FOREST</b> |  |                 |       |      |      |        |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |       |
| S023                    | Rocky Mountain Aspen Forest and Woodland                           | 6,334           | 2.0%  | 0.0% | 0.0% | 57.5%  | 0.1%    | 0.1%  | 0.0% | 0.0%          | 2.1%       | 0.4%       | 3.0%       | 1.2%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.3% | 0.0%        | 33.5% |





| Code                               | Land Cover Type  | Area in UT      | BLM   | BOR  | FWS  | USFS  | DOD/DOE | NPS   | ARS  | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wildl | Other State | Reg. Gov | City | County | Aud  | Land Trust | TNC  | Priv-BioDiv | Priv |       |
|------------------------------------|--|-----------------|-------|------|------|-------|---------|-------|------|---------------|------------|------------|------------|-------------|-------------|----------|------|--------|------|------------|------|-------------|------|-------|
|                                    |  | km <sup>2</sup> | %     | %    | %    | %     | %       | %     | %    | %             | %          | %          | %          | %           | %           | %        | %    | %      | %    | %          | %    | %           | %    | %     |
| S083                               | Rocky Mountain Subalpine Mesic Meadow                                    | 499             | 1.9%  | 0.0% | 0.0% | 76.9% | 0.0%    | 0.3%  | 0.0% | 0.0%          | 0.2%       | 0.3%       | 2.6%       | 0.8%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 16.9% |
| S085                               | Southern Rocky Mountain Montane-Subalpine Grassland                      | 594             | 21.0% | 0.0% | 0.0% | 24.1% | 0.3%    | 0.9%  | 0.2% | 0.0%          | 1.8%       | 0.2%       | 4.8%       | 2.5%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.1%        | 0.0% | 43.7% |
| <b>WOODY WETLAND</b>               |  |                 |       |      |      |       |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |      |       |
| S118                               | Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland   | 292             | 21.8% | 0.0% | 0.0% | 14.9% | 1.7%    | 0.0%  | 0.0% | 0.0%          | 1.5%       | 0.6%       | 4.1%       | 4.1%        | 0.0%        | 0.0%     | 0.0% | 0.1%   | 0.0% | 0.0%       | 0.0% | 0.1%        | 0.0% | 47.7% |
| S096                               | Inter-Mountain Basins Greasewood Flat                                    | 7,310           | 51.2% | 0.0% | 0.2% | 0.0%  | 9.2%    | 1.1%  | 0.1% | 0.0%          | 3.5%       | 0.1%       | 9.3%       | 0.8%        | 0.1%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.1%        | 0.0% | 23.8% |
| S094                               | North American Warm Desert Lower Montane Riparian Woodland and Shrubland | 20              | 41.9% | 0.0% | 0.0% | 1.4%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 13.0%      | 3.2%       | 5.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 34.6% |
| S098                               | North American Warm Desert Riparian Mesquite Bosque                      | 3               | 2.1%  | 0.0% | 0.0% | 0.0%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.2%       | 0.0%       | 1.2%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 96.1% |
| S097                               | North American Warm Desert Riparian Woodland and Shrubland               | 10              | 9.2%  | 0.0% | 0.0% | 0.2%  | 0.0%    | 26.4% | 0.0% | 0.0%          | 0.6%       | 0.0%       | 0.7%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 46.3% |
| S020                               | North American Warm Desert Wash  | 10              | 50.2% | 0.0% | 0.0% | 0.0%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.8%       | 1.1%       | 19.9%      | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 28.0% |
| S093                               | Rocky Mountain Lower Montane Riparian Woodland and Shrubland             | 847             | 16.2% | 0.0% | 0.9% | 13.1% | 0.0%    | 3.8%  | 0.0% | 0.0%          | 11.8%      | 1.7%       | 2.4%       | 1.9%        | 0.0%        | 0.0%     | 0.0% | 0.1%   | 0.0% | 0.0%       | 0.0% | 0.4%        | 0.0% | 46.6% |
| S091                               | Rocky Mountain Subalpine-Montane Riparian Shrubland                      | 298             | 1.2%  | 0.0% | 0.0% | 58.7% | 0.0%    | 0.8%  | 0.0% | 0.0%          | 1.6%       | 0.1%       | 1.9%       | 1.4%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.5% | 0.0%        | 0.0% | 33.6% |
| S092                               | Rocky Mountain Subalpine-Montane Riparian Woodland                       | 4               | 36.0% | 0.0% | 0.0% | 0.0%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 41.8%      | 0.0%       | 0.8%       | 1.5%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 4.6%        | 0.0% | 15.3% |
| <b>EMERGENT HERBACEOUS WETLAND</b> |  |                 |       |      |      |       |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |      |       |
| S100                               | North American Arid West Emergent Marsh                                  | 482             | 5.6%  | 0.0% | 7.7% | 0.0%  | 3.5%    | 0.0%  | 0.0% | 0.0%          | 0.1%       | 2.1%       | 0.8%       | 19.2%       | 2.1%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 1.2%        | 0.0% | 42.1% |
| S102                               | Rocky Mountain Alpine-Montane Wet Meadow                                 | 479             | 2.8%  | 0.0% | 0.0% | 65.3% | 0.0%    | 0.0%  | 0.0% | 0.0%          | 3.4%       | 0.2%       | 2.4%       | 0.8%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.1%        | 0.0% | 23.9% |
| <b>ALTERED or DISTURBED</b>        |  |                 |       |      |      |       |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |      |       |
| D01                                | Disturbed, Non-specific  | 90              | 0.7%  | 0.0% | 0.0% | 0.0%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.2%       | 0.0%       | 5.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 93.0% |
| D14                                | Disturbed, Oil Well  | 46              | 12.6% | 0.0% | 0.0% | 2.1%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 1.8%       | 0.0%       | 5.9%       | 1.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.5%        | 0.0% | 76.1% |
| D09                                | Invasive Annual and Biennial Forbland                                    | 695             | 53.0% | 0.0% | 0.0% | 0.0%  | 1.7%    | 1.1%  | 0.4% | 0.0%          | 0.5%       | 0.2%       | 7.3%       | 0.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 35.3% |
| D08                                | Invasive Annual Grassland  | 3,236           | 45.6% | 0.0% | 0.2% | 0.5%  | 6.0%    | 0.7%  | 0.0% | 0.0%          | 2.9%       | 1.3%       | 5.5%       | 0.2%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 36.8% |
| D06                                | Invasive Perennial Grassland   | 526             | 19.3% | 0.0% | 0.0% | 5.2%  | 0.4%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.3%       | 4.8%       | 2.6%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 67.2% |
| D04                                | Invasive Southwest Riparian Woodland and Shrubland                       | 456             | 39.2% | 0.0% | 1.2% | 0.0%  | 0.0%    | 15.5% | 0.0% | 0.0%          | 21.2%      | 0.0%       | 3.8%       | 2.1%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.6%        | 0.0% | 14.7% |
| D02                                | Recently Burned  | 172             | 19.2% | 0.0% | 0.0% | 59.5% | 0.0%    | 0.0%  | 0.0% | 0.0%          | 1.6%       | 0.0%       | 4.8%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 15.0% |
| D11                                | Recently Chained Pinyon-Juniper Areas                                    | 458             | 50.2% | 0.0% | 0.0% | 22.0% | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.3%       | 0.0%       | 15.4%      | 1.6%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 10.5% |
| D10                                | Recently Logged Areas  | 287             | 2.0%  | 0.0% | 0.0% | 92.5% | 0.0%    | 0.0%  | 0.0% | 0.0%          | 0.6%       | 0.0%       | 0.0%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 4.8%  |
| D03                                | Recently Mined or Quarried   | 177             | 17.6% | 0.0% | 0.0% | 0.1%  | 0.5%    | 0.0%  | 0.0% | 0.0%          | 0.0%       | 0.0%       | 2.0%       | 0.0%        | 28.9%       | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 47.4% |
| <b>DEVELOPED and AGRICULTURE</b>   |  |                 |       |      |      |       |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |      |       |
| N80                                | Agriculture  | 9,196           | 1.0%  | 0.0% | 0.0% | 0.3%  | 0.2%    | 0.0%  | 0.0% | 0.0%          | 1.9%       | 0.1%       | 1.3%       | 0.3%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.2%        | 0.0% | 94.6% |
| N22                                | Developed, Medium - High Intensity                                       | 1,099           | 4.2%  | 0.0% | 0.0% | 0.8%  | 5.3%    | 0.1%  | 0.0% | 0.0%          | 0.4%       | 0.1%       | 2.0%       | 0.2%        | 0.1%        | 0.0%     | 0.2% | 0.1%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 86.4% |
| N21                                | Developed, Open Space - Low Intensity                                    | 1,997           | 2.5%  | 0.0% | 0.0% | 0.5%  | 6.3%    | 0.1%  | 0.0% | 0.0%          | 0.3%       | 0.4%       | 1.7%       | 0.3%        | 0.7%        | 0.0%     | 0.2% | 0.5%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 85.4% |
| <b>OTHER COVER TYPES</b>           |  |                 |       |      |      |       |         |       |      |               |            |            |            |             |             |          |      |        |      |            |      |             |      |       |
| N31                                | Barren Lands, Non-specific   | 42              | 77.2% | 0.0% | 0.0% | 0.0%  | 0.0%    | 0.0%  | 0.0% | 0.0%          | 16.0%      | 1.0%       | 4.5%       | 0.0%        | 0.0%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 1.3%  |
| N11                                | Open Water   | 6,733           | 1.5%  | 0.0% | 0.3% | 0.8%  | 0.0%    | 0.7%  | 0.0% | 0.0%          | 0.7%       | 0.6%       | 0.3%       | 0.8%        | 3.5%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.0% | 0.0%        | 0.0% | 4.1%  |
| <b>TOTAL</b>                       |  | 219,826         | 41.9% | 0.0% | 0.1% | 14.9% | 3.3%    | 3.6%  | 0.1% | 0.0%          | 4.5%       | 0.2%       | 6.4%       | 0.9%        | 0.2%        | 0.0%     | 0.0% | 0.0%   | 0.0% | 0.0%       | 0.1% | 0.0%        | 0.0% | 20.9% |

| Code  | Land Cover Type | Area in UT      | BLM | BOR | FWS | USFS | DOD/DOE | NPS | ARS | Dept. of Com. | Nativ Amer | State Park | State Schl | State Wildl | Other State | Reg. Gov | City | County | Aud | Land Trust | TNC | Priv-BioDiv | Priv |
|---|-----------------|-----------------|-----|-----|-----|------|---------|-----|-----|---------------|------------|------------|------------|-------------|-------------|----------|------|--------|-----|------------|-----|-------------|------|
|   |                 | km <sup>2</sup> | %   | %   | %   | %    | %       | %   | %   | %             | %          | %          | %          | %           | %           | %        | %    | %      | %   | %          | %   | %           | %    |
| * For Land Stewardship headings: BLM = Bureau of Land Management, BOR = Bureau of Reclamation, FWS= U.S. Fish and Wildlife Service, USFS = U.S. Forest Service, DOD/DOE = Dept. of Defense/Dept. of Energy, NPS = U.S. National Park Service , ARS = Agricultural Research Service, Dept. of Com. = Dept. of Commerce, Nativ Amer = Native American Lands, Reg. Gov. = Regional Government, Aud = Audubon, TNC = The Nature Conservancy, Priv-BioDiv = Private Lands Managed for Biodiversity |                 |                 |     |     |     |      |         |     |     |               |            |            |            |             |             |          |      |        |     |            |     |             |      |

**Appendix 5-13. Area and percent distribution of each land cover type represented within the four levels of GAP Management Status in the state of Utah.**

| Code                    | Land Cover Type  | Area in UT      |                 | Status 1 |                 | Status 2 |                 | Status 3 |                 | Status 4 |                 | Status 1&2 |  |
|-------------------------|--|-----------------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|------------|--|
|                         |  | km <sup>2</sup> | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %          |  |
| <b>BARREN LANDS</b>     |  |                 |                 |          |                 |          |                 |          |                 |          |                 |            |  |
| S010                    | Colorado Plateau Mixed Bedrock Canyon and Tableland                | 14,164          | 1,063           | 7.5%     | 4,413           | 31.2%    | 7,637           | 53.9%    | 1,051           | 7.4%     | 5,476           | 38.7%      |  |
| S012                    | Inter-Mountain Basins Active and Stabilized Dune                   | 1,804           | 7               | 0.4%     | 153             | 8.5%     | 1,469           | 81.4%    | 175             | 9.7%     | 160             | 8.9%       |  |
| S009                    | Inter-Mountain Basins Cliff and Canyon                             | 382             | 7               | 1.7%     | 110             | 28.9%    | 179             | 46.8%    | 86              | 22.6%    | 117             | 30.6%      |  |
| S015                    | Inter-Mountain Basins Playa  | 10,998          | 33              | 0.3%     | 376             | 3.4%     | 8,653           | 78.7%    | 1,937           | 17.6%    | 408             | 3.7%       |  |
| S011                    | Inter-Mountain Basins Shale Badland                                | 1,827           | 9               | 0.5%     | 226             | 12.3%    | 1,319           | 72.2%    | 273             | 14.9%    | 235             | 12.9%      |  |
| S013                    | Inter-Mountain Basins Volcanic Rock and Cinder Land                | 316             | 4               | 1.2%     | 3               | 0.9%     | 274             | 86.6%    | 36              | 11.4%    | 7               | 2.1%       |  |
| S014                    | Inter-Mountain Basins Wash   | 1               | 0               | 0.0%     | 0               | 0.0%     | 0               | 92.3%    | 0               | 7.7%     | 0               | 0.0%       |  |
| S001                    | North American Alpine Ice Field                                    | 21              | 5               | 22.8%    | 15              | 71.4%    | 1               | 5.8%     | 0               | 0.0%     | 20              | 94.2%      |  |
| S016                    | North American Warm Desert Bedrock Cliff and Outcrop               | 127             | 0               | 0.0%     | 50              | 39.8%    | 56              | 44.5%    | 20              | 15.6%    | 51              | 39.9%      |  |
| S022                    | North American Warm Desert Playa                                   | 6               | 0               | 1.2%     | 0               | 5.1%     | 1               | 12.7%    | 4               | 81.0%    | 0               | 6.3%       |  |
| S019                    | North American Warm Desert Volcanic Rockland                       | 8               | 0               | 0.0%     | 0               | 0.0%     | 2               | 18.9%    | 6               | 81.1%    | 0               | 0.0%       |  |
| S002                    | Rocky Mountain Alpine Bedrock and Scree                            | 813             | 92              | 11.3%    | 464             | 57.1%    | 231             | 28.5%    | 25              | 3.1%     | 556             | 68.4%      |  |
| S004                    | Rocky Mountain Alpine Fell-Field                                   | 177             | 24              | 13.5%    | 96              | 54.2%    | 57              | 32.2%    | 0               | 0.0%     | 120             | 67.8%      |  |
| S006                    | Rocky Mountain Cliff, Canyon and Massive Bedrock                   | 1,466           | 115             | 7.9%     | 280             | 19.1%    | 858             | 58.5%    | 213             | 14.5%    | 395             | 27.0%      |  |
| <b>EVERGREEN FOREST</b> |  |                 |                 |          |                 |          |                 |          |                 |          |                 |            |  |
| S039                    | Colorado Plateau Pinyon-Juniper Woodland                           | 22,356          | 534             | 2.4%     | 4,995           | 22.3%    | 12,921          | 57.8%    | 3,906           | 17.5%    | 5,530           | 24.7%      |  |
| S040                    | Great Basin Pinyon-Juniper Woodland                                | 10,986          | 144             | 1.3%     | 1,305           | 11.9%    | 7,120           | 64.8%    | 2,417           | 22.0%    | 1,449           | 13.2%      |  |
| S026                    | Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland   | 32              | 0               | 0.2%     | 21              | 65.2%    | 10              | 32.2%    | 1               | 2.4%     | 21              | 65.4%      |  |
| S032                    | Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland | 1,710           | 46              | 2.7%     | 270             | 15.8%    | 972             | 56.8%    | 422             | 24.7%    | 316             | 18.5%      |  |
| S031                    | Rocky Mountain Lodgepole Pine Forest                               | 1,815           | 58              | 3.2%     | 288             | 15.9%    | 1,379           | 76.0%    | 90              | 5.0%     | 346             | 19.1%      |  |
| S034                    | Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland     | 1,427           | 47              | 3.3%     | 225             | 15.8%    | 798             | 55.9%    | 357             | 25.0%    | 272             | 19.1%      |  |
| S028                    | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland  | 3,224           | 150             | 4.7%     | 716             | 22.2%    | 2,128           | 66.0%    | 230             | 7.1%     | 867             | 26.9%      |  |
| S030                    | Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland      | 1,273           | 39              | 3.0%     | 178             | 14.0%    | 860             | 67.6%    | 197             | 15.4%    | 216             | 17.0%      |  |

| Code | Land Cover Type   | Area in UT      |                 | Status 1 |                 | Status 2 |                 | Status 3 |                 | Status 4 |                 | Status 1&2 |  |
|------|---|-----------------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|------------|--|
|      |   | km <sup>2</sup> | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %          |  |
| S025 | Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland | 39              | 4               | 10.8%    | 9               | 24.3%    | 18              | 46.9%    | 7               | 18.0%    | 14              | 35.1%      |  |
| S036 | Southern Rocky Mountain Ponderosa Pine Woodland                   | 2,019           | 71              | 3.5%     | 150             | 7.4%     | 1,598           | 79.1%    | 201             | 9.9%     | 221             | 10.9%      |  |

**DECIDUOUS FOREST**

|      |   |       |    |      |     |      |       |       |       |       |     |       |
|------|---|-------|----|------|-----|------|-------|-------|-------|-------|-----|-------|
| S023 | Rocky Mountain Aspen Forest and Woodland      | 6,334 | 38 | 0.6% | 320 | 5.1% | 3,665 | 57.9% | 2,310 | 36.5% | 359 | 5.7%  |
| S024 | Rocky Mountain Bigtooth Maple Ravine Woodland | 887   | 33 | 3.8% | 69  | 7.8% | 250   | 28.2% | 534   | 60.2% | 103 | 11.6% |

**MIXED FOREST**

|      |   |       |   |      |    |      |     |       |     |       |    |      |
|------|---|-------|---|------|----|------|-----|-------|-----|-------|----|------|
| S042 | Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland | 1,222 | 6 | 0.5% | 84 | 6.9% | 936 | 76.6% | 196 | 16.0% | 90 | 7.3% |
|------|---|-------|---|------|----|------|-----|-------|-----|-------|----|------|

**SHRUB/SCRUB**

|      |  |        |     |       |       |       |        |       |       |       |       |       |
|------|--|--------|-----|-------|-------|-------|--------|-------|-------|-------|-------|-------|
| S059 | Colorado Plateau Blackbrush-Mormon-tea Shrubland               | 9,021  | 443 | 4.9%  | 1,600 | 17.7% | 6,207  | 68.8% | 772   | 8.6%  | 2,042 | 22.6% |
| S056 | Colorado Plateau Mixed Low Sagebrush Shrubland                 | 1,517  | 2   | 0.1%  | 102   | 6.7%  | 971    | 64.0% | 443   | 29.2% | 103   | 6.8%  |
| S052 | Colorado Plateau Pinyon-Juniper Shrubland                      | 9,414  | 344 | 3.7%  | 3,263 | 34.7% | 4,404  | 46.8% | 1,403 | 14.9% | 3,607 | 38.3% |
| S053 | Great Basin Semi-Desert Chaparral                              | 0      | 0   | 0.0%  | 0     | 0.0%  | 0      | 95.5% | 0     | 4.5%  | 0     | 0.0%  |
| S055 | Great Basin Xeric Mixed Sagebrush Shrubland                    | 3,635  | 0   | 0.0%  | 305   | 8.4%  | 2,619  | 72.0% | 710   | 19.5% | 305   | 8.4%  |
| S054 | Inter-Mountain Basins Big Sagebrush Shrubland                  | 19,935 | 104 | 0.5%  | 1,574 | 7.9%  | 10,744 | 53.9% | 7,513 | 37.7% | 1,678 | 8.4%  |
| S045 | Inter-Mountain Basins Mat Saltbush Shrubland                   | 3,036  | 15  | 0.5%  | 184   | 6.1%  | 2,234  | 73.6% | 603   | 19.9% | 199   | 6.6%  |
| S065 | Inter-Mountain Basins Mixed Salt Desert Scrub                  | 15,499 | 132 | 0.8%  | 770   | 5.0%  | 10,891 | 70.3% | 3,707 | 23.9% | 901   | 5.8%  |
| S050 | Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland | 626    | 15  | 2.4%  | 85    | 13.5% | 395    | 63.1% | 131   | 21.0% | 100   | 15.9% |
| S057 | Mogollon Chaparral   | 583    | 71  | 12.1% | 117   | 20.0% | 300    | 51.5% | 95    | 16.4% | 187   | 32.1% |
| S060 | Mojave Mid-Elevation Mixed Desert Scrub                        | 826    | 3   | 0.3%  | 85    | 10.3% | 525    | 63.6% | 213   | 25.8% | 88    | 10.6% |
| S043 | Rocky Mountain Alpine Dwarf-Shrubland                          | 109    | 13  | 11.8% | 75    | 68.5% | 21     | 19.3% | 0     | 0.4%  | 88    | 80.3% |
| S046 | Rocky Mountain Gambel Oak-Mixed Montane Shrubland              | 6,596  | 90  | 1.4%  | 478   | 7.2%  | 3,258  | 49.4% | 2,771 | 42.0% | 568   | 8.6%  |
| S047 | Rocky Mountain Lower Montane-Foothill Shrubland                | 252    | 3   | 1.2%  | 15    | 6.1%  | 170    | 67.6% | 63    | 25.1% | 18    | 7.3%  |
| S069 | Sonora-Mojave Creosotebush-White Bursage Desert Scrub          | 808    | 3   | 0.4%  | 218   | 27.0% | 235    | 29.1% | 351   | 43.5% | 222   | 27.4% |
| S070 | Sonora-Mojave Mixed Salt Desert Scrub                          | 10     | 0   | 0.1%  | 0     | 2.6%  | 3      | 33.5% | 7     | 63.8% | 0     | 2.7%  |
| S114 | Sonora-Mojave Semi-Desert Chaparral                            | 3      | 0   | 0.0%  | 0     | 0.0%  | 3      | 91.9% | 0     | 8.1%  | 0     | 0.0%  |
| S136 | Southern Colorado Plateau Sand Shrubland                       | 855    | 6   | 0.7%  | 49    | 5.7%  | 740    | 86.6% | 60    | 7.0%  | 55    | 6.4%  |
| S128 | Wyoming Basins Low Sagebrush Shrubland                         | 4      | 0   | 5.4%  | 1     | 28.6% | 1      | 21.0% | 2     | 44.9% | 1     | 34.0% |

**GRASSLAND/HERBACEOUS**

|      |  |     |   |      |   |      |     |       |     |       |   |      |
|------|--|-----|---|------|---|------|-----|-------|-----|-------|---|------|
| S078 | Inter-Mountain Basins Big Sagebrush Steppe | 522 | 0 | 0.0% | 8 | 1.6% | 151 | 28.8% | 363 | 69.6% | 8 | 1.6% |
|------|--|-----|---|------|---|------|-----|-------|-----|-------|---|------|

| Code | Land Cover Type                                     | Area in UT      |                 | Status 1 |                 | Status 2 |                 | Status 3 |                 | Status 4 |                 | Status 1&2 |  |
|------|---|-----------------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|----------|-----------------|------------|--|
|      |   | km <sup>2</sup> | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %        | km <sup>2</sup> | %          |  |
| S075 | Inter-Mountain Basins Juniper Savanna               | 9               | 0               | 0.0%     | 0               | 0.9%     | 9               | 98.2%    | 0               | 0.9%     | 0               | 0.9%       |  |
| S071 | Inter-Mountain Basins Montane Sagebrush Steppe      | 14,046          | 77              | 0.5%     | 713             | 5.1%     | 7,218           | 51.4%    | 6,038           | 43.0%    | 790             | 5.6%       |  |
| S090 | Inter-Mountain Basins Semi-Desert Grassland         | 2,011           | 29              | 1.5%     | 265             | 13.2%    | 1,102           | 54.8%    | 615             | 30.6%    | 294             | 14.6%      |  |
| S079 | Inter-Mountain Basins Semi-Desert Shrub-Steppe      | 8,329           | 37              | 0.4%     | 711             | 8.5%     | 6,037           | 72.5%    | 1,543           | 18.5%    | 748             | 9.0%       |  |
| S081 | Rocky Mountain Dry Tundra                           | 293             | 21              | 7.0%     | 84              | 28.8%    | 188             | 64.0%    | 1               | 0.3%     | 105             | 35.8%      |  |
| S083 | Rocky Mountain Subalpine Mesic Meadow               | 499             | 13              | 2.6%     | 88              | 17.6%    | 301             | 60.3%    | 97              | 19.5%    | 101             | 20.2%      |  |
| S085 | Southern Rocky Mountain Montane-Subalpine Grassland | 593             | 9               | 1.4%     | 34              | 5.7%     | 262             | 44.3%    | 288             | 48.6%    | 42              | 7.1%       |  |

**WOODY WETLAND**

|      |  |       |    |      |     |       |       |       |       |       |     |       |
|------|--|-------|----|------|-----|-------|-------|-------|-------|-------|-----|-------|
| S118 | Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland   | 283   | 0  | 0.1% | 26  | 9.4%  | 102   | 36.1% | 154   | 54.4% | 27  | 9.5%  |
| S096 | Inter-Mountain Basins Greasewood Flat                                    | 7,280 | 46 | 0.6% | 224 | 3.1%  | 4,576 | 62.9% | 2,434 | 33.4% | 270 | 3.7%  |
| S094 | North American Warm Desert Lower Montane Riparian Woodland and Shrubland | 20    | 0  | 0.0% | 4   | 19.3% | 6     | 27.6% | 11    | 53.1% | 4   | 19.3% |
| S098 | North American Warm Desert Riparian Mesquite Bosque                      | 3     | 0  | 0.0% | 0   | 0.7%  | 0     | 1.5%  | 3     | 97.9% | 0   | 0.7%  |
| S097 | North American Warm Desert Riparian Woodland and Shrubland               | 8     | 0  | 5.7% | 0   | 0.2%  | 3     | 37.4% | 5     | 56.7% | 0   | 5.9%  |
| S020 | North American Warm Desert Wash  | 10    | 0  | 0.0% | 1   | 8.1%  | 5     | 43.3% | 5     | 48.6% | 1   | 8.1%  |
| S093 | Rocky Mountain Lower Montane Riparian Woodland and Shrubland             | 837   | 30 | 3.6% | 95  | 11.3% | 296   | 35.4% | 416   | 49.7% | 125 | 14.9% |
| S091 | Rocky Mountain Subalpine-Montane Riparian Shrubland                      | 298   | 6  | 2.0% | 29  | 9.7%  | 157   | 52.8% | 106   | 35.6% | 35  | 11.7% |
| S092 | Rocky Mountain Subalpine-Montane Riparian Woodland                       | 4     | 0  | 0.1% | 1   | 28.5% | 2     | 55.1% | 1     | 16.3% | 1   | 28.6% |

**EMERGENT HERBACEOUS WETLAND**

|      |  |     |    |      |     |       |     |       |     |       |     |       |
|------|--|-----|----|------|-----|-------|-----|-------|-----|-------|-----|-------|
| S100 | North American Arid West Emergent Marsh  | 409 | 13 | 3.2% | 133 | 32.5% | 55  | 13.4% | 208 | 50.9% | 146 | 35.7% |
| S102 | Rocky Mountain Alpine-Montane Wet Meadow | 472 | 21 | 4.4% | 98  | 20.7% | 228 | 48.3% | 126 | 26.6% | 118 | 25.1% |

**ALTERED or DISTURBED**

|     |  |       |    |      |     |       |       |       |       |       |     |       |
|-----|--|-------|----|------|-----|-------|-------|-------|-------|-------|-----|-------|
| D01 | Disturbed, Non-specific                            | 90    | 0  | 0.0% | 5   | 5.3%  | 1     | 0.7%  | 84    | 93.9% | 5   | 5.3%  |
| D14 | Disturbed, Oil Well                                | 46    | 0  | 0.0% | 1   | 1.8%  | 7     | 16.2% | 37    | 82.0% | 1   | 1.8%  |
| D09 | Invasive Annual and Biennial Forbland              | 695   | 1  | 0.2% | 24  | 3.5%  | 367   | 52.9% | 302   | 43.5% | 25  | 3.7%  |
| D08 | Invasive Annual Grassland                          | 3,231 | 11 | 0.4% | 123 | 3.8%  | 1,682 | 52.1% | 1,415 | 43.8% | 134 | 4.1%  |
| D06 | Invasive Perennial Grassland                       | 526   | 3  | 0.5% | 19  | 3.7%  | 124   | 23.5% | 380   | 72.3% | 22  | 4.1%  |
| D04 | Invasive Southwest Riparian Woodland and Shrubland | 450   | 43 | 9.6% | 79  | 17.6% | 243   | 54.0% | 85    | 18.8% | 122 | 27.2% |
| D02 | Recently Burned                                    | 172   | 0  | 0.0% | 0   | 0.2%  | 138   | 80.1% | 34    | 19.7% | 0   | 0.2%  |
| D11 | Recently Chained Pinyon-Juniper Areas              | 458   | 0  | 0.0% | 49  | 10.7% | 289   | 63.1% | 120   | 26.2% | 49  | 10.7% |
| D10 | Recently Logged Areas                              | 287   | 0  | 0.1% | 2   | 0.7%  | 271   | 94.3% | 14    | 4.8%  | 2   | 0.8%  |

| Code                             | Land Cover Type                       | Area in UT      | Status 1        |      | Status 2        |       | Status 3        |       | Status 4        |       | Status 1&2      |       |
|----------------------------------|---------------------------------------|-----------------|-----------------|------|-----------------|-------|-----------------|-------|-----------------|-------|-----------------|-------|
|                                  |                                       | km <sup>2</sup> | km <sup>2</sup> | %    | km <sup>2</sup> | %     | km <sup>2</sup> | %     | km <sup>2</sup> | %     | km <sup>2</sup> | %     |
| D03                              | Recently Mined or Quarried            | 171             | 0               | 0.0% | 2               | 1.1%  | 82              | 47.7% | 87              | 51.2% | 2               | 1.1%  |
| <b>DEVELOPED and AGRICULTURE</b> |                                       |                 |                 |      |                 |       |                 |       |                 |       |                 |       |
| N80                              | Agriculture                           | 9,183           | 2               | 0.0% | 40              | 0.4%  | 318             | 3.5%  | 8,823           | 96.1% | 42              | 0.5%  |
| N22                              | Developed, Medium - High Intensity    | 1,098           | 0               | 0.0% | 9               | 0.8%  | 89              | 8.1%  | 999             | 91.0% | 9               | 0.9%  |
| N21                              | Developed, Open Space - Low Intensity | 1,978           | 1               | 0.1% | 8               | 0.4%  | 143             | 7.2%  | 1,826           | 92.3% | 9               | 0.5%  |
| <b>OTHER COVER TYPES</b>         |                                       |                 |                 |      |                 |       |                 |       |                 |       |                 |       |
| N31                              | Barren Lands, Non-specific            | 42              | 0               | 0.0% | 0               | 0.1%  | 40              | 94.2% | 2               | 5.7%  | 0               | 0.1%  |
| N11                              | Open Water                            | 904             | 27              | 3.0% | 98              | 10.8% | 483             | 53.5% | 295             | 32.7% | 125             | 13.8% |
|                                  | <b>TOTAL</b>                          | 213,417         | 4,165           | 2.0% | 26,709          | 12.5% | 122,089         | 57.2% | 60,455          | 28.3% | 30,874          | 14.5% |

**Appendix 5-14A. Percent distribution of each modeled species within 22 Land Stewardship categories by state and region.**

[http://fws-nmcfwru.nmsu.edu/swregap/report/Appendix\\_5-14A.pdf](http://fws-nmcfwru.nmsu.edu/swregap/report/Appendix_5-14A.pdf)

**Appendix 5-14B. Area distribution of each modeled species within 22 Land Stewardship categories by state and region.**

[http://fws-nmcfwru.nmsu.edu/swregap/report/Appendix\\_5-14B.pdf](http://fws-nmcfwru.nmsu.edu/swregap/report/Appendix_5-14B.pdf)

Map and Analysis Range Coding for use with Appendix 5-14A and 5-14B.

| Value | Code | Description  |
|-------|------|--|
| 17    | k12  | Known or probable occurrence, breeding, wintering                          |
| 18    | k13  | Known or probable occurrence, breeding, summering                          |
| 19    | k14  | Known or probable occurrence, breeding, winter and summering               |
| 21    | k21  | Known or probable occurrence, non-breeding, migratory                      |
| 22    | k22  | Known or probable occurrence, non-breeding, wintering                      |
| 23    | k23  | Known or probable occurrence, non-breeding, summering                      |
| 24    | k24  | Known or probable occurrence, non-breeding, winter and summer              |
| 29    | k34  | Known or probable occurrence, breeding and non-breeding, winter and summer |
| 38    | p13  | Potential occurrence, breeding, summering                                  |
| 41    | p21  | Potential occurrence, non-breeding, migratory                              |
| 42    | p22  | Potential occurrence, non-breeding, wintering                              |
| 49    | p34  | Potential occurrence, breeding and non-breeding, winter and summer         |
| 61    | x21  | Extirpated, non-breeding, migratory  |
| 62    | x22  | Extirpated, non-breeding, wintering  |
| 69    | x34  | Extirpated, breeding and non-breeding, winter and summer                   |

**Appendix 5-15. Area and percent distribution of each modeled species represented within the four levels of GAP Management Status by state and region.**

[http://fws-nmcfwru.nmsu.edu/swregap/report/Appendix\\_5-15.pdf](http://fws-nmcfwru.nmsu.edu/swregap/report/Appendix_5-15.pdf)

Map and Analysis Range Coding for use with Appendix 5-15.

| Map Number | Code | Description  |
|------------|------|--|
| 17         | k12  | Known or probable occurrence, breeding, wintering                          |
| 18         | k13  | Known or probable occurrence, breeding, summering                          |
| 19         | k14  | Known or probable occurrence, breeding, winter and summering               |
| 21         | k21  | Known or probable occurrence, non-breeding, migratory                      |
| 22         | k22  | Known or probable occurrence, non-breeding, wintering                      |
| 23         | k23  | Known or probable occurrence, non-breeding, summering                      |
| 24         | k24  | Known or probable occurrence, non-breeding, winter and summer              |
| 29         | k34  | Known or probable occurrence, breeding and non-breeding, winter and summer |
| 38         | p13  | Potential occurrence, breeding, summering                                  |
| 41         | p21  | Potential occurrence, non-breeding, migratory                              |
| 42         | p22  | Potential occurrence, non-breeding, wintering                              |
| 49         | p34  | Potential occurrence, breeding and non-breeding, winter and summer         |
| 61         | x21  | Extirpated, non-breeding, migratory  |
| 62         | x22  | Extirpated, non-breeding, wintering  |
| 69         | x34  | Extirpated, breeding and non-breeding, winter and summer                   |



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## Appendix 7-1. List of Example GAP Applications

### Businesses and Non-government Organizations:

The following are some examples of applications of GAP data by the private sector:

- The New Mexico Natural Heritage Program is using the SWReGAP stewardship layer for New Mexico to update and add detail to their Managed Areas Database.
- Sustainable Energy Solutions at Northern Arizona University used SWReGAP land cover data to perform an analysis of land suitable for wind energy development on the Navajo Nation.
- The Nature Conservancy in Arizona aggregated 98 land cover types from SWReGAP data into 21 potential natural vegetation types (PNVTs). The PNVTs were then assigned a fire return interval (FRI) and a map of historic FRIs for Arizona and New Mexico was prepared. Stewardship data was used to conduct analyses of FRIs by land tenure.
- The Nevada Natural Heritage Program used 17,000 plots of SWReGAP ground data to map invasive annual grasses across Nevada.
- The Grand Canyon Wildlands Council used SWReGAP land cover data to analyze the distribution of more than 70 ecosystems that provide habitat for 2,577 species in the Grand Canyon ecoregion.
- Researchers with the Craighead Environmental Research Institute and the Wildlands Project used Montana GAP vertebrate data to determine the best routes for grizzly bear, elk and cougar, moving across the core protected areas of the Northern Rockies -- the Salmon-Selway, Northern Continental Divide, and Greater Yellowstone Ecosystems. Potential movement corridors were analyzed to find those with habitat most suitable for a wide variety of species. The analysis helped to identify high priority conservation areas.
- Researcher at the University of Georgia with the Georgia Land Use Trends (GLUT) program, have used GAP data to help identify threats to biodiversity at the landscape scale. GLUT has mapped land cover change in Georgia from 1974 to the present. Currently, the project has mapped land cover for 1974, 1985, 1992, and 1998. These land use change data are being integrated with GAP data to develop an assessment of threats to areas of high species richness, land stewardship areas, and key natural communities. Georgia GAP land cover data show significant natural communities. Georgia GAP stewardship data shows which areas are protected. GLUT researchers used GAP and GLUT data to assess land use change within species richness hexagons and various buffer distances around conservation lands and key community types.
- Researchers at Cornell used Gap state data, along with satellite imagery, GIS, and Breeding Bird Atlas data to develop landscape-level habitat models for the Interior Low Plateaus. Their goals were to identify areas of species richness, identify and prioritize areas for potential acquisition or partnerships, identify areas with high restoration potential, identify areas where nesting bird management is a priority, and identify areas that require more intensive inventories.
- The Wyoming Natural Heritage Program (a private non-government organization) transformed the endangered and sensitive species database into a spatially referenced digital geographic information system using the GAP digital base map and other GAP spatial data.
- Weyerhaeuser Corp. is using the Arkansas GAP data in managing their lands in Arkansas.

- Researchers at Michigan's Land Policy Institute used GAP data in the development of a framework for prioritizing the extent farmland at risk of conversion to development in the state.

#### County and City Planning:

Some other examples of the use of GAP by local governments are:

- In Nevada, the Clark County Multi-Species Habitat Conservation Plan identified 37 species that were previously modeled by SWReGAP. Existing SWReGAP models for these species were revised based on additional research and included finer scale datasets that were not available at a regional scale. Revised models were then reanalyzed by intersection with stewardship data.
- The California Coastal Conservancy used a modified Gap Analysis approach, supplemented with groundtruthing and additional data, to select a suite of priority communities in the San Francisco Bay area for management plans to focus on. The results were used to educate the regional conservation community about the successes and limitations of the current conservation reserve system. The Coastal Conservancy encouraged the development of a comprehensive regional conservation planning process, which would build upon the results of this gap analysis to improve the conservation of ecoregional diversity in the San Francisco Bay Area.
- Pierce County planners used GAP and other data to designate a Biodiversity Management Network within their open space maps. Pierce County adopted this revised open space map into their Comprehensive Plan and is currently using the Biodiversity Network information in the community planning process (Dvornich et al. 2005). GAP predicted species lists, augmented by Natural Heritage locations and other data (such as fish and butterfly data) were instrumental in the identification of the BMAs.
- CA-GAP biological data were combined with the Southern California Association of Governments (SCAG) land ownership data to show which ownerships and jurisdictions were needed for joint conservation planning and management of a particular natural community or species, maximizing efficiency and minimizing the potential for yet another conservation crisis.
- In California, county and city planners of several jurisdictions, wildlife agencies, developers of the 4S Ranch property, and the state Natural Communities Conservation Planning program used the GAP regional data, as well as more detailed information, to conserve 1,640 acres of habitat within a 2,900-acre planned development.
- County planners in Piute County, Utah, used GAP data to optimize the siting of a proposed sawmill for aspen with respect to the distribution of aspen stands.
- The City of Bainbridge Island, Washington, used GAP data to assist them in development of a watershed planning project.

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### State Uses:

The following are some examples of uses of GAP data by state agencies.

- The Nevada Department of Wildlife used SWReGAP data in the development of their State Wildlife Action Plan (SWAP). Specifically, land cover and stewardship data were used to analyze patterns of biodiversity and land use to identify species of conservation priority and their key habitats. Ecological systems from SWReGAP land cover were organized into 27 key habitat types.
- The Nevada Department of Wildlife used SWReGAP stewardship data to plan implementation of the Nevada SWAP by summarizing land ownership and management for each key habitat and identifying primary partners for conservation in each habitat.
- The Utah Division of Forestry, Fire, and State Lands chose to employ SWReGAP data in their Forest Stewardship Program (FSP) Spatial Analysis Project. The data was used to help identify privately owned forested lands with the greatest potential to benefit from FSP practices.
- The New Mexico Department of Game and Fish used SWReGAP data in the development of their SWAP. Specific uses include: 1) species of greatest conservation need (SGCN) were associated with land cover types to provide a method to identify key habitats; 2) the stewardship data layer provided an assessment of conservation prioritization.
- The Colorado Division of Wildlife used SWReGAP wildlife habitat relationship models to identify key habitats for SGCN.
- The Utah Fire Assessment Project used GAP land cover data to help identify general hazard areas at a state-wide level for fire management. The assessment defined, and then ranked risks, values, and hazards and assigned a final analysis rating based on a combination of these factors. Risk, defined as the potential for fire occurrence, was based upon historical fire occurrence, fire size, and ignition source. Values, also called "social concerns" were based on features to be protected. Hazard was defined as areas with the potential for extreme fire behavior based upon present vegetation. The vegetation map was produced from modified Utah GAP Analysis data.
- The Minnesota Department of Natural Resources (MN-DNR) assembled species richness maps of priority bird species by compiling the GAP range extent maps of all priority bird species into a statewide hypercoverage for all priority birds by bird habitat groups (open, water, and forest). They discovered that Sherburne Wildlife Refuge lies within an Ecological Classification System with the highest species richness levels, thus managing the refuge for bird conservation would make an important contribution to conservation efforts in the state. The area in which Sherburne lies is rich for bird species that have Oak Savannah as their priority habitat type. They then used GAP land cover classes to identify potential oak savanna within the private lands work area of Sherburne NWR.
- GAP products are incorporated into the Michigan Department of Natural Resources' Integrated Forest Monitoring and Prescription (IFMAP) project. The IFMAP GIS-based decision-support system brings GAP products to the desktop of DNR land managers throughout Michigan. IFMAP addresses all lands in Michigan, so that decisions that once were made only within the context of State land can now be made in concert with other land management agencies and the public. This tool supports sound decision making on timber sales, so that the State of Michigan forest remains a renewable resource.
- GAP land cover imagery was used by the Tennessee Wildlife Resources Agency (TWRA) for locating particular habitat types. Information on the locations of these habitat types is

provided by TWRA to the public for a wide variety of public service functions, from education to cooperative resource management. GAP data have been used by the Tennessee Forestry Stewardship Program to help develop a district program for nine conservation planning districts, outlining Best Management Practices (BMPs) for biological conservation on private lands.

- The Wyoming Department of Fish and Game used GAP data to assist them in transforming the Wildlife Observation System database into a spatially referenced geographic information system.
- The Utah Division of Wildlife Resources and the Bear River Water Conservancy District used the Utah GAP land cover map in a resource management assessment for mitigating conflicts between a proposed groundwater withdrawal project and the maintenance of an elk calving area in the Uinta Mountains.
- The Utah Division of Wildlife Resources, the Rocky Mountain Elk Foundation, and Sheik Safari International used the Utah GAP land cover map to identify critical elk habitat. The environmental profile of these areas was then used to identify other similar areas for elk habitat enhancement.
- The Utah Division of Wildlife Resources used the Utah GAP land cover map for a rapid ecological assessment of the Echo Henefer Wildlife Management Area.
- The Washington Department of Fish and Wildlife uses GAP data from Eastern Washington to assist with an innovative program that brings the forest products industry, state agency biologists, non-government organizations, and tribal biologists together in the field to jointly determine the appropriate management practices for any particular site of concern (Timber, Fish & Wildlife Program).
- The Idaho Department of Fish and Game used GAP data to evaluate the impact from expanded military training activities on public lands in Southern Idaho.
- The Idaho Department of Fish and Game uses GAP data for regional planning efforts on a regular basis.

#### State Wildlife Action Plans:

Each state in the U.S. was mandated to submit a State Wildlife Action Plan to the federal government by October 2005. Each plan included information on species of greatest conservation need (SGCN), SGCN habitats, threats to species and habitat, research needs, necessary plan actions, and conservation priorities. GAP land cover, species and habitat distribution models, and maps were an important component of this planning process. Twenty-two states used GAP land cover data extensively. The vegetation classifications, predicted vertebrate distribution maps, aquatic, stewardship, ownership and species richness data, species lists, and habitat descriptions were also often used in plan development.

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### Federal Agency Applications:

Some examples of applications of GAP data by federal agencies follow:

- The U.S. Fish and Wildlife Service is using SWReGAP data to formulate conservation objectives in the Lower Colorado River watershed. The conservation objectives include: 1) coarse-filter objectives based on prioritized ecological systems and 2) objectives based on habitat requirements of priority species.
- The U.S. Environmental Protection Agency (EPA) has used SWReGAP land cover data to modify drafts and final versions of Level 3 and 4 ecoregions in Colorado. In New Mexico, SWReGAP data were examined in developing the initial draft of New Mexico ecoregions, mapped at 1:250,000 scale. The EPA plans to use the data for ecoregion mapping in Arizona also.
- The Bureau of Land Management state fire management officers in Utah and Nevada used SWReGAP land cover data to categorize vegetation layers into fire regimes and condition classes (FRCCs). The resulting analysis will assist in fire management planning and with establishing hazardous fuels project priorities.
- The LANDFIRE project maps existing vegetation and structure and used SWReGAP field data to train decision-tree models for the project.
- The USDA-Agricultural Research Service, U.S. EPA, and University of Arizona developed the Automated Geospatial Watershed Assessment (AGWA) tool to facilitate modeling runoff at different spatial and temporal scales. SWReGAP land cover data were used in the AGWA tool for watershed assessment.
- The Sagebrush Vegetation Mapping Project, an effort of USGS and Oregon State University, used SWReGAP land cover data as one source of data in their mapping of sagebrush and steppe vegetation in the Western U.S.
- GAP data are being supplied to all military installations in the Great Basin ecoregion for integrated management of the natural resources. These installations constitute a very large amount of land area. Much of it is of high value for native species.
- The Ouachita National Forest used the Arkansas GAP data to help them develop an ecosystem management plan.
- The Wyoming GAP data were used by NASA to calibrate a model that predicts vegetation types based on climate and soil variables.
- The potential contributions to biodiversity conservation of four different options proposed for new wilderness designation in Idaho were quantified by the Idaho Cooperative Fish and Wildlife Research Unit in cooperation with the Park Studies Unit.
- The potential contributions to biodiversity conservation of four different options proposed for new national park designation in Idaho were quantified by the Idaho Cooperative Park Studies Unit.
- The U.S. Fish and Wildlife Service regularly uses the GAP data for Southern California for habitat evaluation and management.
- The U.S. Forest Service, Bureau of Land Management, and National Park Service are using the GAP data for a wide variety of natural resource management operations in Utah. For example, the entire Utah GAP database is directly linked with existing National Park Service databases for use by National Parks.
- The U.S. Forest Service used the Utah GAP data to help assist them in evaluating human-induced impacts to forested lands surrounding ski resorts in central Utah.

- The U.S. Fish and Wildlife Service in Delaware used GAP data to help identify potential habitat for the federally endangered Delmarva fox squirrel. These maps were displayed and served as a catalyst for bringing together people with a stake in the issue.
- The U.S. Fish and Wildlife Service used the Indiana GAP data as part of a biological assessment for the base closure of the Jefferson Proving Grounds and its conversion to a National Wildlife Refuge. This 58,000-acre installation has restricted human access due to unexploded ordinance and contains some of the highest-quality natural habitat in Indiana.
- The U.S. Fish and Wildlife Service in Louisiana used GAP data to avoid conflict over the designation of critical habitat of the federally endangered Louisiana black bear.
- The U.S. Natural Resources Conservation Service (NRCS) in New Mexico is using GAP clustered imagery as a base for their land cover mapping activities.
- The Department of Defense developed an electronic environmental information system for the Mojave ecoregion, which used GAP data as a foundation or base layer of information. The system will link 29 DOD installations to a common source of environmental information.

-3 ARIZONA MYOTIS *Myotis occultus*,  
-2 GUNNISON SAGE-GROUSE *Centrocercus minimus*,  
-1 TRIPLOID CHECKERED WHIPTAIL *Cnemidophorus neotesselatus*,  
173429, COUCH'S SPADEFOOT *Scaphiopus couchii*,  
173438 GREEN FROG *Rana clamitans*,  
173440 WOOD FROG *Rana sylvatica*,  
173441 BULLFROG *Rana catesbeiana*,  
173443 NORTHERN LEOPARD FROG *Rana pipiens*,  
173446 RED-LEGGED FROG *Rana aurora*,  
173447 RIO GRANDE LEOPARD FROG *Rana berlandieri*,  
173448 PLAINS LEOPARD FROG *Rana blairi*,  
173451 CHIRICAHUA LEOPARD FROG *Rana chiricahuensis*,  
173454 MOUNTAIN YELLOW-LEGGED FROG *Rana muscosa*,  
173457 RELICT LEOPARD FROG *Rana onca*,  
173458 SPOTTED FROG *Rana pretiosa*,  
173461 TARAHUMARA FROG *Rana tarahumarae*,  
173462 YAVAPAI LEOPARD FROG *Rana yavapaiensis*,  
173468 GREAT PLAINS NARROWMOUTH TOAD *Gastrophryne olivacea*,  
173476 WOODHOUSE'S TOAD *Bufo woodhousii*,  
173481 COLORADO RIVER TOAD *Bufo alvarius*,  
173482 WESTERN TOAD *Bufo boreas*,  
173484 GREAT PLAINS TOAD *Bufo cognatus*,  
173485 GREEN TOAD *Bufo debilis*,  
173490 SOUTHWESTERN TOAD *Bufo microscaphus*,  
173491 RED-SPOTTED TOAD *Bufo punctatus*,  
173492 SONORAN GREEN TOAD *Bufo retiformis*,  
173493 TEXAS TOAD *Bufo speciosus*,  
173510 CANYON TREEFROG *Hyla arenicolor*,  
173513 MOUNTAIN TREEFROG *Hyla eximia*,  
173520 NORTHERN CRICKET FROG *Acris crepitans*,  
173525 WESTERN CHORUS FROG *Pseudacris triseriata*,  
173534 LOWLAND BURROWING TREEFROG *Pternohyla fodiens*,  
173549 AFRICAN CLAWED FROG *Xenopus laevis*,  
173592 TIGER SALAMANDER *Ambystoma tigrinum*,  
173663 JEMEZ MOUNTAINS SALAMANDER *Plethodon neomexicanus*,  
173702 SACRAMENTO MOUNTAIN SALAMANDER *Aneides hardii*,  
173752 SNAPPING TURTLE *Chelydra serpentina*,  
173766 YELLOW MUD TURTLE *Kinosternon flavescens*,  
173768 SONORAN MUD TURTLE *Kinosternon sonoriense*,  
173774 WESTERN POND TURTLE *Clemmys marmorata*,  
173778 ORNATE BOX TURTLE *Terrapene ornata*,  
173783 PAINTED TURTLE *Chrysemys picta*,  
173819 COMMON SLIDER *Trachemys scripta*,  
173856 DESERT TORTOISE *Gopherus agassizii*,  
173865 EASTERN FENCE LIZARD *Sceloporus undulatus*,  
173868 CLARK'S SPINY LIZARD *Sceloporus clarkii*,  
173870 SAGEBRUSH LIZARD *Sceloporus graciosus*,

173872 YARROW'S SPINY LIZARD *Sceloporus jarrovii*,  
173873 DESERT SPINY LIZARD *Sceloporus magister*,  
173875 WESTERN FENCE LIZARD *Sceloporus occidentalis*,  
173878 CREVICE SPINY LIZARD *Sceloporus poinsettii*,  
173879 BUNCH GRASS LIZARD *Sceloporus scalaris*,  
173881 STRIPED PLATEAU LIZARD *Sceloporus virgatus*,  
173906 ZEBRA-TAILED LIZARD *Callisaurus draconoides*,  
173910 GREATER EARLESS LIZARD *Cophosaurus texanus*,  
173912 COLLARED LIZARD *Crotaphytus collaris*,  
173921 DESERT IGUANA *Dipsosaurus dorsalis*,  
173924 LONG-NOSED LEOPARD LIZARD *Gambelia wislizenii*,  
173927 LESSER EARLESS LIZARD *Holbrookia maculata*,  
173938 TEXAS HORNED LIZARD *Phrynosoma cornutum*,  
173941 FLAT-TAILED HORNED LIZARD *Phrynosoma mcallii*,  
173942 ROUND-TAILED HORNED LIZARD *Phrynosoma modestum*,  
173943 DESERT HORNED LIZARD *Phrynosoma platyrhinus*,  
173944 REGAL HORNED LIZARD *Phrynosoma solare*,  
173949 COLORADO DESERT FRINGE-TOED LIZARD *Uma notata*,  
173950 MOJAVE FRINGE-TOED LIZARD *Uma scoparia*,  
173952 LONG-TAILED BRUSH LIZARD *Urosaurus graciosus*,  
173954 TREE LIZARD *Urosaurus ornatus*,  
173956 SIDE-BLOTCHED LIZARD *Uta stansburiana*,  
173964 MOUNTAIN SKINK *Eumeces callicephalus*,  
173966 GILBERT'S SKINK *Eumeces gilberti*,  
173967 MANY-LINED SKINK *Eumeces multivirgatus*,  
173968 GREAT PLAINS SKINK *Eumeces obsoletus*,  
173970 WESTERN SKINK *Eumeces skiltonianus*,  
173971 FOUR-LINED SKINK *Eumeces tetragrammus*,  
174014 SIX-LINED RACERUNNER *Cnemidophorus sexlineatus*,  
174015 CANYON SPOTTED WHIPTAIL *Cnemidophorus burti*,  
174016 GRAY-CHECKERED WHIPTAIL *Cnemidophorus dixonii*,  
174017 CHIHUAHUAN SPOTTED WHIPTAIL *Cnemidophorus exsanguis*,  
174018 GILA SPOTTED WHIPTAIL *Cnemidophorus flagellicaudus*,  
174019 TEXAS SPOTTED WHIPTAIL *Cnemidophorus gularis*,  
174021 LITTLE STRIPED WHIPTAIL *Cnemidophorus inornatus*,  
174024 NEW MEXICO WHIPTAIL *Cnemidophorus neomexicanus*,  
174025 SONORAN SPOTTED WHIPTAIL *Cnemidophorus sonora*,  
174026 CHECKERED WHIPTAIL *Cnemidophorus tessellatus*,  
174038 TEXAS BANDED GECKO *Coleonyx brevis*,  
174041 WESTERN BANDED GECKO *Coleonyx variegatus*,  
174092 DESERT NIGHT LIZARD *Xantusia vigilis*,  
174113 GILA MONSTER *Heloderma suspectum*,  
174136 COMMON GARTER SNAKE *Thamnophis sirtalis*,  
174140 WESTERN AQUATIC GARTER SNAKE *Thamnophis couchii*,  
174141 BLACK-NECKED GARTER SNAKE *Thamnophis cyrtopsis*,  
174142 WESTERN TERRESTRIAL GARTER SNAKE *Thamnophis elegans*,  
174143 MEXICAN GARTER SNAKE *Thamnophis eques*,



174144 CHECKERED GARTER SNAKE *Thamnophis marcianus*,  
174146 WESTERN RIBBON SNAKE *Thamnophis proximus*,  
174147 PLAINS GARTER SNAKE *Thamnophis radix*,  
174148 NARROW-HEADED GARTER SNAKE *Thamnophis rufipunctatus*,  
174155 WESTERN HOG-NOSED SNAKE *Heterodon nasicus*,  
174158 RING-NECKED SNAKE *Diadophis punctatus*,  
174169 RACER *Coluber constrictor*,  
174175 CORN SNAKE *Elaphe guttata*,  
174187 MILK SNAKE *Lampropeltis triangulum*,  
174192 SONORAN MOUNTAIN KINGSSNAKE *Lampropeltis pyromelana*,  
174202 GLOSSY SNAKE *Arizona elegans*,  
174210 BANDED SAND SNAKE *Chilomeniscus cinctus*,  
174212 WESTERN SHOVEL-NOSED SNAKE *Chionactis occipitalis*,  
174213 SONORAN SHOVEL-NOSED SNAKE *Chionactis palarostris*,  
174230 WESTERN HOOK-NOSED SNAKE *Gyalopion canum*,  
174233 NIGHT SNAKE *Hypsiglena torquata*,  
174237 SONORAN WHIPSNAKE *Masticophis bilineatus*,  
174238 COACHWHIP *Masticophis flagellum*,  
174240 STRIPED WHIPSNAKE *Masticophis taeniatus*,  
174244 PLAIN-BELLIED WATER SNAKE *Nerodia erythrogaster*,  
174251 NORTHERN WATER SNAKE *Nerodia sipedon*,  
174258 BROWN VINE SNAKE *Oxybelis aeneus*,  
174260 SADDLED LEAF-NOSED SNAKE *Phyllorhynchus browni*,  
174261 SPOTTED LEAF-NOSED SNAKE *Phyllorhynchus decurtatus*,  
174267 LONG-NOSED SNAKE *Rhinocheilus lecontei*,  
174269 BIG BEND PATCH-NOSED SNAKE *Salvadora deserticola*,  
174270 MOUNTAIN PATCH-NOSED SNAKE *Salvadora grahamiae*,  
174271 WESTERN PATCH-NOSED SNAKE *Salvadora hexalepis*,  
174275 GROUND SNAKE *Sonora semiannulata*,  
174282 SOUTHWESTERN BLACK-HEADED SNAKE *Tantilla hobartsmithi*,  
174283 PLAINS BLACK-HEADED SNAKE *Tantilla nigriceps*,  
174288 CHIHUAHUAN BLACK-HEADED SNAKE *Tantilla wilcoxi*,  
174289 YAQUI BLACK-HEADED SNAKE *Tantilla yaquia*,  
174291 WESTERN LYRE SNAKE *Trimorphodon biscutatus*,  
174293 LINED SNAKE *Tropidoclonion lineatum*,  
174304 MASSASAUGA *Sistrurus catenatus*,  
174310 WESTERN DIAMONDBACK RATTLESNAKE *Crotalus atrox*,  
174311 SIDEWINDER *Crotalus cerastes*,  
174312 ROCK RATTLESNAKE *Crotalus lepidus*,  
174313 SPECKLED RATTLESNAKE *Crotalus mitchellii*,  
174314 BLACK-TAILED RATTLESNAKE *Crotalus molossus*,  
174315 TWIN-SPOTTED RATTLESNAKE *Crotalus pricei*,  
174317 MOJAVE RATTLESNAKE *Crotalus scutulatus*,  
174318 TIGER RATTLESNAKE *Crotalus tigris*,  
174319 WESTERN RATTLESNAKE *Crotalus viridis*,  
174320 RIDGE-NOSED RATTLESNAKE *Crotalus willardi*,  
174326 RUBBER BOA *Charina bottae*,

174336 TEXAS BLIND SNAKE *Leptotyphlops dulcis*,  
174337 WESTERN BLIND SNAKE *Leptotyphlops humilis*,  
174352 WESTERN CORAL SNAKE *Micruroides euryxanthus*,  
174469 COMMON LOON *Gavia immer*,  
174470 YELLOW-BILLED LOON *Gavia adamsii*,  
174474 RED-THROATED LOON *Gavia stellata*,  
174475 PACIFIC LOON *Gavia pacifica*,  
174479 RED-NECKED GREBE *Podiceps grisegena*,  
174482 HORNED GREBE *Podiceps auritus*,  
174485 EARED GREBE *Podiceps nigricollis*,  
174503 WESTERN GREBE *Aechmophorus occidentalis*,  
174505 PIED-BILLED GREBE *Podilymbus podiceps*,  
174684 AMERICAN WHITE PELICAN *Pelecanus erythrorhynchos*,  
174717 DOUBLE-CRESTED CORMORANT *Phalacrocorax auritus*,  
174773 GREAT BLUE HERON *Ardea herodias*,  
174793 GREEN HERON *Butorides virescens*,  
174803 CATTLE EGRET *Bubulcus ibis*,  
174813 SNOWY EGRET *Egretta thula*,  
174827 LITTLE BLUE HERON *Egretta caerulea*,  
174832 BLACK-CROWNED NIGHT-HERON *Nycticorax nycticorax*,  
174842 YELLOW-CROWNED NIGHT-HERON *Nyctanassa violacea*,  
174846 LEAST BITTERN *Ixobrychus exilis*,  
174856 AMERICAN BITTERN *Botaurus lentiginosus*,  
174926 WHITE-FACED IBIS *Plegadis chihi*,  
174987 TUNDRA SWAN *Cygnus columbianus*,  
174992 TRUMPETER SWAN *Cygnus buccinator*,  
174999 CANADA GOOSE *Branta canadensis*,  
175011 BRANT *Branta bernicla*,  
175020 GREATER WHITE-FRONTED GOOSE *Anser albifrons*,  
175038 SNOW GOOSE *Chen caerulescens*,  
175041 ROSS'S GOOSE *Chen rossii*,  
175044 BLACK-BELLIED WHISTLING-DUCK *Dendrocygna autumnalis*,  
175063 MALLARD *Anas platyrhynchos*,  
175068 AMERICAN BLACK DUCK *Anas rubripes*,  
175073 GADWALL *Anas strepera*,  
175074 NORTHERN PINTAIL *Anas acuta*,  
175081 GREEN-WINGED TEAL *Anas crecca*,  
175086 BLUE-WINGED TEAL *Anas discors*,  
175089 CINNAMON TEAL *Anas cyanoptera*,  
175092 EURASIAN WIGEON *Anas penelope*,  
175094 AMERICAN WIGEON *Anas americana*,  
175096 NORTHERN SHOVELER *Anas clypeata*,  
175122 WOOD DUCK *Aix sponsa*,  
175125 REDHEAD *Aythya americana*,  
175128 RING-NECKED DUCK *Aythya collaris*,  
175129 CANVASBACK *Aythya valisineria*,  
175130 GREATER SCAUP *Aythya marila*,

175134 LESSER SCAUP *Aythya affinis*,  
175141 COMMON GOLDENEYE *Bucephala clangula*,  
175144 BARROW'S GOLDENEYE *Bucephala islandica*,  
175145 BUFFLEHEAD *Bucephala albeola*,  
175147 LONG-TAILED DUCK *Clangula hyemalis*,  
175149 HARLEQUIN DUCK *Histrionicus histrionicus*,  
175163 WHITE-WINGED SCOTER *Melanitta fusca*,  
175170 SURF SCOTER *Melanitta perspicillata*,  
175175 RUDDY DUCK *Oxyura jamaicensis*,  
175183 HOODED MERGANSER *Lophodytes cucullatus*,  
175185 COMMON MERGANSER *Mergus merganser*,  
175187 RED-BREASTED MERGANSER *Mergus serrator*,  
175265 TURKEY VULTURE *Cathartes aura*,  
175272 BLACK VULTURE *Coragyps atratus*,  
175274 CALIFORNIA CONDOR *Gymnogyps californianus*,  
175282 WHITE-TAILED KITE *Elanus leucurus*,  
175300 NORTHERN GOSHAWK *Accipiter gentilis*,  
175304 SHARP-SHINNED HAWK *Accipiter striatus*,  
175309 COOPER'S HAWK *Accipiter cooperii*,  
175350 RED-TAILED HAWK *Buteo jamaicensis*,  
175365 BROAD-WINGED HAWK *Buteo platypterus*,  
175367 SWAINSON'S HAWK *Buteo swainsoni*,  
175368 ZONE-TAILED HAWK *Buteo albonotatus*,  
175373 ROUGH-LEGGED HAWK *Buteo lagopus*,  
175377 FERRUGINOUS HAWK *Buteo regalis*,  
175397 HARRIS'S HAWK *Parabuteo unicinctus*,  
175402 COMMON BLACK-HAWK *Buteogallus anthracinus*,  
175407 GOLDEN EAGLE *Aquila chrysaetos*,  
175420 BALD EAGLE *Haliaeetus leucocephalus*,  
175430 NORTHERN HARRIER *Circus cyaneus*,  
175590 OSPREY *Pandion haliaetus*,  
175599 GYRFALCON *Falco rusticolus*,  
175603 PRAIRIE FALCON *Falco mexicanus*,  
175604 PEREGRINE FALCON *Falco peregrinus*,  
175610 APLOMADO FALCON *Falco femoralis*,  
175613 MERLIN *Falco columbarius*,  
175622 AMERICAN KESTREL *Falco sparverius*,  
175790 RUFFED GROUSE *Bonasa umbellus*,  
175827 WHITE-TAILED PTARMIGAN *Lagopus leucurus*,  
175834 GREATER PRAIRIE-CHICKEN *Tympanuchus cupido*,  
175838 LESSER PRAIRIE-CHICKEN *Tympanuchus pallidicinctus*,  
175841 SHARP-TAILED GROUSE *Tympanuchus phasianellus*,  
175848 SHARP-TAILED GROUSE-COLUMBIAN *Tympanuchus phasianellus columbianus*,  
175852 SHARP-TAILED GROUSE-PLAINS *Tympanuchus phasianellus jamesi*,  
175855 GREATER SAGE-GROUSE *Centrocercus urophasianus*,  
175860 BLUE GROUSE *Dendragapus obscurus*,  
175863 NORTHERN BOBWHITE *Colinus virginianus*,

175872 SCALED QUAIL *Callipepla squamata*,  
175876 CALIFORNIA QUAIL *Callipepla californica*,  
175877 GAMBEL'S QUAIL *Callipepla gambelii*,  
175893 MOUNTAIN QUAIL *Oreortyx pictus*,  
175900 MONTEZUMA QUAIL *Cyrtonyx montezumae*,  
175905 RING-NECKED PHEASANT *Phasianus colchicus*,  
175908 CHUKAR *Alectoris chukar*,  
175915 GRAY PARTRIDGE *Perdix perdix*,  
176136 WILD TURKEY *Meleagris gallopavo*,  
176176 WHOOPING CRANE *Grus americana*,  
176177 SANDHILL CRANE *Grus canadensis*,  
176177 SANDHILL CRANE *Grus canadensis*,  
176209 CLAPPER RAIL *Rallus longirostris*,  
176221 VIRGINIA RAIL *Rallus limicola*,  
176221 VIRGINIA RAIL *Rallus limicola*,  
176242 SORA *Porzana carolina*,  
176263 BLACK RAIL *Laterallus jamaicensis*,  
176284 COMMON MOORHEN *Gallinula chloropus*,  
176292 AMERICAN COOT *Fulica americana*,  
176506 SEMIPALMATED PLOVER *Charadrius semipalmatus*,  
176507 PIPING PLOVER *Charadrius melodus*,  
176510 SNOWY PLOVER *Charadrius alexandrinus*,  
176520 KILLDEER *Charadrius vociferus*,  
176522 MOUNTAIN PLOVER *Charadrius montanus*,  
176564 AMERICAN GOLDEN-PLOVER *Pluvialis dominica*,  
176567 BLACK-BELLIED PLOVER *Pluvialis squatarola*,  
176571 RUDDY TURNSTONE *Arenaria interpres*,  
176580 AMERICAN WOODCOCK *Scolopax minor*,  
176593 LONG-BILLED CURLEW *Numenius americanus*,  
176599 WHIMBREL *Numenius phaeopus*,  
176610 UPLAND SANDPIPER *Bartramia longicauda*,  
176612 SPOTTED SANDPIPER *Actitis macularia*,  
176615 SOLITARY SANDPIPER *Tringa solitaria*,  
176619 GREATER YELLOWLEGS *Tringa melanoleuca*,  
176620 LESSER YELLOWLEGS *Tringa flavipes*,  
176638 WILLET *Catoptrophorus semipalmatus*,  
176642 RED KNOT *Calidris canutus*,  
176653 PECTORAL SANDPIPER *Calidris melanotos*,  
176654 WHITE-RUMPED SANDPIPER *Calidris fuscicollis*,  
176655 BAIRD'S SANDPIPER *Calidris bairdii*,  
176656 LEAST SANDPIPER *Calidris minutilla*,  
176661 DUNLIN *Calidris alpina*,  
176667 SEMIPALMATED SANDPIPER *Calidris pusilla*,  
176668 WESTERN SANDPIPER *Calidris mauri*,  
176669 SANDERLING *Calidris alba*,  
176675 SHORT-BILLED DOWITCHER *Limnodromus griseus*,  
176679 LONG-BILLED DOWITCHER *Limnodromus scolopaceus*,

176684 BUFF-BREASTED SANDPIPER *Tryngites subruficollis*,  
176686 MARBLED GODWIT *Limosa fedoa*,  
176700 COMMON SNIPE *Gallinago gallinago*,  
176721 AMERICAN AVOCET *Recurvirostra americana*,  
176726 BLACK-NECKED STILT *Himantopus mexicanus*,  
176735 RED-NECKED PHALAROPE *Phalaropus lobatus*,  
176736 WILSON'S PHALAROPE *Phalaropus tricolor*,  
176808 GLAUCOUS GULL *Larus hyperboreus*,  
176824 HERRING GULL *Larus argentatus*,  
176828 THAYER'S GULL *Larus thayeri*,  
176829 CALIFORNIA GULL *Larus californicus*,  
176830 RING-BILLED GULL *Larus delawarensis*,  
176838 FRANKLIN'S GULL *Larus pipixcan*,  
176839 BONAPARTE'S GULL *Larus philadelphia*,  
176866 SABINE'S GULL *Xema sabini*,  
176887 FORSTER'S TERN *Sterna forsteri*,  
176888 COMMON TERN *Sterna hirundo*,  
176923 LEAST TERN *Sterna antillarum*,  
176924 CASPIAN TERN *Sterna caspia*,  
176959 BLACK TERN *Chlidonias niger*,  
177065 BAND-TAILED PIGEON *Columba fasciata*,  
177071 ROCK DOVE *Columba livia*,  
177121 WHITE-WINGED DOVE *Zenaida asiatica*,  
177125 MOURNING DOVE *Zenaida macroura*,  
177134 SPOTTED DOVE *Streptopelia chinensis*,  
177152 COMMON GROUND-DOVE *Columbina passerina*,  
177162 INCA DOVE *Columbina inca*,  
177831 YELLOW-BILLED CUCKOO *Coccyzus americanus*,  
177834 BLACK-BILLED CUCKOO *Coccyzus erythrophthalmus*,  
177836 GREATER ROADRUNNER *Geococcyx californianus*,  
177851 COMMON BARN-OWL *Tyto alba*,  
177856 EASTERN SCREECH-OWL *Otus asio*,  
177875 WHISKERED SCREECH-OWL *Otus trichopsis*,  
177878 FLAMMULATED OWL *Otus flammeolus*,  
177884 GREAT HORNED OWL *Bubo virginianus*,  
177896 SNOWY OWL *Nyctea scandiaca*,  
177902 NORTHERN PYGMY-OWL *Glaucidium gnoma*,  
177908 FERRUGINOUS PYGMY-OWL *Glaucidium brasilianum*,  
177912 ELF OWL *Micrathene whitneyi*,  
177925 SPOTTED OWL *Strix occidentalis*,  
177932 LONG-EARED OWL *Asio otus*,  
177935 SHORT-EARED OWL *Asio flammeus*,  
177938 BOREAL OWL *Aegolius funereus*,  
177942 NORTHERN SAW-WHET OWL *Aegolius acadicus*,  
177946 BURROWING OWL *Athene cunicularia*,  
177961 WHIP-POOR-WILL *Caprimulgus vociferus*,  
177966 BUFF-COLLARED NIGHTJAR *Caprimulgus ridgwayi*,

177979 COMMON NIGHTHAWK *Chordeiles minor*,  
177988 LESSER NIGHTHAWK *Chordeiles acutipennis*,  
177997 BLACK SWIFT *Cypseloides niger*,  
178001 CHIMNEY SWIFT *Chaetura pelagica*,  
178002 VAUX'S SWIFT *Chaetura vauxi*,  
178014 WHITE-THROATED SWIFT *Aeronautes saxatalis*,  
178030 LUCIFER HUMMINGBIRD *Calothorax lucifer*,  
178033 BLACK-CHINNED HUMMINGBIRD *Archilochus alexandri*,  
178035 COSTA'S HUMMINGBIRD *Calypte costae*,  
178036 ANNA'S HUMMINGBIRD *Calypte anna*,  
178038 BROAD-TAILED HUMMINGBIRD *Selasphorus platycercus*,  
178040 RUFIOUS HUMMINGBIRD *Selasphorus rufus*,  
178041 ALLEN'S HUMMINGBIRD *Selasphorus sasin*,  
178048 CALLIOPE HUMMINGBIRD *Stellula calliope*,  
178050 MAGNIFICENT HUMMINGBIRD *Eugenes fulgens*,  
178054 BLUE-THROATED HUMMINGBIRD *Lampornis clemenciae*,  
178065 BERYLLINE HUMMINGBIRD *Amazilia beryllina*,  
178066 VIOLET-CROWNED HUMMINGBIRD *Amazilia violiceps*,  
178069 WHITE-EARED HUMMINGBIRD *Hylocharis leucotis*,  
178073 BROAD-BILLED HUMMINGBIRD *Cyanthus latirostris*,  
178096 ELEGANT TROGON *Trogon elegans*,  
178101 EARED TROGON *Euptilotis neoxenus*,  
178112 GREEN KINGFISHER *Chloroceryle americana*,  
178119 BELTED KINGFISHER *Ceryle alcyon*,  
178154 NORTHERN FLICKER *Colaptes auratus*,  
178164 GILDED FLICKER *Colaptes chrysoides*,  
178186 RED-HEADED WOODPECKER *Melanerpes erythrocephalus*,  
178189 ACORN WOODPECKER *Melanerpes formicivorus*,  
178195 RED-BELLIED WOODPECKER *Melanerpes carolinus*,  
178196 LEWIS'S WOODPECKER *Melanerpes lewis*,  
178198 GILA WOODPECKER *Melanerpes uropygialis*,  
178208 WILLIAMSON'S SAPSUCKER *Sphyrapicus thyroideus*,  
178211 RED-NAPED SAPSUCKER *Sphyrapicus nuchalis*,  
178212 RED-BREASTED SAPSUCKER *Sphyrapicus ruber*,  
178251 THREE-TOED WOODPECKER *Picoides tridactylus*,  
178256 WHITE-HEADED WOODPECKER *Picoides albolarvatus*,  
178259 DOWNY WOODPECKER *Picoides pubescens*,  
178260 LADDER-BACKED WOODPECKER *Picoides scalaris*,  
178261 STRICKLAND'S WOODPECKER *Picoides stricklandi*,  
178262 HAIRY WOODPECKER *Picoides villosus*,  
178279 EASTERN KINGBIRD *Tyrannus tyrannus*,  
178282 TROPICAL KINGBIRD *Tyrannus melancholicus*,  
178287 WESTERN KINGBIRD *Tyrannus verticalis*,  
178288 CASSIN'S KINGBIRD *Tyrannus vociferans*,  
178292 THICK-BILLED KINGBIRD *Tyrannus crassirostris*,  
178293 SCISSOR-TAILED FLYCATCHER *Tyrannus forficatus*,  
178305 SULPHUR-BELLIED FLYCATCHER *Myiodynastes luteiventris*,

178309 GREAT CRESTED FLYCATCHER *Myiarchus crinitus*,  
178312 BROWN-CRESTED FLYCATCHER *Myiarchus tyrannulus*,  
178316 ASH-THROATED FLYCATCHER *Myiarchus cinerascens*,  
178319 DUSKY-CAPPED FLYCATCHER *Myiarchus tuberculifer*,  
178329 EASTERN PHOEBE *Sayornis phoebe*,  
178330 BLACK PHOEBE *Sayornis nigricans*,  
178333 SAY'S PHOEBE *Sayornis saya*,  
178340 ALDER FLYCATCHER *Empidonax alnorum*,  
178341 WILLOW FLYCATCHER *Empidonax traillii*,  
178346 DUSKY FLYCATCHER *Empidonax oberholseri*,  
178347 GRAY FLYCATCHER *Empidonax wrightii*,  
178348 PACIFIC-SLOPE FLYCATCHER *Empidonax difficilis*,  
178352 BUFF-BREASTED FLYCATCHER *Empidonax fulvifrons*,  
178356 GREATER PEWEE *Contopus pertinax*,  
178360 WESTERN WOOD-PEWEE *Contopus sordidulus*,  
178371 VERMILION FLYCATCHER *Pyrocephalus rubinus*,  
178376 NORTHERN BEARDLESS-TYRANULET *Camptostoma imberbe*,  
178384 ROSE-THROATED BECARD *Pachyramphus aglaiae*,  
178427 VIOLET-GREEN SWALLOW *Tachycineta thalassina*,  
178431 TREE SWALLOW *Tachycineta bicolor*,  
178436 BANK SWALLOW *Riparia riparia*,  
178443 NORTHERN ROUGH-WINGED SWALLOW *Stelgidopteryx serripennis*,  
178448 BARN SWALLOW *Hirundo rustica*,  
178455 CLIFF SWALLOW *Petrochelidon pyrrhonota*,  
178460 CAVE SWALLOW *Petrochelidon fulva*,  
178464 PURPLE MARTIN *Progne subis*,  
178499 SPRAGUE'S PIPIT *Anthus spragueii*,  
178511 NORTHERN SHRIKE *Lanius excubitor*,  
178515 LOGGERHEAD SHRIKE *Lanius ludovicianus*,  
178529 BOHEMIAN WAXWING *Bombycilla garrulus*,  
178532 CEDAR WAXWING *Bombycilla cedrorum*,  
178536 AMERICAN DIPPER *Cinclus mexicanus*,  
178541 HOUSE WREN *Troglodytes aedon*,  
178547 WINTER WREN *Troglodytes troglodytes*,  
178562 BEWICK'S WREN *Thryomanes bewickii*,  
178581 CAROLINA WREN *Thryothorus ludovicianus*,  
178587 CACTUS WREN *Campylorhynchus brunneicapillus*,  
178605 SEDGE WREN *Cistothorus platensis*,  
178608 MARSH WREN *Cistothorus palustris*,  
178610 CANYON WREN *Catherpes mexicanus*,  
178614 ROCK WREN *Salpinctes obsoletus*,  
178620 NORTHERN MOCKINGBIRD *Mimus polyglottos*,  
178625 GRAY CATBIRD *Dumetella carolinensis*,  
178627 BROWN THRASHER *Toxostoma rufum*,  
178636 BENDIRE'S THRASHER *Toxostoma bendirei*,  
178637 CURVE-BILLED THRASHER *Toxostoma curvirostre*,  
178645 LE CONTE'S THRASHER *Toxostoma lecontei*,

178652 CRISSAL THRASHER *Toxostoma crissale*,  
178654 SAGE THRASHER *Oreoscoptes montanus*,  
178759 VERDIN *Auriparus flaviceps*,  
178764 BUSHTIT *Psaltriparus minimus*,  
178775 WHITE-BREASTED NUTHATCH *Sitta carolinensis*,  
178784 RED-BREASTED NUTHATCH *Sitta canadensis*,  
178788 PYGMY NUTHATCH *Sitta pygmaea*,  
178803 BROWN CREEPER *Certhia americana*,  
178841 RUFIOUS-CAPPED WARBLER *Basileuterus rufifrons*,  
178844 BLACK-AND-WHITE WARBLER *Mniotilta varia*,  
178855 TENNESSEE WARBLER *Vermivora peregrina*,  
178856 ORANGE-CROWNED WARBLER *Vermivora celata*,  
178861 NASHVILLE WARBLER *Vermivora ruficapilla*,  
178864 VIRGINIA'S WARBLER *Vermivora virginiae*,  
178866 LUCY'S WARBLER *Vermivora luciae*,  
178874 OLIVE WARBLER *Peucedramus taeniatus*,  
178878 YELLOW WARBLER *Dendroica petechia*,  
178891 YELLOW-RUMPED WARBLER *Dendroica coronata*,  
178896 BLACK-THROATED GRAY WARBLER *Dendroica nigrescens*,  
178897 TOWNSEND'S WARBLER *Dendroica townsendi*,  
178902 HERMIT WARBLER *Dendroica occidentalis*,  
178909 GRACE'S WARBLER *Dendroica graciae*,  
178913 BLACKPOLL WARBLER *Dendroica striata*,  
178918 PRAIRIE WARBLER *Dendroica discolor*,  
178921 PALM WARBLER *Dendroica palmarum*,  
178927 OVENBIRD *Seiurus aurocapillus*,  
178931 NORTHERN WATERTHRUSH *Seiurus noveboracensis*,  
178940 MACGILLIVRAY'S WARBLER *Oporornis tolmiei*,  
178944 COMMON YELLOWTHROAT *Geothlypis trichas*,  
178964 YELLOW-BREASTED CHAT *Icteria virens*,  
178970 RED-FACED WARBLER *Cardellina rubrifrons*,  
178973 WILSON'S WARBLER *Wilsonia pusilla*,  
178979 AMERICAN REDSTART *Setophaga ruticilla*,  
178986 PAINTED REDSTART *Myioborus pictus*,  
178997 HUTTON'S VIREO *Vireo huttoni*,  
179003 BELL'S VIREO *Vireo bellii*,  
179008 GRAY VIREO *Vireo vicinior*,  
179021 RED-EYED VIREO *Vireo olivaceus*,  
179023 WARBLING VIREO *Vireo gilvus*,  
179032 BOBOLINK *Dolichonyx oryzivorus*,  
179034 EASTERN MEADOWLARK *Sturnella magna*,  
179039 WESTERN MEADOWLARK *Sturnella neglecta*,  
179043 YELLOW-HEADED BLACKBIRD *Xanthocephalus xanthocephalus*,  
179045 RED-WINGED BLACKBIRD *Agelaius phoeniceus*,  
179060 TRICOLORED BLACKBIRD *Agelaius tricolor*,  
179064 ORCHARD ORIOLE *Icterus spurius*,  
179070 HOODED ORIOLE *Icterus cucullatus*,



179079 STREAK-BACKED ORIOLE *Icterus pustulatus*,  
179082 SCOTT'S ORIOLE *Icterus parisorum*,  
179083 BALTIMORE ORIOLE *Icterus galbula*,  
179094 BREWER'S BLACKBIRD *Euphagus cyanocephalus*,  
179104 COMMON GRACKLE *Quiscalus quiscula*,  
179109 GREAT-TAILED GRACKLE *Quiscalus mexicanus*,  
179112 BROWN-HEADED COWBIRD *Molothrus ater*,  
179116 BRONZED COWBIRD *Molothrus aeneus*,  
179124 NORTHERN CARDINAL *Cardinalis cardinalis*,  
179132 PYRRHULOXIA *Cardinalis sinuatus*,  
179139 ROSE-BREASTED GROSBEAK *Pheucticus ludovicianus*,  
179140 BLACK-HEADED GROSBEAK *Pheucticus melanocephalus*,  
179145 BLUE GROSBEAK *Guiraca caerulea*,  
179150 INDIGO BUNTING *Passerina cyanea*,  
179151 LAZULI BUNTING *Passerina amoena*,  
179152 VARIED BUNTING *Passerina versicolor*,  
179156 PAINTED BUNTING *Passerina ciris*,  
179165 DICKCISSEL *Spiza americana*,  
179173 EVENING GROSBEAK *Coccothraustes vespertinus*,  
179186 PURPLE FINCH *Carpodacus purpureus*,  
179190 CASSIN'S FINCH *Carpodacus cassinii*,  
179191 HOUSE FINCH *Carpodacus mexicanus*,  
179205 PINE GROSBEAK *Pinicola enucleator*,  
179215 GRAY-CROWNED ROSY-FINCH *Leucosticte tephrocotis*,  
179222 BLACK ROSY-FINCH *Leucosticte atrata*,  
179222 BLACK ROSY-FINCH *Leucosticte atrata*,  
179223 BROWN-CAPPED ROSY-FINCH *Leucosticte australis*,  
179223 BROWN-CAPPED ROSY-FINCH *Leucosticte australis*,  
179230 COMMON REDPOLL *Carduelis flamma*,  
179232 LAWRENCE'S GOLDFINCH *Carduelis lawrencei*,  
179233 PINE SISKIN *Carduelis pinus*,  
179234 LESSER GOLDFINCH *Carduelis psaltria*,  
179236 AMERICAN GOLDFINCH *Carduelis tristis*,  
179259 RED CROSSBILL *Loxia curvirostra*,  
179268 WHITE-WINGED CROSSBILL *Loxia leucoptera*,  
179293 CANYON TOWHEE *Pipilo fuscus*,  
179307 ABERT'S TOWHEE *Pipilo aberti*,  
179310 GREEN-TAILED TOWHEE *Pipilo chlorurus*,  
179312 LARK BUNTING *Calamospiza melanocorys*,  
179314 SAVANNAH SPARROW *Passerculus sandwichensis*,  
179333 GRASSHOPPER SPARROW *Ammodramus savannarum*,  
179339 BAIRD'S SPARROW *Ammodramus bairdii*,  
179345 LE CONTE'S SPARROW *Ammodramus leconteii*,  
179366 VESPER SPARROW *Poocetes gramineus*,  
179371 LARK SPARROW *Chondestes grammacus*,  
179375 RUFIOUS-WINGED SPARROW *Aimophila carpalis*,  
179377 RUFIOUS-CROWNED SPARROW *Aimophila ruficeps*,

179390 BOTTERI'S SPARROW *Aimophila botterii*,  
179393 CASSIN'S SPARROW *Aimophila cassinii*,  
179395 BLACK-THROATED SPARROW *Amphispiza bilineata*,  
179402 SAGE SPARROW *Amphispiza belli*,  
179410 DARK-EYED JUNCO *Junco hyemalis*,  
179427 YELLOW-EYED JUNCO *Junco phaeonotus*,  
179432 AMERICAN TREE SPARROW *Spizella arborea*,  
179435 CHIPPING SPARROW *Spizella passerina*,  
179439 CLAY-COLORED SPARROW *Spizella pallida*,  
179440 BREWER'S SPARROW *Spizella breweri*,  
179443 FIELD SPARROW *Spizella pusilla*,  
179448 BLACK-CHINNED SPARROW *Spizella atrogularis*,  
179454 HARRIS'S SPARROW *Zonotrichia querula*,  
179455 WHITE-CROWNED SPARROW *Zonotrichia leucophrys*,  
179461 GOLDEN-CROWNED SPARROW *Zonotrichia atricapilla*,  
179462 WHITE-THROATED SPARROW *Zonotrichia albicollis*,  
179464 FOX SPARROW *Passerella iliaca*,  
179484 LINCOLN'S SPARROW *Melospiza lincolni*,  
179488 SWAMP SPARROW *Melospiza georgiana*,  
179492 SONG SPARROW *Melospiza melodia*,  
179525 MCCOWN'S LONGSPUR *Calcarius mccownii*,  
179526 LAPLAND LONGSPUR *Calcarius lapponicus*,  
179530 CHESTNUT-COLLARED LONGSPUR *Calcarius ornatus*,  
179532 SNOW BUNTING *Plectrophenax nivalis*,  
179628 HOUSE SPARROW *Passer domesticus*,  
179637 EUROPEAN STARLING *Sturnus vulgaris*,  
179667 GRAY JAY *Perisoreus canadensis*,  
179680 BLUE JAY *Cyanocitta cristata*,  
179685 STELLER'S JAY *Cyanocitta stelleri*,  
179707 MEXICAN JAY *Aphelocoma ultramarina*,  
179720 BLACK-BILLED MAGPIE *Pica hudsonia*,  
179725 COMMON RAVEN *Corvus corax*,  
179730 CHIHUAHUAN RAVEN *Corvus cryptoleucus*,  
179731 AMERICAN CROW *Corvus brachyrhynchos*,  
179748 PINYON JAY *Gymnorhinus cyanocephalus*,  
179750 CLARK'S NUTCRACKER *Nucifraga columbiana*,  
179759 AMERICAN ROBIN *Turdus migratorius*,  
179773 VARIED THRUSH *Ixoreus naevius*,  
179777 WOOD THRUSH *Hylocichla mustelina*,  
179779 HERMIT THRUSH *Catharus guttatus*,  
179788 SWAINSON'S THRUSH *Catharus ustulatus*,  
179793 GRAY-CHEEKED THRUSH *Catharus minimus*,  
179796 VEERY *Catharus fuscescens*,  
179801 EASTERN BLUEBIRD *Sialia sialis*,  
179806 WESTERN BLUEBIRD *Sialia mexicana*,  
179811 MOUNTAIN BLUEBIRD *Sialia currucoides*,  
179824 TOWNSEND'S SOLITAIRE *Myadestes townsendi*,

179853 BLUE-GRAY GNATCATCHER *Polioptila caerulea*,  
179857 BLACK-TAILED GNATCATCHER *Polioptila melanura*,  
179863 BLACK-CAPPED GNATCATCHER *Polioptila nigriceps*,  
179865 GOLDEN-CROWNED KINGLET *Regulus satrapa*,  
179870 RUBY-CROWNED KINGLET *Regulus calendula*,  
179877 PHAINOPEPLA *Phainopepla nitens*,  
179882 WESTERN TANAGER *Piranga ludoviciana*,  
179884 HEPATIC TANAGER *Piranga flava*,  
179888 SUMMER TANAGER *Piranga rubra*,  
179891 FLAME-COLORED TANAGER *Piranga bidentata*,  
179921 VIRGINIA OPOSSUM *Didelphis virginiana*,  
179929 MASKED SHREW *Sorex cinereus*,  
179932 VAGRANT SHREW *Sorex vagrans*,  
179933 NORTHERN WATER SHREW *Sorex palustris*,  
179939 ARIZONA SHREW *Sorex arizonae*,  
179946 PYGMY SHREW *Sorex hoyi*,  
179949 MERRIAM'S SHREW *Sorex merriami*,  
179950 MONTANE SHREW *Sorex monticolus*,  
179951 DWARF SHREW *Sorex nanus*,  
179954 PREBLE'S SHREW *Sorex preblei*,  
179955 INYO SHREW *Sorex tenellus*,  
179956 TROWBRIDGE'S SHREW *Sorex trowbridgii*,  
179969 ELLIOT'S SHORT-TAILED SHREW *Blarina hylophaga*,  
179971 LEAST SHREW *Cryptotis parva*,  
179973 DESERT SHREW *Notiosorex crawfordi*,  
179979 EASTERN MOLE *Scalopus aquaticus*,  
179981 BROAD-FOOTED MOLE *Scapanus latimanus*,  
179988 LITTLE BROWN BAT *Myotis lucifugus*,  
179990 LONG-LEGGED MYOTIS *Myotis volans*,  
179991 CALIFORNIA MYOTIS *Myotis californicus*,  
179992 SOUTHWESTERN MYOTIS *Myotis auricolus*,  
179995 LONG-EARED MYOTIS *Myotis evotis*,  
179999 WESTERN SMALL-FOOTED MYOTIS *Myotis leibii*,  
180002 FRINGED MYOTIS *Myotis thysanodes*,  
180003 CAVE MYOTIS *Myotis velifer*,  
180004 YUMA MYOTIS *Myotis yumanensis*,  
180006 PALLID BAT *Antrozous pallidus*,  
180008 BIG BROWN BAT *Eptesicus fuscus*,  
180010 SPOTTED BAT *Euderma maculatum*,  
180012 ALLEN'S BIG-EARED BAT *Idionycteris phyllotis*,  
180014 SILVER-HAIRED BAT *Lasionycteris noctivagans*,  
180016 WESTERN RED BAT *Lasiurus blossevillii*,  
180017 HOARY BAT *Lasiurus cinereus*,  
180018 SOUTHERN YELLOW BAT *Lasiurus ega*,  
180024 WESTERN PIPISTRELLE *Pipistrellus hesperus*,  
180062 MEXICAN LONG-TONGUED BAT *Choeronycteris mexicana*,  
180068 MEXICAN LONG-NOSED BAT *Leptonycteris nivalis*,

180071 CALIFORNIA LEAF-NOSED BAT *Macrotus californicus*,  
180080 WESTERN MASTIFF BAT *Eumops perotis*,  
180081 UNDERWOOD'S MASTIFF BAT *Eumops underwoodi*,  
180085 POCKETED FREE-TAILED BAT *Nyctinomops femorosaccus*,  
180086 BIG FREE-TAILED BAT *Nyctinomops macrotis*,  
180088 BRAZILIAN FREE-TAILED BAT *Tadarida brasiliensis*,  
180103 NINE-BANDED ARMADILLO *Dasypus novemcinctus*,  
180109 AMERICAN PIKA *Ochotona princeps*,  
180112 SNOWSHOE HARE *Lepus americanus*,  
180114 ANTELOPE JACK RABBIT *Lepus alleni*,  
180115 BLACK-TAILED JACK RABBIT *Lepus californicus*,  
180116 WHITE-SIDED JACK RABBIT *Lepus callotis*,  
180118 WHITE-TAILED JACK RABBIT *Lepus townsendii*,  
180122 DESERT COTTONTAIL *Sylvilagus audubonii*,  
180124 EASTERN COTTONTAIL *Sylvilagus floridanus*,  
180126 MOUNTAIN COTTONTAIL *Sylvilagus nuttallii*,  
180133 MOUNTAIN BEAVER *Aplodontia rufa*,  
180140 YELLOW-BELLIED MARMOT *Marmota flaviventris*,  
180147 UINTA GROUND SQUIRREL *Spermophilus armatus*,  
180148 CALIFORNIA GROUND SQUIRREL *Spermophilus beecheyi*,  
180149 BELDING'S GROUND SQUIRREL *Spermophilus beldingi*,  
180152 WYOMING GROUND SQUIRREL *Spermophilus elegans*,  
180154 GOLDEN-MANTLED GROUND SQUIRREL *Spermophilus lateralis*,  
180155 MEXICAN GROUND SQUIRREL *Spermophilus mexicanus*,  
180159 SPOTTED GROUND SQUIRREL *Spermophilus pilosoma*,  
180160 ROUND-TAILED GROUND SQUIRREL *Spermophilus tereticaudus*,  
180161 TOWNSEND'S GROUND SQUIRREL *Spermophilus townsendii*,  
180162 THIRTEEN-LINED GROUND SQUIRREL *Spermophilus tridecemlineatus*,  
180163 ROCK SQUIRREL *Spermophilus variegatus*,  
180166 RED SQUIRREL *Tamiasciurus hudsonicus*,  
180167 DOUGLAS' SQUIRREL *Tamiasciurus douglasii*,  
180169 NORTHERN FLYING SQUIRREL *Glaucomys sabrinus*,  
180172 FOX SQUIRREL *Sciurus niger*,  
180173 ABERT'S SQUIRREL *Sciurus aberti*,  
180174 ARIZONA GRAY SQUIRREL *Sciurus arizonensis*,  
180176 WESTERN GRAY SQUIRREL *Sciurus griseus*,  
180177 NAYARIT SQUIRREL *Sciurus nayaritensis*,  
180179 HARRIS' ANTELOPE SQUIRREL *Ammospermophilus harrisi*,  
180180 TEXAS ANTELOPE SQUIRREL *Ammospermophilus interpres*,  
180181 WHITE-TAILED ANTELOPE SQUIRREL *Ammospermophilus leucurus*,  
180184 GUNNISON'S PRAIRIE DOG *Cynomys gunnisoni*,  
180185 WHITE-TAILED PRAIRIE DOG *Cynomys leucurus*,  
180186 BLACK-TAILED PRAIRIE DOG *Cynomys ludovicianus*,  
180187 UTAH PRAIRIE DOG *Cynomys parvidens*,  
180190 YELLOW-PINE CHIPMUNK *Tamias amoenus*,  
180191 GRAY-FOOTED CHIPMUNK *Tamias canipes*,  
180192 GRAY-COLLARED CHIPMUNK *Tamias cinereicollis*,

180193 CLIFF CHIPMUNK *Tamias dorsalis*,  
180195 LEAST CHIPMUNK *Tamias minimus*,  
180198 PALMER'S CHIPMUNK *Tamias palmeri*,  
180199 PANAMINT CHIPMUNK *Tamias panamintinus*,  
180200 LONG-EARED CHIPMUNK *Tamias quadrimaculatus*,  
180201 COLORADO CHIPMUNK *Tamias quadrivittatus*,  
180203 ALLEN'S CHIPMUNK *Tamias senex*,,  
180206 LODGEPOLE CHIPMUNK *Tamias speciosus*,  
180208 TOWNSEND'S CHIPMUNK *Tamias townsendii*,,  
180209 UINTA CHIPMUNK *Tamias umbrinus*,,  
180212 BEAVER *Castor canadensis*,  
180215 DESERT POCKET GOPHER *Geomys arenarius*,  
180216 PLAINS POCKET GOPHER *Geomys bursarius*,  
180220 YELLOW-FACED POCKET GOPHER *Pappogeomys castanops*,  
180222 BOTTA'S POCKET GOPHER *Thomomys bottae*,  
180225 IDAHO POCKET GOPHER *Thomomys idahoensis*,  
180227 MOUNTAIN POCKET GOPHER *Thomomys monticola*,  
180228 NORTHERN POCKET GOPHER *Thomomys talpoides*,  
180229 TOWNSEND'S POCKET GOPHER *Thomomys townsendii*,  
180230 SOUTHERN POCKET GOPHER *Thomomys umbrinus*,  
180236 DESERT KANGAROO RAT *Dipodomys deserti*,  
180241 MERRIAM'S KANGAROO RAT *Dipodomys merriami*,  
180242 CHISEL-TOOTHED KANGAROO RAT *Dipodomys microps*,  
180244 ORD'S KANGAROO RAT *Dipodomys ordii*,  
180245 PANAMINT KANGAROO RAT *Dipodomys panamintinus*,  
180246 BANNER-TAILED KANGAROO RAT *Dipodomys spectabilis*,  
180252 DARK KANGAROO MOUSE *Microdipodops megacephalus*,  
180253 PALE KANGAROO MOUSE *Microdipodops pallidus*,  
180256 ARIZONA POCKET MOUSE *Perognathus amplus*,  
180260 OLIVE-BACKED POCKET MOUSE *Perognathus fasciatus*,  
180261 PLAINS POCKET MOUSE *Perognathus flavescens*,  
180262 SILKY POCKET MOUSE *Perognathus flavus*,  
180267 LITTLE POCKET MOUSE *Perognathus longimembris*,  
180269 GREAT BASIN POCKET MOUSE *Perognathus parvus*,  
180276 DEER MOUSE *Peromyscus maniculatus*,  
180278 WHITE-FOOTED MOUSE *Peromyscus leucopus*,  
180282 BRUSH MOUSE *Peromyscus boylii*,  
180284 CANYON MOUSE *Peromyscus crinitus*,  
180286 CACTUS MOUSE *Peromyscus eremicus*,  
180287 BLACK-EARED MOUSE *Peromyscus melanotis*,  
180288 MERRIAM'S MOUSE *Peromyscus merriami*,  
180289 WHITE-ANKLED MOUSE *Peromyscus pectoralis*,  
180291 PINON MOUSE *Peromyscus truei*,  
180294 SOUTHERN RED-BACKED VOLE *Clethrionomys gapperi*,  
180297 MEADOW VOLE *Microtus pennsylvanicus*,  
180299 LONG-TAILED VOLE *Microtus longicaudus*,  
180310 MONTANE VOLE *Microtus montanus*,

180312 PRAIRIE VOLE *Microtus ochrogaster*,  
180315 WATER VOLE *Microtus richardsoni*,  
180318 MUSKRAT *Ondatra zibethicus*,  
180341 FULVOUS HARVEST MOUSE *Reithrodontomys fulvescens*,  
180343 WESTERN HARVEST MOUSE *Reithrodontomys megalotis*,  
180344 PLAINS HARVEST MOUSE *Reithrodontomys montanus*,  
180347 ARIZONA COTTON RAT *Sigmodon arizonae*,  
180348 TAWNY-BELLIED COTTON RAT *Sigmodon fulviventor*,  
180349 HISPID COTTON RAT *Sigmodon hispidus*,  
180350 YELLOW-NOSED COTTON RAT *Sigmodon ochrognathus*,  
180359 HEATHER VOLE *Phenacomys intermedius*,  
180366 HOUSE MOUSE *Mus musculus*,  
180368 NORTHERN PYGMY MOUSE *Baiomys taylori*,  
180370 WHITE-THROATED WOODRAT *Neotoma albigula*,  
180371 BUSHY-TAILED WOODRAT *Neotoma cinerea*,  
180372 EASTERN WOODRAT *Neotoma floridana*,  
180374 DESERT WOODRAT *Neotoma lepida*,  
180375 MEXICAN WOODRAT *Neotoma mexicana*,  
180376 SOUTHERN PLAINS WOODRAT *Neotoma micropus*,  
180377 STEPHENS' WOODRAT *Neotoma stephensi*,  
180381 MEARNS' GRASSHOPPER MOUSE *Onychomys arenicola*,  
180382 NORTHERN GRASSHOPPER MOUSE *Onychomys leucogaster*,  
180383 SOUTHERN GRASSHOPPER MOUSE *Onychomys torridus*,  
180386 MEADOW JUMPING MOUSE *Zapus hudsonius*,  
180387 WESTERN JUMPING MOUSE *Zapus princeps*,  
180393 PORCUPINE *Erethizon dorsatum*,  
180543 BROWN BEAR *Ursus arctos*,  
180544 AMERICAN BLACK BEAR *Ursus americanus*,  
180549 RIVER OTTER *Lontra canadensis*,  
180551 WOLVERINE *Gulo gulo*,  
180553 MINK *Mustela vison*,  
180555 ERMINE *Mustela erminea*,  
180556 LONG-TAILED WEASEL *Mustela frenata*,  
180557 BLACK-FOOTED FERRET *Mustela nigripes*,  
180559 MARTEN *Martes americana*,  
180560 FISHER *Martes pennanti*,  
180562 STRIPED SKUNK *Mephitis mephitis*,  
180563 HOODED SKUNK *Mephitis macroura*,  
180565 BADGER *Taxidea taxus*,  
180568 HOG-NOSED SKUNK *Conepatus mesoleucus*,  
180570 EASTERN SPOTTED SKUNK *Spilogale putorius*,  
180575 RACCOON *Procyon lotor*,  
180577 RINGTAIL *Bassariscus astutus*,  
180582 BOBCAT *Lynx rufus*,  
180585 LYNX *Lynx canadensis*,  
180593 JAGUAR *Panthera onca*,  
180596 GRAY WOLF *Canis lupus*,

180599 COYOTE *Canis latrans*,  
180604 RED FOX *Vulpes vulpes*,  
180606 KIT FOX *Vulpes macrotis*,  
180607 SWIFT FOX *Vulpes velox*,  
180609 GRAY FOX *Urocyon cinereoargenteus*,  
180695 WAPITI *Cervus elaphus*,  
180698 MULE DEER *Odocoileus hemionus*,  
180699 WHITE-TAILED DEER *Odocoileus virginianus*,  
180703 MOOSE *Alces alces*,  
180711 BIGHORN SHEEP *Ovis canadensis*,  
180713 MOUNTAIN GOAT *Oreamnos americanus*,  
180717 PRONGHORN *Antilocapra americana*,  
180719 BARBARY SHEEP *Ammotragus lervia*  
203452 TOWNSEND'S BIG-EARED BAT *Corynorhinus townsendii*

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|--------------------------------|----------------------------------|
| 180599 COYOTE                  | <i>Canis latrans</i>             |
| 180604 RED FOX                 | <i>Vulpes vulpes</i>             |
| 180606 KIT FOX                 | <i>Vulpes macrotis</i>           |
| 180607 SWIFT FOX               | <i>Vulpes velox</i>              |
| 180609 GRAY FOX                | <i>Urocyon cinereoargenteus</i>  |
| 180695 WAPITI                  | <i>Cervus elaphus</i>            |
| 180698 MULE DEER               | <i>Odocoileus hemionus</i>       |
| 180699 WHITE-TAILED DEER       | <i>Odocoileus virginianus</i>    |
| 180703 MOOSE                   | <i>Alces alces</i>               |
| 180711 BIGHORN SHEEP           | <i>Ovis canadensis</i>           |
| 180717 PRONGHORN               | <i>Antilocapra americana</i>     |
| 180719 BARBARY SHEEP           | <i>Ammotragus lervia</i>         |
| 203452 TOWNSEND'S BIG-EARED B  | <i>Corynorhinus townsendii</i>   |
| 203618 BISON                   | <i>Bos bison</i>                 |
| 206989 PLAINS SPADEFOOT        | <i>Spea bombifrons</i>           |
| 206991 GREAT BASIN SPADEFOOT   | <i>Spea intermontana</i>         |
| 206993 NEW MEXICO SPADEFOOT    | <i>Spea multiplicata</i>         |
| 207312 BOREAL CHORUS FROG      | <i>Pseudacris maculata</i>       |
| 207313 PACIFIC CHORUS FROG     | <i>Pseudacris regilla</i>        |
| 207724 BARKING FROG            | <i>Eleutherodactylus augusti</i> |
| 208657 BIG BEND SLIDER         | <i>Trachemys gaigeae</i>         |
| 208680 SPINY SOFTSHELL TURTLE  | <i>Apalone spinifera</i>         |
| 208791 MOJAVE BLACK-COLLARED   | <i>Crotaphytus bicinctores</i>   |
| 208940 WESTERN WHIPTAIL        | <i>Cnemidophorus tigris</i>      |
| 208947 DESERT GRASSLAND WHIP   | <i>Cnemidophorus uniparens</i>   |
| 208948 PLATEAU STRIPED WHIPTA  | <i>Cnemidophorus velox</i>       |
| 209008 NORTHERN ALLIGATOR LIZ. | <i>Elgaria coerulea</i>          |
| 209017 MADREAN ALLIGATOR LIZA  | <i>Elgaria kingii</i>            |
| 209247 COMMON KINGSSNAKE       | <i>Lampropeltis getula</i>       |
| 209266 GRAY-BANDED KINGSSNAKE  | <i>Lampropeltis alterna</i>      |
| 209400 BULLSNAKE               | <i>Pituophis catenifer</i>       |
| 209455 TRANS-PECOS RAT SNAKE   | <i>Bogertophis subocularis</i>   |
| 209458 GREEN RAT SNAKE         | <i>Senticolis triaspis</i>       |
| 550236 AMARGOSA TOAD           | <i>Bufo nelsoni</i>              |
| 550546 COLUMBIA SPOTTED FROG   | <i>Rana luteiventris</i>         |
| 551766 RIO GRANDE RIVER COOTE  | <i>Pseudemys gorzugi</i>         |
| 552462 WHITE-NOSED COATI       | <i>Nasua narica</i>              |
| 552464 SOUTHERN LONG-NOSED E   | <i>Leptonycteris curasoae</i>    |
| 552479 MOUNTAIN LION           | <i>Puma concolor</i>             |
| 552482 LONG-TAILED POCKET MOI  | <i>Chaetodipus formosus</i>      |
| 552483 HISPID POCKET MOUSE     | <i>Chaetodipus hispidus</i>      |
| 552484 ROCK POCKET MOUSE       | <i>Chaetodipus intermedius</i>   |
| 552486 DESERT POCKET MOUSE     | <i>Chaetodipus penicillatus</i>  |
| 552488 MERRIAM'S POCKET MOUS   | <i>Perognathus merriami</i>      |
| 552490 SAGEBRUSH VOLE          | <i>Lemmiscus curtatus</i>        |
| 552494 ARIZONA WOODRAT         | <i>Neotoma devia</i>             |



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|--------|------------------------|----------------------------------|
| 552495 | OSGOOD'S MOUSE         | <i>Peromyscus gratus</i>         |
| 552496 | ROCK MOUSE             | <i>Peromyscus nasutus</i>        |
| 552499 | MERRIAM'S GROUND SQUI  | <i>Spermophilus canus</i>        |
| 552503 | HOPI CHIPMUNK          | <i>Tamias rufus</i>              |
| 552504 | PIUTE GROUND SQUIRREL  | <i>Spermophilus mollis</i>       |
| 552512 | EASTERN RED BAT        | <i>Lasiurus borealis</i>         |
| 552520 | BAILEY'S POCKET MOUSE  | <i>Chaetodipus baileyi</i>       |
| 552521 | PYGMY RABBIT           | <i>Brachylagus idahoensis</i>    |
| 552761 | COLLARED PECCARY       | <i>Pecari tajacu</i>             |
| 554027 | CLARK'S GREBE          | <i>Aechmophorus clarkii</i>      |
| 554030 | FIVE-STRIPED SPARROW   | <i>Aimophila quinquestriata</i>  |
| 554127 | AMERICAN PIPIT         | <i>Anthus rubescens</i>          |
| 554128 | WESTERN SCRUB-JAY      | <i>Aphelocoma californica</i>    |
| 554135 | GREAT EGRET            | <i>Ardea alba</i>                |
| 554137 | GRAY HAWK              | <i>Asturina nitida</i>           |
| 554139 | JUNIPER TITMOUSE       | <i>Baeolophus ridgwayi</i>       |
| 554141 | BRIDLED TITMOUSE       | <i>Baeolophus wollweberi</i>     |
| 554145 | STILT SANDPIPER        | <i>Calidris himantopus</i>       |
| 554146 | CRESTED CARACARA       | <i>Caracara plancus</i>          |
| 554221 | OLIVE-SIDED FLYCATCHER | <i>Contopus cooperi</i>          |
| 554254 | HAMMOND'S FLYCATCHER   | <i>Empidonax hammondii</i>       |
| 554256 | HORNED LARK            | <i>Eremophila alpestris</i>      |
| 554267 | BULLOCK'S ORIOLE       | <i>Icterus bullockii</i>         |
| 554268 | MISSISSIPPI KITE       | <i>Ictinia mississippiensis</i>  |
| 554375 | NEOTROPIC CORMORANT    | <i>Phalacrocorax brasilianus</i> |
| 554376 | RED PHALAROPE          | <i>Phalaropus fulicaria</i>      |
| 554380 | SPOTTED TOWHEE         | <i>Pipilo maculatus</i>          |
| 554382 | BLACK-CAPPED CHICKADEE | <i>Poecile atricapilla</i>       |
| 554385 | MOUNTAIN CHICKADEE     | <i>Poecile gambeli</i>           |
| 554388 | MEXICAN CHICKADEE      | <i>Poecile sclateri</i>          |
| 554456 | CASSIN'S VIREO         | <i>Vireo cassinii</i>            |
| 554477 | PLUMBEOUS VIREO        | <i>Vireo plumbeus</i>            |
| 555388 | WESTERN SCREECH-OWL    | <i>Otus kennicottii</i>          |
| 555544 | COMMON POORWILL        | <i>Phalaenoptilus nuttallii</i>  |
| 555657 | New Mexico shrew       | <i>Sorex neomexicanus</i>        |
| 555658 | DAVIS MOUNTAIN COTTON  | <i>Sylvilagus robustus</i>       |
| 563907 | ROSY BOA               | <i>Charina trivirgata</i>        |
| 563909 | THORNSCRUB HOOK-NOSE   | <i>Gyalopion quadrangulare</i>   |
| 563910 | SMOOTH GREEN SNAKE     | <i>Liochlorophis vernalis</i>    |
| 564567 | PYGMY SHORT-HORNED LI  | <i>Phrynosoma douglasii</i>      |
| 564574 | Sand dune lizard       | <i>Sceloporus arenicolus</i>     |
| 564594 | GREATER SHORT-HORNED   | <i>Phrynosoma hernandesi</i>     |
| 564596 | COMMON CHUCKWALLA      | <i>Sauromalus ater</i>           |
| 625180 | ORYX                   | <i>Oryx gazella</i>              |