

**Chapter 1:**  
**Introduction**

**In**

**Ecological and Biological Diversity of National Forests in Region 3**

**Bruce Vander Lee, Ruth Smith, and Joanna Bate**  
**The Nature Conservancy**



SAVING THE LAST GREAT PLACES ON EARTH



## EXECUTIVE SUMMARY

We summarized existing regional-scale biological and ecological assessment information from Arizona and New Mexico for use in the development of Forest Plans for the eleven National Forests in USDA Forest Service Region 3 (Region 3). Under the current Planning Rule, Forest Plans are to be strategic documents focusing on ecological, economic, and social sustainability. In addition, Region 3 has identified restoration of the functionality of fire-adapted systems as a central priority to address forest health issues. Assessments were selected for inclusion in this report based on (1) relevance to Forest Planning needs with emphasis on the need to address ecosystem diversity and ecological sustainability, (2) suitability to address restoration of Region 3's major vegetation systems, and (3) suitability to address ecological conditions at regional scales.

We identified five assessments that addressed the distribution and current condition of ecological and biological diversity within Region 3. We summarized each of these assessments to highlight important ecological resources that exist on National Forests in Arizona and New Mexico:

- Extent and distribution of potential natural vegetation types in Arizona and New Mexico
- Distribution and condition of low-elevation grasslands in Arizona
- Distribution of stream reaches with native fish occurrences in Arizona
- Species richness and conservation status attributes for all species on National Forests in Arizona and New Mexico
- Identification of priority areas for biodiversity conservation from Ecoregional Assessments from Arizona and New Mexico

Analyses of available assessments were completed across all management jurisdictions for Arizona and New Mexico, providing a regional context to illustrate the biological and ecological importance of National Forests in Region 3. For example, we identified several ecologically important potential natural vegetation types that occur predominately on Region 3 National Forests – ponderosa pine forest, Madrean encinal woodland, interior chaparral, and mixed conifer forest (Chapter 3). Understanding the regional context of the biological and ecological resources managed by Region 3 – both the distribution and condition of those resources – is a necessary pre-requisite to the identification of management strategies that would enable Region 3 to attain ecosystem diversity and ecological sustainability goals. Moreover, multiple land managers share management responsibility for some of the same resources across Arizona and New Mexico; regional data and syntheses provide a starting point for identifying areas where collaborative restoration would be feasible and an effective means of addressing land health issues that span jurisdictional boundaries.

Syntheses of several other assessments illustrate the importance of National Forests within Arizona. For example, based on an assessment of native fish habitat, headwater streams in Region 3 National Forests contain more native fish habitat with higher levels of species richness than streams managed by any other landowner. Our analysis also identified stream reaches on each National Forest that might appropriately be managed to

maintain native fishes based on contemporary occurrences. Based on the Arizona Grasslands Assessment, we summarized the distribution and condition of low-elevation grasslands (5,000 ft. and below) on National Forests in Arizona. As a statewide assessment, it provides valuable context for identifying appropriate grassland management strategies, as some of the best native-dominated grasslands remaining in Arizona overlap National Forests. The assessment also identifies areas where grassland restoration is most feasible. The Forest Plan revision process provides an important opportunity to develop strategies that will maintain grasslands in good condition or enhance those in need of restoration to maximize Region 3's ability to meet sustainability goals for this important regional ecosystem type.

As with vegetation systems, it is important to address species sustainability at appropriate scales. We aggregated existing information on species occurrences on each Region 3 National Forest to develop a regional database with consistent attributes that are useful in addressing species diversity and conservation needs within Forest Plans. The database can be used to quickly identify potential species of management concern for each Forest. Importantly, the database can also be used to distinguish species that might appropriately be considered at multi-forest scales for planning, management, and monitoring activities.

Ecoregional conservation assessments provide an important starting point for evaluating overall ecosystem diversity and ecological sustainability. These large-landscape assessments synthesize numerous datasets and identify a network of areas that are vital to the sustainability of biodiversity in the region. Our analysis of ecoregional assessment information demonstrated significant overlap between the network and National Forest lands in Arizona and New Mexico, demonstrating the important role Region 3 Forests play in maintaining the region's biological diversity. The assessments also point to priority geographies on National Forest lands where the role of natural disturbance processes in maintaining ecosystem diversity, and the compatibility of land management activities and land-use allocations, should be evaluated to maximize options for attaining ecological sustainability goals.

The assessments analyzed in this report provide basic information on the status and distribution of ecosystems and species that occur throughout Region 3 Forests. The data provide a starting point for understanding the range of biological and ecological elements that would need to be addressed during the Forest Plan revision process. Regional-scale assessment information provides a context for understanding the role USFS plays in managing regional-scale resources and how proposed management strategies will affect the balance of those resources both on USFS lands and the region as a whole.

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## Introduction

The 11 National Forests of the U.S. Forest Service (USFS) Southwestern Region (Region 3) will begin revising their Forest Management Plans (forest plans) in the near future. The new National Forest Management Act (NFMA) planning regulations [published in the *Federal Register* on 5 January 2005 (70 Fed. Reg. 1023)] that will be used in the revision of forest plans within Region 3 emphasize the importance of ecological, social, and economic sustainability as the overall goal in forest planning. Forest plans will be strategic in nature and will describe desired future conditions for ecological, social, and economic components. A central focus of the ecological sustainability component is restoring and maintaining ecosystem health (structure and function) as a means to maintain the plant and animal communities that depend on them. Additionally, the planning regulations provide a framework for maintaining species diversity by identifying and developing provisions for species whose continued existence may be of concern. In addition to the planning regulations, Region 3 has identified strategic priorities for forest plans. A central priority is the restoration of the ecological functionality of southwestern forests and rangelands, with a primary focus on the functionality of fire-adapted systems.

A key need within the plan revision process is the availability of timely and relevant scientific information on the ecosystems, biological processes, and species that occur on Region 3 Forests. In preparation for this, Region 3 developed a *Strategic Approach to Meet Regional Priorities and Prepare for Forest Plan Revisions* that identified tools, techniques and information “to conduct analyses needed to support the regional and national central priority of restoring the functionality of fire-adapted systems,” and to revise forest plans. In 2004, The Nature Conservancy entered into a cost-share agreement with Region 3 to conduct ecological analyses and gather pertinent scientific information relating to the needs identified by Region 3. This collaborative project aims to prepare relevant scientific background information relating to three primary objectives:

1. **Assessment of Assessments**, a review of information developed since creation of the previous Land and Resource Management Plans that will enable the Forest Service to satisfy information standards established under new planning regulations and to ensure that the best available scientific information is integrated into the development of forest plans.
2. **Determining the Historical/Natural Range of Variation** for major vegetation types and the biological diversity they harbor. HRV characterizations provide a baseline for evaluating the short- and long-term effects of natural and anthropogenic disturbances on forest resources. The historical range of variation in disturbance regimes, and climatic effects on those regimes, is the foundation for developing models of vegetative change.
3. **Developing Models of Vegetation Change** for major southwestern vegetation types. Development of ecological models for vegetation types will enable the Forest Service to evaluate management activities and better incorporate the role of ecological processes in forest management.

This report provides a summary and analysis of existing, relevant ecological assessments (Objective 1) pertinent to forest plans in Region 3. In order to provide consistent information

across Region 3, a priority has been placed on identifying and analyzing assessments conducted at large spatial scales, such as state or regional levels. Also, the assessments included in this report are directly related to the ecosystem health, functionality, and species diversity objectives in the planning regulations and Region 3's strategic priorities. Assessments relating to the following types of information relevant to forest planning needs are included:

- Distribution and extent of potential natural vegetation types (PNVTs)
- Distribution and condition of grassland systems
- Distribution of native fish species
- Conservation status of plant and animal species on Region 3 Forests
- Conservation areas and targets associated with Ecoregional Assessments

Details about the specific assessments used for analyses are provided in Chapter 2 (Methods).

A primary focus of this report is to identify the important biological values that occur on National Forests in Region 3. This information may be useful as part of the forest planning process for evaluating the suitability of current management activities and land management designations, identifying ecological characteristics that may be considered in developing desired conditions, and identifying species that may need special consideration due to continuing threats to their existence.

Because understanding ecosystem structure and functions, as well as species diversity, requires information at several scales, this report provides analysis of assessment information at two scales. Chapter 3 provides a detailed analysis of the assessments across major landowners within Region 3, as well as comparisons amongst individual National Forests. Chapters 4 -15 provide a detailed analysis of the assessment information for each National Forest in Region 3 (National Grasslands on the Cibola National Forest are considered in a separate chapter).



**Chapter 2:**

**Methods**

**In**

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## *Introduction*

This report utilizes existing ecological assessment information to identify and summarize important biological values that exist on the 11 U.S. Forest Service (USFS) Southwestern Region (Region 3) National Forests. The individual assessments analyzed in this report were included based on their geographic scale and relevance to the development of forest plans. Assessments conducted at broad geographic scales (regional or state level) and across multiple or all National Forests were included to provide as consistent information as possible for each National Forest. Additionally, we included assessments that were closely associated with the ecological sustainability (ecosystem and species diversity) focus of the National Forest Management Act (NFMA) planning regulation, and Region 3's central priority of restoring the functionality of fire-adapted systems. Descriptions of each assessment analyzed in this report, including a summary of its content, the methods used to create it, its geographic scale, and specific details regarding its analysis are provided below.

In general, the ecological information within each assessment was characterized by major landowners across Region 3 (see Chapter 3; including all of New Mexico and Arizona), as well as for each National Forest within Region 3 (see Chapters 4-15; Grasslands of the Cibola National Forest are considered in a separate chapter). For these analyses, the following two geographic information systems (GIS) data layers were utilized in addition to the assessment data:

1. A land ownership layer developed using data from the Arizona Land Resource Information Service (ALRIS; <http://www.land.state.az.us/alris/index.html>) and the New Mexico Resource Geographic Information System Program (RGIS; <http://rgis.unm.edu/>). ALRIS and RGIS data layers were edge-matched using topological editing procedures and management attributes were cross-walked. Land ownership categories included: US Forest Service, Bureau of Land Management, Department of Defense, National Park Service, Private, State Trust, Tribal, US Fish and Wildlife Service and Other. The 'Other' category included non-federal parks, Valle Calderas National Preserve, county lands, Department of Energy, USDA Research, State Game and Fish, and unnamed areas.
2. National Forest administrative boundaries, including ranger districts.

Due to the occurrence of non-USFS owned lands within the administrative boundaries, the calculation of area or stream lengths relating to National Forest lands may differ between these two scales of analysis. All geo-spatial analyses were conducted using ArcGIS 9.0/9.1 (ESRI; Redlands, CA).

## *I. Potential Natural Vegetation Types*

The distribution of potential natural vegetation types (PNVTs) on Region 3 National Forest lands and across land owners throughout Arizona and New Mexico was analyzed. Potential natural vegetation types are coarse-scale groupings of ecosystem types that share similar geography, vegetation, and historic ecosystem disturbances such as fire, drought, and native herbivory. PNVTs were used to summarize vegetation for this analysis because of their relevance to the characterizations of historic range of variability and vegetation models being developed for PNVTs in preparation for the forest planning process.

To determine PNVTs for Region 3 Forests and throughout Arizona and New Mexico, geo-spatial vegetation data were obtained from The Southwest Regional Gap Analysis Project (SWReGAP). SWReGAP is a collaborative project covering five states (Arizona, Colorado, Nevada, New Mexico and Utah) coordinated by the U.S. Geological Survey's Gap Analysis Program (GAP; USGS National Gap Analysis Program 2004). Parts of the Oklahoma Gap Analysis Program (OK-GAP; USGS National Gap Analysis Program) and the Texas Gap Analysis Program (TX-GAP; USGS National Gap Analysis Program) data were used to analyze PNVTs on Region 3 National Grasslands in Oklahoma and Texas, respectively.

The geo-referenced spatial dataset of SWReGAP is based on multi-season data acquired from Landsat 7 Enhanced Thematic Mapper 30m satellite imagery, coincident digital elevation models, and extensive field observations. The OK-GAP data are based on Thematic Mapper I imagery from 1991- 1993 and field reconnaissance. For more information regarding OK-GAP refer to the following website: <http://www.biosurvey.ou.edu/gap-ok.html>. The TX-GAP data is generated from Multi-Resolution Land Characteristics Consortium's hyper-clustered Landsat Thematic Mapper satellite imagery. For more information regarding TX-GAP see the final report at [ftp://ftp.gap.uidaho.edu/products/Texas/report/TX\\_GAPReport.pdf](ftp://ftp.gap.uidaho.edu/products/Texas/report/TX_GAPReport.pdf).

Land cover (vegetation) types from SWReGAP, OK-GAP, and TX-GAP data were modeled and/or interpreted by each state team and described as ecological systems or map classes as developed by NatureServe. (For information on NatureServe and ecological systems see <http://www.natureserve.org>. For information on the SWReGAP map classes see [http://earth.gis.usu.edu/swgap/legend\\_desc.html](http://earth.gis.usu.edu/swgap/legend_desc.html).) Ecological systems are based on ecological and geographical groupings of vegetation associations as defined by the National Vegetation Classification System (<http://biology.usgs.gov/npsveg/nvcs.html>).

A total of 135 ecological system types were identified from the SWReGAP, OK-GAP, and TX-GAP for all of Arizona, New Mexico, and the Region 3 National Grasslands in Oklahoma and Texas. These ecosystem types were then aggregated and cross-walked to 30 PNVTs identified by The Nature Conservancy (TNC) ecologists. A cross-walk between these ecosystem types and TNC-designated PNVTs can be found in Appendix 2-A. In addition, descriptions of each PNVT can be found in Appendix 2-B.

It should be noted that SWReGAP data have not been accuracy tested, and some errors with this dataset are known. Therefore, these inaccuracies may be compounded by our ecosystem type grouping and cross-walk process. However, this cross-walk allows for a comprehensive look at

PNVTs across the southwest region and hence, is a valuable tool for comparing PNVTs of Region 3 Forests and other landowners within Arizona and New Mexico. Also, it should be noted that SWReGAP, OK-GAP, and TX-GAP data may not be appropriate for use at fine spatial scales.

Other data sources considered for these analyses but not utilized include: Brown, Lowe, and Pase (1980); USFS General Ecosystem Survey; USFS Terrestrial Ecosystem Survey; and the USFS Region 3 mid-scale vegetation maps currently being developed. Data from Brown, Lowe, and Pase (1980) and the General Ecosystem Survey were deemed too coarse in scale for these analyses. The USFS Terrestrial Ecosystem Survey data and USFS Region 3 mid-scale vegetation maps were not completed at the time of this project for all Region 3 National Forests, and were therefore not utilized. Furthermore, data from the General Ecosystem Survey, Terrestrial Ecosystem Survey, and mid-scale vegetation maps do not extend beyond Forest Service boundaries and were therefore not available for comparisons between PNVTs of Region 3 Forests and other landowners in Arizona and New Mexico.

Total area and distribution of PNVTs were calculated for each Region 3 National Forest and compared amongst other Region 3 Forest and to other landowners in Arizona and New Mexico using the land ownership layer for Region 3 described above.

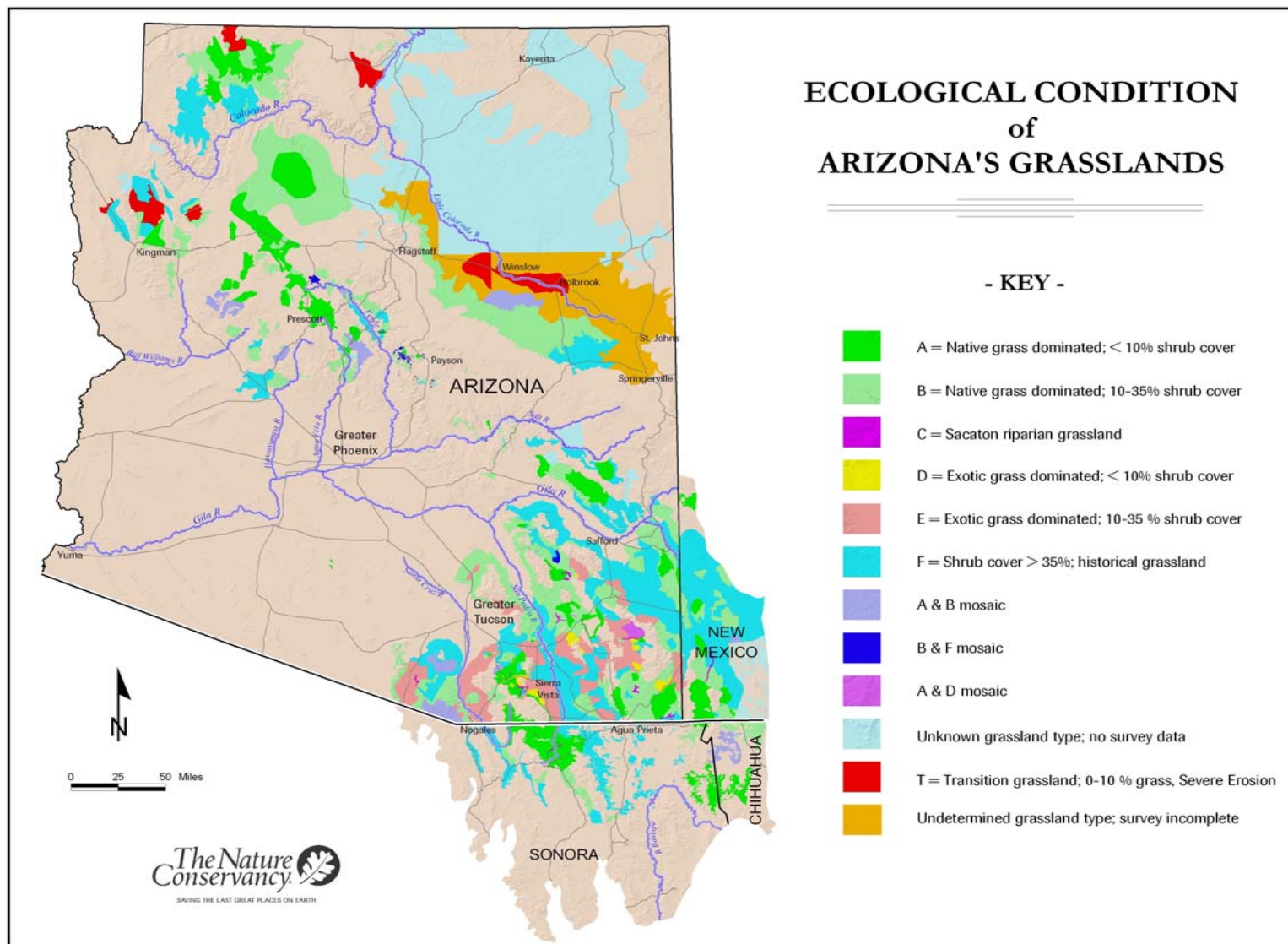
## *II. Distribution and Condition of Grasslands*

The Arizona Statewide Grassland Assessment (grassland assessment, Schussman and Gori 2004, Gori and Enquist 2003; available at <http://www.azconservation.org>) was used to identify the extent, distribution, and condition of former and current grasslands that exist across land ownerships and on each National Forest within Arizona. This statewide assessment (which also includes the portions of southwest New Mexico and Mexico that are within the Apache-Highlands Ecoregion; Figure 2-1) was developed through a combination of expert-based mapping and intensive, quantitative field sampling to verify and improve accuracy. Grassland condition was assessed and assigned to condition classes based on native/non-native grass dominance and cover, shrub cover, and erosion severity. For the purposes of this analysis, condition classes were aggregated into five grassland condition types (Table 2-1).

The Arizona Grasslands Assessment was limited to low-elevation grasslands (< 5000 ft.), and so does not address all grasslands (particularly montane grasslands) that exist within Arizona. Also, approximately 32% of grasslands within the state, predominately on Native American Trust Lands, were not assigned to a condition type. Therefore, these areas were excluded from all percentage calculations associated with relative abundance of grassland classes. In addition, this analysis only includes portions of the grassland assessment in Arizona and New Mexico and does not include the Mexican portion of the assessment. Due to differences in the approach and scale used to classify vegetation, the distribution and extent of grasslands identified by the grassland assessment likely vary from other vegetation assessment and mapping projects, such as the SWReGAP. Comparable data were not available for most of New Mexico.

Detailed descriptions of the grassland categories that exist in Arizona and New Mexico (i.e. desert, Great Basin, Colorado Plateau, Plains, and Montane grasslands), their ecology, and general changes from historic conditions were provided by Finch (2004). This resource provides valuable information for understanding the changes in grassland structure and function documented in the Arizona Grassland Assessment.

In Chapter 3, the Arizona Grasslands GIS-based layer (available at <http://www.azconservation.org>) was used, along with the land ownership layer (described above), to identify the distribution and condition of grasslands amongst major landowners and each National Forest in Arizona. In Chapters 4-15, the grasslands layer was overlaid on the administrative boundaries for each National Forest to identify the location and extent of grasslands of varying condition types amongst ranger districts.



**Figure 2-1.** The Arizona Statewide Grasslands Assessment (Schussman and Gori 2004, Gori and Enquist 2003) GIS-based layer depicts the condition of grasslands across Arizona, as well as parts of southwest New Mexico and north central Mexico that occur within the Apache Highlands Ecoregion.

**Table 2-1.** Grassland types identified in the Arizona Grasslands Assessment (Schussman and Gori 2004, Gori and Enquist 2003) based on native/non-native perennial grass dominance and cover, shrub cover, and soil erosion severity.

Grassland Type	Description
Open Native Grassland	A grassland with <10% shrub cover and herbaceous component is predominantly native perennial grasses and herbs.
Restorable (Shrub Invaded) Native Grassland	A grassland with 10-35% total shrub cover and mesquite or juniper cover < 15% whose herbaceous component is predominantly native perennial grasses and herbs.
Non-native Grassland	A grassland with herbaceous component dominated by non-native perennial grasses. Includes both open (<10% shrub cover) and shrub invaded (10-35% total shrub cover of mesquite and juniper cover > 15%) grassland types.
Former Grasslands	A grassland that has been converted to shrub land, with > 15% canopy cover of mesquite and juniper and/or > 35% total shrub cover, and little or no perennial grass cover.
Transition Grasslands	A grassland with <5% canopy cover of perennial grasses and/or severe soil erosion problems.



### *III. Riparian and Freshwater Systems and Species*

The Arizona Statewide Freshwater Assessment (Turner and List, *In Prep*; available at [www.azconservation.org](http://www.azconservation.org)) was used to summarize the occurrence and distribution of stream reaches with native fish occurrences across major landowners and National Forests in Arizona. This assessment was developed for use in regional planning and includes occurrence information for 33 native fish species (Table 2-2) in streams across all of Arizona. Point localities for each species from 1975 and later were obtained from a variety of sources, including the Arizona Game and Fish Department's (AGFD) Heritage Data Management System, the SONFISHES database (Fagan and others 2002), US Fish and Wildlife Service (Sponholtz and others 2003), U.S. Forest Service, and the AGFD native fish program. For each species, these point localities were mapped to perennial stream reaches on a 1:100,000 scale linear hydrography layer for Arizona to approximate the extent of occupied habitat. This process accounted for biologically significant breaks in stream continuity, including dams and ephemeral reaches. Additionally, the assessment integrated the distributions for all 33 native fishes into a single geo-spatial data layer that represents the number of native fish with occurrences on stream reaches across Arizona. While this analysis currently includes only Arizona (including the Kaibab, Coconino, Prescott, Tonto, Apache-Sitgreaves National Forests, and the Coronado National Forest in Arizona), a similar data set for New Mexico is currently being developed and results from that analysis may be incorporated into this document .

In Chapter 3, this geo-spatial data was overlaid on landownership information from the Arizona Land Resource Information Service and the New Mexico Resource Geographic Information system (see description above) to determine the distribution (number of stream miles) of stream reaches with varying numbers of native fish species occurrences for nine major landowners and six individual National Forests in Arizona. In areas where streams serve as the boundary between landowners for a distance greater than five miles, one-half of the length of that stream reach was attributed to each landowner.

The Freshwater Assessment data was also used, along with a data layer representing the administrative boundaries of each National Forest, to identify and summarize the distribution of each species on stream reaches within each National Forest (Chapters 4-15). It is recognized that at these relatively fine scales, reaches with identified occurrences of various native fish species in the Freshwater Assessment may differ from current native fish distributions. Thus, each National Forest was given the opportunity to review the information in the Freshwater Assessment to identify stream reaches that differed from known current conditions. These differences are addressed and the information is used to demonstrate the types and magnitude of changes in native fish distributions that have occurred on National Forests within the last 30 years. In addition, information from Olden and Poff (2005) was used, where applicable, to characterize the long-term changes in distributions for native fish that occur on National Forest lands. It is important to note that the stream mile lengths for these analyses, based on Forest boundaries, differ from those presented in Chapter 3, which are based on land ownership information.

**Table 2-2.** Common names, scientific names, and status under the Endangered Species Act (ESA) for 33 native fishes included in the Arizona State-wide Freshwater Assessment (Turner and List, *In Prep*).

Common Name	Scientific Name	ESA Status <sup>A</sup>
Longfin Dace	<i>Agosia chrysogaster</i>	SC
Mexican Stoneroller	<i>Campostoma ornatum</i>	SC
Desert Sucker	<i>Catostomus clarki</i>	SC
Bluehead Sucker	<i>Catostomus discobolus</i>	
Sonora Sucker	<i>Catostomus insignis</i>	SC
Flannelmouth Sucker	<i>Catostomus latipinnis</i>	SC
Little Colorado Sucker	<i>Catostomus sp.</i>	
Zuni Mountain Sucker	<i>Catostomus yarrowi</i>	
Beautiful Shiner	<i>Cyprinella formosa</i>	LT
Desert Pupfish	<i>Cyprinodon macularius</i>	LE
Machete (Pacific Tenpounder)	<i>Elops Affinis</i>	
Humpback Chub	<i>Gila cypha</i>	LE
Sonora Chub	<i>Gila ditaenia</i>	LT
Bonytail Chub	<i>Gila elegans</i>	LE
Gila Chub	<i>Gila intermedia</i>	PE
Headwater Chub	<i>Gila nigra</i>	
Yaqui Chub	<i>Gila purpurea</i>	LE
Roundtail Chub	<i>Gila robusta</i>	PS
Virgin River Chub	<i>Gila seminuda</i>	LE
Yaqui Catfish	<i>Ictalurus pricei</i>	LT
Virgin Spinedace	<i>Lepidomeda mollispinis mollispinis</i>	PS
Little Colorado Spinedace	<i>Lepidomeda vittata</i>	LT
Spikedace	<i>Meda fulgida</i>	LT
Striped Mullet	<i>Mugil Cephalus</i>	
Apache (Arizona) Trout	<i>Oncorhynchus apache</i>	LT
Gila Trout	<i>Oncorhynchus gilae</i>	LE
Woundfin	<i>Plagopterus argentissimus</i>	LE
Gila Topminnow	<i>Poeciliopsis occidentalis occidentalis</i>	LE
Yaqui Topminnow	<i>Poeciliopsis occidentalis sonoriensis</i>	LE
Colorado Pikeminnow	<i>Ptychocheilus lucius</i>	LE
Speckled Dace	<i>Rhinichthys osculus</i>	PS
Loach Minnow	<i>Tiaroga cobitis</i>	LT
Razorback Sucker	<i>Xyrauchen texanus</i>	LE

<sup>A</sup>C = Candidate, LE = Listed Endangered, LT = Listed Threatened, SC= Species of Concern, PS = Partial Status

#### *IV. Plant and Animal Species Richness*

The R3 Species Database was used to examine the plant and animal species richness on each Region 3 Forest and the conservation status of these species. The R3 Species Database was developed collaboratively by Region 3 staff, species experts, and The Nature Conservancy to address information needs associated with forest plan revisions. It was compiled from several Regional and Forest level datasets into one database that consists of updated and consistent information across taxa regarding state, federal, non-government, and USFS conservation statuses, and identifies the National Forest(s) a species inhabits. The R3 Species Database incorporates information on all terrestrial and aquatic vertebrates that are known to inhabit Region 3 National Forests. It also includes known crustacean, clam, insect, plant and snail species that are of conservation concern. Table 2-3 lists the taxonomic groups and species' attributes included in the R3 Species Database. More information regarding the R3 Species Database can be found at <http://www.azconservation.org>.

**Table 2-3.** List of taxa and species' attributes included in the R3 Species Database. The R3 Species Database includes all amphibian, bird, fish, mammal, and reptile species that are known to occur on Region 3 National Forest Service lands, and species of conservation concern for crustaceans, clams, insects, plants and snails.

#### **The R3 Species Database Fields**

- General Taxonomic Group
- NatureServe Unique Identifier Number
- NatureServe Scientific Name
- Synonyms
- NatureServe Common Name
- Other Common Names
- NatureServe Global Conservation Status (G-rank)
- NatureServe Subnational Conservation Status (S-rank) for Arizona
- NatureServe Subnational Conservation Status (S-rank) for New Mexico
- NatureServe Subnational Conservation Status (S-rank) for Oklahoma
- NatureServe Subnational Conservation Status (S-rank) for Texas
- Federal Listing Status under Endangered Species Act
- Arizona State Status (Arizona Native Plant Law 1983, Wildlife of Special Concern in Arizona 1996)
- New Mexico State Status under Wildlife Conservation Act (1978) and Endangered Plant Species Act (1985)
- Oklahoma State Status of Threatened, Endangered and Species of Special Concern
- Texas State Status of threatened fish and wildlife
- U.S. Forest Service Region 3 Sensitive Species (Updated 2000)
- U.S. Forest Service Region 3 Proposed Sensitive Species (2005)
- U.S. Fish and Wildlife Service Birds of Conservation Concern
- Partners in Flight Watch List
- Species Occurrence on each National Forest in Region 3

Conservation status information for the R3 Species Database was gathered from USFS data as well as from NatureServe, U.S. Fish and Wildlife Service, Arizona Game and Fish Department, New Mexico Department of Game and Fish, Oklahoma Department of Wildlife and Conservation, Texas Parks and Wildlife Department, and Partners in Flight. It is important to note that nomenclature (NatureServe is the standard used in the database) and conservation statuses can change over time. Data regarding species presence by National Forest were based on datasets maintained by USFS personnel and were reviewed by biologists and other resource staff on each Region 3 Forest. Because the accuracy of these data is dependent upon the quality of the source datasets and the review by a limited number of personnel in each Forest, data gaps may exist in the R3 Species Database.

Because the R3 Species Database was developed specifically for Region 3 National Forests, it was not possible to summarize species information across landowners for Chapter 3. However, information in the R3 Species Database was used to summarize plant and animal information for each Region 3 Forest and National Grasslands in Chapters 4-15. Additionally, the species that occur on each forest, along with the associated conservation status attributes, were included as an appendix within each individual Forest chapter.

*Species Richness* — Occurrence information from the R3 Species Database was used to identify the numbers of species, by taxon, that occur on each National Forest.

*Federally listed threatened, endangered, and candidate species* — Under the Endangered Species Act (1973) the U.S. Fish and Wildlife Service designates a suite of species as federally threatened or endangered. Also of importance are those species that are currently being considered for the status of threatened or endangered (including candidate or proposed species). The R3 Species Database was used to determine the federally listed endangered, threatened, candidate or proposed species (status determined as of 1 May 2005) that inhabit each Region 3 National Forest.

*Arizona, New Mexico, Oklahoma, and Texas state conservation status* — Included in the R3 Species Database are the Arizona, New Mexico, Oklahoma, and Texas state conservation statuses for plant and animal species. The designations for each state are:

- In Arizona, Wildlife of Special Concern (WSC) status may be assigned to species whose occurrence is or may be at risk in the state, as described by the Arizona Game and Fish Department (1996). WSC status does not include plant species. The Arizona Department of Agriculture assigns special state status for plant species under the Arizona Native Plant Law (1993) which includes: highly safeguarded (HS), salvage restricted (SR), export restricted (ER), salvage assessed (SA), and harvest restricted (HR).
- The New Mexico Game and Fish Department designates special state status to both wildlife and plant species as threatened or endangered.
- The Oklahoma Department of Wildlife and Conservation assigns species with the rank of endangered, threatened, or of special concern.
- Texas Parks and Wildlife Department considers fish or wildlife indigenous to Texas endangered if listed on: (1) the United States List of Endangered Native Fish and Wildlife; or (2) the list of fish or wildlife threatened with statewide extinction as filed by the director of the department.

The R3 Species Database was used to identify, by taxon, the numbers of species that have special state conservation status as of 1 May 2005, that occur on each National Forest.

*NatureServe global conservation status ranking* — The R3 Species Database includes NatureServe global rankings that reflect the conservation status of species from a global perspective. These ranks are primarily based on three biological attributes: the number of species occurrences; the total overall abundance of the species; and the overall size of the geographic range of the species (Natural Heritage New Mexico 2005). Global conservation status rankings are determined by NatureServe based on data provided by Natural Heritage Programs and Conservation Data Centers. The global conservation status rankings are: GX = presumed extinct; GH = possibly extinct; G1 = critically imperiled; G2 = imperiled; G3 = vulnerable; G4 = apparently secure; G5 = secure; GNR = not ranked; GU = unrankable; T = infraspecific taxon (subspecies, race, variety). The numbers of species by taxon occurring on each National Forest and assigned to each global conservation status ranking as of 1 May 2005 were identified.

*NatureServe subnational conservation status ranking* — The R3 Species Database incorporates NatureServe subnational rankings for Arizona, New Mexico, Oklahoma, and Texas for species that have rankings assigned to them. The NatureServe subnational conservation status ranking reflects the conservation status of a species from a local perspective, characterizing the relative rarity or risk of a species' population within each state. Rankings are based on the estimated or actual number of extant occurrences of the species within a state and other aspects such as threats, trends and abundance (Natural Heritage New Mexico 2005). The subnational conservation status rankings are: SX = presumed extirpated; SH = possibly extirpated; S1 = critically imperiled; S2 = imperiled; S3 = vulnerable; S4 = apparently secure; S5 = secure; SNA = not applicable; SNR = not ranked; SU = unrankable. Some species in the R3 Species Database have a subnational conservation status ranking from one or more states (Arizona, New Mexico, Oklahoma, and Texas), while some species do not have a subnational conservation status ranking from any state. The numbers of species, by taxon, assigned to each subnational conservation status as of 1 May 2005 were identified.

*Potential Species-of-Concern* — According to the interim directives published in the Federal Register on March 23, 2005 (70 Fed. Reg. 14637), which supplement the NFMA planning regulations (70 Fed. Reg. 1023), each National Forest may consider a category of species called “species-of-concern” as part of the new forest plans. The interim directives suggest determining species-of-concern by their NatureServe Global conservation rank. Any species with a NatureServe global conservation rank of G1, G2, G3, T1, T2, or T3 and not listed as federally endangered or threatened, may be considered a species-of-concern. Federally designated candidate or proposed species may also be considered species-of-concern. The R3 Species Database was used to identify potential species-of-concern for each Region 3 National Forest using the criteria listed above.

*Potential Species-of-Interest* — Another category of species addressed in the interim directives is species-of-interest. According to the sustainability directive in the Forest Service Handbook (FSH 1909.12 chapter 40) that supplements the new NFMA planning regulations, this category may include state-listed threatened and endangered species; birds on the U.S. Fish and Wildlife

Service's "Birds of Conservation Concern National Priority" list; S1 and S2 ranked species in the NatureServe ranking system; and other species of regional or local concern due to significant threats, declining populations, or rarity (FSH 43.22b). For this analysis, if a National Forest occurs in one state, the state conservation status from that state was considered. If a National Forest occurs in more than one state, species that have special state conservation status in any of those states were included as a potential species-of-interest. Based on these criteria, a suite of potential species-of-interest were identified for each Region 3 National Forest, using information from the R3 Species Database. We did not include 'other species of regional or local concern due to significant threats, declining populations, or rarity' as suggested in the interim directives, due to the subjective nature of this determination. Species listed as federally threatened or endangered, or included in species-of-concern were not included as potential species-of-interest.

*Birds of conservation concern* — In 2002, the U.S. Fish and Wildlife Service Division of Migratory Bird Management identified 131 bird species and subspecies as Birds of Conservation Concern for those species that were likely to become federally threatened or endangered under the Endangered Species Act if conservation measures were not taken. The R3 Species Database was used to identify the bird species with this designation for each National Forest.

*Partners in Flight Watch List* — Partners in Flight (PIF), a cooperative effort involving governmental agencies and non-governmental organizations dedicated to the conservation of birds that inhabit terrestrial habitats, developed a Watch List that contains bird species whose populations are thought to be of management concern and are believed to be in need of monitoring. The PIF Watch List consists of three categories of conservation status for bird species, including: species with multiple causes for concern across their entire range; species that are moderately abundant or widespread with declines or high threats; and species with restricted distribution or low population size. For more information about PIF and their Watch List refer to the website at <http://www.partnersinflight.org/>. The R3 Species Database was used to identify the bird species on the PIF Watch List as of 1 May 2005 for each National Forest.

*Accidental species in the R3 Species Database* — The R3 Species Database includes several species of birds that are designated as occurring on one or more Region 3 National Forest, but are considered 'accidental' according to The Sibley Guide to Birds (2001) and NatureServe Explorer (<http://www.natureserve.org/explorer/>). Accidental species are those thought to be out of their normal distributional range for the species' known over-wintering or breeding grounds, or migratory path. Because it is unlikely that more than a few individuals of these species occur on a National Forest at any given time, analyses in this report did not include accidental species.

*Extirpated Species* – Species that are known to be extirpated on individual Forests are not included in the R3 Species Database, but are identified in the individual Forest chapters. This information is based on species experts, forest biologists, scientific literature and wildlife databases that include NatureServe Explorer (<http://www.natureserve.org/explorer/>) and Biota Information System of New Mexico (<http://fwie.fw.vt.edu/states/nm.htm>).

## *V. Ecoregional Assessment Conservation Areas and Conservation Targets*

The results of eight ecoregional assessments (Bell and others 1999, 2004 Marshall and others 2000, 2004, Neely and others 2001, The Nature Conservancy 2001, 2005, Tuhy 2002) were used to identify the extent and distribution of conservation areas across land ownerships in Arizona and New Mexico. Ecoregional assessments are science-based efforts to identify the minimum set of areas (conservation areas) on the landscape that are necessary to maintain the biological diversity of the ecoregion.

Ecoregions are large, contiguous units of land or water defined by ecological and environmental elements, rather than geo-political boundaries, and typically contains geographically distinct assemblages of species, natural communities, and environmental conditions. Because ecoregions typically include large proportions of ecosystem, community, and species distributions, they are useful for conservation planning. Ecoregional assessments rely on a comprehensive scientific analysis to identify conservation areas sufficient in size and distribution to maintain the biological diversity of the entire ecoregion. As an initial step, assessments identify conservation targets, a subset of organisms and ecological systems that comprehensively represent the ecoregion's biological diversity. Targets include ecological systems, typically represented by plant communities and supporting ecological processes, and a broad range of species representing major taxonomic groups, which often serve as surrogates for other species. For each conservation target, a conservation goal is determined that defines the number, spatial distribution, and spatial extent of viable occurrences of the target necessary to maintain its existence. An iterative process relying on computer software and expert review was used to identify a suite of areas that most efficiently meet the conservation goals for all conservation targets within the ecoregion. These conservation areas, collectively called a conservation portfolio, represent the most current and scientifically robust hypotheses on the magnitude and distribution of areas on the landscape necessary to protect the biodiversity of the region.

In general, ecoregional assessments serve several conservation, management and scientific purposes, including:

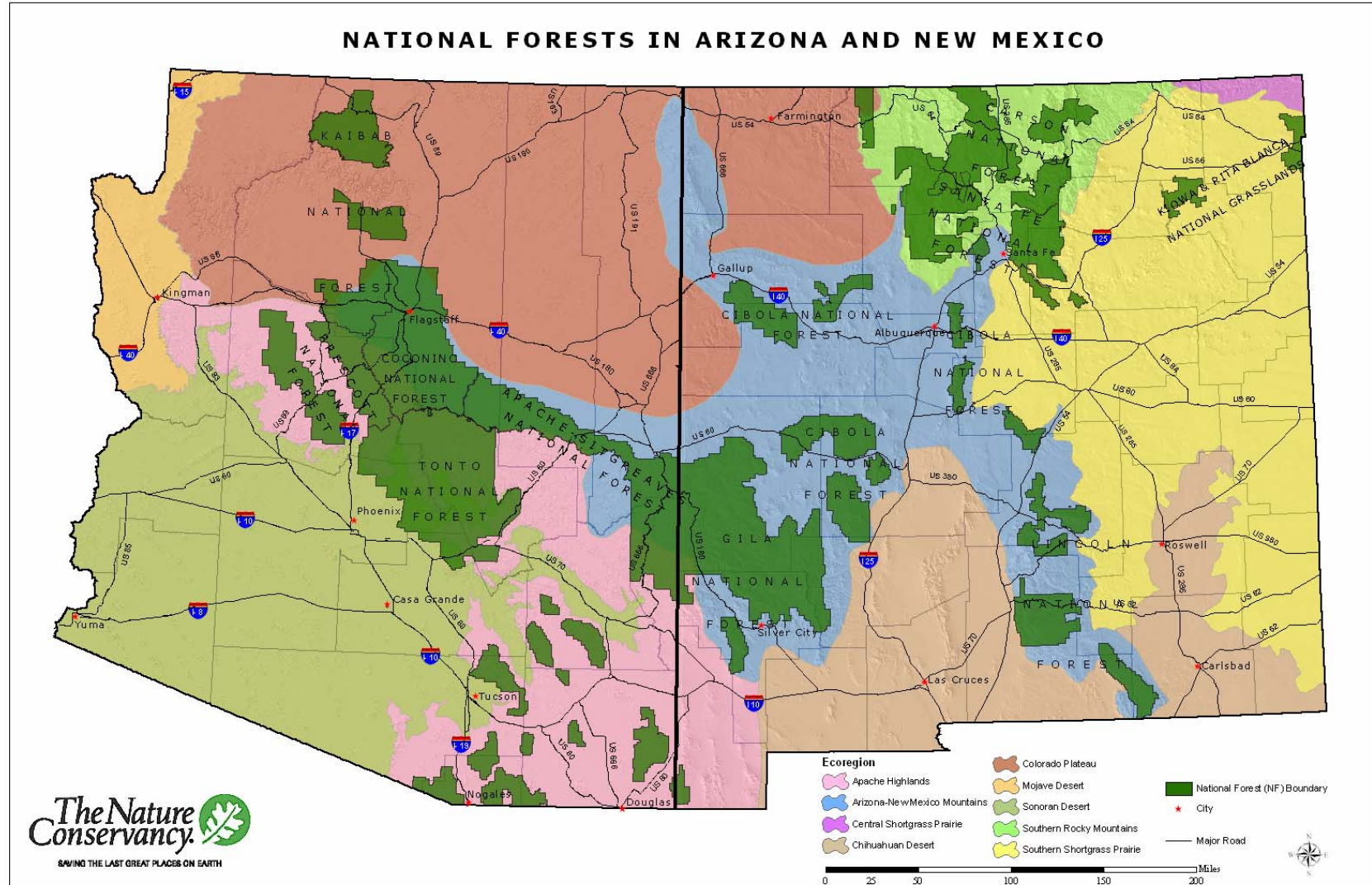
1. A spatial hypothesis on how to maximize the viability of a region's native species and ecological systems.
2. A spatial delineation of the areas where land-uses and land management activities should be evaluated to identify and minimize potential adverse effects to the viability of species and ecological systems.
3. A spatial delineation of priority areas that land managers and others interested in promoting conservation should evaluate first to ensure that disturbance processes that perpetuate native ecological systems (e.g., fire, flooding) are maintained at a scale, frequency, and intensity that falls within the historical range of variation.
4. A network of cross-jurisdictional priorities that could serve as a basis for collaboration and the use of limited resources to maximize conservation values.

While nine ecoregional assessments overlap Arizona and New Mexico (Figure 2-2), information from eight ecoregions was synthesized as part of this analysis. The Central Shortgrass Prairie Ecoregional Assessment (The Nature Conservancy 1998), which overlaps a small portion of

northeast New Mexico (not including any National Forest lands), was not included in this analysis. As part of a regional data rollup effort, The Nature Conservancy merged conservation area information from six individual assessments (Apache Highlands, Arizona-New Mexico Mountains, Colorado Plateau, Mojave Desert, Sonoran Desert, and the Southern Rocky Mountains) into a single regional geo-spatial data layer (<http://www.azconservation.org>). This dataset includes conservation area boundaries and attributes for the conservation targets that occur within each conservation area in those ecoregions. The assessments for Chihuahuan Desert Ecoregion, which overlaps a small part of the Lincoln National Forest, the Southern Shortgrass Prairie Ecoregion, which includes portions of the Santa Fe National Forest and Cibola National Grasslands, were included individually.

Data from the ecoregional assessments were used, along with the land ownership GIS-based layer and National Forest boundary layer (see descriptions above), to identify the extent and distribution of overlap of conservation areas and major landowners (Chapter 3) and each Forest in Region 3 (Chapters 4 - 15). Additionally, the individual targets associated with each conservation area were identified for each Forest. To determine how conservation areas overlap with current land-use designations on each National Forest, conservation areas were overlaid with designated wilderness areas, inventoried roadless areas, and other areas with special designations (e.g. research natural areas, zoological-botanical areas).





**Figure 2-2.** Overlap of The Nature Conservancy ecoregions and U.S. Forest Service Region 3 lands in Arizona and New Mexico.

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**Appendix 2-A:** Potential Natural Vegetation Types (PNVTs) cross-referenced to Southwest Regional GAP

<b>PNVT (Number of Land Cover Types)</b>	<b>SWReGAP, OK-GAP, and TX-GAP Land Cover Types</b>
Alpine and tundra (3)	Rocky Mountain Alpine Bedrock and Scree Rocky Mountain Alpine Fell-Field Rocky Mountain Dry Tundra
Aspen forest and woodland (2)	Inter-Mountain West Aspen-Mixed Conifer Forest and Woodland Rocky Mountain Aspen Forest and Woodland
Barren (2)	Bare Soil Barren Lands, Non-specific
Cottonwood willow riparian forest (7)	Western Bottomland Forests Western Great Plains Riparian Woodland and Shrubland Invasive Southwest Riparian Woodland and Shrubland North American Warm Desert Riparian Mesquite Bosque Temporary Flooded Cold-Deciduous Woodland Temporary Flooded Microphyllous Shrublands Temporary Flooded Temperate Grasslands with Sparse Cold-Deciduous Woodlands
Desert communities (15)	Chihuahuan Mixed Salt Desert Scrub Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub Chihuahuan Succulent Desert Scrub Mojave Mid-Elevation Mixed Desert Scrub North American Warm Desert Active and Stabilized Dune North American Warm Desert Badland North American Warm Desert Bedrock Cliff and Outcrop North American Warm Desert Pavement North American Warm Desert Playa North American Warm Desert Volcanic Rockland North American Warm Desert Wash Sonora-Mojave Creosotebush-White Bursage Desert Scrub Sonora-Mojave Mixed Salt Desert Scrub Sonoran Mid-Elevation Desert Scrub Sonoran Paloverde-Mixed Cacti Desert Scrub
Disturbed/altered (2)	Recently Burned Recently Mined or Quarried
Gallery coniferous riparian forest (1)	Rocky Mountain Sub-alpine-Montane Riparian Woodland
Great Basin / Colorado Plateau grassland and steppe (16)	Colorado Plateau Blackbrush-Mormon-tea Shrubland Colorado Plateau Mixed Bedrock Canyon and Tableland (not with Mixed Conifer) Inter-Mountain Basins Greasewood Flat Inter-Mountain Basins Juniper Savanna Inter-Mountain Basins Mat Saltbush Shrubland Inter-Mountain Basins Mixed Salt Desert Scrub

<b>PNTV (Number of Land Cover Types)</b>	<b>SWReGAP, OK-GAP, and TX-GAP Land Cover Types</b>
	Inter-Mountain Basins Montane Sagebrush Steppe Inter-Mountain Basins Playa Inter-Mountain Basins Semi-Desert Grassland Inter-Mountain Basins Semi-Desert Shrub Steppe Inter-Mountain Basins Shale Badland Inter-Mountain Basins Volcanic Rock and Cinder Land Inter-Mountain Basins Wash Invasive Annual and Biennial Forbland Invasive Annual Grassland Southern Colorado Plateau Sand Shrubland
Great Plains grassland (24)	Annual Graminoid or Forb Vegetation Extremely Xeromorphic Deciduous Shrubland Grama – Buffalograss Prairie Gypsum Grasslands Intermittently Flooded Temperate or Subpolar Grassland Lowland Mixed Evergreen – Drought Deciduous Shrubland Medium – Tall Bunch Temperate or Subpolar Grassland Microphyllous Evergreen Shrubland Midgrass Prairie Midgrass Sand Prairie Midgrass Sandsage Prairie Sandsage Prairie Sandsage Savanna Semi-permanently Flooded Temperate or Subpolar Grassland Shinnery Oak Shrubland Short Sod Temperate or Subpolar Grassland Southern Rocky Mountain Juniper Woodland and Savanna Tall Sod Temperate Grasslands Temperate or Subpolar Grassland with a Sparse Shrub Layer Western Great Plains Cliff and Outcrop Western Great Plains Foothill and Piedmont Grassland Western Great Plains Mesquite Woodland and Shrubland Western Great Plains Sandhill Shrubland Western Great Plains Shortgrass Prairie
Interior chaparral (4)	Coahuilan Chaparral Great Basin Semi-Desert Chaparral Mogollon Chaparral Rocky Mountain Gambel Oak-Mixed Montane Shrubland (Not with Mixed Conifer)
Madrean encinal woodland (2)	Madrean Encinal Madrean Pinyon-Juniper Woodland
Madrean pine-oak woodland (1)	Madrean Pine-Oak Forest and Woodland
Mixed broad leaf deciduous riparian forest (3)	North American Warm Desert Riparian Woodland and Shrubland Rocky Mountain Bigtooth Maple Ravine Woodland Rocky Mountain Lower Montane Riparian Woodland and Shrubland
Mixed conifer forest (5)	Madrean Upper Montane Conifer-Oak Forest and Woodland

<b>PNVT (Number of Land Cover Types)</b>	<b>SWReGAP, OK-GAP, and TX-GAP Land Cover Types</b>
	Recently Logged Areas Rocky Mountain Cliff and Canyon Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland
Montane grassland (1)	Rocky Mountain Sub-alpine Mesic Meadow
Montane Willow Riparian Forests (2)	North American Warm Desert Lower Montane Riparian Woodland Rocky Mountain Sub-alpine-Montane Riparian Shrubland
No Value (1)	No Value
Oklahoma Oak Woodland (1)	Eastern Red Cedar – Oak Woodland
Pinyon-juniper woodland (6)	Colorado Plateau Pinyon-Juniper Shrubland Colorado Plateau Pinyon-Juniper Woodland Great Basin Pinyon-Juniper Woodland Recently Chained Pinyon-Juniper Areas Rocky Mountain Lower Montane-Foothill Shrubland (Not with Montane Conifer) Southern Rocky Mountain Pinyon-Juniper Woodland
Ponderosa pine (1)	Southern Rocky Mountain Ponderosa Pine Woodland
Sagebrush shrubland (3)	Colorado Plateau Mixed Low Sagebrush Shrubland Inter-Mountain Basins Active and Stabilized Dune Inter-Mountain Basins Big Sagebrush Shrubland
Semi-desert grasslands (8)	Apacherian-Chihuahuan Mesquite Upland Scrub Apacherian-Chihuahuan Piedmont Semi-Desert Grassland Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub Chihuahuan Gypsophilous Grassland and Steppe Chihuahuan Sandy Plains Semi-Desert Grassland Chihuahuan-Sonoran Desert Bottomland and Swale Grass Invasive Perennial Grassland Madrean Juniper Savanna
Shinnery Oak Shrubland (1)	Shinnery Oak Shrubland
Spruce-fir forest (4)	Rocky Mountain Lodgepole Pine Forest Rocky Mountain Sub-alpine Dry-Mesic Spruce-Fir Forest Rocky Mountain Sub-alpine Mesic Spruce-Fir Forest and Rocky Mountain Sub-alpine-Montane Limber-Bristlecone
Sub-alpine grassland (1)	Southern Rocky Mountain Montane-Sub-alpine Grassland
Texas Oak Woodland (2)	Cold Deciduous Woodland Temperate Broad-leaved Evergreen Shrubland
Texas Pinyon-Juniper (1)	Round Crowned Temperate or Subpolar Needle-leaved Evergreen Woodland

<b>PNVT (Number of Land Cover Types)</b>	<b>SWReGAP, OK-GAP, and TX-GAP Land Cover Types</b>
Urban and agricultural area (7)	Agriculture Crop – Warm Season Cropland (irrigated, row, herbaceous, etc.) Developed, Medium - High Intensity Developed, Open Space - Low Intensity Improved/Introduced Pasture – Warm Season Residential/ Industrial
Water (5)	Lake/Reservoir Open Water Pond Riverine Water
Wetland/cienega (4)	North American Arid West Emergent Marsh Rocky Mountain Alpine Wet Meadow Western Great Plains Saline Depression Wetland Wetland



## **Appendix 2-B:** Descriptions of potential natural vegetation types (PNVTs).

**Alpine and Tundra** – Alpine conditions begin around 10,600 ft. Alpine areas are typically barren with sparse vegetation including grasses, forbs, lichens and low shrubs. Unstable substrates, exposure to high winds, and short growing season make it difficult for plants to establish and grow in these areas. Barren areas include rocky outcroppings, scree slopes, and open fell-fields. Open fell-fields may include the following species: mountain sandwort (*Arenaria capillaries*), black and white sedge (*Carex albonigra*), Payson's sedge (*Carex paysonis*), Ross's avens (*Geum rossii*), Bellardi bog sedge (*Kobresia myosuroides*), twinflower sandwort (*Minuartia obtusiloba*), Asian forget-me-not (*Myosotis asiatica*), nailwort (*Paronychia pulvinata*), wherry (*Phlox pulvinata*), creeping sibbaldia (*Sibbaldia procumbens*), and moss campion (*Silene acaulis*). Within the alpine region, tundra can be found on gradual to moderate slopes, flat ridges, valleys, and basins, where there is fairly stable soil. The tundra system is typically characterized by low-growing, perennial graminoids and forbs. Rhizomatous, sod-forming sedges are the dominant graminoids, and prostrate and mat-forming plants with thick rootstocks or taproots characterize the forbs. Dominant species include sagebrush (*Artemisia arctica*), sedges (*Carex* spp.), tufted hairgrass (*Deschampsia caespitosa*), fescue grasses (*Festuca* spp.), Ross's avens (*Geum rossii*), Bellardi bog sedge (*Kobresia myosuroides*), wherry (*Phlox pulvinata*), and alpine clover (*Trifolium dasyphyllum*).

**Aspen Forest and Woodland** – Aspen forest and woodlands are found in montane and sub-alpine zones at elevations ranging from approximately 5,000 to 10,000 ft., but occasionally at lower elevations in some areas. These upland forests and woodlands are dominated by quaking aspen (*Populus tremuloides*) and may or may not have a significant conifer component, depending upon successional status. The understory structure may have shrubs and an herbaceous layer, or just an herbaceous layer. The herbaceous layer may be dense or sparse, dominated by graminoids or forbs. Some of the species typically found associated with aspen include Arizona peavine (*Lathyrus arizonica*), meadow rue (*Thalictrum fendleri*), deer's ears (*Swertia radiata*), yarrow (*Achillea lanulosa*), violet (*Viola canadensis*), paintbrush (*Castilleja* spp.), arnica (*Arnica montanum*), and several grasses and sedges (*Poa* spp. and *Carex* spp.). Distribution of this PNVT is limited by several factors including soil type, adequate soil moisture required to meet its high evapotranspiration demand, the length of the growing season or low temperatures, and major disturbances that clear areas of vegetation and stimulate root sprouting and colonization.

**Barren** – Areas where there is less than approximately 15% vegetation cover and accumulation of earthen materials.

**Desert Communities** – This PNVT spans several types of desert communities, and desert provinces including the Sonoran, Chihuahuan, Great Basin and Mojave. Vegetation types and density will vary with geographic location, precipitation, and topography. Some areas within this PNVT may be barren with an abundance of sand, rock, gravel, scree or talus. Other areas may have sparse to dense vegetation cover that includes succulent species, desert grasses, desert scrub, and some herbaceous cover. Some species occurring in desert communities include: catclaw acacia (*Acacia greggii*), triangleleaf bursage (*Ambrosia deltoidea*), white bursage (*Ambrosia dumosa*), mesquite (*Prosopis* spp.), desert ironwood (*Olneya tesota*), saltbush (*Atriplex* spp.), creosote (*Larrea tridentata*), iodine bush (*Allenrolfea occidentalis*), splitleaf brickellia (*Brickellia laciniata*), desert broom (*Baccharis sarothroides*), desert willow (*Chilopsis linearis*), Apache plume (*Fallugia paradoxa*), cheesebush (*Hymenoclea salsola*), barrel cactus (*Ferocactus* spp.), hedgehog cacti (*Echinocereus* spp.), cholla and prickly pear (*Opuntia* spp.) saguaro (*Carnegiea gigantea*), salt grass (*Distichlis spicata*), rice grasses (*Oryzopsis* spp.), and dropseed grasses (*Sporobolus* spp.).

**Disturbed/Altered** – Areas that are barren or have relatively low vegetation cover due to some form of human alteration or management regime.

**Gallery Coniferous Riparian Forest** – Found at montane to sub-alpine elevations (5,000 to 11,000 ft) in the Rocky Mountains and Sierra Madre Occidental, this “canyon bottom forest” system contains many of the woody species that occur in the conifer and aspen woodlands adjacent to montane streams. This PNVT experiences periodic flooding and high water tables. Dominant tree species typically include sub-alpine fir (*Abies lasiocarpa*), Engelmann spruce (*Picea engelmannii*), Douglas-fir (*Pseudotsuga menziesii*), blue spruce (*Picea pungens*), quaking aspen (*Populus tremuloides*), narrowleaf cottonwood (*Populus angustifolia*), bigtooth maple (*Acer gradidentatum*); box elder (*Acer negundo*), alder (*Alnus oblongifolia*), willows (*Salix* spp.), Gambel oak (*Quercus gambelii*), Ponderosa pine (*Pinus ponderosa*), and Rocky Mountain juniper (*Juniperus scopulorum*).

**Great Basin / Colorado Plateau Grassland and Steppe** – In general, this PNVT is found at lower elevations with vegetation coverage consisting of mostly grasses and interspersed shrubs. Grass species may include but are not limited to: Indian ricegrass (*Achnatherum hymenoides*), threeawn spp. (*Aristida* spp.), blue grama (*Bouteloua gracilis*), fescue spp. (*Festuca* spp.), needle and thread grass (*Hesperostipa comata*), spike fescue (*Leucopoa kingii*), *Muhlenbergia* spp., James’ galleta (*Pleuraphis jamesii*), and Sandberg bluegrass (*Poa secunda*). Shrub species may include but are not limited to: sagebrush (*Artemisia tridentata* spp.), saltbush (*Atriplex* spp.), *Ephedra*, snakeweed (*Gutierrezia*), winterfat (*Krascheninnikovia lanata*), one-seeded juniper (*Juniperus monosperma*), and wax currant (*Ribes cereum*).

**Great Plains Grassland** -- This PNVT is characterized by mixed grass to tall grass prairie found on moderate to gentle slopes. Rain, temperature and soils limit this PNVT to lower elevations. This PNVT is mostly dominated by one or some of the following species: big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), mountain muhly (*Muhlenbergia montana*), green needlegrass (*Nassella viridula*), western wheatgrass (*Pascopyrum smithii*), sand dropseed (*Sporobolus cryptandrus*), blue grama (*Bouteloua gracilis*), needle and thread grass (*Hesperostipa comata*), or New Mexico feathergrass (*Hesperostipa neomexicana*). This PNVT may also include areas that are dominated by low cover grasses and forbs.

**Interior Chaparral** – This PNVT is typically found on mountain foothills and lower slopes where low-elevation desert landscapes transition into wooded evergreens. Interior chaparral consists of mixed shrub associations including but not limited to the following species: Manzanita spp. (*Arctostaphylos* spp.), crucifixion thorn (*Canotia holacantha*), desert ceanothus (*Ceanothus greggii*), mountain mahogany (*Cercocarpus montanus*), little-leaved mountain mahogany (*Cercocarpus intricatus*), Antelope bushes (*Purshia* spp.), silktassles (*Garrya* spp.), Stansbury cliffrose (*Purshia stansburiana*), shrub live oak (*Quercus turbinella*), and sumacs (*Rhus* spp.)

**Madrean Encinal Woodland** – Found in the Madrean Province, this PNVT occurs on foothills, canyons, bajadas and plateaus between the semi-desert grasslands and Madrean pine-oak woodlands. This PNVT is dominated by Madrean evergreen oaks such as Arizona white oak (*Quercus arizonica*), Emory oak (*Quercus emoryi*), gray oak (*Quercus grisea*), Mexican blue oak (*Quercus oblongifolia*), and Toumey oak (*Quercus toumeyi*). Madrean pine, Arizona cypress, pinyon and juniper trees and interior chaparral species may be present, but do not co-dominate. The ground cover is dominated by warm-season grasses such as threeawns (*Aristida* spp.), blue grama (*Bouteloua gracilis*), sideoats grama (*Bouteloua curtipendula*), Rothrock grama (*Bouteloua rothrockii*), Arizona cottontop (*Digitaria californica*), plains lovegrass (*Eragrostis intermedia*), curly-mesquite (*Hilaria belangeri*), green sprangletop (*Leptochloa dubia*), muhly grasses (*Muhlenbergia* spp.), or Texas bluestem (*Schizachyrium cirratum*).

**Madrean Pine-Oak Woodland** – Found in the Madrean province, this PNVT is dominated by open to closed canopy of evergreen oaks such as Arizona white oak (*Quercus arizonica*), alligator juniper (*Juniperus deppeana*), Chihuahua pine (*Pinus leiophylla*) and other various pines with a grassy understory. Madrean pine-oak woodlands usually occupy foothills and mountains ranging from approximately 4000 to 7000 ft. in elevation. Climate generally consists of mild winters and wet summers with mean annual precipitation ranging from about 10 to 25 inches; half of the precipitation typically occurs in summer, with the remainder occurring during the winter and spring.

scattered conifers and possibly some quaking aspen (*Populus tremuloides*). Other sites can be dominated by a

**Mixed Conifer Forest** – This PNVT spans a variety of dominant and co-dominant species in both dry and mesic environments in the Rocky Mountain and Madrean Provinces. In the Rocky Mountains, montane conifer forests may be found at elevations between 5,000 and 10,000 ft., situated between ponderosa pine, pine-oak, or pinyon-juniper woodlands and spruce-fir or sub-alpine conifer forests. Dominant and co-dominant vegetation varies in elevation and moisture availability. In the lower and drier elevation portions within this PNVT, Gambel oak (*Quercus gambelii*) and ponderosa pine (*Pinus ponderosa*) may co-dominate. In higher and more mesic areas ponderosa pine may co-dominate with Douglas fir (*Pseudotsuga menziesii*) and white fir (*Abies concolor*). Other vegetation that may be present but does not co-dominate in these higher and mesic areas include Englemann spruce (*Picea engelmannii*) and Colorado blue spruce (*Picea pungens*). In the Madrean Province, this PNVT can be characterized by large and small-patch forests and woodlands dominated by Douglas fir or white fir with Madrean oaks such as silverleaf oak (*Quercus hypoleucoides*) and netleaf oak (*Quercus rugosa*). The understory vegetation is comprised of a wide variety of shrubs, grasses, graminoids (sedges, etc.), and forbs; the compositions depends on soil type, aspect, elevation, disturbance history and other factors.

**Montane Grassland** – This PNVT is typically found at sub-alpine elevations (9,000 ft. and higher) on gentle to moderate gradient slopes. Soils are usually moist throughout the year. Dominant vegetation cover includes forbs with some graminoids. Common species found in this PNVT include but are not limited to: fleabane spp. (*Erigeron* spp.), asters (*Asteraceae* spp.), bluebells (*Mertensia* spp.), *Penstemon* spp., lupine spp. (*Lupinus* spp.) and goldenrods (*Solidago* spp.).

**Montane Willow Riparian Forest** – This PNVT stretches along various elevational gradients from lower elevations (3,500 ft.) in mountain canyons and valleys to higher mountainous elevations (10,000ft.). At lower elevations this PNVT can be found along perennial and seasonally intermittent streams. Here, the dominant woody vegetation includes cottonwood spp. (*Populus* spp.), Arizona sycamore (*Platanus wrightii*), Arizona Walnut, (*Juglans major*), velvet ash (*Fraxinus velutina*), and soapberry (*Sapindus saponaria*). Shrubs include willow spp. (*Salix* spp.), cherry (*Prunus* spp.) and Arizona alder (*Alnus oblongifolia*). At higher elevations, this PNVT is found along streambanks, seeps, fens, and isolated springs. At higher elevations, this PNVT are shrub and herb dominated. Dominant shrubs include alder spp. (*Alnus* spp.), birch spp. (*Betula* spp.), redosier dogwood (*Cornus sericea*), and a variety of willow spp. (*Salix* spp.).

**Oklahoma Oak woodland** – This PNVT can be found on portions of Region 3 National Grasslands. It is dominated by blackjack oak (*Q. marilandica*) and post oak (*Q. stellata*) with a savanna-like structure at the boundaries with the tall grass prairie and denser canopies occurring away from the forest grassland transition. This woodland type occurs throughout the Great Plains region on xeric sites with sandy soils.

**Pinyon-juniper Woodland** – Mostly found on lower slopes of mountains and in upland rolling hills at approximately 4,500 to 7,500 ft. in elevation. Most common pinyon pine is the Colorado pinyon (*Pinus edulis*), with singleleaf pinyon (*Pinus monophylla*) occurring in limited areas. One-seed juniper (*Juniperus monosperma*) is most common in Arizona and New Mexico; however, there are areas with Utah juniper (*Juniperus osteosperma*) and Rocky Mountain juniper (*Juniperus scopulorum*). In addition, annual and perennial grasses and graminoids, forbs, half-shrubs and shrubs can be found beneath the woodland overstory.

**Ponderosa Pine** – The ponderosa pine forest is widespread in the Southwest occurring at elevations ranging from 6,000-9,000 ft on igneous, metamorphic, and sedimentary parent soils with good aeration and drainage, and across elevational and moisture gradients. The dominant species in this system is Ponderosa pine (*Pinus ponderosa*). Other trees, such as Gambel oak (*Quercus gambelii*), Douglas-fir (*Pseudotsuga menziesii*), pinyon pine (*Pinus edulis*), and juniper spp. (*Juniperus* spp.) may be present. There is typically a shrubby understory mixed with

grasses and forbs, although this type sometimes occurs as savannah with extensive grasslands interspersed between widely spaced clumps or individual trees. This system is adapted to drought during the growing season, and has evolved several mechanisms to tolerate frequent, low intensity surface fires.

**Sagebrush Shrubland** -- This PNVT is dominated by big sagebrush (*Artemisia tridentata*) and ranges from the state of Washington east to the Dakotas, and south as far as Arizona and New Mexico. Within the southwest sagebrush shrubland primarily occurs in northern Arizona and northwestern New Mexico adjacent to Great Basin grassland and pinyon juniper woodland PNVTS. While big sagebrush is the dominant species other shrubs such as broom snakeweed and shadscale (*Atriplex confertifolia*) are common, as are grassland species such as blue grama (*Bouteloua gracilis*). Shrubland sites in the southwest are usually found on deep well-drained valley bottom soils between 4,800 and 5,800 ft. with precipitation ranging between 10 to 18 inches per year.

**Semi-desert Grassland** – Semi-desert grassland occurs throughout southeastern Arizona and southern New Mexico at elevations ranging from 3,000 to 4,500 ft. These grasslands are bounded by Sonoran or Chihuahuan desert at the lowest elevations and woodlands or chaparral at the higher elevations. Species composition and dominance varies across the broad range of soils and topography that occur within the two states. Dominant grassland associations/types are black grama (*Bouteloua eriopoda*) grassland, blue grama (*Bouteloua gracilis*) grassland, tobosca (*Hilaria mutica*) grassland, giant sacaton (*Sporobolus wrightii*) grassland, mixed native perennial grassland, and non-native perennial grassland. Shrubs also occupy these grasslands and their abundance and species composition also varies.

**Shinnery Oak Woodland** – This PNVT is can be found on portions of Region 3 National Grasslands. This PNVT is found in the western regions of the Great Plains on primarily sandy soils. The dominant vegetation type is shinnery oak also known as Harvard oak (*Quercus harvardii*). Other vegetation that may be present includes a variety of grasses such as bluestems (*Andropogon gerardi*), grama species (*Bouteloua* spp.), and sand dropseed (*Sporobolus cryptandrus*). Also may be present may be present are yucca spp. (*Yucca* spp.); mesquite species (*Prosopis* spp.); catclaw acacia (*Acacia greggii*), and sand sage (*Artemisia filifolia*) and other vegetation.

**Spruce-fir Forest** – Also known as sub-alpine conifer forests, spruce-fir forests range in elevation from 9,000 to 11,500 ft. along a variety of gradients including gentle to very steep mountain slopes. Englemann spruce (*Picea engelmannii*) and sub-alpine fir (*Abies lasiocarpa*) or corkbark fir (*Abies lasiocarpa* var. *lasiocarpa*) dominate this PNVT either mixed or alone. Douglas-fir (*Pseudotsuga menziesii*) along with mixed conifer and quaking aspen (*Populus tremuloides*) stands may also be present in this system for long periods without regeneration. Herbaceous species may include but are not limited to red baneberry (*Actaea rubra*), starry false Solomon's seal (*Maianthemum stellatum*), fleabane (*Erigeron eximius*), blackberry (*Rubus pedatus*), and sub-alpine lupine (*Lupinus arcticus* spp. *Subalpinus*). Natural disturbances in this PNVT are blow-downs, insect outbreaks and stand replacing fires.

**Sub-alpine Grassland** - Also referred to as montane grasslands, this system occurs at elevations ranging from 8,000-11,000 ft., and often harbors several plant associations with varying dominant grasses and herbaceous species. Such dominant species may include Parry's oatgrass (*Danthonia parryi*), Arizona fescue (*Festuca arizonica*), Thurber's fescue (*Festuca thurberi*), pine dropseed (*Blepharoneuron tricholepis*), Kentucky bluegrass (*Poa pratensis*), small camas (*Camassia quamash*), various sedges (*Carex* spp.), shooting star (*Dodecatheon jeffreyi*), fowl manna grass (*Glyceria striata*), Sierra rush (*Juncus nevadensis*), Rocky Mountain iris (*Iris missouriensis*), Parry's bellflower (*Campanula parryi*), California false hellebore (*Veratrum californicum*), and bulrush spp. (*Scirpus* and/or *Schoenoplectus* spp). Trees may occur along the periphery of the meadows, which may include southwestern white pine (*Pinus strobiformis*), Englemann spruce (*Picea engelmannii*), and sub-alpine fir (*Abies lasiocarpa*). Some shrubs may also be present. These meadows are seasonally wet, which is closely tied to snowmelt. They typically do not experience flooding events.

**Texas Oak Woodland** – This PNVT can be found on small portions of Region 3 National Grasslands. This PNVT includes the Harvard oak or shinnery oak (*Quercus harvardii*) shrubland alliance, honey mesquite (*Prosopis glandulosa*) woodland alliance, and post oak-black jack oak (*Quercus stellata* – *Quercus merilandica*) woodland alliances.

**Texas Pinyon-juniper Woodland** – This can be found on small portions of Region 3 National Grasslands. This PNVT includes the following species: ashe juniper (*Juniperus ashei*), alligator juniper (*Juniperus deppeana*), one-

seed juniper (*Juniperus monosperma*), red berry juniper (*Juniperus erythrocarpa*), pinyon pine (*Pinus edulis*), and a few oak spp. (*Quercus* spp.)

**Urban and Agricultural Area** – Dominated by urban development and land used for agricultural purposes.

**Water** – Areas with water including reservoirs, rivers, and streams.

**Wetland/Cienega** – This PNVT is associated with perennial springs or headwater streams where groundwater intersects the surface and creates pools of standing water, sometime with channels flowing between pools. Often soils in the area are highly saline. Distribution and types of vegetation vary due to a gradient in saturated soils and salinity. Some vegetation types found in wetland/cienegas include salt grass (*Distichlis spicata*), yerba mansa (*Anemopsis californica*), and sacaton in more saline areas; in saturated soils are rushes, sedges, flat sedges and spike rushes and deep pools support a variety of aquatic vegetation. This PNVT also includes high elevation (3,500 – 11,000 ft.) meadows with subsurface flows dominated by herbaceous cover.



**Chapter 3:**  
**Ecological and Biological Assessments Across Major Landowners in  
Arizona and New Mexico**

**In**  
**Ecological and Biological Diversity of National Forests in Region 3**

**Bruce Vander Lee, Ruth Smith, and Joanna Bate**  
**The Nature Conservancy**



SAVING THE LAST GREAT PLACES ON EARTH

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## Introduction

Within Arizona and New Mexico, the US Forest Service (USFS) Region 3 National Forests include a broad range of ecological components, including a large diversity of vegetation systems, ranging along elevational gradients from deserts to alpine/tundra, and the species that depend on these systems. In addition, many important aquatic and riparian systems, some of the most threatened in the nation, occur on Region 3 National Forests. While these important ecological systems and species are distributed across many landowners in the Southwest, Region 3 National Forests contain relatively large proportions of certain systems and species. Identifying these systems and species may be useful in planning efforts that focus on ensuring ecological sustainability across the region.

In this chapter, existing regional (Arizona and New Mexico) scale assessment information was used to highlight the ecological importance of Region 3 National Forests within the context of major landowners in Arizona and New Mexico. Additionally, important ecological components of individual National Forests were identified. Four existing regional-scale assessments were used to examine the ecological diversity and conservation opportunities on Region 3 National Forests relative to other landowners. These include assessments relating to the distribution of potential natural vegetation types (PNVTs), distribution and condition of grasslands, distribution of native fish occurrences, and the distribution of conservation areas identified through ecoregional assessments. A fifth data source, the R3 Species Database, contains species diversity information specific to Region 3 National Forests and was used to compare and highlight animal and plant diversity amongst Region 3 National Forests.

### *I. Potential Natural Vegetation Types*

The relative distribution of potential natural vegetation types in Arizona and New Mexico across the various major landowners was assessed. (Refer to Chapter 2, Appendix 2-A and 2-B for a listing and descriptions of PNVTs). Total acreage of each PNVT was also compared amongst the 11 Region 3 National Forests lands in Arizona and New Mexico. Region 3 National Grasslands in New Mexico, Oklahoma and Texas were not included in either of these analyses.

To conduct these analyses two geo-spatial datasets (described in detail in Chapter 2) were utilized:

- 1) The Southwest Regional Gap Analysis Project (SWReGAP; USGS National Gap Analysis Program 2004). The SWReGAP data are a geo-spatial vegetation dataset based on multi-season data from satellite imagery (Landsat ETM+) and digital elevation models (DEM) from 1999-2001. Ecosystem cover types from SWReGAP were aggregated and cross-walked to PNVTs (see Chapter 2, Appendix 2-A for cross-walk details). Although the accuracy of SWReGAP data have not been assessed, the dataset serves as the most recent and complete data source for all of Arizona and New Mexico at the time of this analysis.

Furthermore, because SWReGAP is built upon remote sensing data, inaccuracies are likely to be found when used at finer spatial scales. Therefore, SWReGAP data may be best suited for regional assessments rather than for project planning or district level analyses.

- 2) The second dataset used was the landownership GIS-based layer. This data layer was generated from information from the Arizona Land Resource Information Service (<http://www.land.state.az.us/alris/index.html>) and the New Mexico Resource Geographic Information System Program (<http://rgis.unm.edu/>). Major landowner categories included in this data layer were: Bureau of Land Management, Department of Defense, National Park Service, private, State Trust, tribal, US Fish and Wildlife Service, USDA Forest Service, and other (which included Bureau of Reclamation, non-federal Parks, Valle Calderas National Preserve, County Lands, Department of Energy, USDA Research, State Game and Fish, and unnamed lands).

Results indicate that Region 3 manages the highest relative proportions of nine of the 25 PNVTs analyzed (36%) across all major landowners in Arizona and New Mexico. These nine PNVTs and the proportions that Region 3 Forests collectively manage for include: aspen forest and woodland (64%), interior chaparral (43%), Madrean encinal woodland (42%), Madrean pine-oak woodland (59%), mixed conifer forest (68%), montane grasslands (47%), ponderosa pine forest (63%), spruce-fir forest (58%) and sub-alpine grasslands (52%; Table 3-1).

Results also demonstrate the diversity and distribution of PNVTs across Region 3 National Forests, and identify which Forests manage large proportions of certain PNVTs within Region 3 (Table 3-2). For example, the Carson National Forest manages the largest proportion of aspen forest and woodlands (35%), gallery coniferous riparian forests (100%), montane grasslands (97%), spruce-fir conifer forests (49%), sub-alpine grasslands (37%), and wetland/cienegas (84%) across all Region 3 Forests. The Cibola National Forest (not including the National Grasslands in New Mexico, Oklahoma or Texas) has the largest proportion of Great Plains grasslands (61%), mixed-broadleaf deciduous riparian forests (34%), and pinyon-juniper woodland (21%). The Coconino National Forest contains the largest proportion of alpine/tundra (80%) and Great Basin/Colorado Plateau grassland and steppe (23%). The Coronado manages 26% of the Madrean encinal found on Region 3 National Forests. The Gila manages the largest proportion (30%) of ponderosa pine forests. The Kaibab National Forest manages 50% of the sagebrush shrubland on Region 3 lands. The Santa Fe National Forest contains the largest proportion of mixed conifer forests (32%) across Region 3. The Tonto National Forest manages the largest proportion of cottonwood willow riparian forests (41%), desert communities (76%), interior chaparral (40%), Madrean pine-oak (41%), montane willow riparian forests (20%), and semi-desert grasslands (37%) on Region 3 Forests. As discussed earlier, these results are based on SWReGAP data that may not be inaccurate at Forest level spatial analyses.

**Table 3-1.** Approximate area (in acres) of potential natural vegetation types (PNVTs) in Arizona and New Mexico across major landowners. The Other landowner category in this table includes: Bureau of Reclamation, non-federal parks, Valle Calderas National Preserve, county lands, Department of Energy, USDA Research, State Game and Fish, and unnamed lands. USFS Region 3 National Grasslands in New Mexico, Oklahoma and Texas were not included in this analysis. Data used to generate this table came from The Southwest Regional Gap Analysis Program (SWReGAP) and the landownership GIS-based layer. Note that accuracy testing has not been conducted for SWReGAP data. See Chapter 2 for further information regarding these datasets.

Potential Natural Vegetation Type	US Forest Service	Bureau of Land Management	Department of Defense	National Park Service	Private	State Trust	Tribal	US Fish and Wildlife Service	Other
Alpine/Tundra	1,600	0	0	0	6,100	0	0	0	0
Aspen Forest and Woodland	335,900	500	0	3,400	93,200	2,200	75,900	0	11,600
Barren	0	26,900	13,000	100	35,900	14,900	196,400	2,100	300
Cottonwood Willow Riparian Forest	19,500	74,800	14,900	7,100	219,500	55,600	389,000	28,500	11,000
Desert Communities	1,018,300	8,593,300	3,537,800	1,321,000	3,418,000	3,340,700	3,429,500	1,583,200	252,800
Disturbed/Altered	83,300	9,200	600	6,000	218,200	37,200	47,800	5,600	400
Gallery Coniferous Riparian Forest	100	0	0	0	1,100	0	100	0	0
Great Basin/ Colorado Plateau Grassland and Steppe	684,400	2,853,400	23,000	572,300	5,695,500	2,599,300	12,175,500	43,200	18,500
Great Plains Grassland	316,800	1,270,300	29,000	10,000	16,055,000	3,158,400	181,000	14,100	11,400
Interior Chaparral	1,345,900	414,600	33,800	31,300	590,500	350,800	333,100	6,400	11,000
Madrean Encinal Woodland	2,736,200	518,800	151,400	34,400	1,259,800	609,300	1,165,200	14,800	2,200
Madrean Pine-Oak Woodland	831,900	20,200	1,700	5,000	89,200	30,100	438,400	100	200
Mixed Broad Leaf Deciduous Riparian Forest	42,600	36,200	5,000	4,200	115,800	17,300	65,500	7,900	4,300
Mixed Conifer Forest	1,216,300	33,900	2,700	43,500	225,900	13,800	191,000	1,000	52,000
Montane Grassland	17,200	0	0	0	16,900	0	2,300	0	0
Montane Willow Riparian Forest	17,300	14,400	800	600	42,800	11,500	12,100	100	4,100
Pinyon-Juniper Woodland	3,375,200	2,872,700	22,300	556,700	4,442,500	1,505,300	5,647,800	19,000	51,600
Ponderosa Pine Forest	5,835,300	112,500	16,400	94,200	1,408,400	147,000	1,588,900	900	44,100
Sagebrush Shrubland	134,500	685,200	1,600	66,300	642,100	184,700	977,200	21,200	11,700
Semi-desert Grassland	1,642,300	8,013,000	1,463,300	99,000	7,996,600	5,914,600	951,900	321,000	185,000
Spruce-fir Forest	355,200	35,000	1,000	7,000	128,200	2,300	72,000	300	10,000
Sub-alpine Grasslands	311,700	13,900	200	2,500	183,400	10,700	55,700	0	27,000
Urban/Agriculture	20,800	35,100	49,200	2,300	4,119,500	219,000	334,900	5,600	23,900
Water	25,300	25,000	2,300	79,100	122,000	900	38,100	15,600	55,500
Wetland/Cienega	8,900	9,500	200	400	35,000	7,100	6,800	2,900	1,100

**Table 3-2.** Approximate area (in acres) of potential natural vegetation types (PNVTs) across 11 Region 3 National Forests in Arizona and New Mexico. Region 3 National Grasslands in New Mexico, Oklahoma and Texas were not included in this analysis. Data used to generate this table included The Southwest Regional Gap Analysis Program (SWReGAP) and the landownership GIS-based layer. Note that SWReGAP data have not been tested for accuracy and is derived from remote sensing; therefore, analyses at the individual National Forest scale may be inaccurate. See Chapter 2 for further information regarding these datasets.

Potential Natural Vegetation Type	Apache-Sitgreaves	Carson	Cibola (Mt. Districts)	Coconino	Coronado	Gila	Kaibab	Lincoln	Prescott	Santa Fe	Tonto
Alpine/Tundra	0	300	0	1,200	0	0	0	0	0	0	0
Aspen Forest and Woodland	29,000	118,400	13,500	18,300	6,600	90,300	7,700	6,100	0	46,000	100
Barren	0	0	0	0	0	0	0	0	0	0	0
Cottonwood Willow Riparian Forest	0	300	1,000	200	5,300	0	0	1,000	200	3,600	7,900
Desert Communities	800	0	19,900	23,000	173,800	4,700	11,000	3,200	10,100	0	771,900
Disturbed/Altered	3,000	3,800	100	10,400	200	9,200	10,300	3,200	500	36,600	5,900
Gallery Coniferous Riparian Forest	0	100	0	0	0	0	0	0	0	0	0
Great Basin/ Colorado Plateau Grassland and Steppe	62,500	51,200	113,400	159,400	13,900	115,900	100,600	1,200	13,900	43,000	9,400
Great Plains Grassland	0	25,000	191,900	0	0	0	0	19,800	0	80,200	0
Interior Chaparral	18,000	32,800	9,500	76,800	151,400	48,800	19,500	53,200	368,400	23,400	543,900
Madrean Encinal Woodland	275,300	0	18,900	219,600	723,900	396,500	500	331,600	370,200	100	399,700
Madrean Pine-Oak Woodland	16,600	0	600	29,700	139,200	32,100	2,900	162,200	103,500	300	344,800
Mixed Broad Leaf Deciduous Riparian Forest	100	2,300	14,300	300	800	200	0	8,900	400	5,400	9,800
Mixed Conifer Forest	146,300	189,500	74,100	31,000	26,800	157,200	70,600	123,100	0	392,700	5,100
Montane Grassland	0	16,600	0	0	0	0	0	100	0	500	0
Montane Willow Riparian Forest	2,500	2,000	2,700	3,100	3,600	1,500	0	5,700	3,300	600	6,200
Pinyon-Juniper Woodland	381,700	278,200	724,800	290,000	100	578,300	640,100	70,800	138,400	269,600	3,300
Ponderosa Pine Forest	926,400	408,000	508,900	814,600	65,400	1,754,600	555,100	68,500	98,400	505,400	130,100
Sagebrush Shrubland	700	58,000	700	100	0	200	67,200	0	0	7,800	0
Semi-desert Grassland	74,100	200	41,000	106,800	406,300	47,900	6,800	204,000	146,500	100	608,600
Spruce-fir Forest	18,500	174,900	10,700	7,200	0	17,900	20,800	17,600	0	87,400	0
Sub-alpine Grasslands	56,800	113,900	1,600	31,900	0	10,200	26,800	14,600	0	55,800	0
Urban/Agriculture	1,200	2,900	1,200	6,700	300	200	1,700	100	1,600	500	4,400
Water	2,000	200	300	2,700	200	300	300	0	100	1,500	17,700
Wetland/Cienega	0	7,400	1,100	0	0	0	0	0	0	300	0

## *II. Distribution and Condition of Grasslands*

The Arizona Statewide Grasslands Assessment (Schussman and Gori 2004, Gori and Enquist 2003) was used to summarize the extent of low elevation historic grasslands and their current condition by major landowners within Arizona and the portion of the Apache Highlands ecoregion that falls within New Mexico (See Chapter 2, Figure 2-1). The Mexico portion of the Grassland Assessment was not included in this analysis. In addition, grasslands on National Forests within the assessment area were summarized for each Forest. This included all of the Kaibab, Coconino, Prescott, Tonto, Apache-Sitgreaves, and Coronado National Forests in Arizona, and a small portion of the Gila National Forest in New Mexico.

The Grassland Assessment used a combination of expert mapping and intensive field verification and vegetation sampling to identify low elevation (< 5000 feet) historic grasslands in Arizona and determine their current condition. Montane grasslands were not included in the assessment. Current grassland condition was assessed based on relative dominance of native/non-native species, degree of encroachment by woody species, and erosion severity. Based on these factors, grasslands were assigned to five condition types: open native, restorable native, former, non-native, and transitional (see Chapter 2, Table 2-1, for detailed descriptions of these condition types). The current condition of grasslands in parts of the assessment area was not determined.

The extent and current condition of grasslands were determined for major landowners within the analysis area using landownership information from the Arizona Land Resource Information Service and the New Mexico Resource Geographic Information system. Detailed information about this data layer is provided in Chapter 2. For this analysis, areas were calculated for each major landowner as well as for each National Forest. It is important to note that the acreages calculated for National Forests in this section of the report which are based strictly on landownership, differ from acreages presented within the individual Forest chapters (Chapters 4-15), which are based on administrative boundaries and include lands owned by other landowners. Areas where current grassland conditions are undetermined are not included in percentages of grassland conditions by landowner.

The Grasslands Assessment identified over 26.6 millions acres of low elevation grasslands (< 5000 feet) within the analysis area (Table 3-3). Tribal lands, privately owned lands, and state trust lands contain the largest acreages of these grasslands. Nearly 2 million acres (7.5%) fall on National Forest lands. Within the National Forests, the Coronado, Coconino, and Apache-Sitgreaves National Forests have the largest acreages of low elevation grassland.

Overall, over 2.9 million acres (18.4%) of grasslands in the analysis area remain in open native condition (Table 3-4). Substantial portions of historic grasslands have experienced some shrub encroachment (restorable native, 37.6%), but can be restored to open native condition, while other portions (30.6%) have experienced significant shrub encroachment and probable conversion to shrubland (former grasslands). Compared to overall

conditions in the analysis area, grasslands on National Forests have higher proportions in open native (20.0%) and restorable native condition (58.5%), and lower proportions that have converted to shrublands (12.4%). The proportion of grasslands on National Forests dominated by non-native grasses is similar to the overall assessment area. However, nearly all non-native grasslands on National Forest occur on the Coronado National Forest, primarily due to the presence of Lehman (*Eragrostis lehmanniana*) and Boer (*Eragrostis chloromelas*) lovegrasses.

**Table 3-3.** Area (acres) identified as low elevation (<5000 feet) historic grasslands (Schussman and Gori 2004, Gori and Enquist 2003) for nine major landowners and seven National Forests in Arizona and parts of New Mexico that fall within the Apache Highlands Ecoregion. Grassland areas are based on all identified historic grasslands areas, even if the current condition was not determined.

Landowner	Total Acres	% of Assessment Area	Grassland Acres	% of Total Grassland Area
Bureau of Land Management	13,103,000	17.3	3,627,900	13.6
Department of Defense	2,848,700	3.8	59,500	0.2
US Fish and Wildlife Service	1,710,800	2.3	115,500	0.4
National Park Service	2,567,300	3.4	334,400	1.3
Other	304,300	0.4	21,500	0.1
Private	13,836,000	18.3	6,872,300	25.8
State Trust	9,789,400	12.9	5,460,800	20.5
Tribal	20,109,400	26.6	8,186,600	30.7
US Forest Service				
Apache-Sitgreaves N.F	2,013,200	2.7	347,000	1.3
Coconino N.F	1,831,300	2.4	365,100	1.4
Coronado N.F.	1,717,900	2.3	726,400	2.7
Gila N.F.	117,400	0.2	10,000	<0.1
Kaibab N.F	1,541,900	2.0	153,300	0.6
Prescott N.F	1,254,100	1.7	271,600	1.0
Tonto N.F	2,865,400	3.8	119,100	0.4
US Forest Service Total	11,341,200	15.0	1,992,400	7.5
Total	75,610,100	100.0	26,670,900	100.0



**Table 3-4.** Current condition of low elevation (< 5000 feet) grasslands for nine landowner categories and seven National Forests in Arizona and parts of New Mexico that fall within the Apache Highlands Ecoregion (from Schussman and Gori 2004, Gori and Enquist 2003). Areas with undetermined current condition are not listed or included in percentage calculations.

Landowner	Grassland Condition									
	Open Native		Restorable Native		Former		Non-native		Transitional	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Bureau of Land Management	404,500	12.2	1,101,300	33.1	1,569,800	47.2	18,800	0.6	234,800	7.1
Department of Defense	8,900	14.9	600	1.0	1,200	2.0	48,900	82.0	0	0.0
US Fish and Wildlife Service	3,100	2.7	13,000	11.3	3,800	3.3	95,600	82.8	0	0.0
National Park Service	1,400	1.0	6,400	4.5	131,000	91.9	2,500	1.8	1,200	0.8
Other	500	5.7	4,400	50.0	2,000	22.7	600	6.8	1,300	14.8
Private	1,230,700	23.4	1,862,100	35.4	1,210,700	23.0	646,000	12.3	313,100	5.9
State Trust	747,100	16.5	1,722,100	38.0	1,453,300	32.0	497,500	11.0	117,400	2.6
Tribal	220,100	25.3	317,000	36.4	324,000	37.2	0	0.0	10,500	1.2
US Forest Service										
Apache-Sitgreaves N.F	0	0.0	236,400	72.6	89,100	27.4	0	0.0	0	0.0
Coconino N.F	3,800	1.4	244,100	90.5	21,800	8.1	0	0.0	0	0.0
Coronado N.F.	180,200	24.8	317,500	43.7	75,700	10.4	153,000	21.1	0	0.0
Gila N.F.	9,000	90.0	0	0.0	1,000	10.0	0	0.0	0	0.0
Kaibab N.F	0	0.0	23,100	83.1	0	0.0	0	0.0	4,700	16.9
Prescott N.F	129,400	47.6	116,900	43.0	23,100	8.5	2,100	0.8	0	0.0
Tonto N.F	27,000	22.7	85,700	72.0	6,300	5.3	0	0.0	0	0.0
US Forest Service Total	349,400	20.0	1,023,800	58.5	217,100	12.4	155,100	8.9	4,700	0.3
Total	2,965,700	18.4	6,050,700	37.6	4,912,900	30.6	1,465,000	9.1	683,000	4.2

### ***III. Distribution of Stream Reaches with Native Fish Occurrences***

The Arizona Statewide Freshwater Assessment (Turner and List, *In Prep*; available at [www.azconservation.org](http://www.azconservation.org)) was used to summarize the occurrence and distribution of stream reaches with native fishes across major landowners and National Forests in Arizona. This assessment was developed for use in regional planning and includes occurrence information for 33 native fish species. Point localities for each species from 1975 and later, obtained from a variety of sources (see Chapter 2 for more details), were mapped to perennial stream reaches on a 1:100,000 scale linear hydrography layer for Arizona. Native fish occurrences were mapped to stream reaches which approximate the bounds of currently occupied habitat. However, it is recognized that at finer scales these reaches may differ somewhat from current native fish distributions. These differences are addressed on a forest by forest basis in the individual Forest chapters (Chapters 4-15). At the large statewide scale of this analysis, this data set provides the most current and useful information available for understanding the distribution of important stream reaches for native fishes. This analysis includes only Arizona. However, a similar data set for New Mexico is currently being developed, and results from that analysis may be incorporated into this document when available.

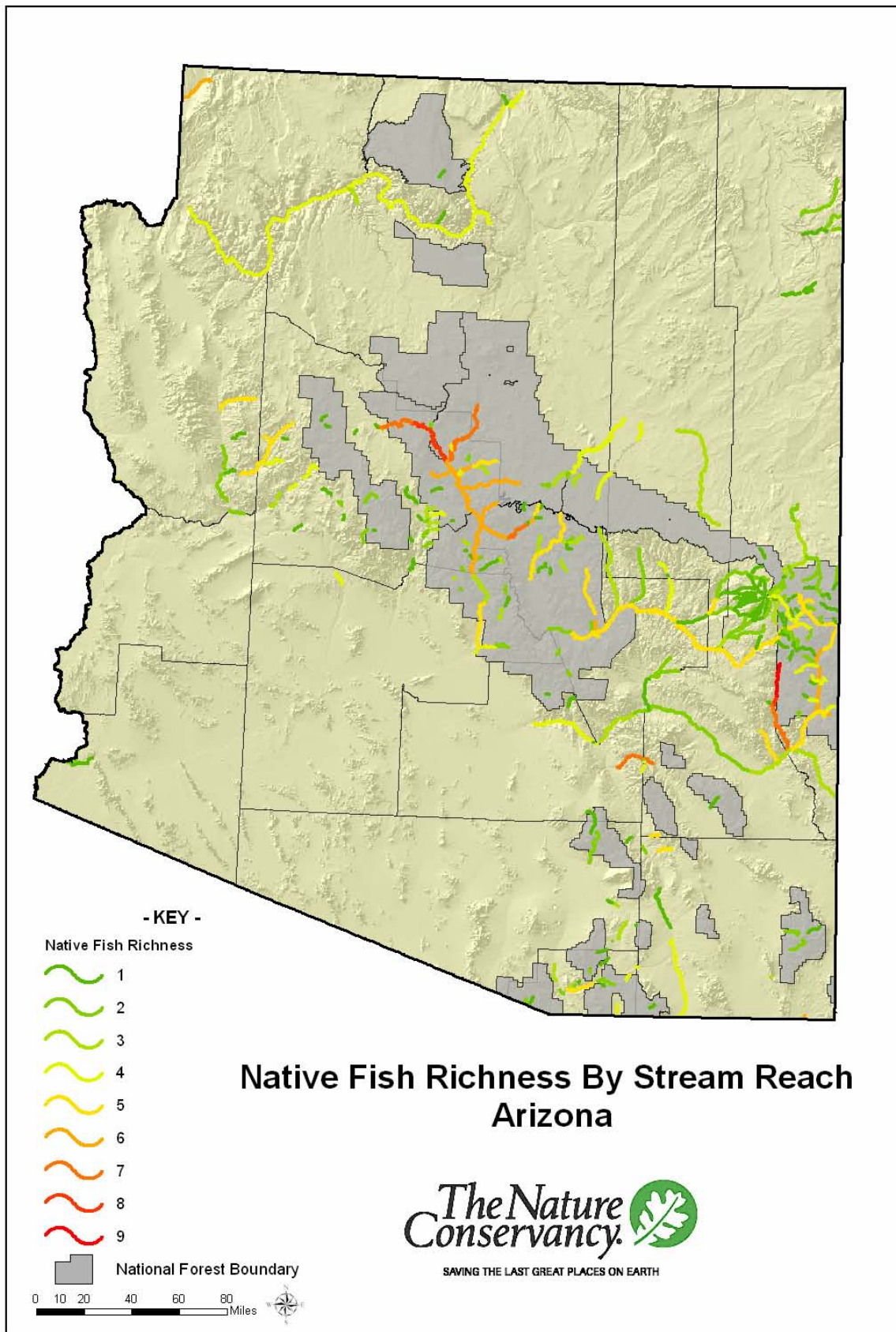
The Freshwater Assessment includes a database that integrates the distribution of all 33 native fishes into a single data layer that represents number of native fish species with occurrences on stream reaches across Arizona. This information was used along with landownership information from the Arizona Land Resource Information Service and the New Mexico Resource Geographic Information system (detailed information about this geo-spatial data layer is provided in Chapter 2) to determine the distribution (number of stream miles) of stream reaches with varying levels of native fish richness by major landowners and for individual National Forests in Arizona. In areas where streams serve as the boundary between landowners for a distance greater than five miles, one-half of the length of that stream reach was attributed to each landowner. More detailed information on the species and stream reaches with occurrences are provided in individual Forest chapters (Chapters 4-15).

Approximately 3,650 miles of stream reaches within Arizona have had occurrences of native fish species in the last 30 years, with the number of species with occurrences on stream reaches ranging from one to nine (Figure 3-1). Of major landowners in the state, the largest number of stream miles with native fish occurrences occurs on USFS lands, followed by Tribal and privately owned lands (Table 3-5). Together, these three landowner categories account for more than 75% of the stream miles with native fish occurrence in Arizona. While tribal lands tend to have more stream miles at low native species richness, National Forest lands tend to have the largest number of stream miles with high native fish richness (Figure 3-2). Overall, 50% of the stream miles with occurrences of five or more native fish species occur on Forest lands. Within National Forests, the Apache-Sitgreaves and Tonto National Forests have the majority of stream miles with native fish occurrences, including a large portion of the stream miles with occurrences of a large number of native fish species. However, the Coconino and Prescott National Forests also have noteworthy areas with occurrences of a high number of native fish species.

Of all native species in Arizona, fish may have suffered the largest losses (Minckley & Deacon, 1968; Williams and others 1985; Minckley & Rinne 1991; Olden & Poff 2005). Arizona has been ranked first among states in the proportion of native freshwater species at risk of extinction (Stein 2002). Olden and Poff (2005) documented substantial changes in the abundances of lower

Colorado River Basin species that occur on USFS lands in Region 3. For example, the following species have shown population declines: the Gila topminnow (36.8% decline), Apache trout (26.9% decline), speckled dace (16.5% decline), Gila chub (15.9% decline), and desert sucker (13.5% decline). However, some species have shown population increases, such as the longfin dace and Sonora (11.4% and 8.2%, respectively).

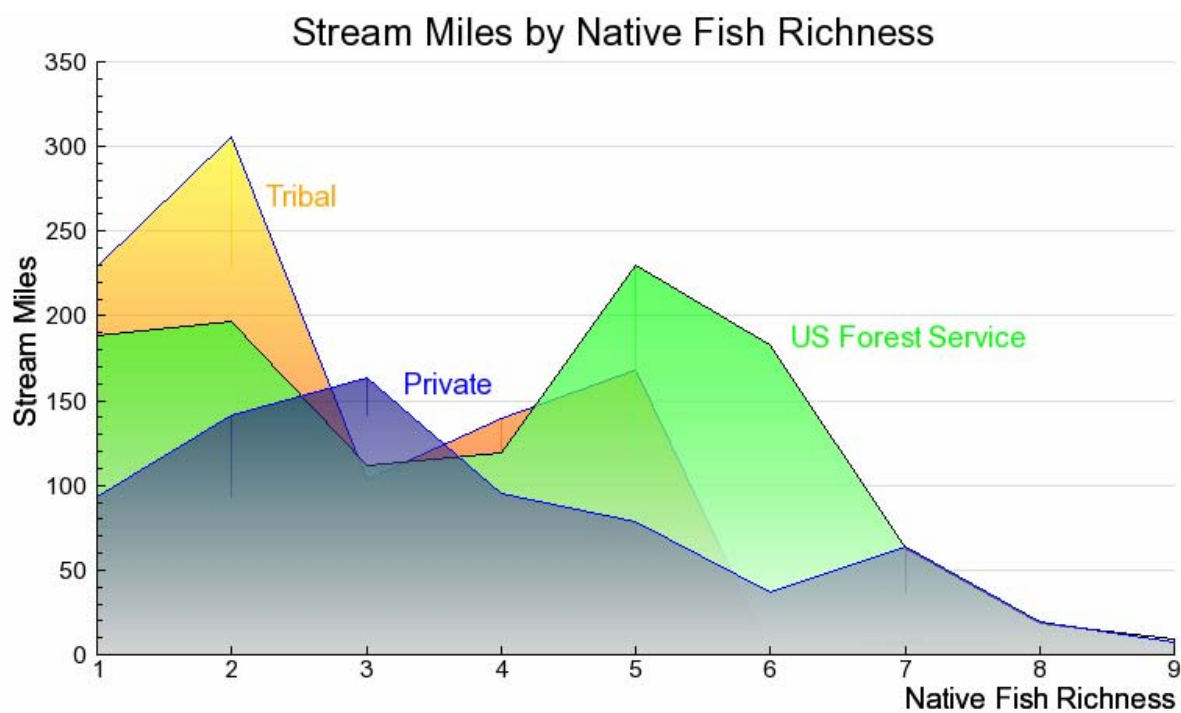
The causes of decline are many and have varied over time and space. Demands placed upon the region's limited water supplies are increasing as Arizona's population continues to grow, suggesting that activities occurring outside Forest boundaries could play an increasing role in the status of resources USFS is responsible for managing in a sustainable manner. Regional assessment data summarized here demonstrate the important role USFS plays in managing native fish habitat. Changes documented in native fish distribution combined with increasing pressure on limited water supplies indicate that native fish, watershed, and ground-water management may be an important focal area for comprehensive evaluation in forest plan revisions.



**Figure 3-1.** Stream reaches with occurrences of a varying number of native fish species (1-9) in Arizona.

**Table 3-5.** Approximate length (miles) of stream reaches with varying numbers of native fish species occurrences (1-9) for nine major landowner categories and six National Forests in Arizona. Native fish occurrences in stream reaches were determined based on occurrence information from 1975 and later.

Landowner	<i>Native Fish Richness</i>									Total
	1	2	3	4	5	6	7	8	9	
Bureau of Land Management	29	63	88	51	52	13	11	0	0	307
Department of Defense	0	4	0	0	0	0	0	0	0	4
US Fish and Wildlife Service	0	36	25	0	0	2	0	0	0	63
National Park Service	27	71	5	207	0	1	0	0	0	311
Other	1	5	9	19	2	0	5	0	0	41
Private	93	141	163	95	78	37	63	19	7	696
State Trust	25	20	24	44	27	1	2	0	0	143
Tribal	229	305	103	140	168	2	9	6	2	964
US. Forest Service										
Apache-Sitgreaves N.F	95	87	21	97	87	34	4	0	10	435
Coconino N.F	0	13	18	7	12	53	21	7	0	131
Coronado N.F.	34	41	0	0	0	0	0	0	0	75
Kaibab N.F	4	0	0	0	0	0	0	0	0	4
Prescott N.F	13	13	3	2	0	13	17	12	0	73
Tonto N.F	43	43	69	13	130	84	21	0	0	403
US. Forest Service Total	189	197	111	119	230	183	63	19	10	1121
Total	593	842	528	675	557	239	153	44	19	3650



**Figure 3-2.** Approximate length (miles) of stream reaches with varying numbers of native fish species occurrences (1-9) for the three landowners (Forest Service, tribal, and private) with the most miles of stream with native fish occurrences.

#### ***IV. Ecoregional Assessments and Conservation Areas***

The results of eight ecoregional assessments (Bell and others 1999, 2004 Marshall and others 2000, 2004, Neely and others 2001, The Nature Conservancy 2001, 2005, Tuhy 2002) were used to identify a network of areas important for sustaining the viability of the region's species and ecological systems across landownerships in Arizona and New Mexico. The individual areas that make up the network are referred to as conservation areas. Ecoregional assessments are comprehensive and systematic efforts to identify the minimum network of conservation areas on the landscape that are necessary to maintain the biological diversity of the ecoregion.

Ecoregions are large, contiguous units of land or water defined by ecological and environmental elements, rather than geo-political boundaries, and typically contain geographically distinct assemblages of species, natural communities, and environmental conditions. Because ecoregions typically include large proportions of ecosystem, community, and species distributions, they are useful for conservation planning. The ecoregional assessment process includes the identification of conservation targets (including species, ecological systems, and important biological features) that represent the biological diversity within the ecoregion. Conservation goals (including distribution, size and minimum number of viable occurrences) are established for each conservation target within the ecoregion. An iterative process is used to identify a network of conservation areas that most efficiently meets the conservation goals for all conservation targets within the ecoregion. These conservation areas, collectively called a conservation portfolio, represent the most current and scientifically robust hypotheses on the magnitude and distribution of areas on the landscape necessary to protect the biodiversity of the region. A more detailed description of the ecoregional assessment process can be found in Chapter 2, and the specific methods used for each ecoregion can be found within the ecoregional assessments. Many of the assessments are available for download at <http://www.azconservation.org>.

In general, ecoregional assessments serve several conservation, management and scientific purposes, including:

1. A spatial hypothesis on how to maximize the viability of a region's native species and ecological systems.
2. A spatial delineation of areas where land-uses and land management activities should be evaluated to identify and minimize potential adverse effects to the viability of species and ecological systems.
3. A spatial delineation of priority areas that land managers and others interested in promoting conservation should evaluate first to ensure that disturbance processes that perpetuate native ecological systems (e.g., fire, flooding) are maintained at a scale, frequency, and intensity that falls within the historical range of variation.
4. A network of cross-jurisdictional priorities that could serve as a basis for collaboration and the efficient use of limited resources to maximize conservation values.

While nine ecoregional assessments overlap Arizona and New Mexico (See Chapter 2, Figure 2-2), information from eight ecoregions was synthesized as part of this analysis. The Central Shortgrass Prairie Ecoregional Assessment (The Nature Conservancy 1998), which overlaps a small portion of northeast New Mexico (not including any National Forest lands), was not

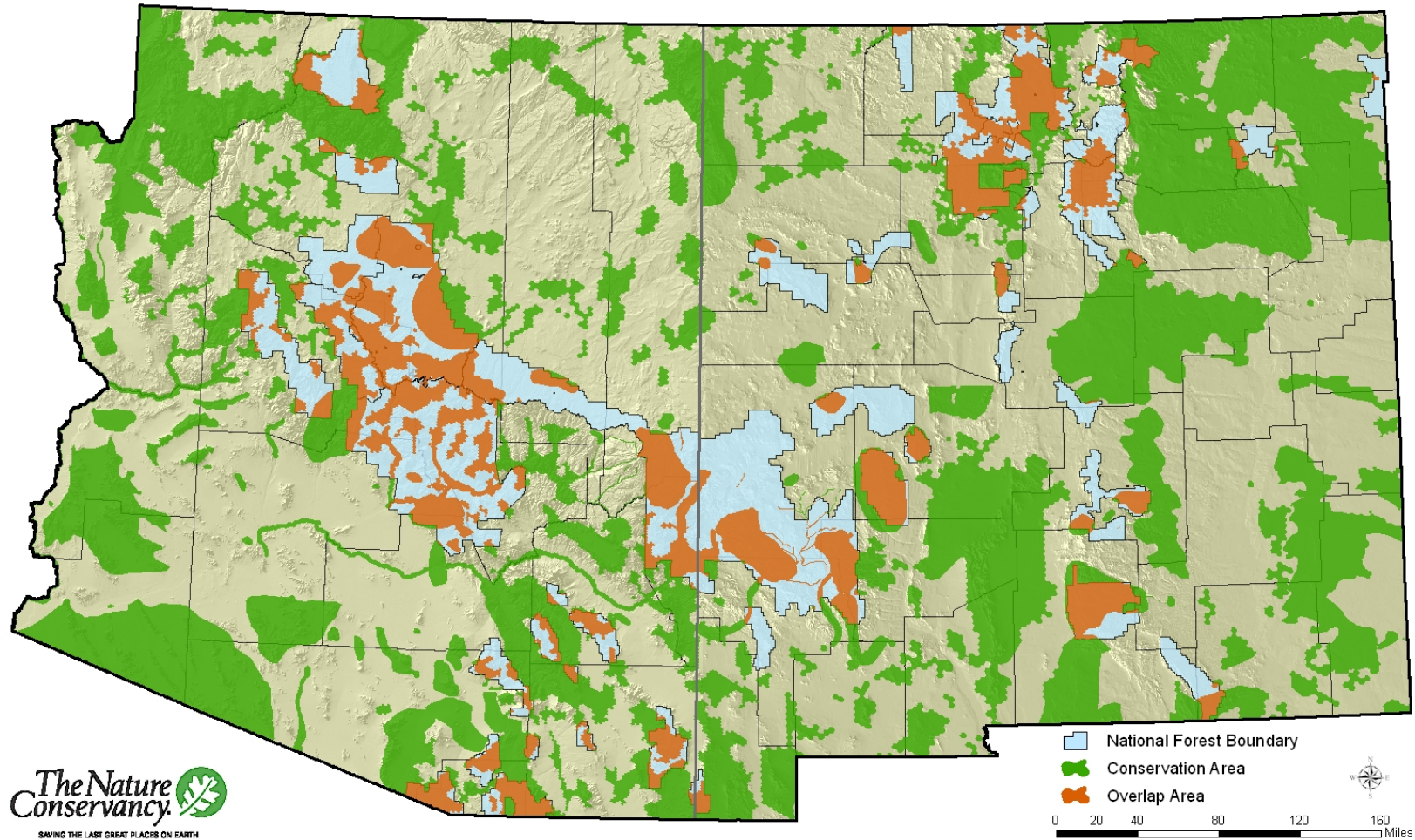
included in this analysis. As part of a regional data rollup effort, The Nature Conservancy merged conservation area information from six individual assessments (Apache Highlands, Arizona-New Mexico Mountains, Colorado Plateau, Mojave Desert, Sonoran Desert, and the Southern Rocky Mountains) into a single regional data layer (<http://www.azconservation.org>). This dataset includes conservation area boundaries and attributes for the conservation targets that occur within each conservation area in those ecoregions. The assessments for Chihuahuan Desert Ecoregion, which overlaps a small part of the Lincoln National Forest, the Southern Shortgrass Prairie Ecoregion, which includes portions of the Santa Fe National Forest and Cibola Grasslands, were included individually.

The amount of overlap between conservation areas from the eight ecoregional assessments and major landowners within Arizona and New Mexico was calculated using landownership information from the Arizona Land Resource Information Service and the New Mexico Resource Geographic Information system. Detailed information about this geo-spatial data layer is provided in Chapter 2. It is important to note that the acreages calculated for National Forests here, based strictly on landownership, differ from those presented within the individual Forest chapters (Chapters 4-15), which are based on administrative boundaries and include lands owned by other landowners.

Nearly 57 million acres (37.6%) of land within Arizona and New Mexico have been identified as part of the network of conservation areas (Figure 3-3). The majority of these acres occur on private (29.7%), Region 3 US Forest Service (17.1%), and Bureau of Land Management (15.8%) lands (Table 3-6). However, the highest percentage overlap with conservation areas occurs on US Fish and Wildlife Service (93.1%), National Park Service (83%), and the Department of Defense (72.4%) lands, followed by US Forest Service (47.1%). Within National Forests, the Tonto (1,349,500 acres), Coconino (1,294,700 acres), Coronado (1,067,200 acres), and Gila (1,016,200 acres) National Forests have the largest acreages within conservation areas, while the Coconino (70.7%), Coronado (62.1%), and Santa Fe (58.8%) National Forests have the highest proportion of their lands overlapping with conservation areas.



# Conservation Areas in Arizona and New Mexico



**Figure 3-3.** Conservation areas from eight ecoregional assessments in Arizona and New Mexico showing overlap with National Forest boundaries.

**Table 3-6.** Overlap between conservation areas from eight ecoregional assessments with major landowners and 11 National Forests in Arizona and New Mexico.

Landowner	Total Acres Overlapped by Conservation Areas	% in Conservation Areas	% of All Conservation Areas
Bureau of Land Management	8,940,200	34.9	15.8
Department of Defense	3,876,500	72.4	6.8
US Fish and Wildlife Service	1,950,300	93.1	3.4
National Park Service	2,448,100	83.0	4.3
Other	366,200	46.3	0.6
Private	16,834,500	35.7	29.7
State Trust	6,372,300	35.0	11.2
Tribal	6,244,700	22.2	11.0
US Forest Service			
Apache-Sitgreaves N.F	943,500	46.9	1.7
Carson N.F.	769,000	51.7	1.4
Cibola N.F.	683,300	39.1	1.2
Coconino N.F	1,294,700	70.7	2.3
Coronado N.F.	1,067,200	62.1	1.9
Gila N.F.	1,016,200	31.1	1.8
Kaibab N.F	547,200	35.5	1.0
Lincoln N.F.	539,600	49.3	1.0
Prescott N.F	560,500	44.7	1.0
Santa Fe N.F.	918,100	58.8	1.6
Tonto N.F	1,349,500	47.1	2.4
US Forest Service Total	9,688,800	47.5	17.1
Total	56,721,700	37.6	100.0

## Discussion

This synthesis of existing regional assessment information highlights the ecological components that exist on National Forests and places them in context of other major landowners in Arizona and New Mexico. This information may be useful in identifying the opportunities and challenges that National Forests across the region face in developing forest plans that meet the ecological sustainability standard of the new forest planning rule [36 CFR sec. 219.10(b)]. In addition, the synthesis also provides a comparison of the ecological components across individual Forests. Each Forest contains ecological components that are either unique or occur disproportionately on their lands.

### *Potential Natural Vegetation Types*

Within Arizona and New Mexico, Region 3 National Forests contain large proportions of several PNVTs that support unique plant and animal species. For example, according to SWReGAP data (note limitations of these data discussed earlier in this Chapter), Region 3 (led by the Carson, Gila, and Tonto National Forests) manages more high elevation PNVTs (aspen forest and woodlands, Madrean pine-oak, mixed conifer forests, montane grasslands, ponderosa pine forests, spruce-fir forests, and sub-alpine grasslands) than other major landowners in the Southwest. Also, Region 3 manages more interior chaparral (led by the Tonto National Forest) and Madrean encinal (led by the Coronado National Forest) than other landowners. It is obvious that Region 3 National Forests have an important role to play in maintaining the sustainability of these systems and the species that depend on them. Within the forest planning process, it may be important to consider the range of ecological processes that shaped historic conditions within these PNVTs, and evaluate the ability of current management actions to support ecosystem and species diversity. By understanding the context in which these PNVTs exist on National Forests, this information can be used to identify processes and conditions that support sustainability, formulate strategic goals, and evaluate the need to change management to meet the goal of ecological sustainability across the region.

According to the Arizona Grasslands Assessment (Schussman and Gori 2004) National Forests within the Southwest contain a relatively small proportion of low elevation (< 5000 feet) grasslands compared to other landowners. While a similar proportion of grasslands on National Forests remain in open native condition compared to other landowners, the proportions of other grassland conditions differ from other landowners in notable ways. For example, it is apparent that grasslands for all landowners, including National Forests face significant threats from encroachment by woody species as noted by the high proportion of grasslands in restorable native and former grassland conditions. However, on National Forests, a smaller proportion of these encroached grasslands have undergone a type conversion to shrublands while a larger proportion retains the potential for restoration to open native condition. Amongst National Forests, the Apache-Sitgreaves has seen a larger proportion of its grasslands converted to shrublands. The Coronado National Forest, due to the threats from non-native lovegrasses, has the largest proportion of non-native grasslands.

Based on the documented loss of grasslands region-wide, the need for appropriate maintenance and restoration goals and management to arrest declines is paramount. Based on this analysis, the Coronado, Prescott, Apache-Sitgreaves, Coconino, and Tonto National Forests, with their large acreages of open native and restorable grasslands, can make a significant contribution to regional sustainability of grasslands by identifying and evaluating the drivers of grassland change and developing strategic goals that would provide for the restoration and maintenance of this important ecological system.

Protecting and restoring grasslands in the Southwest from encroaching shrubs and non-native grasses are some of the major challenges landowners, including USFS, face in maintaining the ecological and biological integrity of grassland systems. Brunson and others (2001) suggest that prescribed burns can be utilized to reduce shrub cover when sufficient fuel loads are present, which may require rest from grazing. According to Schussman and Gori (2004), some

grasslands in Arizona could be burned with only three growing seasons or less of rest, while other sites would require longer periods of rest to build adequate fuel loads. In contrast, fire may not be a useful approach when attempting to control the spread of non-native grasses. Because some non-native grasses may spread further when burned and the general lack of information of how many non-native grasses respond to fire, Schussman and Gori (2004) suggest using caution when burning areas dominated by non-native grass species such as Lehmann lovegrass (*Eragrostis lehmanniana*), Boer lovegrass (*Eragrostis chloromelas*) and especially cheatgrass (*Bromus tectorum*).

### *Freshwater Species and Systems*

It is widely recognized that native freshwater fishes in the United States are highly imperiled, and Arizona and New Mexico have some of the highest percentages of threatened fish species (85% and 30%, respectively; Warran and Burr 1994). It is thought that the first and most dramatic decline in native fishes in the Southwest occurred between 1890 and 1935 as a result of intensive water management, introduction of non-native species, and the construction of dams (Mueller and Marsh 2002, Olden and Poff 2005). Today, many native fish species in the Southwest have limited distributions, making their continued viability particularly vulnerable to local and regional threats. Within Arizona, National Forests have a vital role in assuring the sustainability of these species. Amongst major landowners, National Forests have the largest proportion of stream miles with occurrences of one or more of 33 native fish species. The Apache-Sitgreaves and Tonto National Forests, in particular, have substantial stream miles with native fishes. Compared to other landowners, National Forests have a greater proportion (as much as one-half) of the stream miles with high native fish species richness. From a planning perspective, these areas, which are identified in individual Forest chapters (Chapters 4-15) may serve as important areas in considering the sustainability of aquatic vertebrate species. Given the magnitude and rate of loss of native fishes in the Southwest, and the potential role Region 3 can play in maintaining biodiversity of freshwater systems, it is vital that these systems and the species that depend upon them are an integral component of the ecological sustainability of forest plans.

### *Ecoregional Assessments*

The ecoregional assessments that address Arizona and New Mexico provide a useful regional perspective on areas important for sustaining biodiversity. They also point to the role that National Forest lands play in maintaining biodiversity in the region. The degree of overlap between ecoregional conservation areas and National Forests in Arizona and New Mexico underscores the important ecological values that exist on National Forests lands. Nearly one-half of National Forest lands overlap conservation areas, representing over 17% of all conservation areas in the two-state region, which is the second highest percentage of any landowner overlap. Nearly all Region 3 National Forests have significant areas of overlap, led by the Tonto, which has the largest acreage (1,349,500 acres) and proportion (2.4%) of overlap.

The suite of conservation areas, when considered as a whole, represents not only priority locations in these two states for maintaining biodiversity, but also the minimum area on the landscape needed to maintain the region's biodiversity. As such, the suite of areas is intended to be highly strategic and can provide important leverage for maintaining biodiversity at large, ecoregional scales. Furthermore, none of the identified conservation areas should be considered inconsequential for maintaining biodiversity at an ecoregional scale. Each conservation area is important and should be evaluated in terms of currently allowable uses and activities and their associated impacts to biodiversity. In some cases, analyses of this type may indicate the need for management change.

It is important to note that these conservation areas do not necessarily imply the need for special protections; nor does it necessitate blanket restriction of activities within these areas. Rather, conservation areas can be viewed as priority areas for assessment of impacts associated with ongoing uses and activities and determination of their compatibility with sustaining biodiversity at ecoregional scales. From the perspective of forest planning for the maintenance of ecosystem and species diversity, conservation areas can serve several important functions. First, they can be used as an analysis tool for assessing land use suitability. Second, they can be used to help determine appropriate objectives for individual management areas; for example, managing ecosystem characteristics and processes within the historic range of variability. Third, they can aid in identifying specific plan components, including management objectives and guidelines, for species whose sustainability is threatened.

To further aid in planning efforts, each conservation area has associated with it a number of conservation targets (species, vegetation systems, and ecological features), which are representative of the biodiversity in the area. An analysis and breakdown of these conservation targets is provided for each National Forest in the individual Forest chapters (Chapters 4-15). These conservation targets and the threats they face can be used to analyze and address the likely impacts of current management on ecological sustainability in terms of both ecosystem and species diversity. These targets can also aid in identifying and characterizing the need for management change and evaluating new management strategies for addressing sustainability, i.e., maintaining both ecosystem and species diversity.

Given the regional perspective of the ecoregional assessments and the strategic nature of the conservation areas, use of conservation areas and conservation targets as analysis tools for addressing the threats facing biodiversity can provide a key step, within the context of forest planning, in sustaining the ecosystems and species that exist in the region.

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**Chapter 15:**  
**Ecological & Biological Diversity of the Lincoln National Forest,**  
**In**  
**Ecological and Biological Diversity of National Forests in Region 3**

**Bruce Vander Lee, Ruth Smith, and Joanna Bate**  
**The Nature Conservancy**





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## **Introduction**

The Lincoln National Forest, located in south-central New Mexico, is one of eleven National Forests within the U.S. Forest Service (USFS) Southwestern Region (Region 3). The Lincoln encompasses approximately 1,094,000 acres, and comprises about 2.7% of the total area of Region 3 National Forest lands.

There are four major mountain ranges found on the Lincoln National Forest: the Sacramento, White, Capitan, and Guadalupe Mountains. Elevation on the Lincoln ranges from approximately 4,000 ft. to approximately 11,500 ft. This includes five different life zones ranging from the Chihuahuan Desert life zone at the lower elevations to the sub-alpine forest life zone at the highest elevations. The diversity of vegetation systems provides habitat for numerous plants and animals, some of which are rare or have limited distributions. Such a diversity of plants, animals, and vegetation systems provide many opportunities to sustain biodiversity and ecological integrity on the Lincoln National Forest.

The goal of this chapter is to synthesize information from existing regional-scale assessments to identify important ecological and biological values that occur on the Lincoln National Forest and highlight information that may be pertinent to forest planning. Information from three assessments was synthesized for the Forest, including:

- Distribution and extent of potential natural vegetation types (PNVTs)
- Plant and animal species richness and their conservation statuses
- Conservation areas and targets associated with Ecoregional Assessments

These types of information may be useful within the forest planning process for evaluating the suitability of current management activities and land management designations, identifying ecological characteristics that may be considered in developing desired conditions, and identifying species that may need special consideration because of continuing threats to their existence. Detailed descriptions of these datasets and the methods used to analyze them are available in Chapter 2. A summary and analysis of these assessments and comparisons of the Lincoln National Forest to other major landowners in the Southwest (Arizona and New Mexico) and National Forests in Region 3 are provided in Chapter 3.

## Results

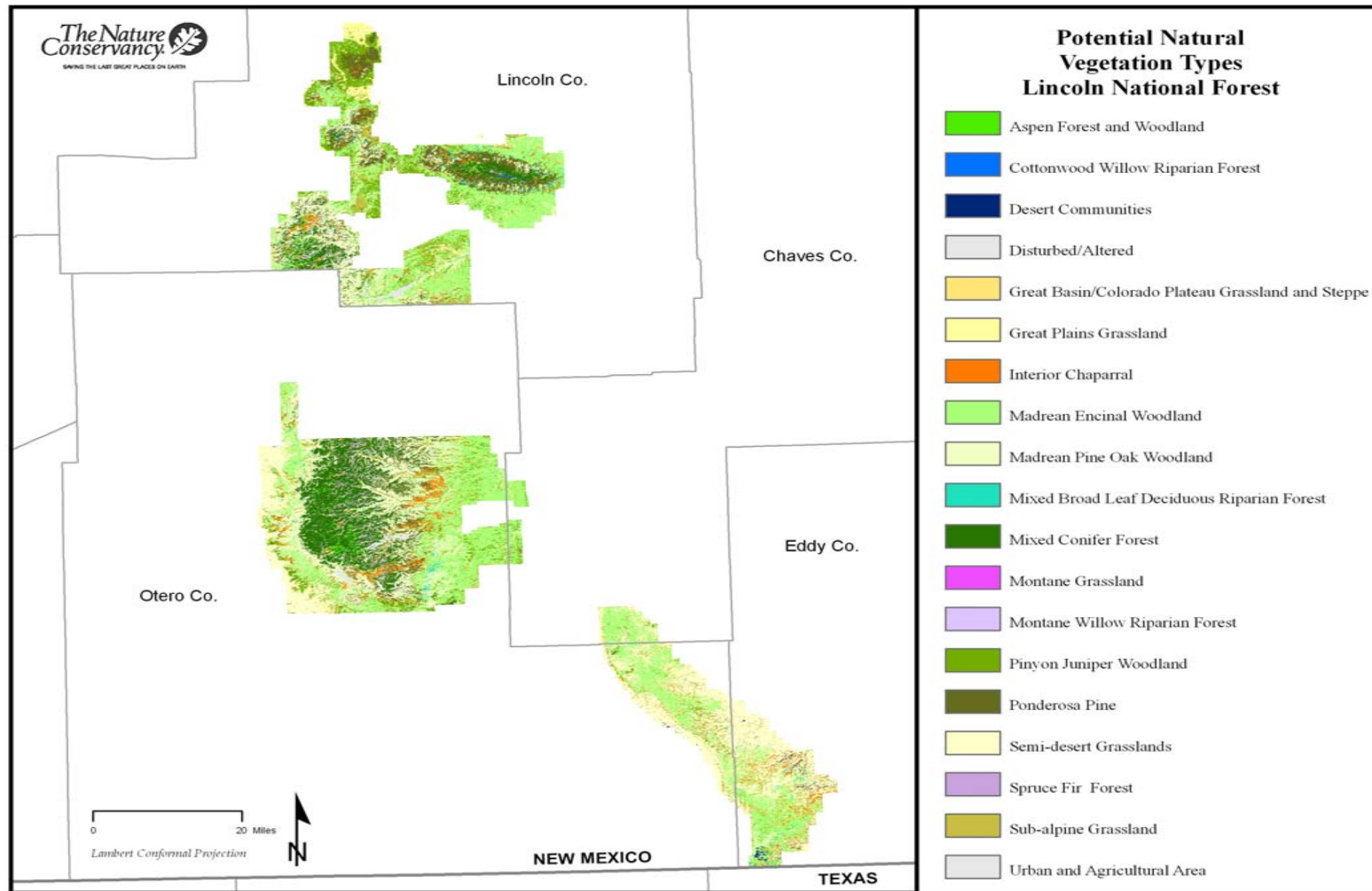
### *I. Potential Natural Vegetation Types within the Lincoln National Forest*

Information from the Southwest Regional Gap Analysis Project (SWReGAP; USGS National Gap Analysis Program 2004) was used to characterize the distribution of potential natural vegetation types (PNVTs) on the Lincoln National Forest. PNVTs represent the climax vegetation type that would dominate a site under natural disturbance regimes and biological processes. PNVTs were used to summarize vegetation for this analysis because of their relevance to the characterizations of historic range of variability and vegetation models being developed in preparation for the forest planning process.

For this analysis, the extent and proportion of each PNVT on the Lincoln were summarized, as well as the proportion of each PNVT within Region 3 that occurs on the Lincoln. More detailed information on the data and methods used in this analysis can be found in Chapter 2, and comparisons of PNVTs on the Lincoln to other Region 3 Forests and landowners in the Southwest is available in Chapter 3.

Nineteen PNVTs were identified on the Lincoln National Forest (Figure 15-1; see Appendices 2-A and 2-B in Chapter 2, respectively, for detailed descriptions of each PNVT and the cross-walk of SWReGAP land cover types to PNVTs). However, four PNVTs comprise approximately 75% of the total area on the Lincoln National Forest. These four PNVTs include: Madrean encinal woodland (30.3%), semi-desert grassland (18.6%), Madrean pine-oak woodland (14.8%) and mixed conifer forest (11.2%). Pinyon-juniper (6.5%), ponderosa pine forest (6.3%) and interior chaparral (4.9%) encompass the next largest proportions of the Forest. The remaining 12 PNVTs cover relatively small percentages of the landscape, and combined cover approximately 7.4% of the Forest (Table 15-1).





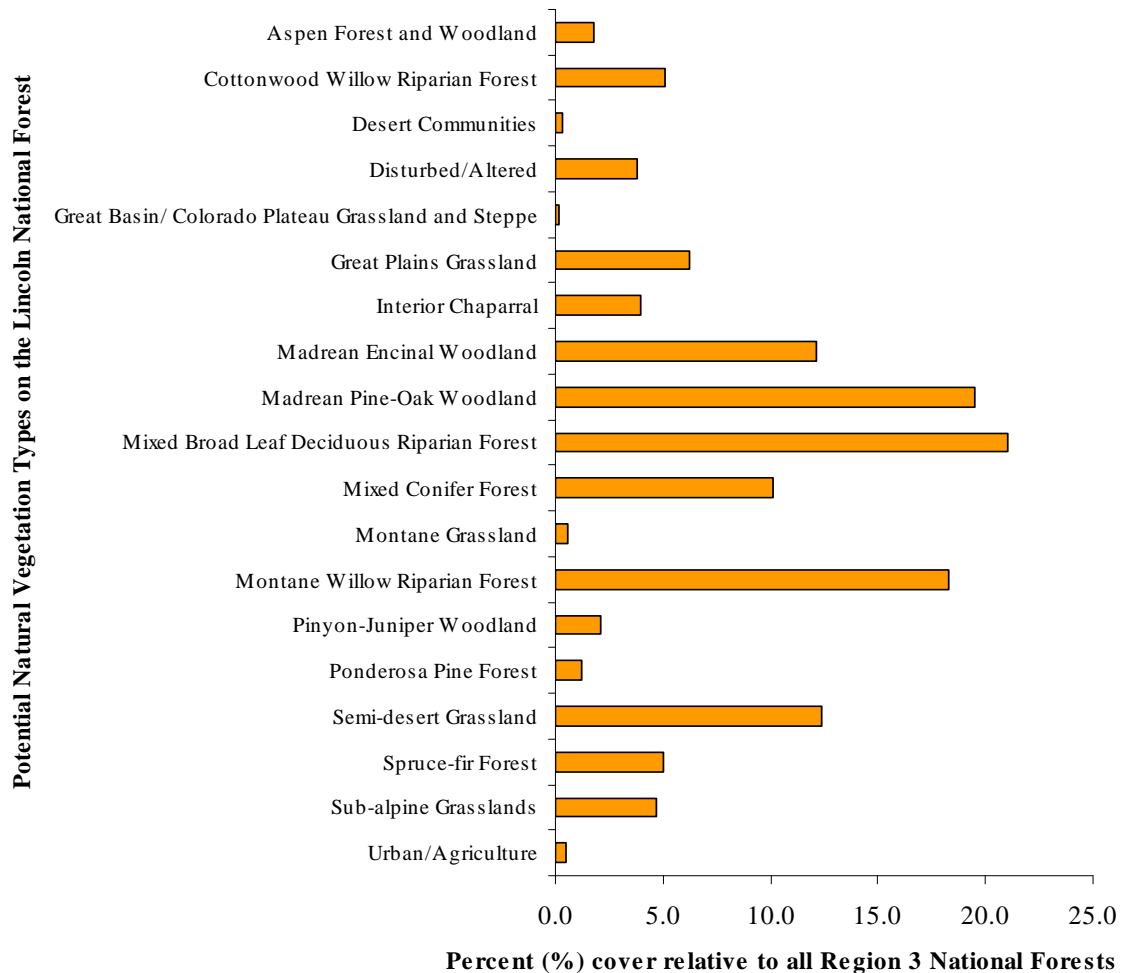
**Figure 15-1.** Distribution of potential natural vegetation types on the Lincoln National Forest. Map was created using data from the Southwest Regional Gap Analysis Project (SWReGAP; U.S. Geological Survey National Gap Analysis Program. 2004). SWReGAP vegetation types were aggregated and converted to potential natural vegetation types. See Chapter 2 for more information regarding methods used. SWReGAP data have not been accuracy tested and are based on satellite imagery. Therefore, SWReGAP may not be appropriate at fine spatial scales.

**Table 15-1.** Approximate area (in acres) and percent of total area of each potential natural vegetation type on the Lincoln National Forest. Areas were calculated using data from the Southwest Regional Gap Analysis Project (SWReGAP). SWReGAP land cover types were aggregated and converted to potential natural vegetation types. See Chapter 2 for more details on methods utilized.

Potential Natural Vegetation Type	Total Area (acres)	Percent of Total Area (%)
Aspen Forest and Woodland	6,100	0.6
Cottonwood Willow Riparian Forest	1,000	0.1
Desert Communities	3,200	0.3
Disturbed/Altered (quarries and mines)	3,200	0.3
Great Basin/ Colorado Plateau Grassland and Steppe	1,200	0.1
Great Plains Grasslands	19,800	1.8
Interior Chaparral	53,200	4.9
Madrean Encinal Woodland	331,600	<b>30.3</b>
Madrean Pine-Oak Woodland	162,200	<b>14.8</b>
Mixed Broadleaf Deciduous Riparian Forest	8,900	0.8
Mixed Conifer Forest	123,100	<b>11.2</b>
Montane Grassland	100	<0.1
Montane Willow Riparian Forest	5,700	0.5
Pinyon-juniper Woodland	70,800	6.5
Ponderosa Pine	68,500	6.3
Semi-desert Grassland	204,000	<b>18.6</b>
Spruce-fir Forest	17,600	1.6
Sub-alpine Grasslands	14,600	1.3
Urban and Agricultural Area	100	<0.1
<b>Total</b>	<b>1,094,900</b>	

### *Potential Natural Vegetation Types relative to all Region 3 Forests*

The Lincoln National Forest is responsible for managing large percentages of certain PNVTs relative to all other National Forests in Region 3. For example, 21.0% of mixed broadleaf deciduous riparian forest found in all Region 3 Forests can be found on the Lincoln. Furthermore, the Lincoln manages 19.5% of Madrean pine-oak woodland, 18.3% of montane willow riparian forest, 12.4% of semi-desert grassland and 12.1% of Madrean encinal woodland that occurs within Region 3.



**Figure 15-2.** Percent area of cover of each potential natural vegetation type that occurs on the Lincoln National Forest in relation to all Region 3 National Forests combined. Analysis was conducted using data from the Southwest Regional Gap Analysis Project (SWReGAP). See Chapter 2 for information regarding the limitations of SWReGAP.

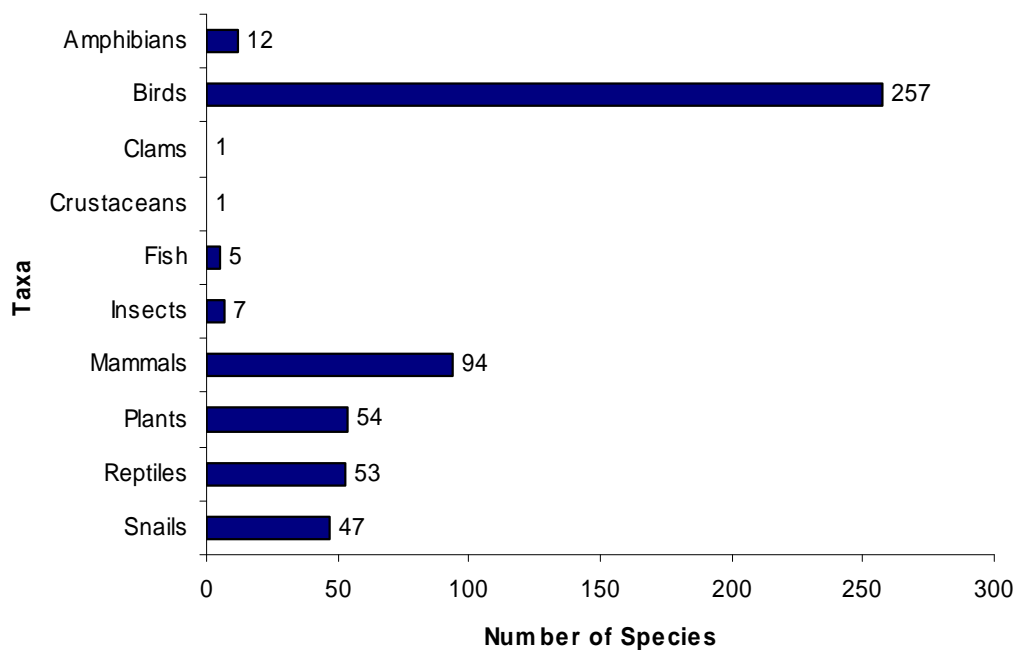
### *Potential Natural Vegetation Types across all landowners in the Southwest*

The Lincoln National Forest also manages for a large proportion (11.4%) of Madrean pine-oak woodland found throughout all landowners of Arizona and New Mexico. Refer to Chapter 3 for more information regarding the proportions of PNVTs the Lincoln National Forest manages relative to other landowners in the Southwest.

## II. Plant and Animal Species Richness

The R3 Species Database (described in detail in Chapter 2) was used to summarize the conservation status of species that exist on the Lincoln National Forest, and to identify species that might potentially be considered as species-of-interest and species-of-concern within the USFS forest plan revision process. The R3 Species Database was synthesized from multiple datasets and provides updated and consistent attributes for species that occur on Region 3 Forests, including: taxonomy, NatureServe conservation status rankings, state and federal endangered species listings, and other pertinent conservation status rankings. The database includes all known terrestrial and aquatic vertebrate species, and plant and invertebrate species that may be of conservation concern. Non-native aquatic vertebrate species were not included in these analyses. The complete list of species used in this analysis and their conservation status attributes are provided in Appendix 15-A.

According to the R3 Species Database, 531 species of plants and animal occur on the Lincoln National Forest (Figure 15-3; a complete list is provided in Appendix 15-A). This number is likely conservative in terms of overall species diversity as it may not account for all vertebrate species that may occur in this area, and is not comprehensive for plant and invertebrates. It is also important to note that the number and type of species inhabiting the Lincoln National Forest likely changes over time.



**Figure 15-3.** Number of species, by taxon, that inhabit the Lincoln National Forest according to the R3 Species Database. The R3 Species Database includes all known terrestrial vertebrates and native fishes, but only invertebrates and plants of management concern. Because of the limitations of the R3 Species Database (see Chapter 2 for complete description of the database), the numbers reported in these results are conservative.

### *Threatened and Endangered Species Listings*

*Federal listing under the Endangered Species Act* — Six species that inhabit the Lincoln National Forest are listed by the U.S. Fish and Wildlife Service as endangered or threatened under the Endangered Species Act of 1973 (Table 15-6). Two candidate species, Western Yellow-Billed Cuckoo and Texas Hornshell, also occur on the Forest. The agency lists species as candidate species when there is sufficient information to support a proposal for the endangered or threatened status. The American peregrine falcon (*Falco peregrinus anatum*) was de-listed in 1999.

*New Mexico state conservation status* — Twenty-three species that are designated by the New Mexico Game and Fish Department as threatened or endangered occur on the Lincoln National Forest. Refer to Appendix 15-A for a complete list of those species. Currently, there are four animal and seven plant species designated by the state as endangered and 12 animal species that are listed as threatened on the Forest. Birds and plants comprise the largest proportions (30.4% each) of these species.

### *NatureServe Conservation Status Rankings*

*Global conservation status rankings (G-ranks)* — Seventy-nine species (15.1%) were ranked with a global conservation status of G1, G2, G3, T1, T2 or T3, indicating conservation concern across their range (Table 15-2). Results indicate 440 species (84.3%) were ranked as G4/T4 or G5/T5 species. These are species whose populations are considered ‘apparently secure’ or ‘secure’, respectively. Nine species (1.7%) of 531 were not included in this analysis because they were not assigned a NatureServe global conservation rank. The remaining 3 species were considered not rankable, according to NatureServe.

*National conservation status rankings (N-ranks)* — Eighty species (15.3%) were ranked with a national conservation status of N1, N2, or N3, indicating conservation concern at the national level (Table 15-3). Four hundred twenty-four species on the Forest (81.1%) were ranked as N4 or N5 species, whose populations are considered ‘apparently secure’ or ‘secure’, respectively. Eight species were not considered rankable by NatureServe, and 19 species were not assigned a NatureServe national rank.

*Subnational conservation status rankings (S-ranks)* — Of the 531 species analyzed for the Lincoln National Forest, 505 (95.1%) had assigned subnational conservation status ranks (S-ranks) in the state of New Mexico (Table 15-4). One hundred twenty-one species (24.0%) of these had rankings that merit conservation concern on a state or more local scale (S1, S2, S3). Three hundred thirty-three (66.0%) were considered secure or apparently secure (S5 and S4, respectively). The remaining 51 species (10.1%) were not ranked. See Appendix 15-A for the complete list of species with their associated S-ranks.

**Table 15-2.** Number of species, by taxon, that inhabit the Lincoln National Forest with the various global rankings assigned by NatureServe. Nine species are not included in this table because they do not have an assigned global rank. G1 = critically imperiled; G2 = imperiled; G3 = vulnerable; G4 = apparently secure; G5 = secure; T = infraspecific taxon (subspecies or varieties), TNR = unranked/not yet assessed; TU = unrankable.

Global Ranking	Amphibian	Bird	Clam	Crustacean	Fish	Insect	Mammal	Plant	Reptile	Snail	<b>Total</b>
G1	0	0	1	0	0	0	0	1	0	2	<b>4</b>
G2	0	0	0	0	0	1	0	11	0	4	<b>16</b>
G3	1	0	0	0	3	1	3	20	0	3	<b>31</b>
G4	0	13	0	0	0	2	9	10	1	6	<b>41</b>
G5	10	235	0	0	1	0	66	0	46	27	<b>385</b>
T1	0	0	0	0	0	1	1	2	0	2	<b>6</b>
T2	0	1	0	0	0	0	2	8	0	2	<b>13</b>
T3	0	2	0	0	1	2	1	1	1	1	<b>9</b>
T4	0	2	0	0	0	0	2	0	2	0	<b>6</b>
T5	1	1	0	0	0	0	3	0	3	0	<b>8</b>
TNR	0	1	0	0	0	0	0	1	0	0	<b>2</b>
TU	0	1	0	0	0	0	0	0	0	0	<b>1</b>
total	12	256	1	0	5	7	87	54	53	47	<b>522</b>

**Table 15-3.** Number of species, by taxon, that inhabit the Lincoln National Forest with national rankings assigned by NatureServe. Eight species are not included because they do not have an assigned rank. N1 = critically imperiled; N2 = imperiled; N3 = vulnerable; N4 = apparently secure; N5 = secure; NNA = not applicable; NNR = not ranked.

National Ranking	Amphibian	Bird	Clam	Crustacean	Fish	Insect	Mammal	Plant	Reptile	Snail	Total
N1	0	0	1	0	0	2	1	3	0	5	<b>12</b>
N2	0	0	0	1	2	1	2	17	0	4	<b>27</b>
N3	1	5	0	0	2	3	7	17	2	4	<b>41</b>
N4	1	26	0	0	0	1	11	7	5	7	<b>58</b>
N5	10	220	0	0	1	0	64	0	46	25	<b>366</b>
NNA	0	3	0	0	0	0	2	0	0	2	<b>7</b>
NNR	0	2	0	0	0	0	0	10	0	0	<b>12</b>

**Table 15-4.** Number of species, per taxon, currently inhabiting the Lincoln National Forest that are assigned to the various subnational rankings by New Mexico Natural Heritage. Twenty-eight of the 542 species were not assigned a subnational conservation rank by New Mexico Natural Heritage, and therefore are not included in this analysis. S1 = critically imperiled; S2 = imperiled; S3 = vulnerable; S4 = apparently secure; S5 = secure; SNA = not applicable; SNR = not ranked.

State Ranking	Amphibian	Bird	Clam	Crustacean	Fish	Insect	Mammal	Plant	Reptile	Snail	Total
S1	0	9	1	0	1	0	3	4	1	3	<b>22</b>
S2	0	14	0	0	2	0	9	19	2	4	<b>50</b>
S3	3	17	0	0	1	0	9	14	4	1	<b>49</b>
S4	2	108	0	0	0	0	24	3	10	4	<b>151</b>
S5	7	100	0	0	0	0	34	0	33	8	<b>182</b>
SNA	0	3	0	0	1	0	1	0	0	0	<b>5</b>
SNR	0	0	0	0	0	7	1	14	0	24	<b>46</b>

### *Other Conservation Rankings*

*Birds of Conservation Concern* — According to the R3 Species Database, the Lincoln National Forest, is home to at least 257 birds, of which 18 (7.0%) are listed on the U.S. Fish and Wildlife Service Birds of Conservation Concern National Priority list (Table 15-5). In all, the U.S. Fish and Wildlife Service lists 131 species of Birds of Conservation Concern, and 13.7% of these inhabit the Lincoln National Forest. Three of these species also are listed as threatened under the state of New Mexico: American peregrine falcon, baird's sparrow, and gray vireo.

*Partners in Flight Watch List* — Of the 100 birds species currently on the Partners in Flight Watch List, 21 (21%) can be found on the Lincoln National Forest (Table 15-5). This comprises 8.2% of the known 257 bird species that inhabit the Forest. Three species, the Baird's Sparrow, Gray Vireo, and the Varied Bunting, are also listed as threatened under the state of New Mexico. Eight species on the Forest occur on both the Partners in Flight Watch List and the U.S. Fish and Wildlife Service Birds of Conservation Concern list, and are highlighted in bold in Table 15-6.



**Table 15-5.** Bird species on the Partners in Flight Watch list or the U.S. Fish and Wildlife Service Birds of Conservation Concern list that inhabit the Lincoln National Forest. P = Species on the Partners in Flight Watch list; CC = USFWS Bird of Conservation Concern; \* = New Mexico Department of Game and Fish Threatened Species; species on both lists are in bold.

<b><u>Diurnal Raptors</u></b>	<b><u>Shrikes and Vireos</u></b>
American peregrine falcon* (CC)	Arizona Bell's Vireo (CC)
Ferruginous hawk* (CC)	<b>Gray vireo</b>
Northern harrier (CC)	Loggerhead Shrike (CC)
Swainson's hawk (P)	
<b><u>Cuckoos and Allies</u></b>	<b><u>Jays, Crows, and Allies</u></b>
Western yellow-billed cuckoo (CC)	Pinyon jay (P)
<b><u>Upland Game Birds</u></b>	<b><u>Mimids – Catbirds, Mockingbirds and Thrashers</u></b>
Montezuma Quail (P)	Crissal thrasher (CC)
Scaled Quail (P)	
<b><u>Pigeons and Doves</u></b>	<b><u>Wagtails and Pipits</u></b>
Band-tailed pigeon (P)	<b>Sprague's Pipit</b>
<b><u>Owls</u></b>	<b><u>Wood Warblers</u></b>
Elf owl	Black-throated gray warbler (CC)
<b>Flammulated owl</b>	<b>Grace's warbler</b>
Short-Eared Owl (P)	<b>Red-faced warbler</b>
	Virginia's warbler (P)
<b><u>Goatsuckers and Swifts</u></b>	<b><u>Emberizine Sparrows and Allies</u></b>
White-throated swift (P)	<b>Baird's sparrow*</b>
<b><u>Hummingbirds</u></b>	<b>Black-chinned sparrow</b>
Calliope hummingbird (P)	Cassin's sparrow (CC)
Rufous hummingbird (P)	Lark bunting (CC)
	McCown's longspur (P)
<b><u>Tyrant Flycatchers</u></b>	Varied bunting (P)
Olive-sided flycatcher (P)	

### *Potential Species Lists for Forest Planning*

The R3 Species Database was used to identify species that are potential species-of-concern and species-of-interest as defined in the USFS planning directives. For the purposes of this analysis, the definitions used to categorize species were similar, but not identical, to the definitions provided in the directives.

1. Threatened and Endangered Species
  - a. Listed as a threatened or endangered species under the Federal Endangered Species Act.
2. Species-of-concern were defined as species that fall in one or more of the following categories:
  - a. NatureServe G/T-rank of 1, 2, or 3
  - b. Proposed or candidate species under the Federal Endangered Species Act
  - c. Recently (<5 years) de-listed under the Federal Endangered Species Act
  - d. Has been petitioned for federal listing and for which a positive “90-day finding” has been made
3. Species-of-interest were defined as species that fall in one or more of the following categories:
  - a. NatureServe N-rank or S-rank of 1 or 2 in New Mexico
  - b. Listed as threatened or endangered species in New Mexico
  - c. Identified a priority species in the New Mexico Comprehensive Wildlife Conservation Strategy
  - d. On the U.S. Fish and Wildlife Service Birds of Conservation Concern National Priority List

In particular, the directives provide further criteria that can be used in considering species-of-interest, such as trends, rarity, ranges, and public interest. However, this information was not available in the R3 Species Database and is beyond the scope of this analysis.

*Extirpated Species* — Some species are known to have inhabited the Lincoln National Forest, but have since been extirpated. While the cause of extirpation for each species may not be fully understood, it is well accepted that major threats to species’ existence can include loss or alteration of habitat, competition and/or predation by non-native species and poaching. Mexican wolf (*Canis lupus baileyi*) and Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) are known to have existed historically on the Lincoln National Forest, but are now considered extirpated. These species are not considered in the species diversity analysis for the Lincoln National Forest.

*Threatened and Endangered Species* – Six species from two taxa that occur on the Forest are listed by the U.S. Fish and Wildlife Service as endangered or threatened under the Endangered Species Act (Table 15-6).

**Table 15-6.** Species listed as endangered or threatened under the Federal Endangered Species Act of 1973 that inhabit the Lincoln National Forest. The table includes common names recognized by NatureServe.

<b>Taxa</b>	<b>Endangered</b>	<b>Threatened</b>
Bird		Bald Eagle Mexican Spotted Owl
Plant	Kuenzler's Hedgehog Cactus Sacramento Prickly Poppy Todsens's Pennyroyal	Sacramento Mountain Thistle

*Potential species-of-concern* — The Lincoln National Forest is home to at least 74 potential species-of-concern across nine distinct taxonomic groups (

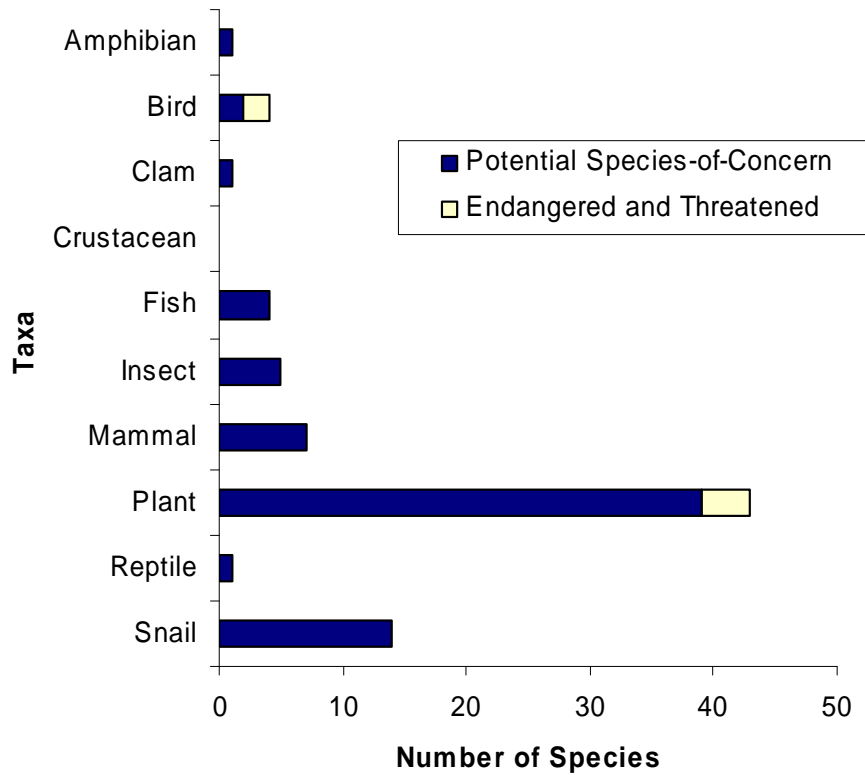
Table 15-7). Plants comprise over one-half of all potential species-of-concern on the Forest, 52.7%; snails comprise the next largest proportion (18.9%); mammals represent 9.4%; insects, 6.8%; fish, 5.4%; birds, 2.7%; and amphibians, clams, and reptiles, 1.4% each (Figure 15-5). Two candidate species for federal listing inhabit the Lincoln National Forest, the Western Yellow-Billed Cuckoo (*Coccyzus americanus occidentalis*) and Texas Hornshell (*Popenaias popeii*), and are included in the list of potential species-of-concern. The R3 Species Database, which may not be comprehensive for the Lincoln National Forest, was used to derive these results. Therefore, it is feasible that some species may be absent from these results.

Among both potential species-of-concern and ESA listed threatened and endangered species, plants continue to comprise over half of all listed species on the Forest (approximately 53.8%); snails (17.5%) and mammals (8.8%) make up the next largest proportions (Figure 15-4).

**Table 15-7.** Potential species-of-concern on the Lincoln National Forest. Potential species-of-concern include species with NatureServe global ranks (G/T-ranks) of three or less, species that are listed as candidate or proposed under the Federal Endangered Species Act (ESA), have been recently de-listed under ESA, or species which have been petitioned for listing under ESA and for which a positive '90 day finding' has been made.

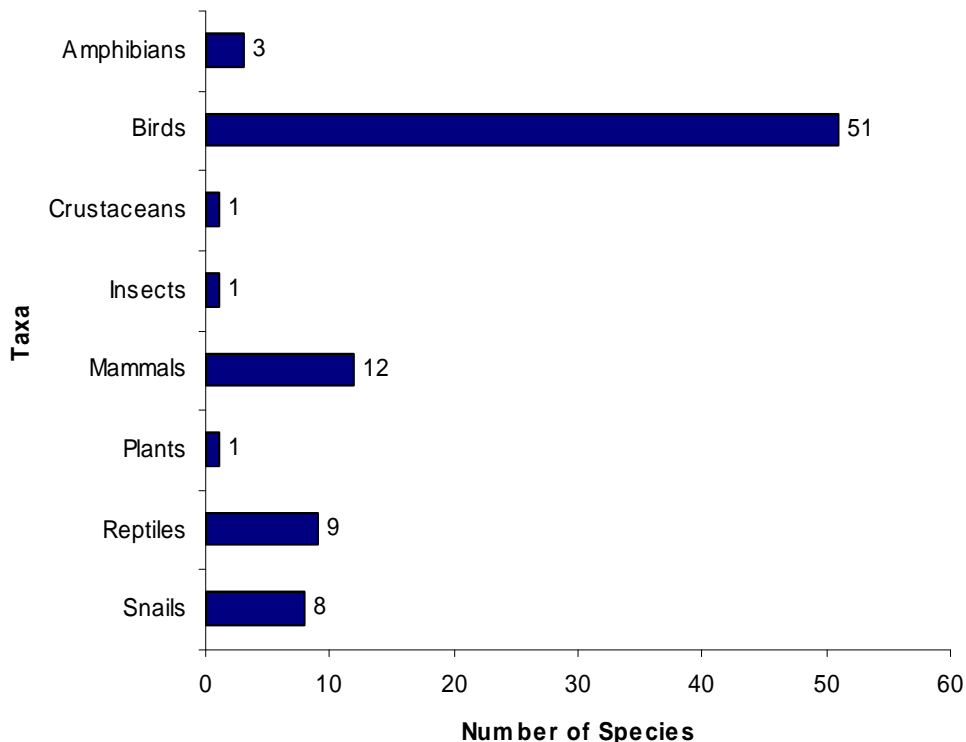
Taxa	Scientific Name	Common Name	G/T-rank	ESA Status	Recently Delisted
<b>Amphibians</b>					
	<i>Aneides hardii</i>	Sacramento Mtn. Salamander	G3		
<b>Birds</b>					
	<i>Coccyzus americanus occidentalis</i>	Western Yellow-Billed Cuckoo	T2	Candidate	
	<i>Falco peregrinus anatum</i>	American Peregrine Falcon	T3		Yes
<b>Clams</b>					
	<i>Popenaias popeii</i>	Texas Hornshell	G1	Candidate	
<b>Fish</b>					
	<i>Etheostoma lepidum</i>	Greenthroat Darter	G3		
	<i>Gila pandora</i>	Rio Grande Chub	G3		
	<i>Ictalurus lupus</i>	Headwater Catfish	G3		
	<i>Oncorhynchus clarkii virginalis</i>	Rio Grande Cutthroat Trout	T3		
<b>Insects</b>					
	<i>Amblycheila picolomini</i>	Plateau Giant Tiger Beetle	G3		
	<i>Cicindela politula petrophila</i>	Guadalupe Mountains Tiger Beetle	T3		
	<i>Euphydryas chalcedona cloudcrofti</i>	Chalcedon Checkerspot	T1		
	<i>Megathymus ursus violae</i>	Viola Yucca Borer	T3		
	<i>Satyrrium polingi</i>	Poling's Hairstreak	G2		
<b>Mammals</b>					
	<i>Cynomys ludovicianus</i>	Black-Tailed Prairie Dog	G3		
	<i>Myotis occultus</i>	Occult Little Brn. Myotis Bat	G3		
	<i>Spermophilus tridecemlineatus monticola</i>	White-Mountain Ground Squirrel	T3		
	<i>Tamias minimus atristriatus</i>	Penasco Chipmunk	T1		
	<i>Thomomys bottae guadalupensis</i>	Guadalupe Pocket Gopher	T2		
	<i>Vulpes velox</i>	Swift Fox	G3		
	<i>Zapus hudsonius luteus</i>	New Mexican Jumping Mouse	T2		
<b>Plants</b>					
	<i>Agastache pringlei</i> var. <i>verticillata</i>		T2		
	<i>Anulocaulis leiosolenus</i> var. <i>howardii</i>	Howard's Gyp Ringstem	T2		
	<i>Aquilegia chrysantha</i> var. <i>chaplinei</i>	Chapline's Columbine	T2		
	<i>Astragalus altus</i>	Winged Milkvetch	G2		
	<i>Astragalus kerrii</i>	Kerr's Milkvetch	G2		
	<i>Astragalus neomexicanus</i>	New Mexico Milkvetch	G3		
	<i>Besseyia oblongifolia</i>	Egg-Leaf Coral-Drops	G2		
	<i>Brickellia floribunda</i>	Chihuahuan Desert Brickell-Bush	G3		
	<i>Brickellia rusbyi</i>	Stinking Brickell-Bush	G3		
	<i>Brickellia simplex</i>	Sonoran Brickell Brush	G3		
	<i>Chaetopappa hersheyi</i>	Guadalupe Cliff Daisy	G3		
	<i>Cirsium wrightii</i>	Wright's Marsh Thistle	G2		
	<i>Crataegus wootoniana</i>	Wooton's Hawthorn	G2		
	<i>Ericameria nauseosa</i> var. <i>texensis</i>	Guadalupe Rabbitbrush	T2		

Taxa	Scientific Name	Common Name	G/T- rank	ESA Status	Recently Delisted
	<i>Erigeron rybius</i>	Sacramento Mountain fleabane	G3		
	<i>Eriogonum jamesii</i> var. <i>wootonii</i>		T2		
	<i>Escobaria guadalupensis</i>	Guadalupe Mountain Pincushion Cactus	G1		
	<i>Escobaria villardii</i>	Villard's Pincushion Cactus	G2		
	<i>Hedeoma apiculata</i>	Mckittrick Pennyroyal	G3		
	<i>Hedeoma pulcherrima</i>	White Mountain false penny- royal	G2		
	<i>Heuchera wootonii</i>	White Mountain allumroot	G3		
	<i>Hexalectris nitida</i>	Glass Mountain Coralroot	G3		
	<i>Hymenopappus biennis</i>	Biennial Woolly-white	G3		
	<i>Hymenopappus mexicanus</i>	Mexican Woolly-white	G3		
	<i>Hymenoxys rusbyi</i>	Ruby's Bitterweed	G3		
	<i>Ionactis elegans</i>	Sierra Blanca Cliff Daisy	G2		
	<i>Lesquerella aurea</i>	Golden Bladderpod	G3		
	<i>Ligusticum porteri</i>	Porter's Lovage	G3		
	<i>Mentzelia humilis</i> var. <i>guadalupensis</i>	Gypsum Blazing-Star	T2		
	<i>Penstemon alamosensis</i>	Alamo Beardtongue	G3		
	<i>Penstemon cardinalis</i> ssp. <i>regalis</i>	Royal Red Penstemon	T2		
	<i>Perityle staurophylla</i> var. <i>staurophylla</i>	New Mexico Rock Daisy	T3		
	<i>Rumex orthoneurus</i>	Bloomer's Dock	G3		
	<i>Salvia summa</i>	Great Sage	G3		
	<i>Senecio sacramentanus</i>	Sacramento groundsel	G3		
	<i>Sibara grisea</i>	Marble Canyon Rockcress	G3		
	<i>Sophora gypsophila</i> var. <i>guadalupensis</i>	Guadalupe Mescal Bean	T1		
	<i>Streptanthus sparsiflorus</i>	Sparsely Flowered Jewelflower	G2		
	<i>Valeriana texana</i>	Guadalupe Valerian	G3		
<b>Reptiles</b>					
	<i>Sistrurus catenatus edwardsii</i>	Desert Massasauga	T3		
<b>Snails</b>					
	<i>Ashmunella carlsbadensis</i>	Guadalupe Woodlandsnail	G1		
	<i>Ashmunella pseudodonta</i>	Capitan Woodlandsnail	G1		
	<i>Ashmunella rhyssa altissima</i>		T1		
	<i>Columella columella alticola</i>		T1		
	<i>Gastrocopta armifera ruidosensis</i>		T3		
	<i>Gastrocopta ashmuni</i>	Sluice Snaggletooth	G3		
	<i>Gastrocopta quadridens</i>	Cross Snaggletooth	G2		
	<i>Holospira montivaga</i>	Vagabond Holospira	G2		
	<i>Humboldtiana ultima</i>	Northern Threeband	G2		
	<i>Oreohelix neomexicana</i>		G2		
	<i>Rabdotus dealbatus neomexicanus</i>		T2		
	<i>Radiodiscus millicostatus</i>	Ribbed Pinwheel	G3		
	<i>Thysanophora hornii</i>	Southwestern Fringed Snail	G3		
	<i>Vertigo modesta ingersolli</i>		T2		



**Figure 15-4.** Number of potential species-of-concern (in blue) and federally listed endangered and threatened species (yellow) by taxon that currently inhabit the Lincoln National Forest. Potential species-of-concern include species with NatureServe global ranks (G/T-ranks) of three or less, species that are listed as candidate or proposed under the Federal Endangered Species Act (ESA), have been recently de-listed under ESA, or species which have been petitioned for listing under ESA and for which a positive '90 day finding' has been made.

*Potential species-of-interest* —At least 86 potential species-of-interest representing six taxonomic groups occur on the Lincoln National Forest (Figure 15-5). Birds make up the largest proportion (59.3%) of potential species-of-interest. Mammals comprise 14.0% of the total, while reptiles comprise 10.5%, and snails make up approximately 9.3%. Amphibians comprise 3.5%, while crustaceans, insects, and plants comprise 1.2% each of all potential species-of-interest on the Lincoln National Forest. The species used in this analysis for Lincoln National Forest are listed in Appendix 15-A, and those determined as potential species-of-interest are identified.



**Figure 15-5.** Number of potential species-of-interest, by taxa, that currently inhabit the Lincoln National Forest. Species were considered potential species-of-interest if they fell into one or more of the following categories: state listed threatened or endangered species (NM); listed as a species of concern or priority species in the NM State Comprehensive Wildlife Conservation Strategy; on the U.S. Fish and Wildlife Service Birds of Conservation Concern National Priority list; or NatureServe national or subnational conservation rank of N1, N2, S1, or S2. These are the criteria listed in the published Forest Service draft directives (70 Fed. Reg. 14637) for determining species-of-interest. Species that were federally endangered or threatened, or that were determined to be potential species-of concern were not included as potential species-of-interest.



*Summary* – Almost one-third (31.3%) of all species on the Lincoln National Forest were identified as falling within categories defined by the USFS planning directives (Table 15-8). While 13.9% were identified as potential species-of-concern, approximately 16.3% were identified as potential species-of-interest. Notably, 79.6% of all plants that occur on the Lincoln are either federally listed as threatened or endangered or are identified as potential species-of-concern. Also, a majority of the insects (71.4%) and fish (80.0%) that occur on the Lincoln are identified as potential species-of-concern.

In addition to the criteria used to define these categories, the R3 Species Database includes additional conservation status information, such as species listed on the Region 3 Sensitive Species List and animals on the state Comprehensive Wildlife Conservation Strategy list. Only two species (Cactus mouse (*Peromyscus eremicus*) and Orange giant skipper (*Agathymus neumoegeni*)) on the current Region 3 Sensitive Species List that inhabit the Lincoln National Forest were not captured within the categories defined by the directives.

**Table 15-8.** Number of species identified as endangered or threatened, species-of-concern, species-of-interest, or no category for the Lincoln National Forest based on information in the R3 Species Database.

Taxa	Endangered and Threatened		Potential Species-of-Concern		Potential Species-of-Interest		No Category		Total
	#	%	#	%	#	%	#	%	
Amphibian	0	0.0	1	8.3	3	25.0	8	66.7	<b>12</b>
Bird	2	0.8	2	0.8	51	19.8	202	78.6	<b>257</b>
Clam	0	0.0	1	100.0	0	0.0	0	0.0	<b>1</b>
Crustacean	0	0.0	0	0.0	1	100.0	0	0.0	<b>1</b>
Fish	0	0.0	4	80.0	0	0.0	1	20.0	<b>5</b>
Insect	0	0.0	5	71.4	1	14.3	1	14.3	<b>7</b>
Mammal	0	0.0	7	7.4	12	12.8	75	79.8	<b>94</b>
Plant	4	7.4	39	72.2	1	1.9	10	18.5	<b>54</b>
Reptile	0	0.0	1	1.9	9	17.0	43	81.1	<b>53</b>
Snail	0	0.0	14	29.8	8	17.0	25	53.2	<b>47</b>
Total	6	1.1	74	13.9	86	16.3	365	68.7	<b>531</b>

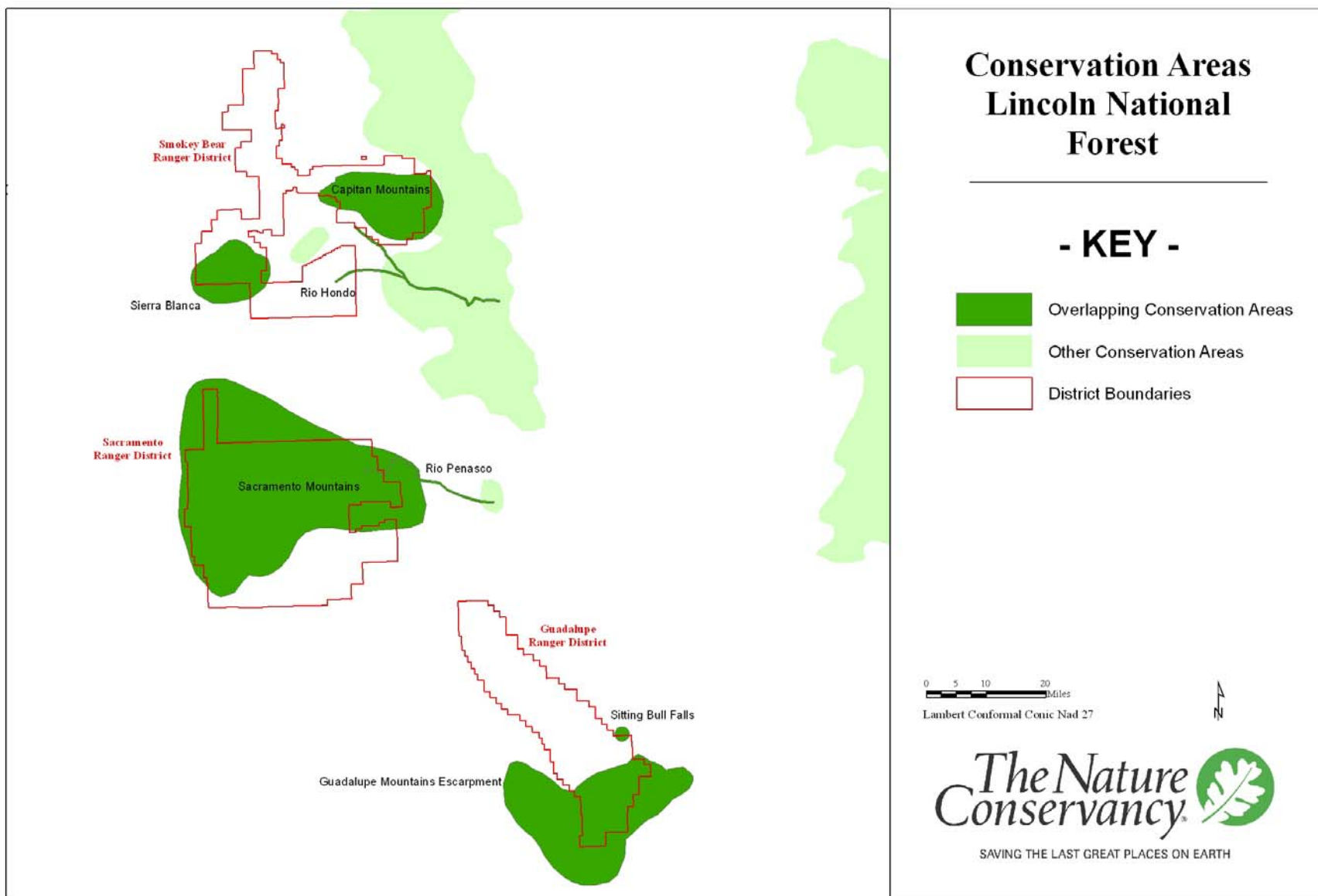
### *III. Ecoregional Assessment Conservation Areas and Conservation Targets*

Ecoregional assessments are science-based efforts to identify the minimum set of areas (conservation areas) on the landscape necessary to maintain the biological diversity of the ecoregion. The ecoregional assessment process includes the identification of conservation targets (including species, ecological systems, and important biological features) that represent the biological diversity within the ecoregion. Conservation goals (including distribution, size and minimum number of viable occurrences) are established for each conservation target within the ecoregion. An iterative process is used to identify a suite of conservation areas that most efficiently meets the conservation goals for all conservation targets within the ecoregion. A more detailed explanation of the ecoregional assessment process is provided in Chapter 2. For this report, the results of these ecoregional analyses were used to identify the extent and distribution of overlap between conservation areas and ranger districts, roadless areas, and wilderness areas on the Lincoln National Forest. The conservation targets associated with each overlapping conservation area were also identified.

Seven individual conservation areas from ecoregional assessments overlap the Lincoln National Forest (Figure 15-6, Table 15-9), totaling 609,600 acres, or 48.4% of the Forest. Conservation area overlap on individual districts ranged from 24.5% on the Guadalupe District to 73.1% on the Sacramento Ranger District (Table 15-10). Overall, 59.8% of the total area of these ten conservation areas overlaps the Lincoln National Forest. For several conservation areas, a large proportion of the conservation area overlaps the Lincoln National Forest (Table 15-1), demonstrating the Forest has the primary responsibility for managing these areas to sustain the biodiversity within them.

Approximately 25% of the area of the Lincoln National Forest overlapped by conservation areas is designated wilderness area (9.8%) or inventoried roadless area (14.1%), while approximately 75% overlap areas without these designations (Table 15-12). Nearly three-quarters (72.2%) of all wilderness areas and just under one-half of inventoried roadless areas (47.3%) and undesignated areas (46.5%) on the forest are overlapped by conservation areas.

Conservation targets were summarized for all seven conservation areas that overlap the Lincoln National Forest. A total of 69 conservation targets occur within these conservation areas. Of these, nine (13.0%) are coarse filter targets (ecological systems, communities or features), while 60 (87.0%) are individual species. Ten (14.5%) targets are associated with riparian and aquatic systems, while 59 (85.5%) are associated with terrestrial habitats (Table 15-11). A complete listing of all conservation targets by taxonomic group for the Lincoln is provided in Appendix 15-B and conservation targets for each conservation area are provided in Appendix 15-C.



**Figure 15-6.** Conservation areas (N=7) that overlap three ranger districts on the Lincoln National Forest in New Mexico.

**Table 15-9.** Conservation areas (N=7) that overlap three ranger districts on the Lincoln National Forest in New Mexico.

Conservation Area	Ranger Districts <sup>A</sup>	Overlap (Acres)	% of Conservation Area
Capitan Mountains	SB	91,500	85.4
Guadalupe Mountains Escarpment	G	69,500	28.1
Rio Hondo	SB	1,200	11.0
Rio Penasco	S	800	11.9
Sacramento Mountains	S	400,400	69.2
Sierra Blanca	SB	45,000	68.4
Sitting Bull Falls	G	1,200	38.7

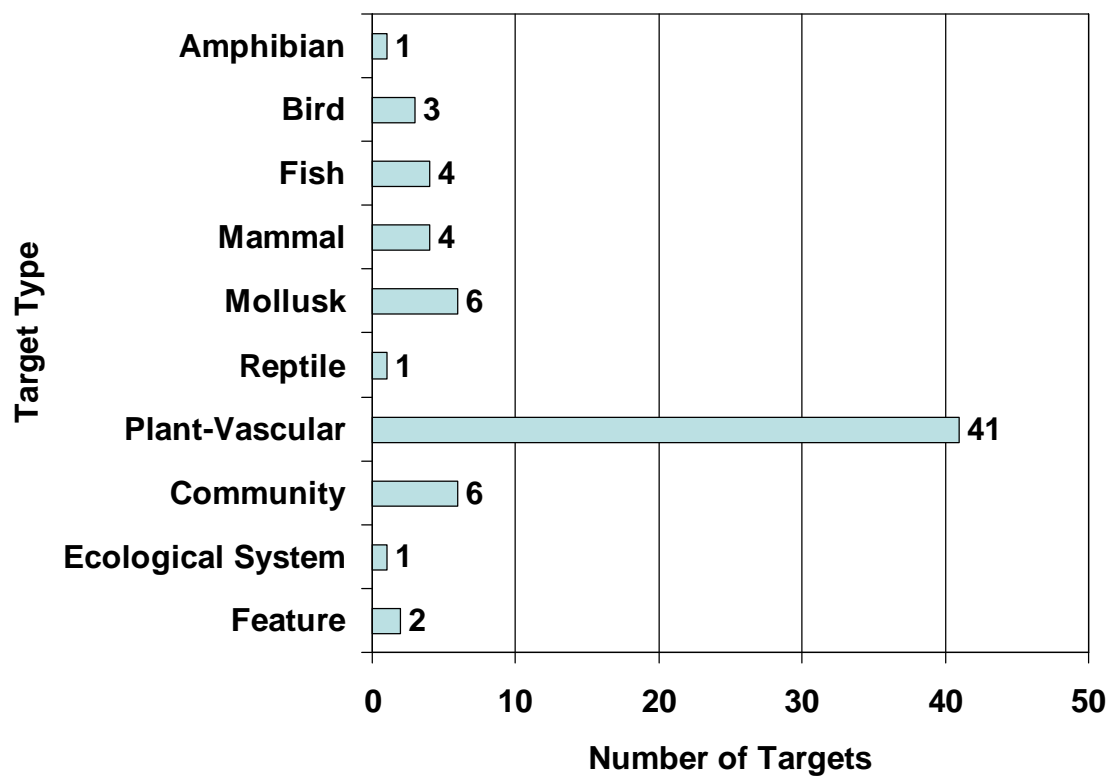
<sup>A</sup>G = Guadalupe, S = Sacramento, SB = Smokey Bear

**Table 15-10.** Extent of overlap between ecoregional conservation areas and three ranger districts on the Lincoln National Forest in New Mexico.

District	Number of Conservation Areas	Overlap (Acres)	Percent of District
Guadalupe	2	70,700	24.5%
Sacramento	2	401,200	73.1%
Smokey Bear	3	137,700	32.5%
Lincoln N.F Total	7	609,600	48.4%

**Table 15-11.** Number of conservation targets associated with aquatic/riparian and terrestrial habitats for seven conservation areas that overlap the Lincoln National Forest in New Mexico.

Conservation Area	Habitat		Total
	Aquatic/ Riparian	Terrestrial	
Capitan Mountains	1	8	9
Guadalupe Mountains Escarpment	0	21	21
Rio Hondo	1	0	1
Rio Penasco	1	3	4
Sacramento Mountains	5	37	42
Sierra Blanca	3	18	21
Sitting Bull Falls	1	0	1



**Figure 15-7.** Number of conservation targets, by type, that occur on 7 conservation areas that overlap the Lincoln National Forest in New Mexico.

**Table 15-12.** Overlap between conservation areas wilderness areas, and non-wilderness inventoried roadless areas on the Lincoln National Forest in New Mexico.

Designation	Acres within Conservation Areas	% of Conservation Areas	% of Designated Areas
Wilderness Areas	59,800	9.8	72.2
Roadless Areas	85,900	14.1	47.3
No Designation	463,500	76.1	46.5

## Discussion

### *Systems Diversity*

According to Southwest Regional Gap Analysis Project (USGS National Gap Analysis Program 2004), four PNVTs cover three-quarters of the Lincoln National Forest, including Madrean encinal woodland, semi-desert grassland, Madrean pine-oak woodland, and mixed conifer forest. All of these systems are restricted to the Southwest in the United States, and consequently support a host of plant and animal species that are also restricted in their distribution and range. The health and ecological integrity of these systems and the species that inhabit them are currently being threatened, primarily by altered fire regimes. Madrean encinal woodland, semi-desert grassland, and Madrean pine-oak woodland depend upon the maintenance of low intensity, frequent fires. Over the past century, common management practices have excluded fire, which can result in catastrophic crown fires and changes in species composition of the system. Other threats, especially those to semi-desert grasslands, include drought and inappropriate grazing techniques.

The Lincoln National Forest manages a fairly large proportion of Madrean pine-oak woodland relative to other Region 3 Forests (19.5%) and other landowners throughout the Southwest (11.4%). Recently, the Madrean pine-oak woodland system was added to a list of global conservation “hotspots” by Conservation International (Conservation International 2005). These hotspots represent vegetation systems that are rich in biodiversity (at least 1,500 plant species) and have experienced at least a 70% loss in total area. The Madrean pine-oak woodland system spans 178,095 square miles and harbors approximately 3,975 flowering plant species throughout its range. This system remains intact within less than 20% of the area of its historical range (Conservation International 2005). It is not clear if the historical range of Madrean pine-oak woodland on the Lincoln National Forest is currently diminishing; however, fire has largely been excluded for some time on the Forest and is an important natural disturbance that maintains essential ecological processes. Implementing appropriate disturbance regimes may allow the Lincoln an opportunity to preserve a large portion of this system throughout the Southwest, while preserving its ecological integrity.

### *Species Richness and Conservation Status*

The R3 Species Database includes conservation status information for 531 species that inhabit the Lincoln National Forest. Because the database is not comprehensive for plants and invertebrates, this does not represent the overall diversity of the Forest. However, the database does serve as a useful tool for identifying species that might, because of their conservation status, need to be addressed within forest planning. For example, the Lincoln manages 8 federally endangered, threatened, candidate or proposed species. Furthermore, the Lincoln manages 23 species listed by the state of New Mexico as threatened or endangered; 79 species with NatureServe global rankings that warrant conservation concern; 80 species with NatureServe national rankings that warrant conservation concern; and 121 species with NatureServe state rankings that warrant conservation concern.

Seventy-four potential species-of-concern were identified. Species-of-concern are those for which ‘management actions may be necessary to prevent listing under the Endangered Species Act’ according to forest planning directives. An additional 86 species were identified as potential species-of-interest, which, according to the directives, are species for which ‘management actions may be necessary or desirable to achieve ecological or other multiple-use objectives.’ Overall, almost one-third (31.3%) of all species that are known to inhabit Lincoln National Forest were identified as species that might need to be considered within Forest planning.

As habitat loss and degradation is a major threat for many species of conservation concern, maintaining healthy vegetation systems that support these species should be an important component in sustaining viable species populations on the Lincoln National Forest. The assessments in this report provide important information on the systems and locations on the Lincoln that are important for maintaining system and species diversity. For instance, the analysis of PNVTs highlighted the important vegetation systems that occur on the Lincoln, which include Madrean encinal woodlands, semi-desert grasslands, Madrean pine-oak, and mixed conifer forest. In addition, conservation areas, identified through ecoregional assessments, identify and delineate areas on the landscape that provide the greatest opportunity for sustaining these systems and species.

The Lincoln National Forest has significant areas of overlap with ecoregional conservation areas. All of the ranger districts on the Lincoln are overlapped by one or more conservation areas. These conservation areas include 69 conservation targets, including 60 individual species. The specific locations where conservation areas overlap the Lincoln highlight important places for the conservation of ecosystem and species diversity on the Forest and within the region. These areas of overlap represent the most viable locations on the Lincoln for sustaining the suite of species, ecological systems, and biological processes that are represented by the conservation targets associated with each conservation area that overlaps the Lincoln National Forest.

### *Relevance to Forest Planning*

This analysis of existing regional assessment information identifies important biological and ecological characteristics of the Lincoln National Forest. This information serves as an important baseline for addressing the ecological sustainability component of the forest plan process under the new National Forest Management Act planning regulations, both in terms of ecosystem and species diversity. It may also be useful in understanding the current condition of ecological resources on the Lincoln, identifying ecological characteristics that may be useful in defining desired future conditions, and identifying areas where changes in management may be necessary to sustain biodiversity. For example, the analysis of ecosystem data demonstrates the variety of systems that occur on the Lincoln, and identifies systems (and their associated species diversity) for which the Lincoln has disproportionate responsibility within the context of Region 3, such as mixed broadleaf deciduous riparian forest, Madrean pine-oak woodland, montane willow riparian forest, semi-desert grassland and Madrean encinal woodland.

Ecoregional assessments provide a strategic, regional perspective on maintaining biodiversity at large scales that may be useful in forest planning. The suite of conservation areas identified in

the ecoregional assessments represents the minimum area on the landscape needed to maintain the region's biodiversity and may serve as priority areas for considering the impacts of management on ecological sustainability. Used within a forest planning context, consideration of conservation areas incorporates, by default, a regional perspective on ecological sustainability and demonstrates consideration of sustainability issues at scales beyond Forest boundaries.

Within the forest planning framework, it may be useful to evaluate currently allowed land uses and activities within conservation areas and determine associated impacts to biodiversity. As an example, a synthesis of conservation area overlap with designated wilderness and inventoried roadless areas on the Lincoln demonstrates the variety of current management emphases and activities that occur within conservation areas. The largest proportion (76.1%) of conservation areas that overlap the Lincoln National Forest are not designated wilderness areas or inventoried roadless areas. For forest planning purposes, it may be useful to determine the compatibility of current forest structure and ecological processes within these overlap areas with Forest biodiversity goals, and identify management actions that may be needed to achieve sustainability. It is apparent that achieving biodiversity sustainability on the Lincoln must be accomplished within the varied uses and activities that occur on the Forest. Regardless of the types of land use considered, conservation areas provide a means to prioritize consideration of areas based on their importance to ecological sustainability.

While the above example focused on wilderness and roadless areas, it is important to note that conservation areas do not imply the need for special protections or blanket restrictions of activities. Rather, conservation areas can be viewed as priority areas, based on the large scale perspective of ecoregional assessments, for assessing the impacts of ongoing or planned uses and activities in regards to their compatibility with sustaining biodiversity at regional scales. To aid in these planning efforts, each conservation area has associated with it a suite of conservation targets (species, vegetation communities, and ecological systems, and features) that are representative of the biodiversity in that area. Evaluation of the environmental and ecological needs of these conservation targets, including both the habitats and ecological processes that support them, as well as identifying threats to their sustainability can be used to assess the compatibility of ongoing or planned activities in these areas.

For example, the Capitan Mountains conservation area encompasses 107,100 acres, of which 91,500 (85.4%) acres overlap the Smokey Bear Ranger District of the Lincoln National Forest. Nine conservation targets, including 7 individual species and 2 vegetation communities (see Appendix 15-C), are associated with the Capitan Mountains conservation area. These targets can be used as a tool to assess the compatibility of current or planned activities within the conservation area with sustainability goals. For example, it may be useful to evaluate current conditions of the forest communities within this conservation area relative to the historic range of variability and, if desired, identify potential changes in management that may move these systems to within historic ranges. Similarly, by identifying the ecological needs of species conservation targets and threats to their sustainability, the compatibility of current and future activities can be assessed. It may be useful to evaluate management prescriptions within the conservation area and if necessary, identify changes in allowed activities or uses that may reduce or mitigate these threats.



## References

- Conservation International. Obtained May 2005. [http://www.conservation.org/xp/Hotspots/pine\\_oak/](http://www.conservation.org/xp/Hotspots/pine_oak/).
- U.S. Geological Survey National Gap Analysis Program. 2004. Provisional Digital Land Cover Map for the Southwestern United States. Version 1.0. RS/GIS Laboratory, College of Natural Resources, Utah State University.

**Appendix 15-A.** Plants and animals of the Lincoln National Forest. Refer to Chapter 2 for more information on how the data was generated for this table. Also, see information regarding the R3 Species data base at [www.azconservation.org](http://www.azconservation.org).

NatureServe Scientific Name <sup>A</sup>	NatureServe Common Name <sup>A</sup>	Potential Species List <sup>B</sup>	G- rank	N-rank	NM S-rank	ESA Status <sup>C</sup>	NM State Status <sup>C</sup>	NM CWCS <sup>D</sup>	Birds of Conserv. Concern	Partners in Flight Watch List
<i>Ambystoma tigrinum</i>	Tiger Salamander	SOI	G5	N5	S5			X		
<i>Aneides hardii</i>	Sacramento Mtn. Salamander	SOC	G3	N3	S3		T	X		
<i>Bufo cognatus</i>	Great Plains Toad		G5	N5	S5					
<i>Bufo debilis insidiosus</i>	Western Green Toad		T5	N4	S4					
<i>Bufo punctatus</i>	Red-Spotted Toad		G5	N5	S5					
<i>Bufo speciosus</i>	Texas Toad		G5	N5	S3					
<i>Bufo woodhousii</i>	Woodhouse's Toad		G5	N5	S5					
<i>Rana berlandieri</i>	Rio Grande Leopard Frog	SOI	G5	N5	S3			X		
<i>Rana blairi</i>	Plains Leopard Frog	SOI	G5	N5	S4			X		
<i>Scaphiopus couchii</i>	Couch's Spadefoot		G5	N5	S5					
<i>Spea bombifrons</i>	Plains Spadefoot		G5	N5	S5					
<i>Spea multiplicata</i>	New Mexico Spadefoot		G5	N5	S5					
<i>Accipiter cooperii</i>	Cooper's Hawk		G5	N5B	S4B S4N					
<i>Accipiter gentilis</i>	Northern Goshawk	SOI	G5	N4B	S2B S2N			X		
<i>Accipiter striatus velox</i>	Sharp-Shinned Hawk		T5	N5B						
<i>Actitis macularia</i>	Spotted Sandpiper		G5	N5B	S4B S5N					
<i>Aechmophorus occidentalis</i>	Western Grebe		G5	N5B	S4B S5N					
<i>Aegolius acadicus acadicus</i>	Northern Saw-Whet Owl		TU	NNR						
<i>Aeronautes saxatalis</i>	White-Throated Swift		G5	N5B	S4B S4N					X
<i>Agelaius phoeniceus</i>	Red-Winged Blackbird		G5	N5	S5B S5N					
<i>Aimophila cassinii</i>	Cassin's Sparrow	SOI	G5	N4N	S5B S5N				X	
<i>Aimophila ruficeps</i>	Rufous-Crowned Sparrow		G5	N5	S5B S5N					
<i>Aix sponsa</i>	Wood Duck		G5	N5B	S4B S4N					
<i>Ammodramus bairdii</i>	Baird's Sparrow	SOI	G4	N3B,N2N	S2N		T	X	X	X
<i>Amphispiza belli</i>	Sage Sparrow	SOI	G5	N5	S4B S4N			X	X	
<i>Amphispiza bilineata</i>	Black-Throated Sparrow		G5	N5	S5B S5N					
<i>Anas acuta</i>	Northern Pintail	SOI	G5	N5B	S4B S5N			X		

<sup>A</sup> NatureServe common and scientific names are used unless highlighted in bold.

<sup>B</sup> TE = Listed as Threatened or Endangered under the Endangered Species Act, SOC = potential species-of-concern, SOI = potential species-of-interest

<sup>C</sup> T = Threatened, E = Endangered, C = Candidate

<sup>D</sup> Listed as priority species in the New Mexico Comprehensive Wildlife Conservation Strategy

NatureServe Scientific Name <sup>A</sup>	NatureServe Common Name <sup>A</sup>	Potential Species List <sup>B</sup>	G- rank	N-rank	NM S-rank	ESA Status <sup>C</sup>	NM State Status <sup>C</sup>	NM CWCS <sup>D</sup>	Birds of Conserv. Concern	Partners in Flight Watch List
<i>Anas americana</i>	American Wigeon		G5	N5B	S4B S5N					
<i>Anas clypeata</i>	Northern Shoveler		G5	N5B	S4B S5N					
<i>Anas crecca</i>	Green-Winged Teal		G5	N5B	S4B S5N					
<i>Anas cyanoptera</i>	Cinnamon Teal		G5	N5B	S4B S5N					
<i>Anas discors</i>	Blue-Winged Teal		G5	N5B	S4B S5N					
<i>Anas platyrhynchos</i>	Mallard		G5	N5B	S5B S5N					
<i>Anas strepera</i>	Gadwall		G5	N5B	S4B S5N					
<i>Anthus rubescens</i>	American Pipit		G5	N5B	S4B S5N					
<i>Anthus spragueii</i>	Sprague's Pipit	SOI	G4	N4B	S2N			X	X	X
<i>Aphelocoma californica</i>	Western Scrub-Jay		G5	N5	S5B S5N					
<i>Aquila chrysaetos</i>	Golden Eagle	SOI	G5	N5B	S4B S4N			X		
<i>Archilochus alexandri</i>	Black-Chinned Hummingbird		G5	N5B	S5B S5N					
<i>Ardea alba egretta</i>	Great Egret		TNR	NNR						
<i>Ardea herodias</i>	Great Blue Heron		G5	N5B	S4B S5N					
<i>Asio flammeus</i>	Short-Eared Owl	SOI	G5	N5B	S2N					X
<i>Asio otus</i>	Long-Eared Owl		G5	N5B	S4B S4N					
<i>Auriparus flaviceps</i>	Verdin		G5	N5	S4B S4N					
<i>Aythya affinis</i>	Lesser Scaup Duck		G5	N5B	S4B S5N					
<i>Aythya americana</i>	Redhead		G5	N5B	S4B S5N					
<i>Aythya collaris</i>	Ring-Necked Duck	SOI	G5	N5B	S1B S5N					
<i>Aythya valisineria</i>	Canvasback Duck		G5	N5B	S4B S4N					
<i>Baeolophus ridgwayi</i>	Juniper Titmouse	SOI	G5	N5	S5B			X		
<i>Bombycilla cedrorum</i>	Cedar Waxwing		G5	N5	S5N					
<i>Botaurus lentiginosus</i>	American Bittern	SOI	G4	N4B	S3B S4N			X		
<i>Branta canadensis</i>	Canada Goose		G5	N5B	S4B S5N					
<i>Bubo virginianus</i>	Great-Horned Owl		G5	N5	S5B S5N					
<i>Bubulcus ibis</i>	Cattle Egret		G5	N5B	S3B S4N					
<i>Bucephala albeola</i>	Bufflehead		G5	N5B	S5N					
<i>Bucephala clangula</i>	Common Goldeneye		G5	N5B	S5N					
<i>Buteo albonotatus</i>	Zone-Tailed Hawk		G4	N4B	S3B S3N					
<i>Buteo jamaicensis</i>	Red-Tailed Hawk		G5	N5B	S5B S5N					
<i>Buteo lagopus</i>	Rough-Legged Hawk		G5	N5B	S4N					
<i>Buteo swainsoni</i>	Swainson's Hawk		G5	N5B	S4B S4N					X
<i>Butorides virescens</i>	Green Heron		G5	N5B	S4B S4N					

NatureServe Scientific Name <sup>A</sup>	NatureServe Common Name <sup>A</sup>	Potential Species List <sup>B</sup>	G- rank	N-rank	NM S-rank	ESA Status <sup>C</sup>	NM State Status <sup>C</sup>	NM CWCS <sup>D</sup>	Birds of Conserv. Concern	Partners in Flight Watch List
<i>Calamospiza melanocorys</i>	Lark Bunting	SOI	G5	N5B	S4B S5N				X	
<i>Calcarius mccownii</i>	Mccown's Longspur		G4	N4B	S4N					X
<i>Calcarius ornatus</i>	Chestnut-Collared Longspur		G5	N5B	S5N					
<i>Calidris minutilla</i>	Least Sandpiper		G5	N5B	S4N					
<i>Callipepla gambelii</i>	Gambel's Quail		G5	N5	S5B S5N					
<i>Callipepla squamata</i>	Scaled Quail	SOI	G5	N5	S5B S5N			X		X
<i>Calypte anna</i>	Anna's Hummingbird		G5	N5	S3N					
<i>Campylorhynchus brunneicapillus</i>	Cactus Wren		G5	N5	S5B S5N					
<i>Caprimulgus vociferus</i>	Whip-Poor-Will		G5	N5B,NNRN	S4B S4N					
<i>Cardellina rubrifrons</i>	Red-Faced Warbler	SOI	G5	N4B	S4B S4N			X	X	X
<i>Cardinalis sinuatus</i>	Pyrrhuloxia		G5	N5	S5B S5N					
<i>Carduelis pinus</i>	Pine Siskin		G5	N5	S5B S5N					
<i>Carduelis psaltria</i>	Lesser Goldfinch		G5	N5	S5B S5N					
<i>Carduelis tristis</i>	American Goldfinch		G5	N5	S4B S5N					
<i>Carpodacus cassinii</i>	Cassin's Finch		G5	N5	S4B S5N					
<i>Carpodacus mexicanus</i>	House Finch		G5	N5	S5B S5N					
<i>Cathartes aura</i>	Turkey Vulture		G5	N5B	S5B S5N					
<i>Catharus guttatus</i>	Hermit Thrush		G5	N5	S5B S5N					
<i>Catharus ustulatus</i>	Swainson's Thrush		G5	N5B	S3B S4N					
<i>Catherpes mexicanus</i>	Canyon Wren		G5	N5	S5B S5N					
<i>Certhia americana</i>	Brown Creeper		G5	N5	S5B S5N					
<i>Ceryle alcyon</i>	Belted Kingfisher		G5	N5B	S4B S4N					
<i>Charadrius vociferus</i>	Killdeer		G5	N5B	S5B S5N					
<i>Chen caerulescens</i>	Snow Goose		G5	N5B	S5N					
<i>Chen rossii</i>	Ross's Goose		G4	N4N	S4N					
<i>Chondestes grammacus</i>	Lark Sparrow		G5	N5B	S5B S4N					
<i>Chordeiles acutipennis</i>	Lesser Nighthawk		G5	N5B	S5B S5N					
<i>Chordeiles minor</i>	Common Nighthawk		G5	N5B	S5B S5N					
<i>Cinclus mexicanus</i>	American Dipper		G5	N5	S4B S4N					
<i>Circus cyaneus</i>	Northern Harrier	SOI	G5	N5B	S2B S5N			X	X	
<i>Cistothorus palustris</i>	Marsh Wren	SOI	G5	N5B	S1B S5N					
<i>Coccothraustes vespertinus</i>	Evening Grosbeak		G5	N5	S4B S4N					
<i>Coccyzus americanus</i>	Western Yellow-Billed Cuckoo	SOC	T2	N3B	S4B S4N	C		X	X	

NatureServe Scientific Name <sup>A</sup>	NatureServe Common Name <sup>A</sup>	Potential Species List <sup>B</sup>	G- rank	N-rank	NM S-rank	ESA Status <sup>C</sup>	NM State Status <sup>C</sup>	NM CWCS <sup>D</sup>	Birds of Conserv. Concern	Partners in Flight Watch List
<i>occidentalis</i>										
<i>Colaptes auratus</i>	Northern Flicker		G5	N5B	S5B S5N					
<i>Columba livia</i>	Rock Dove		G5	NNA	SNA					
<i>Columbina inca</i>	Inca Dove		G5	N5	S4B S4N					
<i>Columbina passerina</i>	Common Ground-Dove	SOI	G5	N5	S1B S1N		E	X		
<i>Contopus cooperi</i>	Olive-Sided Flycatcher	SOI	G4	N4B	S4B S4N			X		X
<i>Contopus sordidulus</i>	Western Wood-Pewee		G5	N5B	S5B S5N					
<i>Corvus brachyrhynchos</i>	American Crow		G5	N5B	S5B S5N					
<i>Corvus corax</i>	Common Raven		G5	N5	S5B S5N					
<i>Corvus cryptoleucus</i>	Chihuahuan Raven		G5	N5B	S5B S5N					
<i>Cyanocitta stelleri</i>	Steller's Jay		G5	N5	S5B S5N					
<i>Cyrtonyx montezumae</i>	Montezuma Quail	SOI	G4	N4	S3B S3N			X		X
<i>Dendroica coronata</i>	Yellow-Rumped Warbler		G5	N5B	S5B S5N					
<i>Dendroica graciae</i>	Grace's Warbler	SOI	G5	N5B	S5B S5N			X	X	X
<i>Dendroica magnolia</i>	Magnolia Warbler	SOI	G5	N5B	S2N					
<i>Dendroica nigrescens</i>	Black-Throated Gray Warbler	SOI	G5	N5B	S4B S4N			X	X	
<i>Dendroica petechia</i>	Yellow Warbler	SOI	G5	N5B	S4B S5N			X		
<i>Dendroica townsendi</i>	Townsend's Warbler		G5	N5B	S4N					
<i>Dumetella carolinensis</i>	Gray Catbird		G5	N5B	S4B S4N					
<i>Egretta caerulea</i>	Little Blue Heron	SOI	G5	N5B	S2B S4N					
<i>Egretta thula</i>	Snowy Egret		G5	N5B	S4B S4N					
<i>Empidonax hammondi</i>	Hammond's Flycatcher		G5	N5B	S4B S4N					
<i>Empidonax oberholseri</i>	Dusky Flycatcher		G5	N5B	S4B S4N					
<i>Empidonax occidentalis</i>	Cordilleran Flycatcher		G5	N5B	S5B S5N					
<i>Empidonax wrightii</i>	Gray Flycatcher		G5	N5B	S4B S4N					
<i>Eremophila alpestris</i>	Horned Lark		G5	N5B	S5B S5N					
<i>Eugenes fulgens</i>	Magnificent Hummingbird		G5	N4B	S4B S4N					
<i>Euphagus cyanocephalus</i>	Brewer's Blackbird		G5	N5B	S5B S5N					
<i>Falco columbarius</i>	Merlin		G5	N4B	S4N					
<i>Falco mexicanus</i>	Prairie Falcon		G5	N5B	S4B S4N					
<i>Falco peregrinus anatum</i>	American Peregrine Falcon	SOC	T3	N3B	S2B S3N		T	X	X	
<i>Falco sparverius</i>	American Kestrel		G5	N5B	S5B S5N					
<i>Fulica americana</i>	American Coot		G5	N5B	S5B S5N					
<i>Gallinago delicata</i>	Wilson's Snipe	SOI	G5	N5B	S2B S5N					

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<i>Gallinula chloropus</i>	Common Moorhen		G5	N5B	S4B S4N					
<i>Gavia immer</i>	Common Loon		G5	N4B,N5N	S4N					
<i>Geococcyx californianus</i>	Greater Roadrunner		G5	N5	S5B S5N					
<i>Geothlypis trichas</i>	Common Yellowthroat		G5	N5	S4B S4N					
<i>Glaucidium gnoma californicum</i>	Northern Pygmy Owl		T4	N4N5						
<i>Grus canadensis</i>	Sandhill Crane	SOI	G5	N5B	S4N			X		
<i>Gymnorhinus cyanocephalus</i>	Pinyon Jay	SOI	G5	N5	S3B S3N			X		X
<i>Haliaeetus leucocephalus</i>	Bald Eagle	TE	G4	N5B	S1B S3N	T	T	X		
<i>Himantopus mexicanus</i>	Black-Necked Stilt		G5	N5B	S4B S4N					
<i>Hirundo rustica</i>	Barn Swallow		G5	N5B	S5B S5N					
<i>Icteria virens</i>	Yellow-Breasted Chat		G5	N5B	S4B S4N					
<i>Icterus bullockii</i>	Bullock's Oriole		G5	N5B	S5B					
<i>Icterus parisorum</i>	Scott's Oriole		G5	N5B	S5B S5N					
<i>Ictinia mississippiensis</i>	Mississippi Kite	SOI	G5	N5B	S2B S3N					
<i>Junco hyemalis</i>	Dark-Eyed Junco		G5	N5	S5B S5N					
<i>Lampornis clemenciae</i>	Blue-Throated Hummingbird	SOI	G5	N3B	S2B S2N					
<i>Lanius ludovicianus</i>	Loggerhead Shrike	SOI	G4	N4	S4B S4N			X	X	
<i>Limnodromus scolopaceus</i>	Long-Billed Dowitcher		G5	N5B	S5N					
<i>Lophodytes cucullatus</i>	Hooded Merganser	SOI	G5	N5B	S1B S4N					
<i>Loxia curvirostra</i>	Red Crossbill		G5	N5	S4B S4N					
<i>Megascops kennicottii</i>	Western Screech Owl		G5	N5	S4B S4N					
<i>Melanerpes formicivorus</i>	Acorn Woodpecker		G5	N5	S4B S4N					
<i>Meleagris gallopavo</i>	Wild Turkey	SOI	G5	N5	S5B S5N		T			
<i>Melospiza georgiana</i>	Swamp Sparrow		G5	N5B	S4N					
<i>Melospiza lincolnii</i>	Lincoln's Sparrow		G5	N5B	S4B S5N					
<i>Melospiza melodia</i>	Song Sparrow		G5	N5	S4B S5N					
<i>Mergus merganser</i>	Common Merganser Duck		G5	N5B	S3B S5N					
<i>Micrathene whitneyi</i>	Elf Owl	SOI	G5	N5B	S4B S4N			X	X	X
<i>Mimus polyglottos</i>	Northern Mockingbird		G5	N5	S5B S5N					
<i>Mniotilta varia</i>	Black-And-White Warbler		G5	N5B,N4N5N	S4N					
<i>Molothrus aeneus</i>	Bronzed Cowbird		G5	N4N5N,N5B	S4B S4N					
<i>Molothrus ater</i>	Brown-Headed Cowbird		G5	N5	S5B S5N					
<i>Myadestes townsendi</i>	Townsend's Solitaire		G5	N5	S5B S5N					
<i>Myiarchus cinerascens</i>	Ash-Throated Flycatcher		G5	N5B	S5B S5N					

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<i>Myioborus miniatus</i>	<b>Slate-Throated Redstart</b>									
<i>Myioborus pictus</i>	Painted Redstart	SOI	G5	N4B	S4B S4N			X		
<i>Nucifraga columbiana</i>	Clark's Nutcracker		G5	N5	S4B S4N					
<i>Nycticorax nycticorax</i>	Black-Crowned Night Heron		G5	N5B	S4B S4N					
<i>Oporornis tolmiei</i>	Macgillivray's Warbler		G5	N5B	S5B S5N					
<i>Oreoscoptes montanus</i>	Sage Thrasher	SOI	G5	N5B	S4B S5N			X		
<i>Otus flammeolus</i>	Flammulated Owl	SOI	G4	N4B	S4B S4N				X	X
<i>Oxyura jamaicensis</i>	Ruddy Duck		G5	N5B	S4B S5N					
<i>Pandion haliaetus</i>	Osprey	SOI	G5	N5B	S1B S4N			X		
<i>Parabuteo unicinctus</i>	Harris's Hawk		G5	N5	S3B S3N					
<i>Passer domesticus</i>	House Sparrow		G5	NNA	SNA					
<i>Passerculus sandwichensis</i>	Savannah Sparrow		G5	N5B	S3B S5N					
<i>Passerella iliaca</i>	Fox Sparrow		G5	N5B	S4N					
<i>Passerina amoena</i>	Lazuli Bunting		G5	N5B	S5B S5N					
<i>Passerina caerulea</i>	Blue Grosbeak		G5	N5B	S5B S5N					
<i>Passerina cyanea</i>	Indigo Bunting		G5	N5B	S5B S5N					
<i>Passerina versicolor</i>	Varied Bunting	SOI	G5	N4B	S1B S1N		T	X		X
<i>Patagioenas fasciata</i>	Band-Tailed Pigeon	SOI	G4	N4B	S4B S4N			X		X
<i>Petrochelidon fulva</i>	Cave Swallow		G5	N4B	S3B S3N					
<i>Petrochelidon pyrrhonota</i>	Cliff Swallow		G5	N5B	S5B S5N					
<i>Phainopepla nitens</i>	Phainopepla		G5	N5	S4B S4N					
<i>Phalaenoptilus nuttallii</i>	Common Poorwill		G5	N5B	S5B S5N					
<i>Pheucticus ludovicianus</i>	Rose-Breasted Grosbeak		G5	N5B	S4N					
<i>Pheucticus melanocephalus</i>	Black-Headed Grosbeak		G5	N5B	S5B S5N					
<i>Picoides dorsalis</i>	American Three-Toed Woodpecker			N5	S3B S3N					
<i>Picoides pubescens</i>	Downy Woodpecker		G5	N5	S5B S5N					
<i>Picoides scalaris</i>	Ladder-Backed Woodpecker		G5	N5	S5B S5N					
<i>Picoides villosus</i>	Hairy Woodpecker	G5	G5	N5	S5B S5N					
<i>Pinicola enucleator</i>	Pine Grosbeak	SOI	G5	N5	S2B S3N					
<i>Pipilo chlorurus</i>	Green-Tailed Towhee		G5	N5B	S4B S4N					
<i>Pipilo erythrophthalmus</i>	Eastern Towhee		G5	N5						
<i>Pipilo fuscus</i>	Canyon Towhee		G5	N5	S5B S5N					
<i>Pipilo maculatus</i>	Spotted Towhee		G5	N5	S5B S5N					

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<i>Piranga flava</i>	Hepatic Tanager		G5	N5B	S5B S5N					
<i>Piranga ludoviciana</i>	Western Tanager		G5	N5B	S5B S5N					
<i>Piranga rubra</i>	Summer Tanager		G5	N5B	S5B S5N					
<i>Plegadis chihi</i>	White-Faced Ibis	SOI	G5	N4B	S1B S4N			X		
<i>Podiceps nigricollis</i>	Eared Grebe	SOI	G5	N5B	S4B S5N			X		
<i>Podilymbus podiceps</i>	Pied-Billed Grebe		G5	N5B	S5B S5N					
<i>Poecile gambeli</i>	Mountain Chickadee		G5	N5	S5B S5N					
<i>Poliophtila caerulea</i>	Blue-Gray Gnatcatcher		G5	N5B	S4B S4N					
<i>Poliophtila melanura</i>	Black-Tailed Gnatcatcher		G5	N5	S3B S3N					
<i>Pooecetes gramineus</i>	Vesper Sparrow		G5	N5B	S5B S4N					
<i>Porzana carolina</i>	Sora		G5	N5B	S4B S4N					
<i>Progne subis</i>	Purple Martin		G5	N5B	S4B S4N					
<i>Psaltiriparus minimus</i>	Bushtit		G5	N5	S5B S5N					
<i>Pyrocephalus rubinus</i>	Vermilion Flycatcher		G5	N5B	S4B S4N					
<i>Quiscalus mexicanus</i>	Great-Tailed Grackle		G5	N5	S5B S5N					
<i>Quiscalus quiscula</i>	Common Grackle		G5	N5	S5B S5N					
<i>Rallus limicola</i>	Virginia Rail		G5	N5B	S4B S4N					
<i>Recurvirostra americana</i>	American Avocet		G5	N5B	S4B S4N					
<i>Regulus calendula</i>	Ruby-Crowned Kinglet		G5	N5B	S5B S5N					
<i>Regulus satrapa</i>	Golden-Crowned Kinglet		G5	N5	S4B S4N					
<i>Riparia riparia</i>	Bank Swallow	SOI	G5	N5B	S4B S5N			X		
<i>Salpinctes obsoletus</i>	Rock Wren		G5	N5	S5B S5N					
<i>Sayornis nigricans</i>	Black Phoebe		G5	N5	S5B S5N					
<i>Sayornis phoebe</i>	Eastern Phoebe		G5	N5B	S3B S4N					
<i>Sayornis saya</i>	Say's Phoebe		G5	N4N	S5B S4N					
<i>Seiurus noveboracensis</i>	Northern Waterthrush		G5	N5B	S4N					
<i>Selasphorus platycercus</i>	Broad-Tailed Hummingbird		G5	N5B	S4B S4N					
<i>Selasphorus rufus</i>	Rufous Hummingbird		G5	N5B	S5N					X
<i>Setophaga ruticilla</i>	American Redstart		G5	N5B	S4N					
<i>Sialia currucoides</i>	Mountain Bluebird		G5	N5	S5B S5N					
<i>Sialia mexicana</i>	Western Bluebird		G5	N5	S5B S5N					
<i>Sialia sialis</i>	Eastern Bluebird	SOI	G5	N5B	S1B S5N					
<i>Sitta canadensis</i>	Red-Breasted Nuthatch		G5	N5	S4B S4N					
<i>Sitta carolinensis</i>	White-Breasted Nuthatch		G5	N5	S5B S5N					



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<i>Sitta pygmaea</i>	Pygmy Nuthatch		G5	N5	S5B S5N					
<i>Sphyrapicus nuchalis</i>	Red-Naped Sapsucker		G5	N5B	S5B S5N					
<i>Sphyrapicus thyroideus</i>	Williamson's Sapsucker	SOI	G5	N5B	S5B S5N			X		
<i>Sphyrapicus varius</i>	Yellow-Bellied Sapsucker			N5B	S4N					
<i>Spizella atrogularis</i>	Black-Chinned Sparrow	SOI	G5	N5	S4B S4N				X	X
<i>Spizella pallida</i>	Clay-Colored Sparrow		G5	N4N5B	S4N					
<i>Spizella passerina</i>	Chipping Sparrow	G5	G5	N5B	S5B S5N					
	Northern Rough-Winged									
<i>Stelgidopteryx serripennis</i>	Swallow		G5	N5B	S4B S5N					
<i>Stellula calliope</i>	Calliope Hummingbird		G5	N5B	S4N					X
<i>Strix occidentalis lucida</i>	Mexican Spotted Owl	TE	T3	N3	S2B S2N	T		X		
<i>Sturnella magna</i>	Eastern Meadowlark		G5	N5	S5B S5N					
<i>Sturnella neglecta</i>	Western Meadowlark		G5	N5	S5B S5N					
<i>Sturnus vulgaris</i>	European Starling		G5	NNA	SNA					
<i>Tachycineta bicolor</i>	Tree Swallow		G5	N5B	S4B S4N					
<i>Tachycineta thalassina</i>	Violet-Green Swallow		G5	N5B	S5B S5N					
<i>Thryomanes bewickii</i>	Bewick's Wren		G5	N5B	S5B S5N					
<i>Toxostoma crissale</i>	Crissal Thrasher	SOI	G5	N5	S5B S5N				X	
<i>Toxostoma curvirostre</i>	Curve-Billed Thrasher		G5	N5	S5B S5N					
<i>Tringa flavipes</i>	Lesser Yellowlegs		G5	N5B	S5N					
<i>Tringa melanoleuca</i>	Greater Yellowlegs		G5	N5B	S5N					
<i>Troglodytes aedon</i>	House Wren		G5	N5B	S5B S5N					
<i>Turdus migratorius</i>	American Robin		G5	N5	S5B S5N					
<i>Tyrannus verticalis</i>	Western Kingbird		G5	N5B	S5B S5N					
<i>Tyrannus vociferans</i>	Cassin's Kingbird		G5	N5B	S5B S5N					
<i>Tyto alba</i>	Barn Owl		G5	N5	S4B S4N					
<i>Vermivora celata</i>	Orange-Crowned Warbler		G5	N5B	S4B S5N					
<i>Vermivora luciae</i>	Lucy's Warbler	SOI	G5	N5B	S4B S4N			X		
<i>Vermivora peregrina</i>	Tennessee Warbler		G5	N5B	S3N					
<i>Vermivora ruficapilla</i>	Nashville Warbler		G5	N5B	S4N					
<i>Vermivora virginiae</i>	Virginia's Warbler		G5	N5B	S4B S4N					X
<i>Vireo bellii arizonae</i>	Arizona Bell's Vireo	SOI	T4	N4B	S2B S2N				X	
<i>Vireo gilvus</i>	Warbling Vireo		G5	N5B	S5B S5N					
<i>Vireo olivaceus</i>	Red-Eyed Vireo		G5	N5B	S3N					

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<i>Vireo plumbeus</i>	Plumbeus Vireo		G5	N5B	S5B S5N					
<i>Vireo vicinior</i>	Gray Vireo	SOI	G4	N4B	S4B S3N		T	X	X	X
<i>Wilsonia pusilla</i>	Wilson's Warbler		G5	N5B	S4B S5N					
<i>Xanthocephalus xanthocephalus</i>	Yellow-Headed Blackbird		G5	N5B	S4B S5N					
<i>Zenaida asiatica</i>	White-Winged Dove		G5	N5	S4B S4N					
<i>Zenaida macroura</i>	Mourning Dove	SOI	G5	N5	S5B S5N			X		
<i>Zonotrichia albicollis</i>	White-Throated Sparrow		G5	N5B	S4N					
<i>Zonotrichia leucophrys</i>	White-Crowned Sparrow		G5	N5B	S5B S5N					
<i>Popenaias popeii</i>	Texas Hornshell	SOC	G1	N1	S1	C	E	X		
<i>Stygobromus arizonensis</i>	<b>Fairy Shrimp</b>	SOI		N2N3				X		
<i>Etheostoma lepidum</i>	Greenthroat Darter	SOC	G3	N3	S2		T	X		
<i>Gila pandora</i>	Rio Grande Chub	SOC	G3	N3	S3			X		
<i>Ictalurus lupus</i>	Headwater Catfish	SOC	G3	N2	S1			X		
<i>Oncorhynchus clarkii virginalis</i>	Rio Grande Cutthroat Trout	SOC	T3	N2	S2			X		
<i>Rhinichthys cataractae</i>	Longnose Dace		G5	N5	SNA					
<i>Aeshna dugesi</i>	Arroyo Darner	SOI	G4	N2N3	SNR			X		
<i>Agathymus neumogeni</i>	Orange Giant Skipper		G4	N4N5	SNR					
<i>Amblycheila picolominii</i>	Plateau Giant Tiger Beetle	SOC	G3	N3	SNR					
	Guadalupe Mountains Tiger Beetle									
<i>Cicindela politula petrophila</i>	Beetle	SOC	T3	N3	SNR			X		
<i>Euphydryas chalcedona cloudcrofti</i>	Chalcedon Checkerspot	SOC	T1	N1	SNR			X		
<i>Megathymus ursus violae</i>	Viola Yucca Borer	SOC	T3	N3	SNR					
<i>Satyrium polingi</i>	Poling's Hairstreak	SOC	G2	N1	SNR			X		
<i>Ammospermophilus interpres</i>	Texas Antelope Squirrel		G4	N4N5	S3					
<i>Antilocapra americana</i>	Pronghorn		G5	N5	S5					
<i>Antrozous pallidus</i>	Pallid Bat		G5	N5	S5					
<i>Bassariscus astutus</i>	Ringtail		G5	N5	S4					
<i>Canis latrans</i>	Coyote		G5	N5	S5					
<i>Castor canadensis</i>	American Beaver	SOI	G5	N5	S3			X		
<i>Cervus canadensis nelsoni</i>	Rocky Mountain Elk		T5	N5						
	Chihuahuan Desert Pocket Mouse									
<i>Chaetodipus eremicus</i>	Mouse		G5	N5	S4					
<i>Chaetodipus intermedius intermedius</i>	Rock Pocket Mouse		T5	N5						

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<i>Chaetodipus penicillatus</i>	Desert Pocket Mouse		G5	N5	S4					
<i>Conepatus leuconotus</i>	White-backed Hog-Nosed Skunk	SOI	G4	N3	S2S3					
<i>Corynorhinus townsendii</i>	Townsend's Big-Eared Bat			N4	S3					
<i>Corynorhinus townsendii pallascens</i>	Pale Lump-nosed Bat		T4	N4	S3					
<i>Cratogeomys castanops</i>	Yellow-Faced Pocket Gopher	SOI	G4	N5	S2					
<i>Cynomys ludovicianus</i>	Black-Tailed Prairie Dog	SOC	G3	N3N4	S2?			X		
<i>Dipodomys merriami</i>	Merriam's Kangaroo Rat		G5	N5	S5					
<i>Dipodomys ordii</i>	Ord's Kangaroo Rat		G5	N5	S5					
<i>Dipodomys spectabilis baileyi</i>	New Mexico Banner-Tailed Kangaroo Rat			N4	S4					
<i>Eptesicus fuscus</i>	Big Brown Bat		G5	N5	S5					
<i>Erethizon dorsatum</i>	North American Porcupine		G5	N5	S5					
<i>Euderma maculatum</i>	Spotted Bat	SOI	G4	N3N4	S3		T	X		
<i>Lasionycteris noctivagans</i>	Silver-Haired Bat		G5	N5	S5					
<i>Lasiurus borealis</i>	Eastern Red Bat		G5	N5						
<i>Lasiurus cinereus</i>	Hoary Bat		G5	N5	S3N					
<i>Lepus californicus</i>	Black-Tailed Jack Rabbit		G5	N5	S5					
<i>Lynx rufus</i>	Bobcat		G5	N5	S4					
<i>Mephitis macroura</i>	Hooded Skunk	SOI	G5	N4	S2					
<i>Mephitis mephitis</i>	Striped Skunk		G5	N5	S5					
<i>Microtus longicaudus</i>	Long-Tailed Vole		G5	N5	S4					
<i>Microtus mogollonensis</i>	Mogollon Vole		G4	N5						
<i>Mus musculus</i>	House Mouse		G5	NNA	SNA					
<i>Mustela frenata</i>	Long-Tailed Weasel		G5	N5	S4					
<i>Myocastor coypus</i>	Nutria		G5	NNA	SNR					
<i>Myotis auriculus</i>	Southwestern Myotis		G5	N4	S4					
<i>Myotis californicus</i>	California Myotis Bat		G5	N5	S5					
<i>Myotis ciliolabrum</i>	Western Small-Footed Myotis Bat		G5	N5	S5					
<b><i>Myotis ciliolabrum melanorhinus</i></b>	<b>Western Small Footed Myotis</b>									
<i>Myotis occultus</i>	Occult Little Brn. Myotis Bat	SOC	G3	N3N4	S3					
<i>Myotis thysanodes</i>	Fringed Myotis Bat		G4	N4N5	S5					
<b><i>Myotis thysanodes thysanodes</i></b>	<b>Fringe-tailed Myotis</b>									

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<i>Myotis velifer</i>	Cave Myotis Bat		G5	N4	S4					
<i>Myotis volans interior</i>	Long-legged Myotis									
<i>Myotis yumanensis</i>	Yuma Myotis Bat		G5	N5	S5					
<i>Myotis yumanensis yumanensis</i>										
<i>Neotamias minimus arizonensis</i>	White Mountains Least Chipmunk									
<i>Neotamias minimus atristriatus</i>	Penasco Least Chipmunk									
<i>Neotoma albigula</i>	Woodrat		G5	N5	S5					
<i>Neotoma mexicana</i>	Mexican Wood Rat		G5	N5	S5					
<i>Neotoma micropus</i>	Southern Plains Wood Rat		G5	N5	S5					
<i>Notiosorex crawfordi</i>	Crawford's Desert Shrew		G5	N5	S4					
<i>Nyctinomops macrotis</i>	Big Free-Tailed Bat	SOI	G5	N3N4	S2					
<i>Odocoileus hemionus</i>	Mule Deer	SOI	G5	N5	S5			X		
<i>Odocoileus virginianus</i>	White-Tailed Deer		G5	N5	S4					
<i>Ondatra zibethicus</i>	Muskrat		G5	N5	S4					
<i>Onychomys arenicola</i>	Mearn's Grasshopper Mouse		G4	N4N5	S3					
<i>Onychomys leucogaster</i>	Northern Grasshopper Mouse		G5	N5	S5					
<i>Onychomys torridus</i>	Southern Grasshopper Mouse		G5	N5	S4					
<i>Perognathus flavus</i>	Silky Pocket Mouse		G5	N5	S5					
<i>Peromyscus boylii</i>	Brush Mouse		G5	N5	S5					
<i>Peromyscus eremicus</i>	Cactus Mouse		G5	N5	S5					
<i>Peromyscus leucopus</i>	White-Footed Mouse		G5	N5	S5					
<i>Peromyscus maniculatus</i>	Deer Mouse		G5	N5	S5					
<i>Peromyscus nasutus</i>	Northern Rock Mouse		G5	N5	S4					
<i>Peromyscus pectoralis</i>	White-Ankled Mouse	SOI	G5	N5	S1					
<i>Peromyscus truei</i>	Pinyon Mouse		G5	N5	S5					
<i>Pipistrellus hesperus</i>	Western Pipistrelle		G5	N5	S5					
<i>Procyon lotor</i>	Northern Raccoon		G5	N5	S4					
<i>Puma concolor</i>	Puma	SOI	G5	N5	S3?			X		
<i>Reithrodontomys megalotis</i>	Western Harvest Mouse		G5	N5	S5					
<i>Reithrodontomys montanus</i>	Plains Harvest Mouse		G5	N5	S4					
<i>Sigmodon hispidus</i>	Hispid Cotton Rat		G5	N5	S5					
<i>Sorex monticolus</i>	Montane Shrew		G5	N5	S4					

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<i>Sorex nanus</i>	Dwarf Shrew	SOI	G4	N4	S2					
<i>Spermophilus spilosoma</i>	Spotted Ground Squirrel		G5	N5	S5					
<i>Spermophilus tridecemlineatus</i>	Thirteen-Lined Ground Squirrel		G5	N5	S4					
<i>Spermophilus tridecemlineatus monticola</i>	White-Mountain Ground Squirrel	SOC	T3	N3						
<i>Spermophilus variegatus</i>	Rock Squirrel		G5	N5	S5					
<i>Spilogale gracilis</i>	Western Spotted Skunk		G5	N5	S4					
<i>Sylvilagus audubonii</i>	Desert Cottontail		G5	N5	S5					
<i>Sylvilagus floridanus</i>	Eastern Cottontail		G5	N5	S4					
<i>Sylvilagus nuttallii pinetis</i>	Nuttall's Cottontail Rabbit		T5	N5						
<i>Tadarida brasiliensis</i>	Brazilian Free-Tailed Bat	SOI	G5	N5	S2					
<b><i>Tadarida brasiliensis mexicana</i></b>	<b>Mexican Free-tailed Bat</b>									
<i>Tamias minimus</i>	Least Chipmunk		G5	N5	S4					
<i>Tamias minimus atristriatus</i>	Penasco Chipmunk	SOC	T1	N1	S1		E	X		
<i>Tamiasciurus hudsonicus</i>	Red Squirrel		G5	N5	S5					
<i>Taxidea taxus</i>	American Badger		G5	N5	S4					
<i>Thomomys bottae</i>	Botta's Pocket Gopher		G5	N5	S5					
<i>Thomomys bottae guadalupensis</i>	Guadalupe Pocket Gopher	SOC	T2	N2	S1					
<i>Urocyon cinereoargenteus</i>	Gray Fox		G5	N5	S5					
<i>Ursus americanus</i>	Black Bear	SOI	G5	N5	S4			X		
<i>Vulpes macrotis</i>	Kit Fox		G4	N4	S4					
<i>Vulpes velox</i>	Swift Fox	SOC	G3	N3	S2			X		
<i>Zapus hudsonius luteus</i>	New Mexican Jumping Mouse	SOC	T2	N2	S2		T	X		
<i>Agastache pringlei</i> var. <i>verticillata</i>			T2	N2	S2					
<i>Allium gooddingii</i>	Goodding's Onion	SOI	G4	N4	S1		E			
<i>Anulocaulis leiosolenus</i> var. <i>howardii</i>	<b>Howard's Gyp Ringstem</b>	SOC	T2	NNR	SNR					
<i>Aquilegia chrysantha</i> var. <i>chaplinei</i>	<b>Chapline's Columbine</b>	SOC	T2	N2	S2					
<i>Argemone pleiacantha</i> ssp. <i>pinnatisecta</i>	Sacramento Prickly Poppy	TE	T2	N2	S2	E	E			
<i>Astragalus altus</i>	Winged Milkvetch	SOC	G2	N2	S2					
<i>Astragalus kerrii</i>	Kerr's Milkvetch	SOC	G2	N2	S2					
<i>Astragalus neomexicanus</i>	New Mexico Milkvetch	SOC	G3	N3	S3					
<i>Besseyia oblongifolia</i>	Egg-Leaf Coral-Drops	SOC	G2	N2	S2					

NatureServe Scientific Name <sup>A</sup>	NatureServe Common Name <sup>A</sup>	Potential Species List <sup>B</sup>	G- rank	N-rank	NM S-rank	ESA Status <sup>C</sup>	NM State Status <sup>C</sup>	NM CWCS <sup>D</sup>	Birds of Conserv. Concern	Partners in Flight Watch List
<i>Brickellia floribunda</i>	Chihuahuan Desert Brickell- Bush	SOC	G3	NNR	SNR					
<i>Brickellia rusbyi</i>	Stinking Brickell-Bush	SOC	G3	NNR	SNR					
<i>Brickellia simplex</i>	Sonoran Brickell Brush	SOC	G3	N3	S3?					
<i>Chaetopappa hersheyi</i>	Guadalupe Cliff Daisy	SOC	G3	N3	S3					
<i>Cirsium parryi</i>	Parry Thistle		G4	N4?	SNR					
<i>Cirsium vinaceum</i>	Sacramento Mountain Thistle	TE	G2	N2	S2	T	E			
<i>Cirsium wrightii</i>	Wright's Marsh Thistle	SOC	G2	N2	S2					
<i>Crataegus wootoniana</i>	Wooton's Hawthorn	SOC	G2	N2	S2					
<i>Echinocereus fendleri</i> var. <i>kuenzleri</i>	Kuenzler's Hedgehog Cactus	TE	T1	N1	S1	E	E			
<i>Ericameria nauseosa</i> var. <i>texensis</i>	<b>Guadalupe Rabbitbrush</b>	SOC	T2	N2	S2					
<i>Erigeron rybius</i>	Sacramento Mountain fleabane	SOC	G3	N3	S3					
<i>Eriogonum jamesii</i> var. <i>wootonii</i>	No Common Name	SOC	T2	N2	S2					
	Guadalupe Mountain Pincushion Cactus	SOC	G1	N1	SNR					
<i>Escobaria guadalupensis</i>										
<i>Escobaria villardii</i>	<b>Villard's Pincushion Cactus</b>	SOC	G2	N2	S2		E			
<i>Gutierrezia wrightii</i>	Wright's snakeweed		G4	N3	S3?					
<i>Hedeoma apiculata</i>	Mckittrick Pennyroyal	SOC	G3	N3	S3					
	White Mountain false penny- royal	SOC	G2	N2	S2					
<i>Hedeoma pulcherrima</i>										
<i>Hedeoma todsenii</i>	Todsen's Pennyroyal	TE	G2	N2	S2	E	E			
<i>Helianthella parryi</i>	Dwarf Rockrose		G4	NNR	SNR					
<i>Heuchera wootonii</i>	White Mountain allumroot	SOC	G3	N3	S3					
<i>Hexaletris nitida</i>	Glass Mountain Coralroot	SOC	G3	N3	S1		E			
<i>Hymenopappus biennis</i>	Biennial Woolly-white	SOC	G3	N3	SNR					
<i>Hymenopappus mexicanus</i>	Mexican Woolly-white	SOC	G3	NNR	SNR					
<i>Hymenoxys rusbyi</i>	Ruby's Bitterweed	SOC	G3	NNR	SNR					
<i>Ionactis elegans</i>	Sierra Blanca Cliff Daisy	SOC	G2	N2	S2					
<i>Lesquerella aurea</i>	Golden Bladderpod	SOC	G3	N3	S2					
<i>Ligusticum porteri</i>	Porter's Lovage	SOC	G3	N3N4	SNR					
<i>Lupinus sierrae-blancae</i>	White Mountain Lupine		G4	N4	S3					
<i>Mentzelia humilis</i> var. <i>guadalupensis</i>	Gypsum Blazing-Star	SOC	T2	NNR	SNR					
<i>Nama xylopodum</i>	Yellowseed fiddleleaf		G4	N4	S4?					

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<i>Penstemon alamosensis</i>	Alamo Beardtongue	SOC	G3	N3	S3					
<i>Penstemon cardinalis</i> ssp. <i>regalis</i>	Royal Red Penstemon	SOC	T2	N2	S2					
<i>Penstemon neomexicanus</i>	New Mexico beardtongue		G4	N4	S4					
<i>Perityle quinqueflora</i>	Five-Flowered Rock Daisy		G4	N4	S3					
<i>Perityle staurophylla</i> var. <i>staurophylla</i>	<b>New Mexico Rock Daisy</b>	SOC	T3	NNR	SNR					
<i>Polygonatum cobrense</i>	Mckittrick Solomon's-seal		G4	NNR	SNR					
<i>Rhodiola integrifolia</i> ssp. <i>procera</i>	<b>New Mexican Stonecrop</b>			NNR	SNR					
<i>Ribes mescalemium</i>	Mescalero Currant		G4	N4	S4?					
<i>Rumex orthoneurus</i>	Bloomer's Dock	SOC	G3	N3	S2?					
<i>Salvia summa</i>	Great Sage	TNR SOC	G3	N3	S3?					
<i>Senecio sacramentanus</i>	Sacramento groundsel	SOC	G3	N3	S3					
<i>Sibara grisea</i>	Marble Canyon Rockcress	SOC	G3	N3	S3?					
<i>Sophora gypsophila</i> var. <i>guadalupensis</i>	Guadalupe Mescal Bean	SOC	T1	N1	S1					
<i>Streptanthus sparsiflorus</i>	Sparsely Flowered Jewelflower	SOC	G2	N2	S2					
<i>Valeriana texana</i>	Guadalupe Valerian	SOC	G3	N3	S3					
<i>Arizona elegans</i>	Glossy Snake		G5	N5	S5					
<i>Aspidoscelis exsanguis</i>	Chihuahuan Spotted Whiptail		G5	N5	S5					
<i>Aspidoscelis inornata</i>	Little Striped Whiptail		G5	N5	S5					
<i>Aspidoscelis tessellata</i>	Common Checkered Whiptail		G5	N5	S5					
<i>Aspidoscelis tigris</i>	Western Whiptail		G5	N5	S3					
<i>Bogertophis subocularis</i>	Trans-Pecos Snake		G5	N4N5	S3					
<i>Coleonyx brevis</i>	Texas Banded Gecko	SOI	G5	N5	S4			X		
<i>Coluber constrictor</i>	Racer		G5	N5	S3					
<i>Cophosaurus texanus</i>	Greater Earless Lizard		G5	N5	S5					
	Western Diamondback									
<i>Crotalus atrox</i>	Rattlesnake	SOI	G5	N5	S5			X		
<i>Crotalus lepidus klauberi</i>	Banded Rock Rattlesnake	SOI	T5	N4	S2			X		
<i>Crotalus lepidus lepidus</i>	Mottled Rock Rattlesnake	SOI	T4	N4N5	S2		T	X		
<i>Crotalus molossus</i>	Blacktail Rattlesnake		G5	N5	S5					
<i>Crotalus viridis</i>	Western Rattlesnake		G5	N5	S5					
<i>Crotaphytus collaris</i>	Collared Lizard	SOI	G5	N5	S5			X		
<i>Diadophis punctatus</i>	Ringneck Snake		G5	N5	S4					

NatureServe Scientific Name <sup>A</sup>	NatureServe Common Name <sup>A</sup>	Potential Species List <sup>B</sup>	G- rank	N-rank	NM S-rank	ESA Status <sup>C</sup>	NM State Status <sup>C</sup>	NM CWCS <sup>D</sup>	Birds of Conserv. Concern	Partners in Flight Watch List
<i>Elaphe guttata</i>	Corn Snake		G5	N5	S5					
<i>Eumeces multivirgatus</i>										
<i>epipleurotus</i>	Variable Skink		T5	N4N5						
<i>Eumeces obsoletus</i>	Great Plains Skink		G5	N5	S5					
<i>Gambelia wislizenii</i>	Longnose Leopard Lizard		G5	N5	S5					
<i>Gyalopion canum</i>	Western Hooknose Snake		G5	N5	S4					
<i>Heterodon nasicus</i>	Western Hognose Snake		G5	N5	S5					
<i>Holbrookia maculata</i>	Lesser Earless Lizard		G5	N5	S5					
<i>Hypsiglena torquata</i>	Night Snake		G5	N5	S5					
<i>Lampropeltis getula splendida</i>	Desert Kingsnake		T5	N5	S5					
<i>Leptotyphlops dulcis</i>	Texas Threadsnake		G5	N5	S4					
<i>Liochlorophis vernalis</i>	Smooth Green Snake		G5	N5	S4					
<i>Masticophis flagellum</i>	Coachwhip		G5	N5	S5					
<i>Masticophis taeniatus</i>	Striped Whipsnake		G5	N5	S5					
<i>Nerodia erythrogaster</i>	Plain Belly Water Snake	SOI	G5	N5	S1S2		E			
<i>Phrynosoma cornutum</i>	Texas Horned Lizard		G4	N4N5	S5					
<i>Phrynosoma hernandesi</i>	Short-Horned Lizard		G5	N5	S5					
<i>Phrynosoma modestum</i>	Roundtail Horned Lizard		G5	N5	S5					
<i>Pituophis catenifer</i>	Gopher Snake		G5	N5	S5					
<i>Rhinocheilus lecontei</i>	Longnose Snake		G5	N5	S5					
<i>Salvadora grahamiae</i>	Mountain Patchnose Snake		G5	N5	S5					
<i>Sceloporus magister</i>	Desert Spiny Lizard		G5	N5	S5					
<i>Sceloporus poinsettii</i>	Crevice Spiny Lizard		G5	N5	S5					
<i>Sceloporus undulatus</i>	Fence/ Prairie/ Plateau Lizard		G5	N5	S5					
<i>Sistrurus catenatus edwardsii</i>	Desert Massasauga	SOC	T3	N3N4				X		
<i>Sonora semiannulata</i>	Ground Snake		G5	N5	S5					
<i>Tantilla hobartsmithi</i>	Southwestern Black-Headed Snake			N5	S4					
<i>Tantilla nigriceps</i>	Plains Black-Headed Snake		G5	N5	S5					
<i>Terrapene ornata</i>	Western Box Turtle	SOI	G5	N5	S4			X		
<i>Thamnophis cyrtopsis</i>	Western Blackneck Garter Snake	G5		N5	S5					
<i>Thamnophis elegans</i>	Western Terrestrial Garter Snake			N5	S5					
<i>Thamnophis marcianus</i>	Checkered Garter Snake	G5	G5	N5	S4					
		G5								



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<i>Thamnophis proximus</i>	Western Ribbon Snake	SOI	G5	N5	S3		T			
<i>Thamnophis proximus diabolicus</i>	Arid Land Ribbon Snake	SOI	T4	N3N4				X		
<i>Thamnophis sirtalis</i>	Common Garter Snake		G5	N5	S4					
<i>Tropidoclonion lineatum</i>	Lined Snake		G5	N5	S4					
<i>Urosaurus ornatus</i>	Tree Lizard		G5	N5	S5					
<i>Uta stansburiana</i>	Side-Blotched Lizard		G5	N5	S5					
<i>Ashmunella carlsbadensis</i>	Guadalupe Woodlandsnail	SOC	G1	N1	SNR					
<i>Ashmunella pseudodonta</i>	Capitan Woodlandsnail	SOC	G1	N1	SNR					
<i>Ashmunella rhyssa altissima</i>			T1	N1	S1					
<i>Carychium exiguum</i>	Obese Thom	SOI	G5	N5	SNR			X		
<i>Cionella lubrica</i>	Glossy Pillar		G5	N5						
<i>Columella columella</i>	Mellow Column		G5	N5	SNR					
<i>Columella columella alticola</i>			T1	N1	SNR					
<i>Deroceras laeve</i>	Meadow Slug		G5	N5	SNR					
<i>Discus whitneyi</i>	Forest Disc		G5	N5	SNR					
<i>Euconulus fulvus</i>	Brown Hive		G5	N5	SNR					
<i>Gastrocopta armifera ruidosensis</i>			T3	N3	S3					
<i>Gastrocopta ashmuni</i>	Sluice Snaggletooth	SOC	G3	N4N5	S5					
<i>Gastrocopta contracta</i>	Shortneck Snaggletooth	SOI	G5	N5	S2					
<i>Gastrocopta cristata</i>	Crested Snaggletooth		G5	N5	S5					
<i>Gastrocopta pellucida</i>	Slim Snaggletooth		G5	N5	S5					
<i>Gastrocopta pilsbryana</i>	Montane Snaggletooth		G4	N4N5	S5					
<i>Gastrocopta procera</i>	Long Snaggletooth		G5	N5	S5					
<i>Gastrocopta quadridens</i>	Cross Snaggletooth	SOC	G2	N2N3	S4					
<i>Glyphyalinia indentata</i>	Carved Glyph		G5	N5	SNR					
<i>Hawaiiia minuscula</i>	Minute Gem		G5	N5	SNR					
<i>Helicodiscus eigenmanni</i>	Mexican Coil		G5	N5	SNR					
<i>Helicodiscus singleyanus</i>	Smooth Coil	SOC	G5	N5	SNR					
<i>Helix aspersa</i>	Brown Gardensnail		G5	NNA						
<i>Holospira montivaga</i>	Vagabond Holospira	SOC	G2	N2	S2					
<i>Humboldtiana ultima</i>	Northern Threeband	SOC	G2	N2	S2			X		
<i>Metastoma roemeri</i>	Distorted Metastoma	SOI	G4	N4	S2			X		
<i>Microphysula ingersolli</i>	Spruce Snail	SOI	G4	N4N5	SNR			X		

NatureServe Scientific Name <sup>A</sup>	NatureServe Common Name <sup>A</sup>	Potential Species List <sup>B</sup>	G- rank	N-rank	NM S-rank	ESA Status <sup>C</sup>	NM State Status <sup>C</sup>	NM CWCS <sup>D</sup>	Birds of Conserv. Concern	Partners in Flight Watch List
<i>Oreohelix neomexicana</i>			G2	N3	S4					
<i>Oxyloma retusum</i>	Blunt Ambersnail	SOI	G5	N5	S1					
<i>Paralaoma caputspinulae</i>	Pinhead Spot		G5	N5	SNR					
<i>Punctum minutissimum</i>	Small Spot		G5	N5	SNR					
<i>Pupilla blandi</i>	Rocky Mountain Column		G4	N4	S5					
<i>Pupilla muscorum</i>	Widespread Column		G5	N5	S5					
<i>Pupilla sonora</i>	Threetooth Column	SOI	G4	N4N5	S4			X		
<i>Rabdotus dealbatus</i> <i>neomexicanus</i>			T2	N2	SNR					
<i>Radiodiscus millecostatus</i>	Ribbed Pinwheel	SOC	G3	N3	SNR					
<i>Rumina decollata</i>	Decollate Snail		G5	NNA						
<i>Striatura meridionalis</i>	Modian Striate		G5	N5	S5					
<i>Thysanophora hornii</i>	Southwestern Fringed Snail	SOC	G3	N3N4	SNR					
<i>Vallonia cyclophorella</i>	Silky Vallonia		G5	N5	SNR					
<i>Vallonia gracilicosta</i>	Multirib Vallonia	SOI	G5	N5	S1					
<i>Vallonia perspectiva</i>	Thin-lip Vallonia		G4	N4N5	SNR					
<i>Vertigo elatior</i>	Tapered Vertigo		G5	N5	SNR					
<i>Vertigo gouldii</i>	Variable Vertigo		G5	N5	S4					
<i>Vertigo modesta ingersolli</i>		SOC	T2	N1N3	SNR					
<i>Vitrina pellucida</i>	Western Glass-snail	SOI	G5	N5	SNR			X		
<i>Zonitoides arboreus</i>	Quick Gloss		G5	N5	SNR					

**Appendix 15-B.** Conservation targets (N=69), by target type, that occur on one or more of seven conservation areas that overlap the Lincoln National Forest in New Mexico.

Target Type / Scientific Name	Common Name	Habitat Type	# of Conservation Areas	Conservation Areas <sup>E</sup>
<b>Amphibian</b>				
<i>Aneides hardii</i>	Sacramento Mtn. Salamander	Terrestrial	3	1,5,6
<b>Bird</b>				
<i>Accipiter gentilis</i>	Northern Goshawk	Terrestrial	1	5
<i>Empidonax traillii extimus</i>	Southwest Willow Flycatcher	Aquatic/Riparian	1	4
<i>Strix occidentalis lucida</i>	Mexican Spotted Owl	Terrestrial	3	2,5,6
<b>Fish</b>				
<i>Etheostoma lepidum</i>	Greenthroat Darter	Aquatic/Riparian	1	5
<i>Gila pandora</i>	Rio Grande Chub	Aquatic/Riparian	1	3
<i>Ictalurus lupus</i>	Headwater Catfish	Aquatic/Riparian	1	7
<i>Oncorhynchus clarki virginalis</i>	Rio Grande Cutthroat Trout Intraspecific.	Aquatic/Riparian	1	6
<b>Mammal</b>				
<i>Myotis lucifugus occultus</i>		Terrestrial	1	5
<i>Sorex neomexicanus</i>	New Mexico Shrew	Terrestrial	1	5
<i>Tamias minimus atristriatus</i>	Penasco Chipmunk	Terrestrial	1	5
<i>Zapus hudsonius luteus</i>	New Mexican Jumping Mouse	Aquatic/Riparian	1	5
<b>Mollusk</b>				
<i>Ashmunella carlsbadensis</i>	Guadalupe Woodlandsnail	Terrestrial	1	2
<i>Ashmunella pseudodonta</i>	Capitan Woodlandsnail	Terrestrial	1	1
<i>Ashmunella rhyssa altissima</i>		Terrestrial	1	6
<i>Holospira montivaga</i>	Vagabond Holospira	Terrestrial	1	2
<i>Humboldtiana ultima</i>	Northern Threeband	Terrestrial	1	2
<i>Oreohelix nogalensis</i>		Terrestrial	1	6
<b>Reptile</b>				
<i>Lampropeltis alterna</i>		Terrestrial	1	2
<b>Plant-Vascular</b>				

<sup>E</sup> 1=Capitan Mountains, 2=Guadalupe Mountains Escarpment, 3=Rio Hondo, 4=Rio Penasco, 5=Sacramento Mountains, 6=Sierra Blanca, 7=Sitting Bull Falls

Target Type / Scientific Name	Common Name	Habitat Type	# of Conservation Areas	Conservation Areas <sup>E</sup>
<i>Allium gooddingii</i>	Goodding's Onion	Aquatic/Riparian	1	6
<i>Aquilegia chrysantha</i> var. <i>chaplinei</i>		Terrestrial	1	2
<i>Argemone pleiacantha</i> ssp. <i>pinnatisecta</i>	Sacramento Prickly Poppy	Terrestrial	1	5
<i>Astragalus altus</i>	Winged Milkvetch	Terrestrial	1	5
<i>Astragalus kerrii</i>	Kerr's Milkvetch	Terrestrial	1	1
<i>Astragalus neomexicanus</i>	New Mexico Milkvetch	Terrestrial	3	4,5,6
<i>Besseyia oblongifolia</i>	Egg-Leaf Coral-Drops	Terrestrial	1	6
<i>Brickellia modesta</i>		Terrestrial	1	4
<i>Chaetopappa hersheyi</i>	Guadalupe Cliff Daisy	Terrestrial	1	2
<i>Cirsium vinaceum</i>	Sacramento Mountain Thistle	Aquatic/Riparian	1	5
<i>Cirsium wrightii</i>	Wright's Marsh Thistle	Aquatic/Riparian	1	5
<i>Crataegus wootoniana</i>	Wooton's Hawthorn	Terrestrial	2	5,6
<i>Delphinium novomexicanum</i>	White Mountain Larkspur	Aquatic/Riparian	1	5
<i>Echinocereus fendleri</i> var. <i>kuenzleri</i>	Kuenzler's Hedgehog Cactus	Terrestrial	3	1,4,5
<i>Erigeron rybius</i>	Sacramento Mountain fleabane	Terrestrial	1	5
<i>Eriogonum jamesii</i> var. <i>wootonii</i>	No Common Name	Terrestrial	1	6
<i>Escobaria guadalupensis</i>	Guadalupe Mountain Pincushion Cactus	Terrestrial	1	2
<i>Escobaria sneedii</i> var. <i>leei</i>		Terrestrial	1	2
<i>Escobaria villardii</i>		Terrestrial	1	5
<i>Hedeoma apiculata</i>	Mckittrick Pennyroyal	Terrestrial	1	2
<i>Hedeoma pulcherrima</i>	White Mountain false penny-royal	Terrestrial	2	1,5
<i>Hedeoma todsenii</i>	Todsen's Pennyroyal	Terrestrial	1	5
<i>Heuchera wootonii</i>	White Mountain allumroot	Terrestrial	1	5
<i>Hymenopappus biennis</i>		Terrestrial	1	2
<i>Ionactis elegans</i>	Sierra Blanca Cliff Daisy	Terrestrial	1	6
<i>Lesquerella aurea</i>	Golden Bladderpod	Terrestrial	1	5
<i>Lesquerella valida</i>		Terrestrial	2	1,2
<i>Lupinus sierrae-blancae</i>	White Mountain Lupine	Terrestrial	2	5,6
<i>Penstemon alamosensis</i>	Alamo Beardtongue	Terrestrial	1	5
<b>Community</b>				
Blue Spruce Forest Community (specific)		Terrestrial	1	5
Douglas Fir Forest Community (specific)		Terrestrial	2	1,5
Engelmann Spruce / Rocky Mountain Maple Forest		Terrestrial	1	1
Ponderosa Pine Forest Community (specific)		Terrestrial	1	5
White Fir / Arizona Walnut Forest		Terrestrial	1	6
White Fir Forest Community (specific)		Terrestrial	3	1,5,6

Target Type / Scientific Name	Common Name	Habitat Type	# of Conservation Areas	Conservation Areas <sup>E</sup>
<b>Ecological System</b>				
Montane Mixed Forest		Terrestrial	1	5
<b>Feature</b>				
Unique Pinyon pine-Texas madrone in regards to the composition of plant species and their elematic niche.		Terrestrial	1	2
Unique plant assoc. of P. pine- Dunn Oak of limited extent.		Terrestrial	1	2

**Appendix 15-C.** Conservation targets associated with seven conservation areas that overlap the Lincoln National Forest in New Mexico.

Conservation Area/ Target Type	Scientific Name	Common Name	Habitat Type	Global Rank	ESA Status
<b>Capitan Mountains</b>					
Amphibian	<i>Aneides hardii</i>	Sacramento Mtn. Salamander	Aquatic/Riparian	G3	SC
Mollusk	<i>Ashmunella pseudodonta</i>	Capitan Woodlandsnail	Terrestrial	GU	
Plant-Vascular	<i>Lesquerella valida</i>		Terrestrial	G3	
Plant-Vascular	<i>Echinocereus fendleri</i> var. <i>Kuenzleri</i>	Kuenzler's Hedgehog Cactus	Terrestrial	G1	
Plant-Vascular	<i>Hedeoma pulcherrima</i>	White Mountain false penny-royal	Terrestrial	G2	
Plant-Vascular	<i>Astragalus kerrii</i>	Kerr's Milkvetch	Terrestrial	G2	
Plant-Vascular	<i>Valeriana texana</i>	Guadalupe Valerian	Terrestrial	G3	
Community	White Fir Forest Community (specific)		Terrestrial	GU	
Community	Douglas Fir Forest Community (specific)		Terrestrial	GU	
<b>Guadalupe Mountains Escarpment</b>					
Bird	<i>Strix occidentalis lucida</i>	Mexican Spotted Owl	Terrestrial	G3	LT
Mollusk	<i>Ashmunella carlsbadensis</i>	Guadalupe Woodlandsnail	Terrestrial	GU	
Mollusk	<i>Humboldtiana ultima</i>	Northern Threeband	Terrestrial	G2	
Mollusk	<i>Holospira montivaga</i>	Vagabond Holospira	Terrestrial	G2	
Reptile	<i>Lampropeltis alterna</i>		Terrestrial	G5	
Plant-Vascular	<i>Sibara grisea</i>	Marble Canyon Rockcress	Terrestrial	G3	
Plant-Vascular	<i>Streptanthus sparsiflorus</i>	Sparsely Flowered Jewelflower	Terrestrial	G2	SC
Plant-Vascular	<i>Hedeoma apiculata</i>	Mckittrick Pennyroyal	Terrestrial	G3	
Plant-Vascular	<i>Sophora gypsophila</i> var. <i>Guadalupensis</i>	Guadalupe Mescal Bean	Terrestrial	G1	
Plant-Vascular	<i>Valeriana texana</i>	Guadalupe Valerian	Terrestrial	G3	
Plant-Vascular	<i>Hymenopappus biennis</i>		Terrestrial	G2	
Plant-Vascular	<i>Escobaria sneedii</i> var. <i>Leei</i>		Terrestrial	G2	
Plant-Vascular	<i>Chaetopappa hersheyi</i>	Guadalupe Cliff Daisy	Terrestrial	G3	SC
Plant-Vascular	<i>Escobaria guadalupensis</i>	Guadalupe Mountain Pincushion Cactus	Terrestrial	G1	
Plant-Vascular	<i>Lesquerella valida</i>		Terrestrial	G3	
Plant-Vascular	<i>Polygala rimulicola</i> var. <i>Rimulicola</i>		Terrestrial	G3	
Plant-Vascular	<i>Aquilegia chrysantha</i> var. <i>Chaplinei</i>		Terrestrial	G2	
Plant-Vascular	<i>Penstemon cardinalis</i>		Terrestrial	G3	
Plant-Vascular	<i>Penstemon cardinalis</i> ssp. <i>Regalis</i>	Royal Red Penstemon	Terrestrial	G2	
Feature	Unique Pinyon pine-Texas madrone in regards to the composition of plant species and their		Terrestrial	G3	
Feature	elematic niche.				
Feature	Unique plant assoc. of P. pine- Dunn Oak of limited extent.		Terrestrial	G3	
<b>Rio Hondo</b>					

Conservation Area/ Target Type	Scientific Name	Common Name	Habitat Type	Global Rank	ESA Status
Fish	<i>Gila pandora</i>	Rio Grande Chub	Aquatic/Riparian	G3	
<b>Rio Penasco</b>					
Bird	<i>Empidonax traillii extimus</i>	Southwest Willow Flycatcher	Aquatic/Riparian	G2	LE
Plant-Vascular	<i>Echinocereus fendleri</i> var. <i>kuenzleri</i>	Kuenzler's Hedgehog Cactus	Terrestrial	G1	
Plant-Vascular	<i>Brickellia modesta</i>		Terrestrial	GU	
Plant-Vascular	<i>Astragalus neomexicanus</i>	New Mexico Milkvetch	Terrestrial	G3	
<b>Sacramento Mountains</b>					
Amphibian	<i>Aneides hardii</i>	Sacramento Mtn. Salamander	Aquatic/Riparian	G3	SC
Bird	<i>Strix occidentalis lucida</i>	Mexican Spotted Owl	Terrestrial	G3	LT
Bird	<i>Accipiter gentilis</i>	Northern Goshawk	Terrestrial	G5	
Fish	<i>Etheostoma lepidum</i>	Greenthroat Darter	Aquatic/Riparian	G3	
Mammal	<i>Myotis lucifugus occultus</i>		Terrestrial	G3	
Mammal	<i>Zapus hudsonius luteus</i>	New Mexican Jumping Mouse	Aquatic/Riparian	G2	SC
Mammal	<i>Tamias minimus atristriatus</i>	Penasco Chipmunk	Terrestrial	G1	
Mammal	<i>Sorex neomexicanus</i>	New Mexico Shrew	Terrestrial	G2	
Plant-Vascular	<i>Delphinium novomexicanum</i>	White Mountain Larkspur	Aquatic/Riparian	G3	
Plant-Vascular	<i>Astragalus altus</i>	Winged Milkvetch	Terrestrial	G2	
Plant-Vascular	<i>Argemone pleiacantha</i> ssp. <i>pinnatisecta</i>	Sacramento Prickly Poppy	Terrestrial	G2	LE
Plant-Vascular	<i>Astragalus neomexicanus</i>	New Mexico Milkvetch	Terrestrial	G3	
Plant-Vascular	<i>Lesquerella aurea</i>	Golden Bladderpod	Terrestrial	G3	
Plant-Vascular	<i>Sibara grisea</i>	Marble Canyon Rockcress	Terrestrial	G3	
Plant-Vascular	<i>Senecio sacramentanus</i>	Sacramento groundsel	Terrestrial	G3	
Plant-Vascular	<i>Ribes mescalerium</i>	Mescalero Currant	Terrestrial	G4	
Plant-Vascular	<i>Philadelphus argyrocalyx</i>		Terrestrial	G4	
Plant-Vascular	<i>Penstemon neomexicanus</i>	New Mexico beardtongue	Terrestrial	G4	
Plant-Vascular	<i>Penstemon cardinalis</i>		Terrestrial	G3	
Plant-Vascular	<i>Penstemon alamosensis</i>	Alamo Beardtongue	Terrestrial	G3	SC
Plant-Vascular	<i>Lupinus sierrae-blancae</i>	White Mountain Lupine	Terrestrial	G3	
Plant-Vascular	<i>Heuchera wootonii</i>	White Mountain allumroot	Terrestrial	G3	
Plant-Vascular	<i>Hedeoma todsenii</i>	Todsen's Pennyroyal	Terrestrial	G2	
Plant-Vascular	<i>Hedeoma pulcherrima</i>	White Mountain false penny-royal	Terrestrial	G2	
Plant-Vascular	<i>Escobaria villardii</i>		Terrestrial	G2	
Plant-Vascular	<i>Cirsium wrightii</i>	Wright's Marsh Thistle	Aquatic/Riparian	G1	
Plant-Vascular	<i>Crataegus wootoniana</i>	Wooton's Hawthorn	Terrestrial	G3	
Plant-Vascular	<i>Echinocereus fendleri</i> var. <i>kuenzleri</i>	Kuenzler's Hedgehog Cactus	Terrestrial	G1	
Plant-Vascular	<i>Erigeron rybius</i>	Sacramento Mountain fleabane	Terrestrial	G3	

Conservation Area/ Target Type	Scientific Name	Common Name	Habitat Type	Global Rank	ESA Status
Plant-Vascular	<i>Cirsium vinaceum</i>	Sacramento Mountain Thistle	Terrestrial	G2	LT
Community	White Fir Forest Community (specific)		Terrestrial	GU	
Community	Douglas Fir Forest Community (3 specific occurrences)		Terrestrial	GU	
Community	Blue Spruce Forest Community (2 specific occurrences)		Terrestrial	GU	
Community	Ponderosa Pine Forest Community (specific)		Terrestrial	GU	
Community	White Fir Forest Community (3 specific occurrences)		Terrestrial	GU	
Community	Engelmann Spruce / Rocky Mountain Maple Forest		Terrestrial	G2	
Ecological System	Montane Mixed Forest		Terrestrial	GU	
<b>Sierra Blanca</b>					
Amphibian	<i>Aneides hardii</i>	Sacramento Mtn. Salamander	Aquatic/Riparian	G3	SC
Bird	<i>Strix occidentalis lucida</i>	Mexican Spotted Owl	Terrestrial	G3	LT
Fish	<i>Oncorhynchus clarki virginalis</i>	Rio Grande Cutthroat Trout Intraspecific.	Aquatic/Riparian	G3	
Mollusk	<i>Oreohelix nogalensis</i>		Terrestrial	GU	
Mollusk	<i>Ashmunella rhyssa altissima</i>		Terrestrial	G1	
Plant-Vascular	<i>Besseyia oblongifolia</i>	Egg-Leaf Coral-Drops	Terrestrial	G2	
Plant-Vascular	<i>Ribes mescalerium</i>	Mescalero Currant	Terrestrial	G4	
Plant-Vascular	<i>Potentilla sierrae-blancae</i>		Terrestrial	G2	
Plant-Vascular	<i>Philadelphus argyrocalyx</i>		Terrestrial	G4	
Plant-Vascular	<i>Lupinus sierrae-blancae</i>	White Mountain Lupine	Terrestrial	G3	
Plant-Vascular	<i>Ionactis elegans</i>	Sierra Blanca Cliff Daisy	Terrestrial	G2	SC
Plant-Vascular	<i>Eriogonum jamesii</i> var. <i>wootonii</i>	No Common Name	Terrestrial	G2	
Plant-Vascular	<i>Crataegus wootoniana</i>	Wooton's Hawthorn	Terrestrial	G3	
Plant-Vascular	<i>Astragalus neomexicanus</i>	New Mexico Milkvetch	Terrestrial	G3	
Plant-Vascular	<i>Allium gooddingii</i>	Goodding's Onion	Aquatic/Riparian	G4	
Community	White Fir / Arizona Walnut Forest		Terrestrial	G2	
Community	White Fir Forest Community (5 specific occurrences)		Terrestrial	GU	
<b>Sitting Bull Falls</b>					
Fish	<i>Ictalurus lupus</i>	Headwater Catfish	Aquatic/Riparian	G3	