

**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.

## Acknowledgments

We would like to thank the following people for their assistance in reviewing and/or developing the Ecological and Biological Diversity Reports:

- Wayne Robbie, Bryce Rickell, Amy Unthank, Ron Maes, Charlie McDonald, Rueban Weisz, Ernie Taylor, and several anonymous reviewers from the U.S. Forest Service Region 3 Office
- Jennifer Ruyle, Tom Skinner, Larry Jones, Gary Helbing, Glenn Frederick, Anne Casey from the Coronado National Forest
- Susan Bruin, Beverly DeGruyter, Dan Garcia de la Cadena, Bryan Hajny, Chuck Milner, David Heft, Alan Warren, Rick Newmon, and Hart Schwartz from the Cibola National Forest and Grasslands
- Bruce Higgins and Bill Noble from the Kaibab National Forest
- Jerry Ward, Mitchel R. White, and Cathy Taylor From the Apache-Sitgreaves National Forests
- Katherine Farr, Mike Manthei, Carol Boyd, Rory Steinke, Russ Copp, Cecelia Overby, Barbara Phillips, and Heather Green from the Coconino National Forest
- Maximillian Wahlberg, Maximillian Wahlberg, and Noel Fletcher from the Prescott National Forest
- Art Telles from the Gila National Forest
- Bill Britton and Esther Nelson from the Santa Fe National Forest
- Chirre Keckler from the Carson National Forest
- Danney Salas, Larry Paul, and Larry Cordova from the Lincoln National Forest
- Richard Holthausen from the U.S. Forest Service Washington Office
- Marilyn Myers from U.S. Fish and Wildlife Service
- Rob Marshall, Patrick McCarthy, Bill Ulfelder, Gary Bell, Dave Gori, Heather Schussman, Ed Smith, Bob Dale, Mike List, Dale Turner, Reese Lolley, and Carrie Enquist of The Nature Conservancy



## 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.

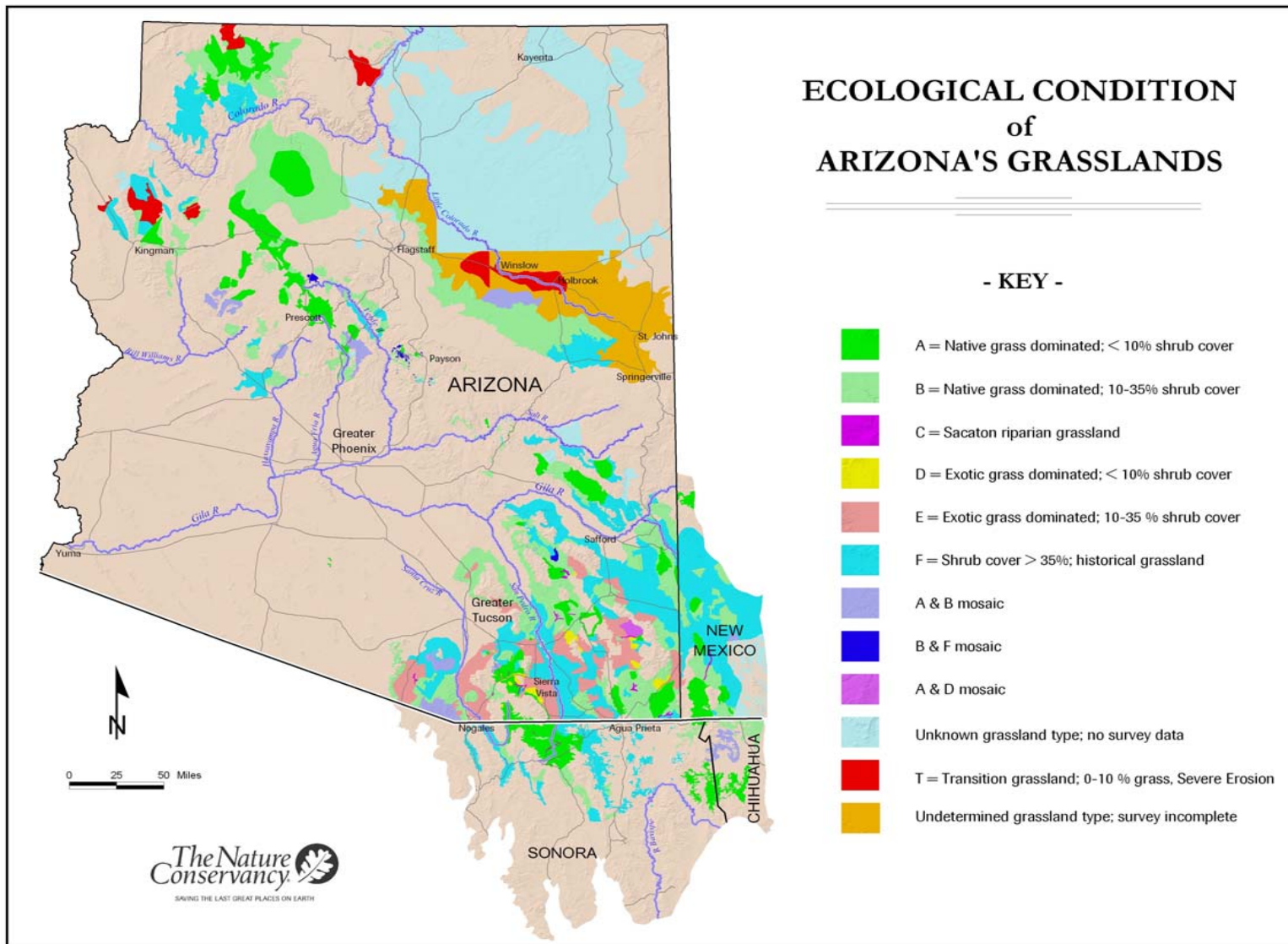
## *II. Distribution and Condition of Grasslands*

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).



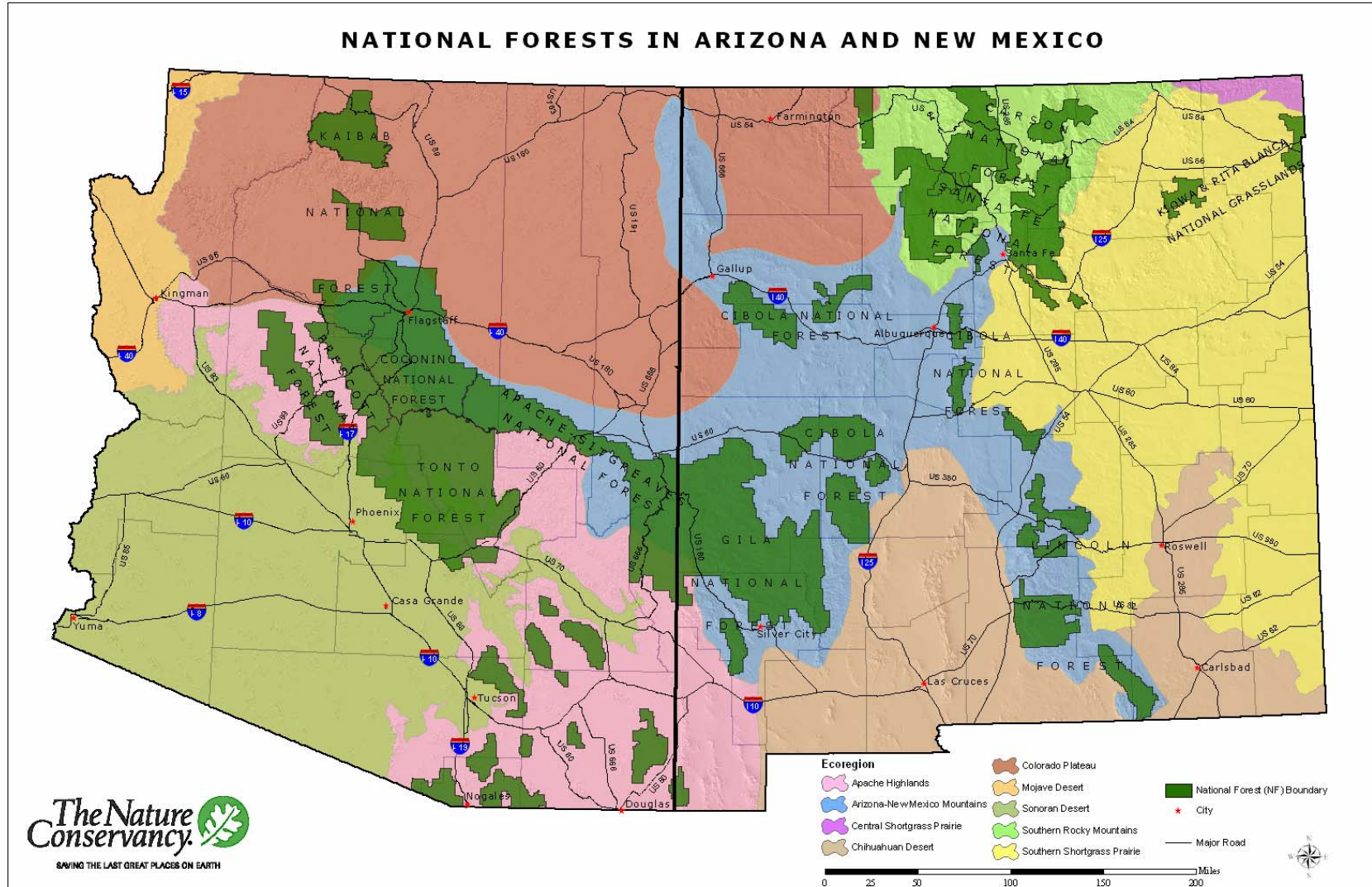


Figure 2-2. Overlap of The Nature Conservancy ecoregions and U.S. Forest Service Region 3 lands in Arizona and New Mexico.

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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

PNVT (Number of Land Cover Types)	SWReGAP, OK-GAP, and TX-GAP Land Cover Types
Great Plains grassland (24)	<p>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</p> <p>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</p>
Interior chaparral (4)	<p>Coahuilan Chaparral  Great Basin Semi-Desert Chaparral  Mogollon Chaparral  Rocky Mountain Gambel Oak-Mixed Montane Shrubland (Not with Mixed Conifer)</p>
Madrean encinal woodland (2)	<p>Madrean Encinal  Madrean Pinyon-Juniper Woodland</p>
Madrean pine-oak woodland (1)	<p>Madrean Pine-Oak Forest and Woodland</p>
Mixed broad leaf deciduous riparian forest (3)	<p>North American Warm Desert Riparian Woodland and Shrubland  Rocky Mountain Bigtooth Maple Ravine Woodland  Rocky Mountain Lower Montane Riparian Woodland and Shrubland</p>
Mixed conifer forest (5)	<p>Madrean Upper Montane Conifer-Oak Forest and Woodland</p>

<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-leafed Evergreen Shrubland
Texas Pinyon-Juniper (1)	Round Crowned Temperate or Subpolar Needle-leaved Evergreen Woodland

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PNVT (Number of Land Cover Types)	SWReGAP, OK-GAP, and TX-GAP Land Cover Types
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

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## **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 tridentate*), 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 tridentate* 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 hypoleucooides*) 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	<b>6,100</b>	0	0	0	0
Aspen Forest and Woodland	<b>335,900</b>	500	0	3,400	93,200	2,200	75,900	0	11,600
Barren	0	26,900	13,000	100	35,900	14,900	<b>196,400</b>	2,100	300
Cottonwood Willow Riparian Forest	19,500	74,800	14,900	7,100	219,500	55,600	<b>389,000</b>	28,500	11,000
Desert Communities	1,018,300	<b>8,593,300</b>	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	<b>218,200</b>	37,200	47,800	5,600	400
Gallery Coniferous Riparian Forest	100	0	0	0	<b>1,100</b>	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	<b>12,175,500</b>	43,200	18,500
Great Plains Grassland	316,800	1,270,300	29,000	10,000	<b>16,055,000</b>	3,158,400	181,000	14,100	11,400
Interior Chaparral	<b>1,345,900</b>	414,600	33,800	31,300	590,500	350,800	333,100	6,400	11,000
Madrean Encinal Woodland	<b>2,736,200</b>	518,800	151,400	34,400	1,259,800	609,300	1,165,200	14,800	2,200
Madrean Pine-Oak Woodland	<b>831,900</b>	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	<b>115,800</b>	17,300	65,500	7,900	4,300
Mixed Conifer Forest	<b>1,216,300</b>	33,900	2,700	43,500	225,900	13,800	191,000	1,000	52,000
Montane Grassland	<b>17,200</b>	0	0	0	16,900	0	2,300	0	0
Montane Willow Riparian Forest	17,300	14,400	800	600	<b>42,800</b>	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	<b>5,647,800</b>	19,000	51,600
Ponderosa Pine Forest	<b>5,835,300</b>	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	<b>977,200</b>	21,200	11,700
Semi-desert Grassland	1,642,300	8,013,000	1,463,300	99,000	<b>7,996,600</b>	5,914,600	951,900	321,000	185,000
Spruce-fir Forest	<b>355,200</b>	35,000	1,000	7,000	128,200	2,300	72,000	300	10,000
Sub-alpine Grasslands	<b>311,700</b>	13,900	200	2,500	183,400	10,700	55,700	0	27,000
Urban/Agriculture	20,800	35,100	49,200	2,300	<b>4,119,500</b>	219,000	334,900	5,600	23,900
Water	25,300	25,000	2,300	79,100	<b>122,000</b>	900	38,100	15,600	55,500
Wetland/Cienega	8,900	9,500	200	400	<b>35,000</b>	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	Cibola										
	Apache-Sitgreaves	Carson	(Mt. Districts)	Coconino	Coronado	Gila	Kaibab	Lincoln	Prescott	Santa Fe	Tonto
Alpine/Tundra	0	300	0	<b>1,200</b>	0	0	0	0	0	0	0
Aspen Forest and Woodland	29,000	<b>118,400</b>	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	<b>7,900</b>
Desert Communities	800	0	19,900	23,000	173,800	4,700	11,000	3,200	10,100	0	<b>771,900</b>
Disturbed/Altered	3,000	3,800	100	10,400	200	9,200	10,300	3,200	500	<b>36,600</b>	5,900
Gallery Coniferous Riparian Forest	0	<b>100</b>	0	0	0	0	0	0	0	0	0
Great Basin/ Colorado Plateau Grassland and Steppe	62,500	51,200	113,400	<b>159,400</b>	13,900	115,900	100,600	1,200	13,900	43,000	9,400
Great Plains Grassland	0	25,000	<b>191,900</b>	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	<b>543,900</b>
Madrean Encinal Woodland	275,300	0	18,900	219,600	<b>723,900</b>	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	<b>344,800</b>
Mixed Broad Leaf Deciduous Riparian Forest	100	2,300	<b>14,300</b>	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	<b>392,700</b>	5,100
Montane Grassland	0	<b>16,600</b>	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	<b>6,200</b>
Pinyon-Juniper Woodland	381,700	278,200	<b>724,800</b>	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	<b>1,754,600</b>	555,100	68,500	98,400	505,400	130,100
Sagebrush Shrubland	700	58,000	700	100	0	200	<b>67,200</b>	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	<b>608,600</b>
Spruce-fir Forest	18,500	<b>174,900</b>	10,700	7,200	0	17,900	20,800	17,600	0	87,400	0
Sub-alpine Grasslands	56,800	<b>113,900</b>	1,600	31,900	0	10,200	26,800	14,600	0	55,800	0
Urban/Agriculture	1,200	2,900	1,200	<b>6,700</b>	300	200	1,700	100	1,600	500	4,400
Water	2,000	200	300	2,700	200	300	300	0	100	1,500	<b>17,700</b>
Wetland/Cienega	0	<b>7,400</b>	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.

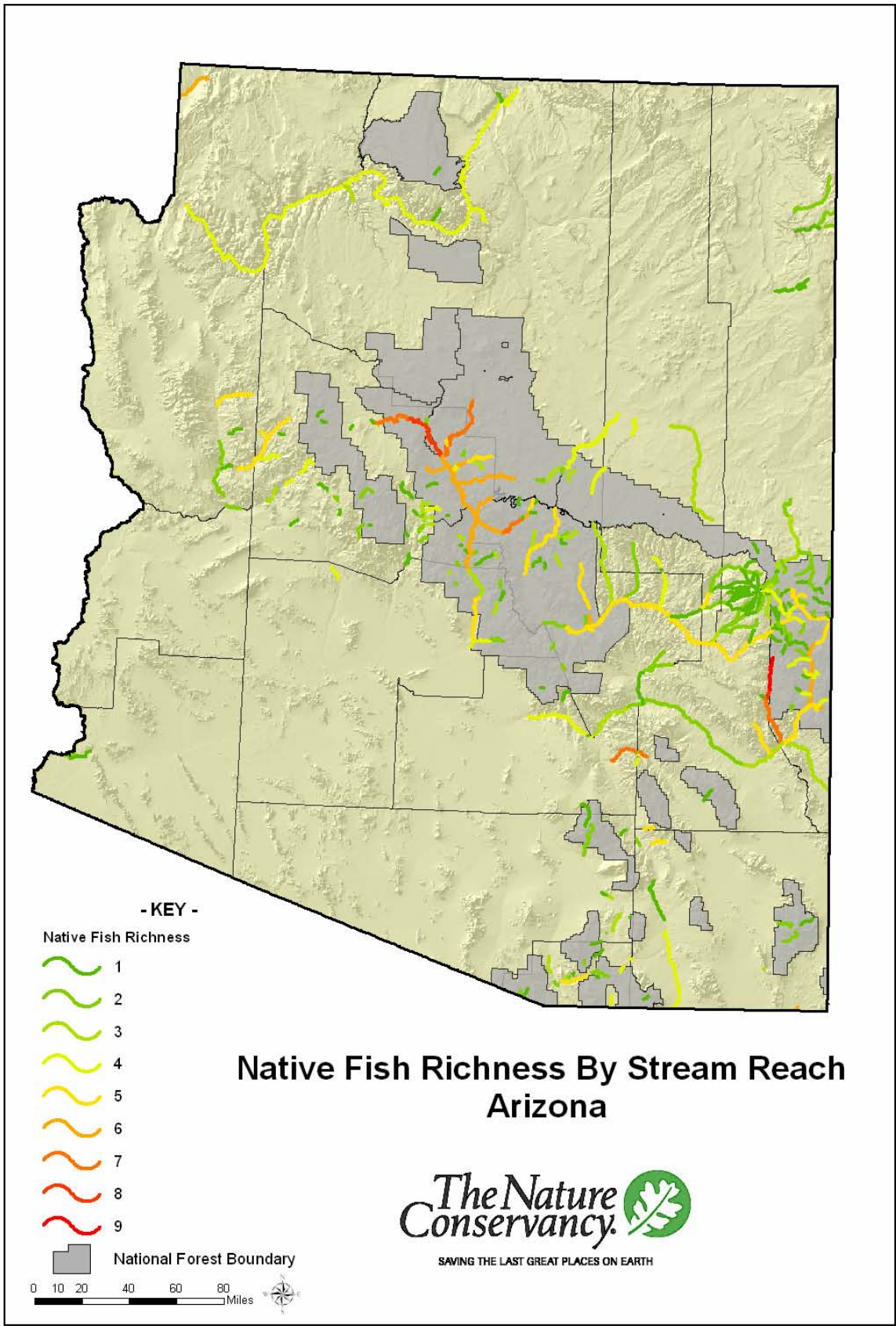
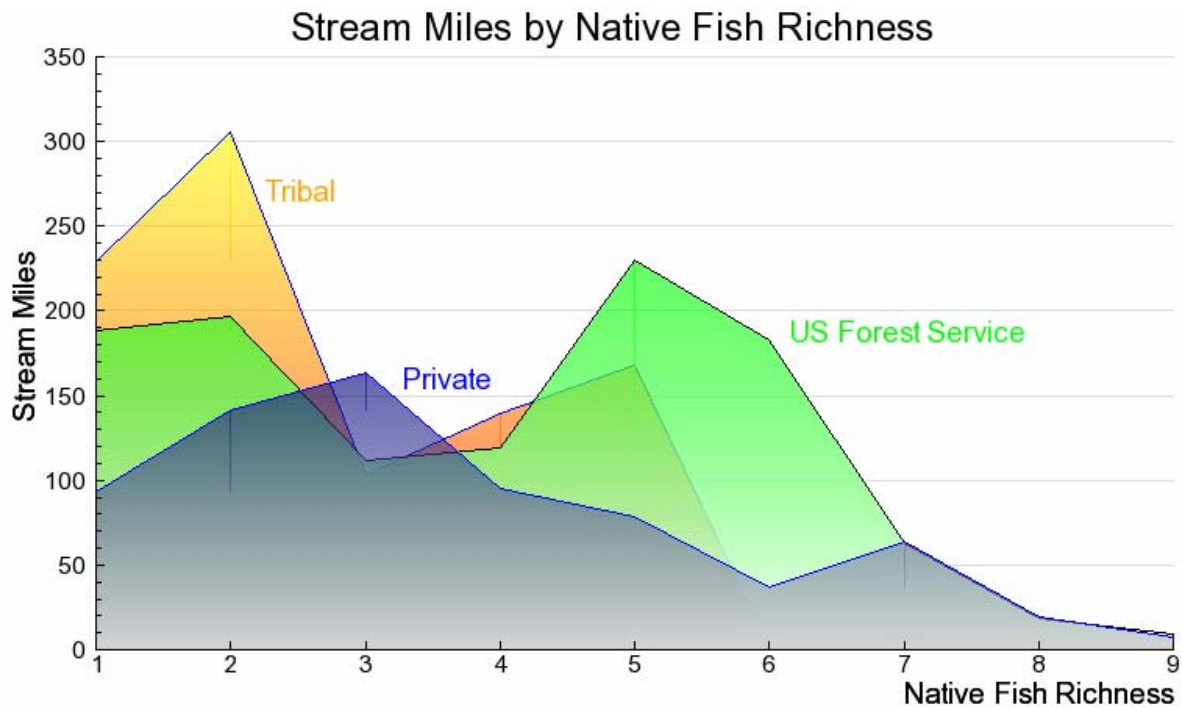


Figure 3-1. Stream reaches with occurrences of a varying number of native fish species (1-9) in Arizona.

**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

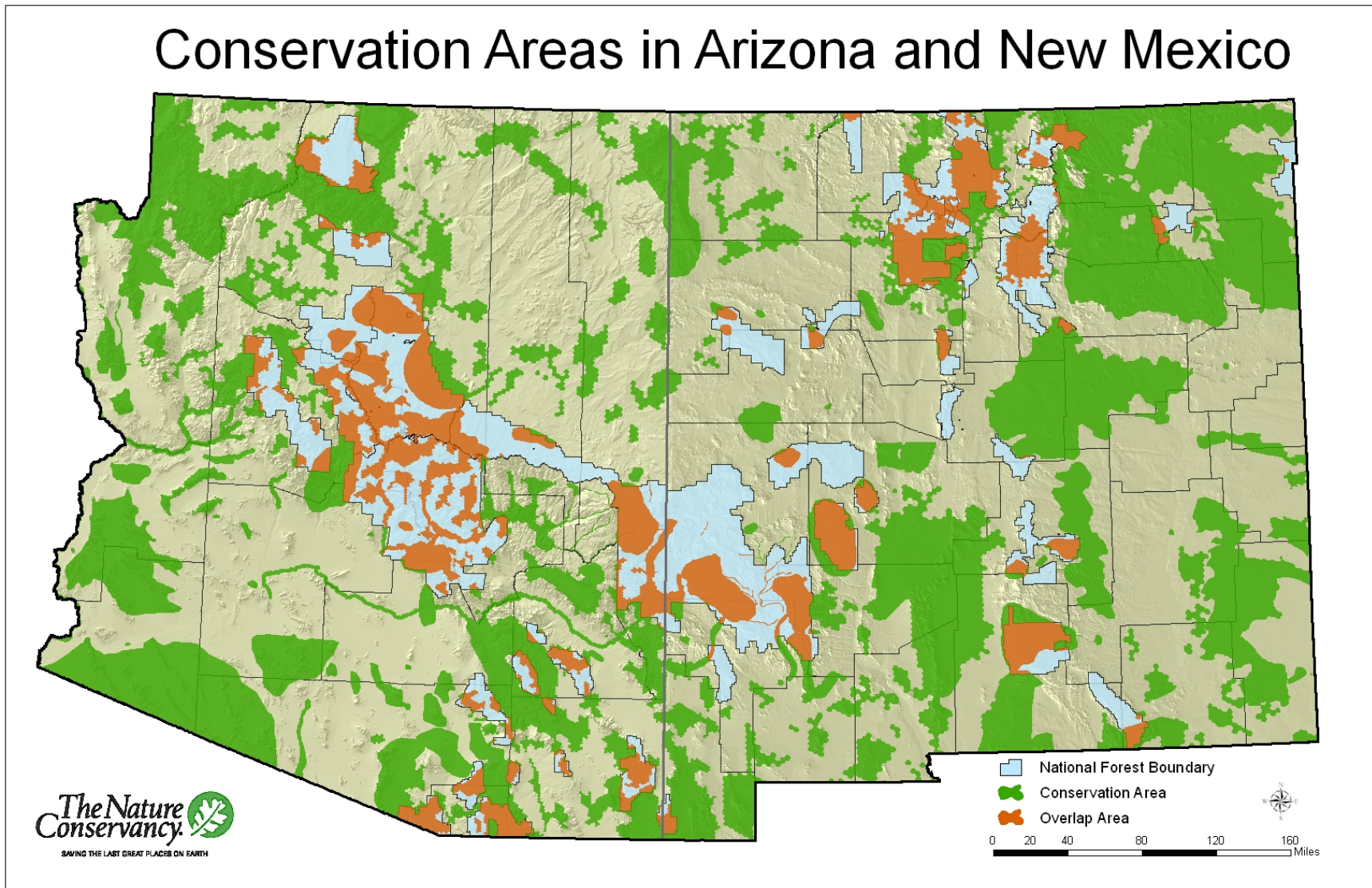


Figure 3-3. Conservation areas from eight ecoregional assessments in Arizona and New Mexico showing overlap with National Forest boundaries.

**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
<b>Total</b>	<b>56,721,700</b>	<b>37.6</b>	<b>100.0</b>

## 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 8:**

**Ecological & Biological Diversity of the Coconino National Forest**

**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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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. .... 8-29

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## Introduction

The Coconino Forest is one of 11 National Forests of the U.S. Forest Service (USFS) Southwestern Region (Region 3) and comprises approximately 9% of the total area of Region 3 Forests, not including the Cibola National Grasslands. This Forest consists of approximately 2.1 million acres (849,000 hectares) in central Arizona, where it is bordered on the south by the Mogollon Rim and the Verde River.

The Coconino National Forest boasts a wide variation in elevation, from low-elevation desert communities to alpine/tundra communities on San Francisco Mountain, which includes Humphreys Peak (12,633 ft), the highest peak in Arizona. This large elevational gradient provides suitable conditions for a myriad of vegetation systems and a multitude of organisms, making this Forest an important area for biodiversity within the Southwest.

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 Coconino National Forest and highlight information that may be pertinent to forest planning. Information from four assessments was synthesized for the Coconino National Forest, including:

- Distribution and extent of potential natural vegetation types (PNVTs)
- Distribution and condition of low-elevation (<5000 ft) grassland systems
- Distribution of native fish species
- 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 Coconino National Forest to other major landowners in the Southwest (Arizona and New Mexico) and National Forests in Region 3 is provided in Chapter 3.

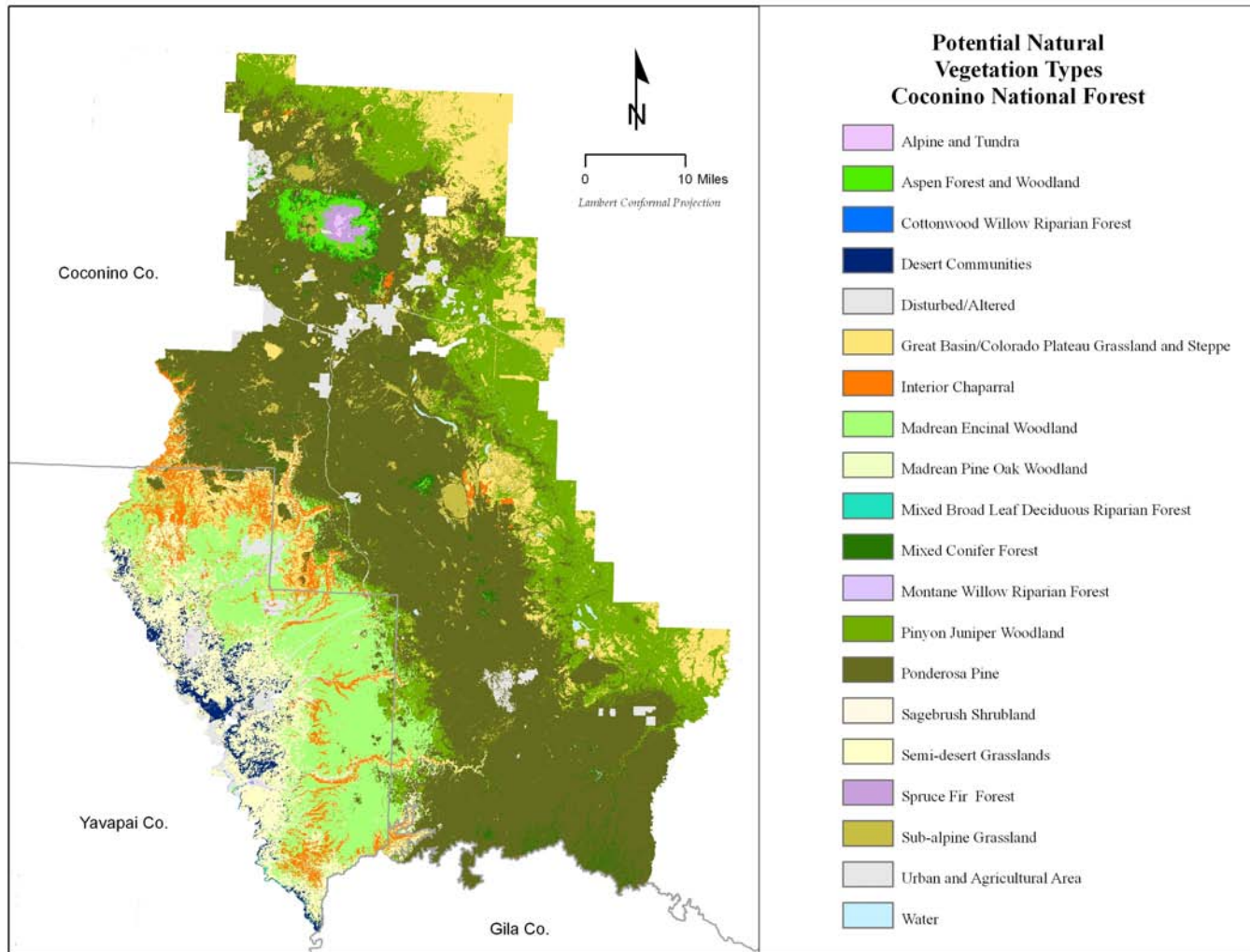


## Results

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

Data from the Southwest Regional Gap Analysis Project (SWReGAP; USGS National Gap Analysis Program 2004) were used to characterize the extent of potential natural vegetation types (PNVTs) on the Coconino 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 for PNVTs in preparation for forest planning. For this analysis, the extent and proportion of each PNVT on the Coconino were summarized, as well as the proportion of each PNVT within Region 3 that occurs on the Coconino National Forest. More detailed information on the data and methods used in this analysis can be found in Chapter 2, and information comparing PNVTs on the Coconino to other major landowners in the Southwest and National Forests within Region 3 is available in Chapter 3.

Twenty PNVTs were identified on the Coconino National Forest (Figure 8-1). Three PNVTs dominate the vegetation community on the Forest and comprise approximately 72% of the Forest (Table 8-1). These PNVTs include ponderosa pine (44.4%), pinyon-juniper (15.8%), and Madrean encinal woodland (12.0%). Great Basin/Colorado Plateau Grassland and Steppe encompasses the next largest proportion of the Forest (8.6%), followed by semi-desert grasslands (5.8%), and interior chaparral (4.2%). The remaining 14 PNVTs combined make up 9% of the Coconino National Forest.

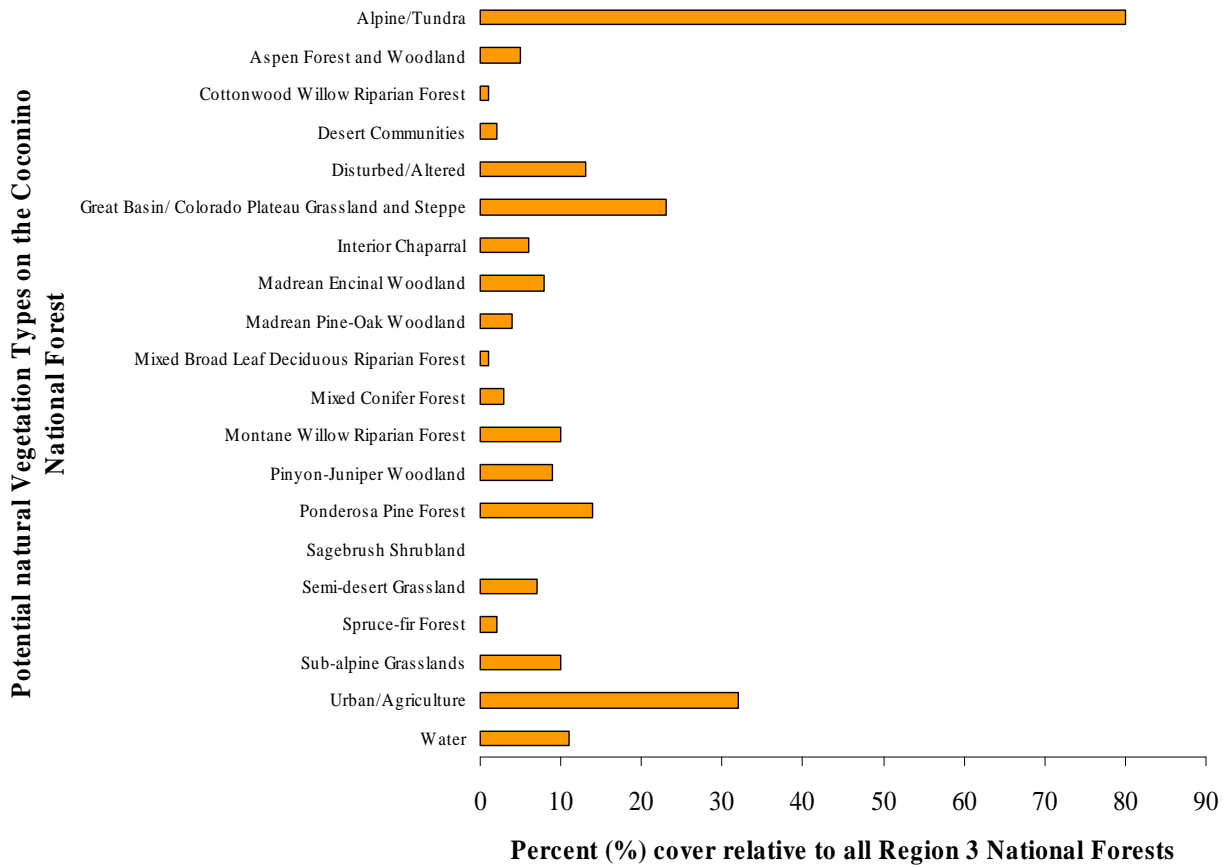


**Figure 8-1.** Distribution of potential natural vegetation types on the Coconino National Forest. Map was created using data from the Southwest Regional Gap Analysis Project (SWReGAP; U.S. Geological Survey National Gap Analysis Program, 2004). SWReGAP vegetation types were aggregated and converted 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 8-1.** Approximate area (in acres) and percent of total area of each potential natural vegetation type on the Coconino 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 used.

<b>Potential Natural Vegetation Type</b>	<b>Total Area (acres)</b>	<b>Percent of Total Area (%)</b>
Alpine Tundra	1,200	<0.1
Aspen Forest and Woodland	18,300	1.0
Cottonwood Willow Riparian Forest	200	<0.1
Desert Communities	23,000	1.3
Disturbed/Altered (quarries and mines)	10,400	0.6
Great Basin/ Colorado Plateau Grassland and Steppe	159,400	8.6
Interior Chaparral	76,800	4.2
Madrean Encinal Woodland	219,600	<b>12.0</b>
Madrean Pine-Oak Woodland	29,700	1.6
Mixed Broadleaf Deciduous Riparian Forest	300	<0.1
Mixed Conifer Forest	31,000	1.7
Montane Willow Riparian Forest	3,100	0.2
Pinyon-juniper Woodland	290,000	<b>15.8</b>
Ponderosa Pine	814,600	<b>44.4</b>
Sagebrush Shrubland	100	<0.1
Semi-desert Grassland	106,800	5.8
Spruce-fir Forest	7,200	0.4
Sub-alpine Grassland	31,900	1.7
Urban and Agricultural Area	6,700	0.4
Water	2,700	0.1
<b>Total</b>	<b>1,833,000</b>	

The Coconino is responsible for managing large proportions of certain PNVTs within Region 3 National Forests. For example, the largest proportion (approximately 80%) of alpine/tundra on Region 3 Forests can be found on San Francisco Mountain. In addition, the Coconino manages the largest proportion (23%) of Great Basin/Colorado Plateau grassland and steppe, and significant proportions of ponderosa pine forest (14%), subalpine grasslands (11%), pinyon-juniper woodland (10%), and montane willow riparian forest (10%) on Region 3 National Forest lands (Figure 8-2).



**Figure 8-2.** Percent area of cover of each potential natural vegetation type that occurs on the Coconino 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.

In addition, the Coconino National Forest manages large proportions of certain PNVTs across all landowners in the Southwest. For example, approximately 16% of all alpine/tundra (100% of alpine/tundra in Arizona) and approximately 9% of the ponderosa pine forests in Arizona and New Mexico can be found on the Coconino. See Chapter 3 for more information regarding the proportions of PNVTs the Coconino National Forest manages relative to other landowners in the Southwest.

## II. Distribution and Condition of Low Elevation Grasslands

The Arizona Statewide 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 historic and current low-elevation (<5000 ft) grasslands on the Coconino National Forest. This statewide assessment (which also includes the portions of southwest New Mexico and Mexico that are within the Apache-Highlands Ecoregion; Figure 2-1 in Chapter 2) 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 8-2): open native, restorable native, non-native, former, and transitional grasslands. More detailed information on the data and methods used in this analysis can be found in Chapter 2, and information comparing the extent and distribution of grasslands on the Coconino to other major landowners and National Forests within Region 3 is available in Chapter 3. It is important to note that high elevation/montane grasslands which occur on the Coconino National Forest were not addressed by the Grassland Assessment and are not included in these analyses. This analysis is based on Coconino National Forest boundaries, so area and percentages calculations include non-Forest lands within this area.

**Table 8-2.** 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.

The Arizona Grassland Assessment identified approximately 299,100 acres of extant and historic grasslands on the Coconino National Forest (Table 8-3), representing 16.8% of the Forest. An additional 100,600 acres of historic grassland were identified; however, the current condition of these grasslands (primarily located in the northern Peaks Ranger District) was not determined and these acres are not included in percentage calculations. Overall, the Coconino National Forest manages 15.8% of all grasslands, 24.3% of restorable grasslands, 12.7% of former grasslands, and 1.2% of open native grasslands that occur on National Forests in Arizona. The majority (87.5%) of grasslands on the Coconino is in restorable native condition, with the remainder in former grassland condition (10.9%) or open native condition (1.6%; Table 8-3).

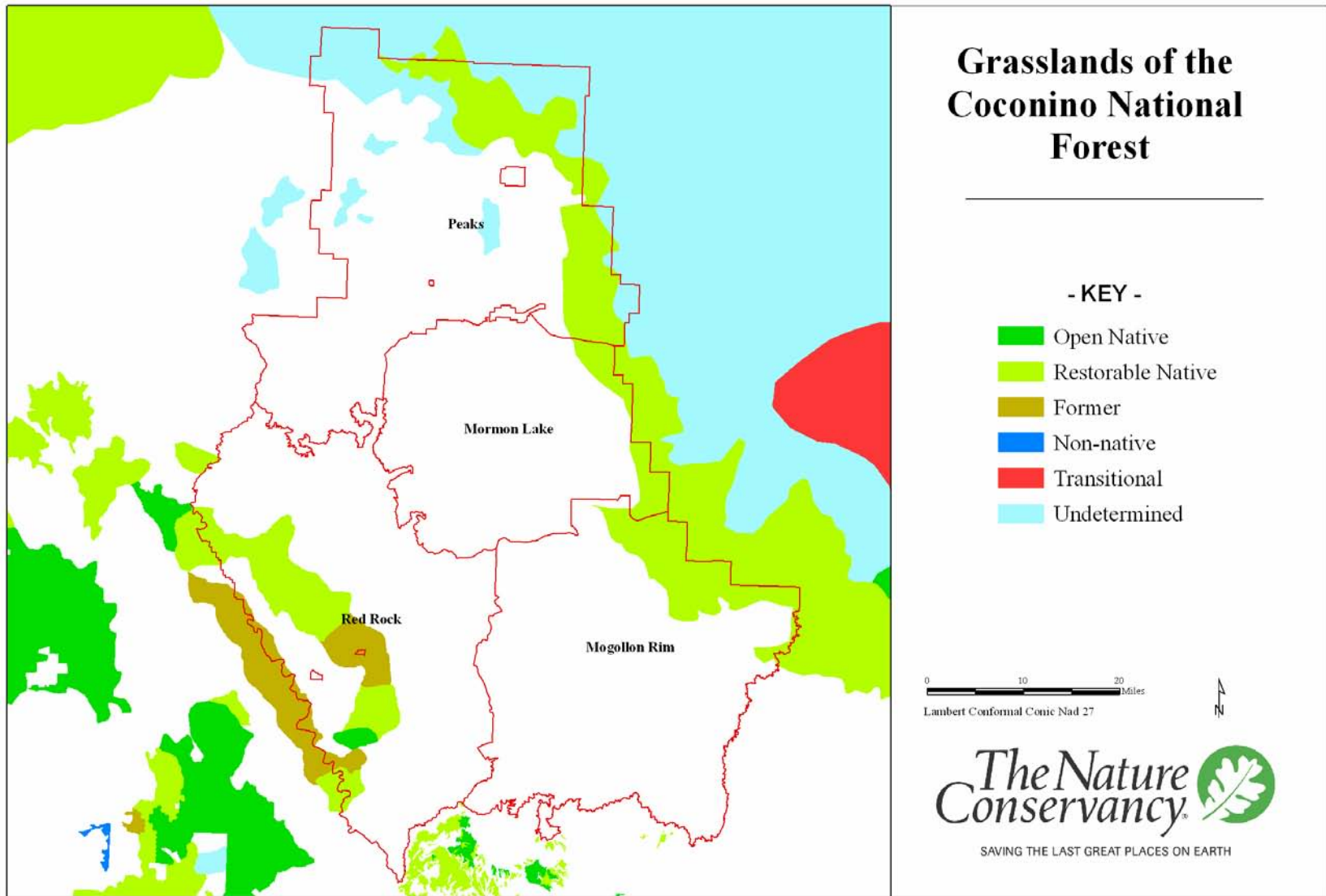
The largest proportions of identified grasslands occur on the Red Rock (36.1%) and Peaks (34.7%) Ranger Districts (Table 8-3). All of the grasslands on the Mogollon Rim, Mormon Lake, and Peaks Ranger Districts were identified as being in restorable native condition, meaning that they have been encroached by shrubs and woody species, but have the potential to be restored to open native condition. While grasslands on the Red Rock District are also primarily in restorable native condition (65.5%), a large proportion (30.2%) of grasslands have become shrub invaded, and have likely undergone a type conversion with little potential to be restored to open native grassland condition.

**Table 8-3.** Acres of low elevation grasslands in three condition types occurring on four ranger districts on the Coconino National Forest in Arizona (from Schussman and Gori 2004, Gori and Enquist 2003).

District	Grassland Type							
	Open Native		Restorable Native		Former		Total	
	Acres	% <sup>A</sup>	Acres	% <sup>A</sup>	Acres	% <sup>A</sup>	Acres	% <sup>B</sup>
Mogollon Rim	0	0.0	61,700	100.0	0	0.0	61,700	20.6
Mormon Lake	0	0.0	25,600	100.0	0	0.0	25,600	8.6
Peaks	0	0.0	103,700	100.0	0	0.0	103,700	34.7
Red Rock	4,700	4.3	70,800	65.5	32,600	30.2	108,100	36.1
<b>Total</b>	<b>4,700</b>	<b>1.6</b>	<b>261,800</b>	<b>87.5</b>	<b>32,600</b>	<b>10.9</b>	<b>299,100</b>	<b>100.0</b>

<sup>A</sup> Percent of total grasslands on each ranger district in that grassland condition type

<sup>B</sup> Percent of total grasslands on Coconino NF on each ranger district



**Figure 8-3.** Grassland types, based on condition, on four ranger districts on the Coconino National Forest in Arizona (from Schussman and Gori 2004, Gori and Enquist 2003).

### *III. Native Fish Assessment*

The Arizona Statewide Freshwater Assessment (Turner and List, *In Press*; 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 (1975 to present) for 33 native fish species (Table 2-2 in Chapter 2) in streams across all of Arizona. This information was used to identify and summarize the occurrences of each native fish species on stream reaches within the Coconino National Forest and to summarize the number of native fish species with occurrences on stream reaches on the Forest. More detailed information on the data and methods used in this analysis can be found in Chapter 2, and information comparing the extent of native fish occurrences on the Coconino to other landowners in the Southwest and National Forests within Region 3 is available in Chapter 3.

According to the Arizona Freshwater assessment, 15 native fish species have occurrences on one or more stream reaches on the Coconino National Forest (Table 8-4; see Table 2-2 for scientific names). Together, these 15 species have occurrences on approximately 195 miles (79.3%) of the 246 miles of perennial streams that exist on the Coconino (Table 8-4). Overall, the Coconino accounts for 13.2% of the perennial streams and 15.3% of the stream reaches with native fish occurrences that exist on National Forests in Arizona.

According to the Arizona Freshwater assessment, the speckled dace, desert sucker, and Sonora sucker have the largest distributions on the Coconino National Forest, while the headwater chub and spikedace have the smallest. Within National Forests in Arizona, a large proportion of the stream reaches with occurrences of the Gila topminnow (54.3%), Gila chub (48.9%), headwater chub (44.4%), and Little Colorado spinedace (33.7%) occur on the Coconino (Table 8-4). Olden and Poff (2005) characterized the temporal trends in native fish distributions within the Lower Colorado River Basin, including 14 of the 15 (93.3%) native fish species on the Coconino (not including the little Colorado sucker). Ten of these 14 (71.4%) native fish species on the Coconino have undergone declines in distribution across the basin, with the remaining four showing slight increases (Table 8-4).

Within National Forests in Arizona, 36.0% of stream reaches with occurrence of six or more native fish species occur on the Coconino National Forest. The Red Rock Ranger District, in particular, has significant lengths of streams with occurrences of six or more native fish species (Figure 8-4), which includes Verde River, Oak Creek, Fossil Creek, West Clear Creek, and Wet Beaver Creek. According to the Arizona Freshwater Assessment, 14 stream reaches (ranging from less than three to 51 miles in length) on the Coconino National Forest have occurrences of native fish species, with the number of species on each reach ranging from two to eight (Table 8-6, Figure 8-5).



**Table 8-4.** Number of stream miles with occurrences of 15 native fishes on two ranger districts on the Coconino National Forest in Arizona based on the Arizona Freshwater Assessment (Turner and List, In Press).

Species	Ranger District		Total	% of AZ Forests <sup>A</sup>	% Change in Distribution <sup>B</sup>
	Mogollon Rim	Red Rock			
Apache Trout	11	25	36	16.3	-26.9
Bluehead Sucker	3	0	3	5.4	-3.5
Colorado Pikeminnow	0	25	25	23.6	-100.0
Desert Sucker	11	147	158	19.6	-13.5
Gila Chub	0	86	86	48.9	-15.9
Gila Topminnow	0	51	51	54.3	-36.8
Headwater Chub	0	8	8	44.4	12.6
Little Colorado Spinedace	30	0	30	33.7	14.1
Little Colorado Sucker	30	0	30	30.3	-
Longfin Dace	11	130	141	19.2	11.4
Razorback Sucker	0	33	33	12.5	-49.7
Roundtail Chub	17	110	127	23.0	-6.2
Sonora Sucker	11	143	154	21.1	8.2
Speckled Dace	37	125	162	18.9	-16.5
Spikedace	0	6	6	9.7	-45.9

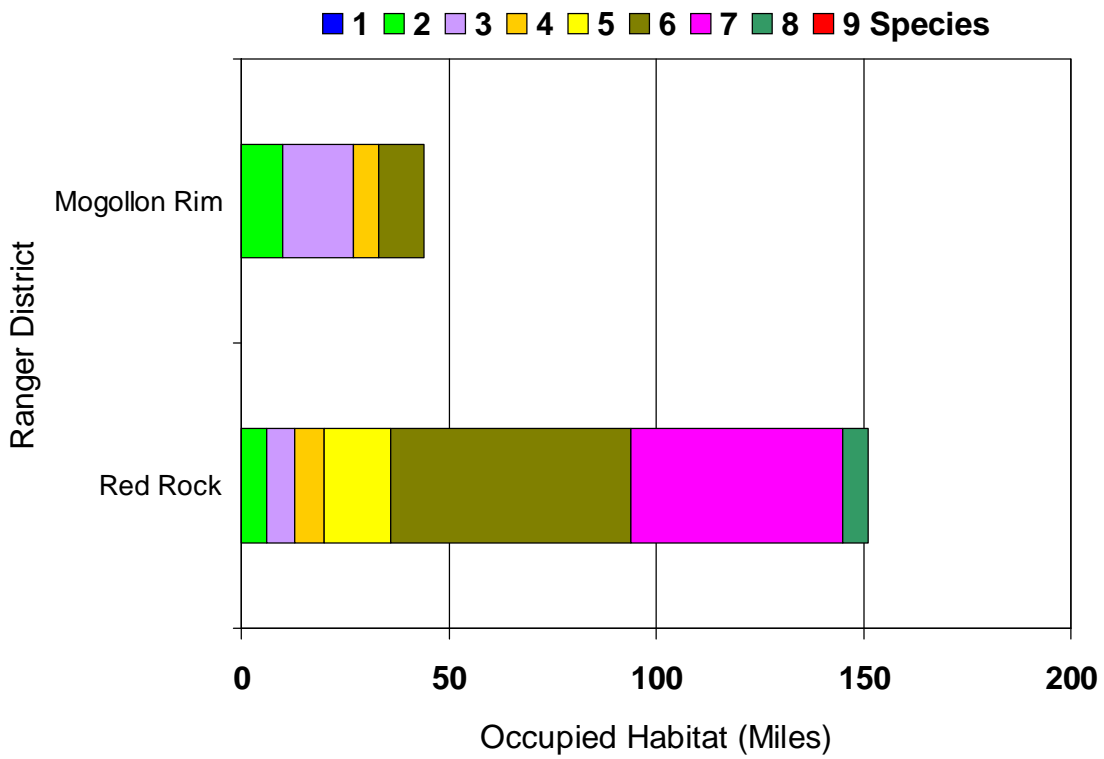
<sup>A</sup>Percent of all stream reaches with occurrences on National Forests

<sup>B</sup>Based on Olden and Poff (2005) from the Lower Colorado River basin

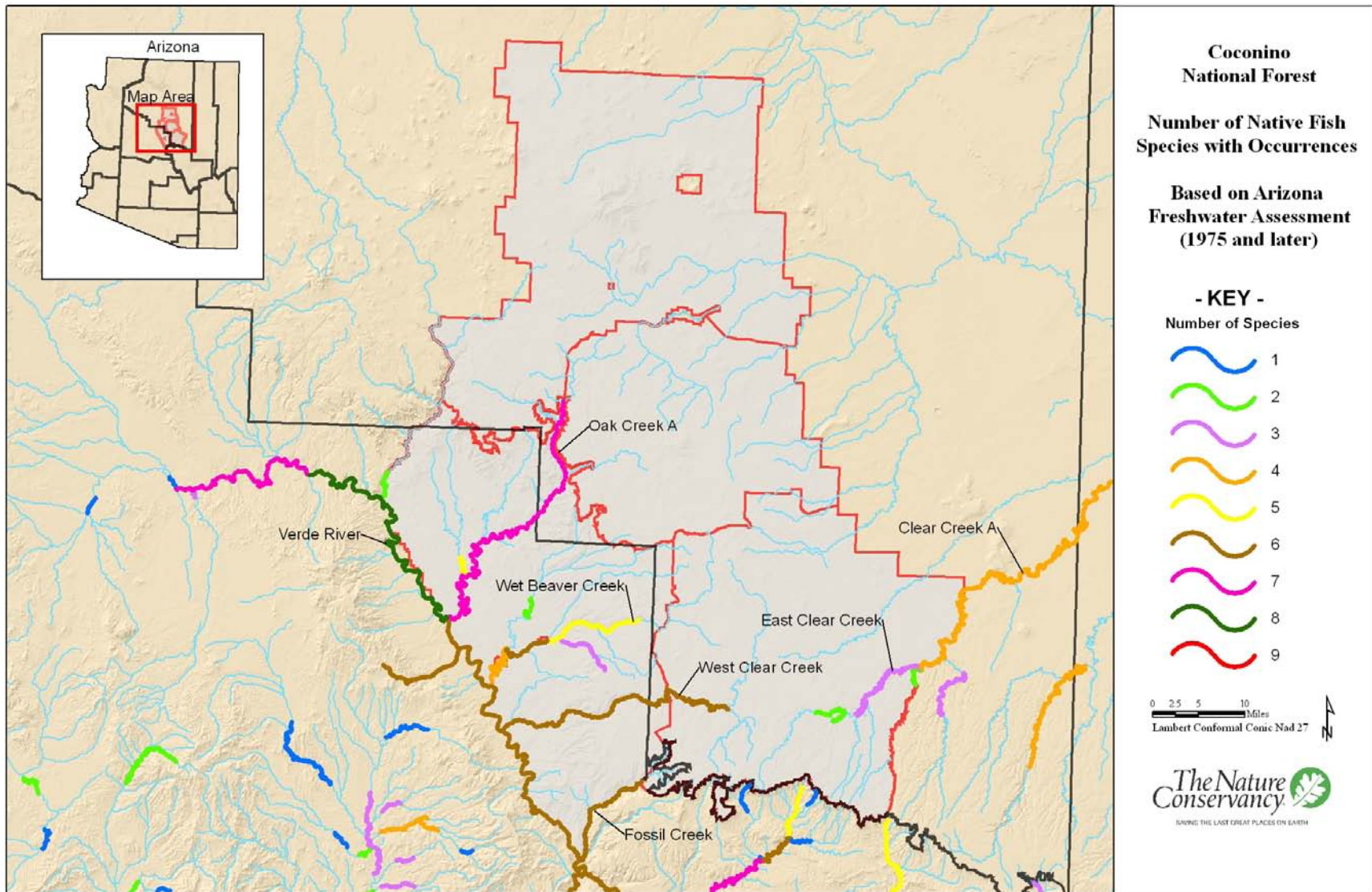
**Table 8-5.** Number of perennial stream miles, number of stream miles with occurrences (1975 to present) of one or more native fish species, and number of native fish species with occurrences on four ranger districts on the Coconino National Forest in Arizona based on the Arizona Freshwater Assessment (Turner and List, In Press).

Ranger District	Perennial Flow (Miles)	Occupied Habitat (Miles)	Number of Native Fish Species
Mogollon Rim	72	44	9
Mormon Lake	12	0	0
Peaks	5	0	0
Red Rock	157	151	12
Total	246	195	15 <sup>A</sup>

<sup>A</sup>Total number of native fish species with occurrences on the Coconino National Forest. Several species occur on multiple ranger districts.



**Figure 8-4.** Number of stream miles with varying native fish species richness based on occurrences from 1975 to present (Turner and List, In Press) for four districts on the Coconino National Forest, Arizona. No native fish occurrences were identified on the Peaks or Mormon Lake districts.



**Figure 8-5.** Perennial stream reaches with varying numbers of native fish species with occurrences on four ranger districts on the Coconino National Forest in Arizona. Non-occupied streams are presented in light blue.

**Table 8-6.** Stream systems, number of native fish species with occurrences, and the total stream reach length with native fish occurrences for 14 stream systems with native fish occurrences on the Coconino National Forest in Arizona.

Stream Name <sup>A</sup>	Occupied Habitat (miles)	Number of Native Fish Species <sup>B</sup>
Beaver Creek A	7	4
Clear Creek A	5	4
Dry Beaver Creek	3	2
East Clear Creek	23	4
Fossil Creek	8	6
General Springs Canyon	2	2
Leonard Canyon Creek	3	2
Oak Creek A	51	7
Spring Creek I	3	5
Sycamore Creek D	3	2
Verde River	25	8
Walker Creek B	7	3
West Clear Creek	36	6
Wet Beaver Creek	19	6

<sup>A</sup>Letters following stream names differentiate multiple streams with identical names elsewhere within Arizona.

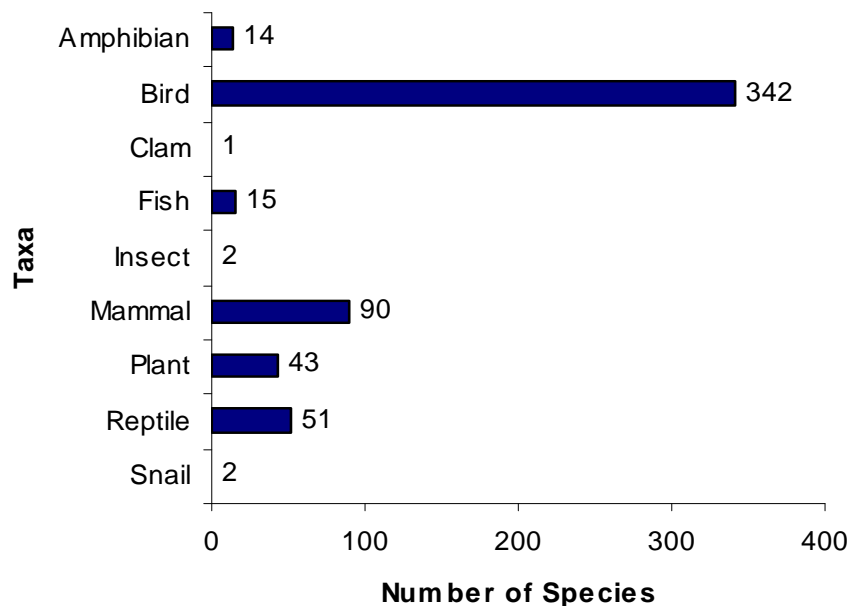
<sup>B</sup>The maximum number of species with occurrences within a reach. Portions of the stream system may have fewer species.

#### IV. Plant and Animal Species Richness

##### 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 Coconino National Forest, and to identify species that might potentially be considered as species-of-interest and species-of-concern as defined in the USFS planning directives. The R3 Species Database was synthesized from multiple datasets and provides updated and consistent attributes for species that occur on Region 3 Forests: taxonomy, NatureServe conservation status rankings, state and federal endangered species listings, and other pertinent conservation status rankings. The database includes all 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 is provided in Appendix 8-A.

Results indicate that the Coconino National Forest contains at least 560 species of plants and animals (Figure 8-6). This number is conservative, as the dataset used for this analysis only includes vertebrate species known to inhabit the Forest, and plant and invertebrate species of management concern. It is also important to note that the number and type of species inhabiting the Coconino National Forest likely changes over time. Two species considered extirpated on the Coconino National Forest, Loach Minnow (*Rhinichthys cobitis*) and Arizona Cotton Rat (*Sigmodon arizonae*), are not included in the analysis.



**Figure 8-6.** Number of species, by taxon, that inhabit the Coconino 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* – Twelve species that inhabit the Coconino National Forest are listed by the U.S. Fish and Wildlife Service as endangered or threatened under the Endangered Species Act of 1973. Two candidate species 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. Refer to Appendix 8-A for a list of threatened and endangered species.

*Arizona state conservation status* — Forty-seven species of special state conservation status designated by the Arizona Game and Fish Department occur on the Coconino National Forest. Refer to Appendix 8-A for a complete list of those species. Currently, there are 36 animals designated as Wildlife of Special Concern (WSC) and 11 plant species that are highly safeguarded (HS), or salvage restricted (SR) on the Forest. Birds comprise just over half (51%) of all species with state conservation status on the Forest.

## NatureServe Conservation Status Rankings

*Global conservation status rankings (G-ranks)* -- Ten species (1.7%) of 560 were not included in this analysis because they were not assigned a NatureServe global conservation rank. Results indicate 477 species (86.7%) were ranked as G4/T4 or G5/T5 species (Table 8-7). These are species whose populations are considered ‘apparently secure’ or ‘secure’, respectively. Sixty-nine species (12.5 %) were ranked with a global conservation status of G1, G2, G3, T1, T2 or T3, which warrants conservation concern. The remaining 4 species were considered not rankable, according to NatureServe.

**Table 8-7.** Number of species, by taxon, that inhabit the Coconino National Forest with the various global rankings assigned by NatureServe. Ten 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; GU = unrankable; T = infraspecific taxon (subspecies or varieties).

Global Ranking	Amphibian	Bird	Clam	Fish	Insect	Mammal	Plant	Reptile	Snail	Total
G1	0	0	0	4	0	0	1	0	2	7
G2	0	0	0	3	1	0	8	0	0	12
G3	2	3	1	4	0	2	21	2	0	35
G4	2	23	0	2	0	8	4	2	0	41
G5	10	303	0	2	0	66	1	40	0	422
GNA	0	0	0	0	0	0	1	0	0	1
T1	0	0	0	0	0	0	1	0	0	1
T2	0	1	0	0	0	1	1	1	0	4
T3	0	5	0	0	1	1	2	1	0	10
T4	0	3	0	0	0	1	1	2	0	7
T5	0	1	0	0	0	3	0	3	0	7
TNR	0	1	0	0	0	0	0	0	0	1
TU	0	2	0	0	0	0	0	0	0	2

*National conservation status rankings (N-ranks)* — The same suite of species was used in this analysis as in the global rankings. Four hundred fifty-four species on the Forest, 82.5%, were ranked as N4 or N5 species, whose populations are considered ‘apparently secure’ or ‘secure’, respectively (Table 8-8). Seventy-four species (13.4%) were ranked with a national conservation status of N1, N2, or N3 that warrants conservation concern. The remaining 22 species (4%) were considered not rankable, according to NatureServe.

**Table 8-8.** Number of species, by taxon, that inhabit the Coconino NF with national rankings assigned by NatureServe. Ten 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	Fish	Insect	Mammal	Plant	Reptile	Snail	Total
N1	0	0	0	4	0	0	3	0	2	<b>9</b>
N2	0	1	0	3	0	1	9	2	0	<b>16</b>
N3	2	18	1	4	1	4	17	2	0	<b>49</b>
N4	2	42	0	2	0	10	2	6	0	<b>64</b>
N5	10	272	0	1	0	66	0	41	0	<b>390</b>
NH	0	0	0	0	0	0	0	0	0	<b>0</b>
NNA	0	7	0	1	0	1	0	0	0	<b>9</b>
NNR	0	2	0	0	1	0	10	0	0	<b>13</b>

*Subnational conservation status rankings (S-ranks)* — Of the 560 species analyzed for the Coconino National Forest, 520 (92.8%) had assigned subnational conservation status ranks (S-ranks) in the state of Arizona (Table 8-9). Of these, 270 (53.4%) were considered secure or apparently secure (S5 and S4, respectively). One-hundred eighty-two species (35%) had rankings that merit conservation concern on a state or more local scale (S1, S2, S3). Three species are considered possibly extirpated (SH) in Arizona by their Natural Heritage rankings: Gila Trout, Colorado Pikeminnow, and Crenulate Moonwort. The remaining 57 species (11%) were assigned SNA or SNR rankings. See Appendix 8-A for the complete list of species with their associated S-ranks.

**Table 8-9.** Number of species, per taxon, currently inhabiting the Coconino National Forest that are assigned to the various subnational rankings by Arizona Natural Heritage. Forty of the 560 species were not assigned a subnational conservation rank by Arizona Natural Heritage, and therefore are not included in this analysis. S1 = critically imperiled; S2 = imperiled; S3 = vulnerable; S4 = apparently secure; S5 = secure; SX = presumed extirpated; SNA = not applicable; SNR = not ranked.

Subnational Ranking	Amphibian	Bird	Clam	Fish	Insect	Mammal	Plant	Reptile	Snail	Total
S1	0	40	1	4	1	2	6	1	2	<b>57</b>
S2	1	30	0	3	0	2	10	4	0	<b>50</b>
S3	3	40	0	5	1	12	11	3	0	<b>75</b>
S4	2	45	0	0	0	21	0	7	0	<b>75</b>
S5	7	122	0	0	0	42	0	32	0	<b>203</b>
SH	0	0	0	2	0	0	1	0	0	<b>3</b>
SNA	1	30	0	1	0	2	0	1	0	<b>35</b>
SNR*	0	6	0	0	0	0	13	3	0	<b>22</b>

### *Other Conservation Rankings*

*Birds of Conservation Concern* —According to the R3 Species Database, the Coconino National Forest, is home to at least 342 birds, of which 28 (8.1%) are listed by the U.S. Fish and Wildlife Service as a Bird of Conservation Concern (Table 8-10). In all, the U.S. Fish and Wildlife Service lists 131 species of Birds of Conservation Concern, and 21% of these inhabit the Coconino National Forest. Four of these species also have special conservation status under the state of Arizona (as WSC).

*Partners in Flight Watch List* — Of the 100 birds species currently on the Partners in Flight Watch List, 43 (43%) can be found on the Coconino National Forest (Table 8-10). This comprises 12.6% of the known 250 bird species that inhabit the Forest. One species, the Willow Flycatcher, also has special conservation status under the state of Arizona. Nine species occur on both the Watch List and the U.S. Fish and Wildlife Service Birds of Conservation Concern list, and are highlighted in bold.



**Table 8-10.** 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 Coconino National Forest.

<p><b><u>Diurnal Raptors</u></b>            Swainson's Hawk (P)            American Peregrine Falcon* (CC)            Ferruginous Hawk* (CC)            Northern Harrier (CC)            Common Black-Hawk* (CC)</p>	<p><b><u>Flycatchers</u></b>            Greater Pewee (CC)            Olive-Sided Flycatcher (P)            Scissor-tailed Flycatcher (CC)            Willow Flycatcher* (P)</p>
<p><b><u>Shorebirds</u></b>            Long-Billed Curlew (CC)            Stilt Sandpiper (CC)            Whimbrel (CC)            Wilson's Phalarope (CC)</p>	<p><b><u>Shrikes and Vireos</u></b>            Arizona Bell's Vireo (CC)  <b>Gray Vireo</b>            Loggerhead Shrike (CC)</p>
<p><b><u>Cuckoos and Allies</u></b>            Western Yellow-Billed Cuckoo* (CC)</p>	<p><b><u>Jays, Crows, and Allies</u></b>            Pinyon Jay (P)</p>
<p><b><u>Upland Game Birds</u></b>            Blue Grouse (P)            Montezuma Quail (P)</p>	<p><b><u>Mimids - Catbirds, Mockingbirds, Thrashers</u></b>  <b>Bendire's Thrasher</b>            Crissal Thrasher (CC)</p>
<p><b><u>Pigeons and Doves</u></b>            Band-Tailed Pigeon (P)</p>	<p><b><u>Wood Warblers</u></b>            Black-Throated Gray Warbler (CC)  <b>Grace's Warbler</b>            Hermit Warbler (P)  <b>Kentucky Warbler</b>            Olive Warbler (CC)  <b>Prothonotary Warbler</b>  <b>Red-Faced Warbler</b>            Virginia's Warbler (P)</p>
<p><b><u>Owls</u></b>            Burrowing Owl (CC)  <b>Elf Owl</b>  <b>Flammulated Owl</b>            Short-Eared Owl (P)</p>	<p><b><u>Blackbirds, Orioles, and Allies</u></b>            Rusty Blackbird (P)</p>
<p><b><u>Goatsuckers and Swifts</u></b>            Black Swift (P)            White-Throated Swift (P)</p>	<p><b><u>Emberizine Sparrows and Allies</u></b>            Abert's Towhee (P)            Brewer's Sparrow (P)            Harris's Sparrow (P)            Lark Bunting (CC)            Mccown's Longspur (P)            Painted Bunting (P)            Sage Sparrow            Dickcissel (P)</p>
<p><b><u>Hummingbirds</u></b>            Allen's Hummingbird (P)            Calliope Hummingbird (P)            Costa's Hummingbird (P)            Rufous Hummingbird (P)</p>	<p><b><u>Finches and Old World Sparrows</u></b>            Black Rosy Finch (P)            Lawrence's Goldfinch (P)</p>
<p><b><u>Woodpeckers</u></b>  <b>Lewis's Woodpecker</b></p>	
<p>(P) Bird species on the Partners in Flight Watch list            (CC) USFWS Bird of Conservation Concern            * AZ G&amp;F Wildlife of Special Concern (WSC)</p>	
<p><b>Species in bold</b> appear on both lists</p>	

## *Potential Species Lists for Forest Planning*

The R3 Species Database was used to identify species that might potentially be considered as 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 three or less
  - b. Proposed or candidate species under the Federal Endangered Species Act
  - c. Recently (<5 years) delisted 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 of N1/N2, or S-rank of S1/S2 in Arizona
  - b. Listed as Wildlife of Special Concern or a plant species with state status in Arizona
  - c. Identified a priority species in the Arizona 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

*Threatened and Endangered Species* – Twelve species in four 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 8-11). This analysis does not include two species known to be extirpated on the Forest: Loach Minnow (*Rhinichthys cobitis*) and Arizona Cotton Rat (*Sigmodon arizonae*).

**Table 8-11.** Species listed as endangered or threatened under the Federal Endangered Species Act of 1973 that inhabit the Coconino National Forest. The table includes common names that are recognized by NatureServe.

<b>Taxa</b>	<b>Endangered</b>	<b>Threatened</b>
Amphibian		Chiricahua Leopard Frog
Bird	Brown Pelican Yuma Clapper Rail	Bald Eagle Mexican Spotted Owl
Fish	Gila Trout Colorado Pikeminnow Razorback Sucker	Little Colorado Spinedace Spikedace
Plant	Arizona Cliff Rose	San Francisco Peaks Groundsel

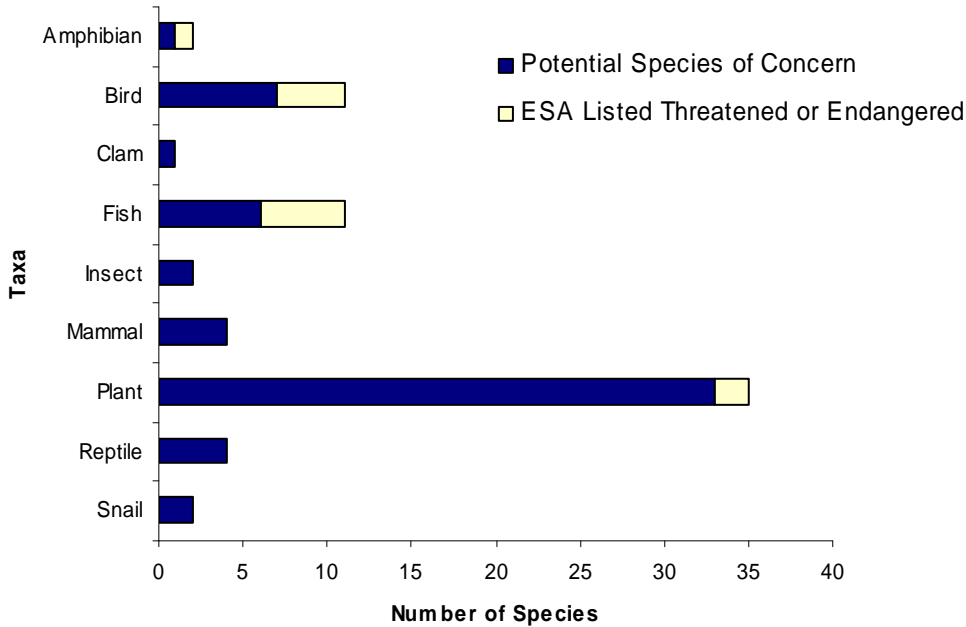
*Potential species-of-concern* -- The Coconino National Forest is home to at least 60 potential species-of-concern across nine distinct taxonomic groups (Table 8-8). Plants comprise the largest proportion of potential species-of-concern, approximately 55%; birds represent approximately 11.7%; fish, 10%; mammals and reptiles each comprise 6.7%; snails and insects, 3.3% each; and amphibians and clams, 1.7% each (Figure 8-5). Two candidate species for federal listing inhabit the Coconino National Forest, western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) and page springsnail (*Pyrgulopsis morrisoni*), and are included in the list of potential species-of-concern.

The R3 Species Database, which may not be comprehensive for the Coconino National Forest, was used to derive these results. Therefore, it is feasible that some species may be absent from these results. When combining both potential species-of-concern and ESA listed threatened and endangered species, plants continue to comprise the largest proportion of species (approximately 49%); fish and birds follow with the second largest proportion (15.3% each; Figure 8-7).

**Table 8-12.** Potential species-of-concern on the Coconino National Forest. Species with NatureServe G-ranks/T-ranks of three or less, listed as candidate or proposed species under the Federal Endangered Species Act, or having been recently (<5 years) delisted were identified as potential species-of-concern.

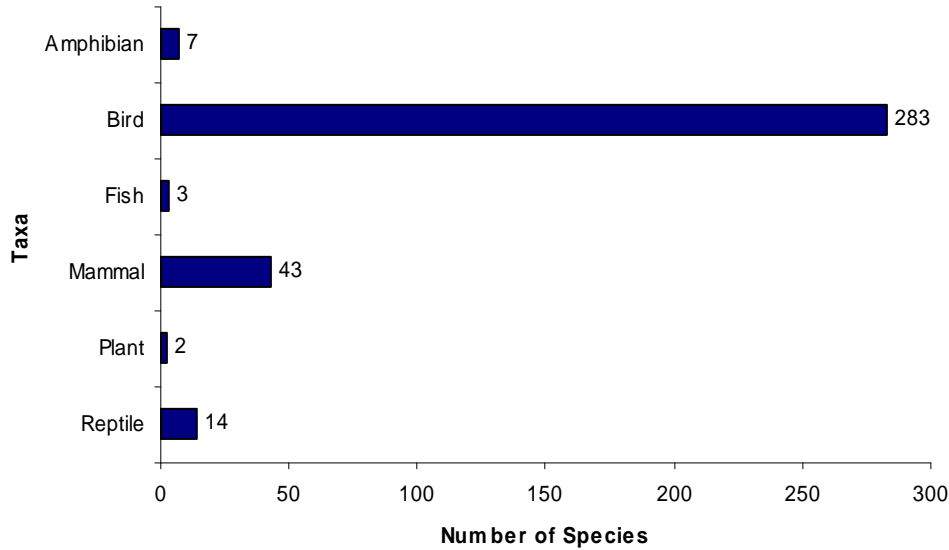
Taxa	Scientific Name	Common Name	G/T-rank	ESA status	Recently delisted
<b>Amphibians</b>					
	<i>Bufo microscaphus</i>	Arizona Toad	G3		
<b>Birds</b>					
	<i>Buteo nitidus maxima</i>	Northern Gray Hawk	T3		
	<i>Carduelis lawrencei</i>	Lawrence's Goldfinch	G3		
	<i>Charadrius alexandrinus nivosus</i>	Western Snowy Plover	T3		
	<i>Coccyzus americanus occidentalis</i>	Western Yellow-Billed Cuckoo	T2	Candidate	
	<i>Falco peregrinus anatum</i>	American Peregrine Falcon	T3		Yes
	<i>Pelecanus erythrorhynchos</i>	American White Pelican	G3		
	<i>Pipilo aberti</i>	Abert's Towhee	G3		
<b>Clams</b>					
	<i>Anodonta californiensis</i>	California Floater	G3		
<b>Fish</b>					
	<i>Catostomus clarki</i>	Desert Sucker	G3		
	<i>Catostomus discobolus</i>	Bluehead Sucker	G4		
	<i>Catostomus insignis</i>	Sonora Sucker	G3		
	<i>Catostomus sp. 3</i>	Little Colorado Sucker	G2		
	<i>Gila intermedia</i>	Gila Chub	G2	Proposed	
	<i>Gila robusta</i>	Roundtail Chub	G3		
<b>Insects</b>					
	<i>Cicindela oregona maricopa</i>	Maricopa Tiger Beetle	T3		
		Arizona Giant Sand Treader			
	<i>Daihinibaenetes arizonensis</i>	Cricket	G2		
<b>Mammals</b>					
	<i>Idionycteris phyllotis</i>	Allen's Big-Eared Bat	G3		
	<i>Microtus mogollonensis navaho</i>	Navajo Mexican Vole	T2		
		Occult Little Brn. Myotis			
	<i>Myotis occultus</i>	Bat	G3		
	<i>Perognathus amplus cineris</i>	Wupatki Pocket Mouse	T3		
<b>Plants</b>					
	<i>Actaea arizonica</i>	Arizona Bugbane	G2		
	<i>Agave delamateri</i>	Tonto Basin Agave	G2		
	<i>Arenaria aberrans</i>	Mt. Dellenbaugh Sandwort	G3		
	<i>Astragalus rusbyi</i>	A Milkvetch	G3		
	<i>Botrychium crenulatum</i>	Crenulate Moonwort	G3		
		Chihuahuan Desert			
	<i>Brickellia floribunda</i>	Brickell-Bush	G3		
	<i>Carex ultra</i>	Cochise Sedge	G3		
	<i>Chrysothamnus molestus</i>	Arizona Rabbit-Brush	G3		
	<i>Cirsium parryi ssp. mogollonicum</i>		T1		
	<i>Desmodium metcalfei</i>	Metcalfe's Tick-Trefoil	G3		
	<i>Erigeron saxatilis</i>	Rock Fleabane	G3		

Taxa	Scientific Name	Common Name	G/T-rank	ESA status	Recently delisted
	<i>Eriogonum ericifolium</i> var. <i>ericifolium</i>	Heathleaf Wild Buckwheat	T2		
	<i>Eriogonum ripleyi</i>	Ripley's Wild Buckwheat	G2		
	<i>Gentianopsis barbellata</i>	Perennial Fringed Gentian	G3		
	<i>Hedeoma diffusa</i>	Flagstaff Pennyroyal	G3		
	<i>Helenium arizonicum</i>	Arizona Sneezeweed	G3		
	<i>Heuchera eastwoodiae</i>	Senator Mine Allum-Root	G3		
	<i>Hymenopappus mexicanus</i>	Mexican Woolly-white	G3		
	<i>Hymenoxys rusbyi</i>	Ruby's Bitterweed	G3		
	<i>Ligusticum porteri</i>	Porter's Lovage	G3		
	<i>Pellaea lyngholmii</i>	Lyngholm's Cliffbrake	G2		
	<i>Penstemon clutei</i>	A Beardtongue	G2		
	<i>Penstemon nudiflorus</i>	Flagstaff Beardtongue	G2		
	<i>Penstemon ophianthus</i>	Arizona Beardtongue	G3		
	<i>Phacelia serrata</i>	Serrate Phacelia	G3		
	<i>Phacelia welshii</i>	A Phacelia	G2		
	<i>Platanthera zothecina</i>	Alcove Bog Orchid	G2		
	<i>Polygala rusbyi</i>	Rusby's Milkwort	G3		
	<i>Rumex orthoneurus</i>	Bloomer's Dock	G3		
	<i>Salvia dorrii</i> ssp. <i>mearnsii</i>	Mearns Sage	T3		
	<i>Senecio bigelovii</i> var. <i>bigelovii</i>	Nodding Ragwort	T3		
	<i>Stachys rothrockii</i>	Rothrock's Hedge-nettle	G3		
	<i>Talinum validulum</i>	Western Flame Flower	G3		
<b>Reptiles</b>					
	<i>Phyllorhynchus browni</i>				
	<i>lucidus</i>	Maricopa Leafnose Snake	T2		
	<i>Thamnophis eques megalops</i>	Mexican Garter Snake	T3		
	<i>Thamnophis rufipunctatus</i>	Narrowhead Garter Snake	G3		
	<i>Xantusia arizonae</i>	Arizona Night Lizard	G3		
<b>Snails</b>					
	<i>Pyrgulopsis morrisoni</i>	Page Springsnail	G1	Candidate	
	<i>Pyrgulopsis simplex</i>	Fossil Springsnail	G1		



**Figure 8-7.** The number of potential species-of-concern (in blue) and federally listed endangered and threatened species (yellow) by taxon that currently inhabit the Coconino National Forest. According to the published Forest Service draft directives (70 Fed. Reg. 14637), species are considered potential species-of-concern if they have a NatureServe global conservation rank of G1, G2, G3, T1, T2, or T3 and are not listed as federally endangered or threatened species. Candidate or proposed species for federal listing may be considered for species-of-concern status.

*Potential species-of-interest* —At least 348 potential species-of-interest representing six taxonomic groups occur on the Coconino National Forest (Figure 8-8). Birds make up the largest proportion (approximately 81%) of potential species-of-interest. Mammals comprise 12.4% of the total, while reptiles comprise 4.0%, and amphibians make up approximately 2.0%. Fish and plants comprise less than 1% of all potential species-of-interest on the Coconino National Forest. The species used in this analysis for Coconino National Forest are listed in Appendix 8-A and those determined as potential species-of-interest are identified.



**Figure 8-8.** The number of potential species-of-interest, by taxa, that currently inhabit the Coconino National Forest. Species were considered potential species-of-interest if they fell into one or more of the following categories: special state conservation status (WSC, HS, and SR in Arizona); listed as a species of concern or priority species in the AZ State Comprehensive Wildlife Conservation Strategies; 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* – Over three-quarters (75.7%) of all species on the Coconino National Forest were identified as falling within categories defined by the USFS planning directives (Table 8-13). While only 10.7% were identified as potential species-of-concern, approximately 63% were identified as potential species-of-interest. Notably, almost one-third (33%) of all fish that inhabit the Coconino National Forest are federally listed threatened or endangered, and another 40% are identified as potential species-of-concern. Also, over 80% of all plants that occur on the Coconino are either federally listed as threatened or endangered or 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. All but two species on the Region 3 Sensitive Species List that inhabit Apache-Sitgreaves National Forest were captured within the categories defined by the directives. Cactus mouse (*Peromyscus eremicus*) and Arizona sunflower (*Helianthus arizonensis*) are listed on the Region 3 Sensitive Species List but are not captured in categories defined by the directives.

**Table 8-13.** Number of species identified as endangered or threatened, species-of-concern, species-of-interest, or no category for the Coconino National Forest based on information in the R3 Species Database.

	Endangered and Threatened		Species-of- Concern		Species-of- Interest		No Category		Total
	#	%	#	%	#	%	#	%	
Amphibian	1	7.1	1	7.1	7	50.0	5	35.7	14
Bird	4	1.2	7	2.0	283	82.7	48	14.0	342
Clam	0	0.0	1	100.0	0	0.0	0	0.0	1
Fish	5	33.3	6	40.0	3	20.0	1	6.7	15
Insect	0	0.0	2	100.0	0	0.0	0	0.0	2
Mammal	0	0.0	4	4.4	43	47.8	43	47.8	90
Plant	2	4.7	33	76.7	2	4.7	6	14.0	43
Reptile	0	0.0	4	7.8	14	27.5	33	64.7	51
Snail	0	0.0	2	100.0	0	0.0	0	0.0	2
<b>Total</b>	<b>12</b>	<b>2.1</b>	<b>60</b>	<b>10.7</b>	<b>352</b>	<b>62.9</b>	<b>136</b>	<b>24.3</b>	<b>560</b>

#### V. 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 that are 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, inventoried roadless areas (based on data set provided by Region 3), and Congressionally designated wilderness areas on the Coconino National Forest. The conservation targets associated with each overlapping conservation area were also identified.

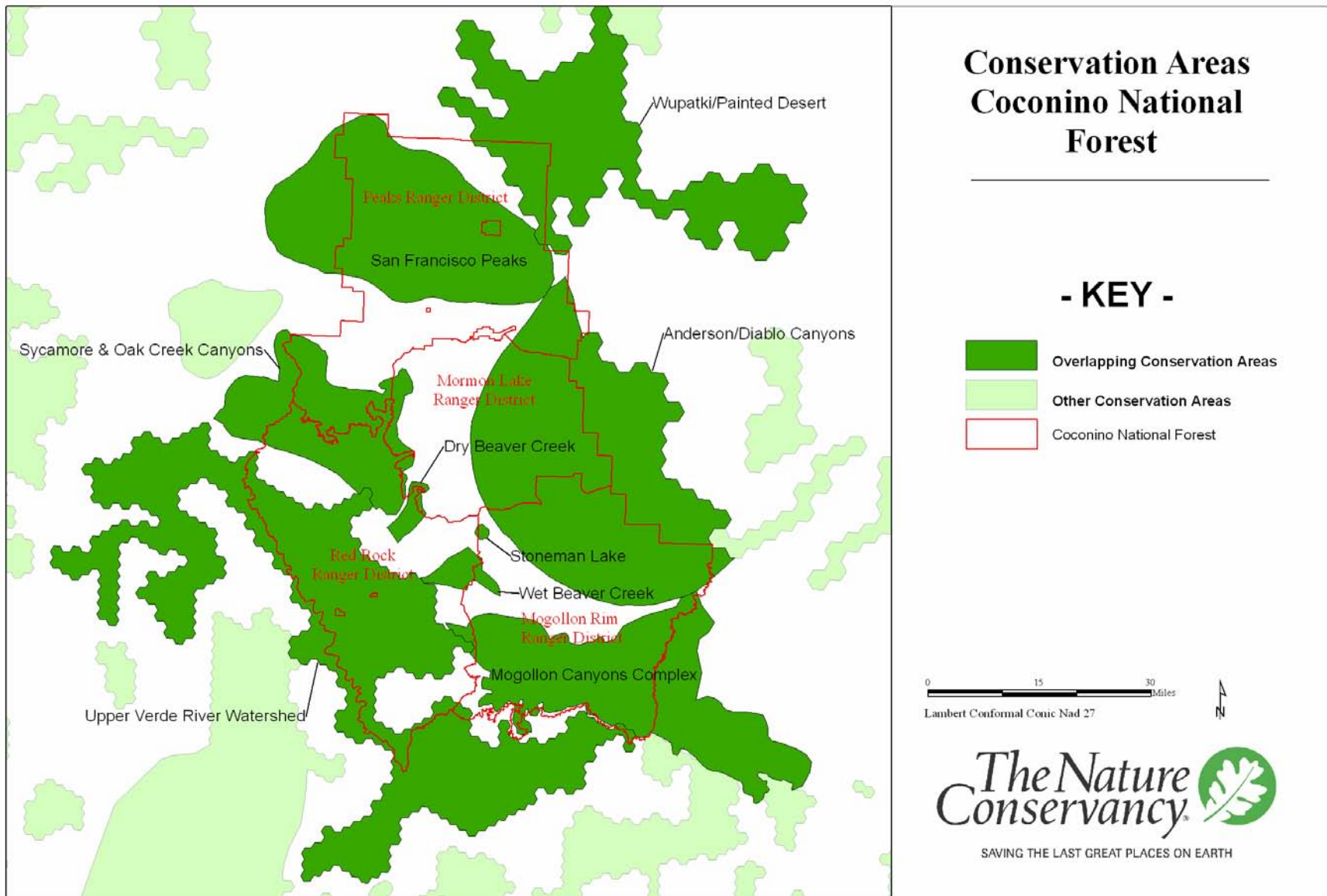
Nine individual conservation areas from ecoregional assessments overlap the Coconino National Forest (Figure 8-9, Table 8-14), totaling 1,389,700 acres, or 69.2% of the Forest. Conservation area overlap on individual districts ranged from 57.1% on the Mormon Lake to 76.2% on the Mogollon Rim District (Table 8-15). Overall, 51.5% of the total area of these nine conservation areas overlaps the Coconino National Forest. For all but two (Upper Verde River Watershed and



Wupatki/Painted Desert) of the nine overlapping conservation areas, more than half of the conservation area overlaps the Coconino (Table 8-14).

Over 85% of the area of the Coconino National Forest overlapped by conservation areas does not have specific designations (Table 8-17), while approximately 10.0% of the overlap area is wilderness area and 2.0% is roadless area. A higher proportion of wilderness areas (90.6%) is overlapped by conservation areas than roadless areas (62.0%) or areas with no designations (67.5%).

Conservation targets were summarized for all nine conservation areas that overlap with the Coconino National Forest. A total of 112 conservation targets occur within these conservation areas (Figure 8-10). Of these, 39 (34.8%) are coarse filter targets (ecological systems, communities or features), while 73 (65.2%) are individual species. Fifty (44.6%) targets are associated with riparian and aquatic systems, while 62 (55.4%) are associated with terrestrial habitats (Table 8-16). A complete listing of all conservation targets by taxonomic group for the Coconino is provided in Appendix 8-B and conservation targets for each conservation area are provided in Appendix 8-C.



**Figure 8-9.** Conservation areas (N=9) that overlap the Coconino National Forest in Arizona.

**Table 8-14.** Conservation areas (N=9) that overlap four ranger districts on the Coconino National Forest in Arizona.

Conservation Area	Ranger Districts <sup>A</sup>	Overlap (Acres)	% of Conservation Area
Anderson/Diablo Canyons	MR,ML,P	408,200	70.3
Dry Beaver Creek	ML,RR	12,500	100.0
Mogollon Canyons Complex	MR,RR	196,600	57.8
San Francisco Peaks	P	298,800	75.5
Stoneman Lake	MR,RR	1,900	100.0
Sycamore & Oak Creek Canyons	ML,P,RR	154,900	75.2
Upper Verde River Watershed	MR,RR	260,000	33.7
Wet Beaver Creek	MR,RR	19,800	100.0
Wupatki/Painted Desert	P	37,100	10.0

<sup>A</sup>MR = Mogollon Rim, ML= Mormon Lake, P = Peaks, RR = Red Rock

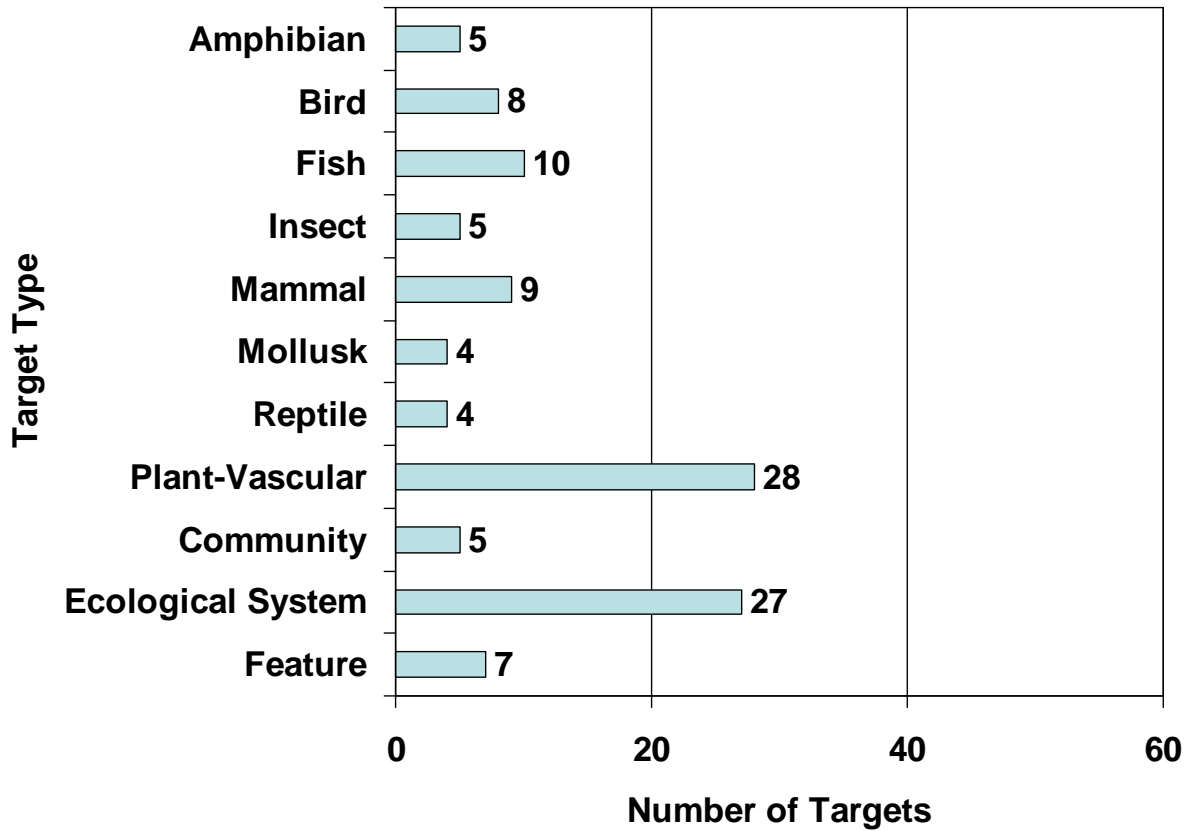
**Table 8-15.** Extent of overlap between ecoregional conservation areas and four ranger districts on the Coconino National Forest in Arizona.

District	Number of Conservation Areas	Overlap (Acres)	Percent of District
Mogollon Rim	5	394,400	76.2
Mormon Lake	3	197,700	57.1
Peaks	4	431,000	71.0
Red Rock	6	366,600	68.3
Coconino N.F Total	9 <sup>A</sup>	1,389,700	69.2

<sup>A</sup>Several conservation areas overlap more than one ranger district

**Table 8-16.** Number of conservation targets associated with aquatic/riparian and terrestrial habitats for nine conservation areas that overlap the Coconino National Forest in Arizona.

Conservation Area	Habitat		Total
	Aquatic/Riparian	Terrestrial	
Anderson/Diablo Canyons	11	22	33
Dry Beaver Creek	1	0	1
Mogollon Canyons Complex	14	23	37
San Francisco Peaks	1	31	32
Stoneman Lake	1	3	4
Sycamore & Oak Creek Canyons	7	17	24
Upper Verde River Watershed	35	29	64
Wet Beaver Creek	1	2	3
Wupatki/Painted Desert	7	7	14



**Figure 8-10.** Number of conservation targets, by type, that occur on nine conservation areas overlapping the Coconino National Forest in Arizona.

**Table 8-17.** Overlap between conservation areas inventoried roadless areas (based on data set provided by Region 3), and Congressionally designated wilderness areas on the Coconino National Forest in Arizona.

Designation	Acres within Conservation Areas	% of Conservation Areas	% of Designated Areas
Wilderness Areas	139,300	10.0	90.6
Inventiroed Roadless Areas	31,300	2.3	62.0
Neither Categorrie	1,217,800	87.7	67.5

## Discussion

### *Systems Diversity*

Three PNVTs dominate the Coconino National Forest landscape, including ponderosa pine (44.4%), pinyon-juniper (15.8%), and Madrean encinal woodland (12.0%). In total, these three PNVTs comprise approximately 1,324,200 acres or 72.2% of the Forest. All three systems are unique to the Southwest or western North America, support a host of distinct organisms that depend primarily on these vegetation systems for their survival, and face a variety conservation threats.

For example, ponderosa pine forests are restricted primarily to western North America. Ponderosa pine dependent species in Region 3 include the Abert's squirrel (*Sciurus aberti*), whose populations are mostly confined to the ponderosa pine forests in Arizona, New Mexico, Colorado and small areas in Utah and Wyoming. This system also provides important habitat to a myriad of other plants and animals, some of which are of state or federal conservation concern, such as the Northern goshawk (*Accipiter gentilis*) and the Mexican spotted owl (*Strix occidentalis lucida*), respectively. Currently, research efforts on Southwest forests have largely focused on threats that ponderosa pine systems face, especially that of large scale stand-replacing fires. These fires can have a negative impact on the biodiversity this system supports. The Coconino National Forest manages 14% of the ponderosa pine forests on Region 3 lands and 9% of this system across all of Arizona and New Mexico. Therefore, the Coconino National Forest has a unique opportunity to utilize current scientific knowledge to guide management to support the important biodiversity that exists within this system.

Pinyon-juniper woodlands, which covers the second largest total area on the Coconino, is unique to southwestern United States (primarily found in Arizona, Colorado, New Mexico, Nevada, and Utah), and also support a host of distinct organisms. For example, pinyon-juniper woodland provides habitat for the pinyon jay (*Gymnorhinus cyanocephalus*), that depends primarily on this vegetation type for its existence. Currently, the health of pinyon-juniper woodlands faces threats across Region 3 Forest Service lands, primarily due to the combined interactions of drought, bark beetle invasions, and altered fire regimes. Such threats to the system also endanger the existence of the species that depend upon the health of the pinyon-juniper woodlands. The Coconino manages approximately 9% of all pinyon-juniper woodlands across Region 3.

Madrean encinal woodlands encompass the third largest total area on the Coconino. This system is largely restricted to the extreme southwestern United States (Arizona, New Mexico and Texas), where it is considered at its northern distributional limit. Unique assemblages of vegetation of both tropical and sub-tropical origins make up this system, which supports unique biota of both northern and southern origins. Maintaining these unique assemblages of plant and animal species is critical for sustaining biodiversity in the Southwest and for Region 3 Forests. Currently, Region 3 Forests manage the largest portion (42%) of Madrean encinal woodlands of all landowners in Arizona and New Mexico, and the Coconino is responsible for approximately 8% of this system in Region 3.

Finally, it is important to emphasize that the Coconino is responsible for managing the largest proportion (80%) of alpine/tundra on Region 3 Forest lands. This comprises 16% of all alpine/tundra found in the Southwest and all of the alpine/tundra in Arizona. The high elevation and geographical location of San Francisco Mountain creates favorable conditions for this fragile system that is uncommon in the Southwest. Therefore, maintaining this system and the species it supports is vital for preserving biodiversity of the Southwest.

### *Low Elevation Grasslands*

Low elevation grasslands in the Southwest typically maintain high levels of diversity for both plants and animals. In part, this is a result of the blending of several biogeographical regions (Parmenter and others 1995) and the resultant mixing of species from northern and southern regions. Also, southwestern grasslands tend to lie adjacent to other habitat types and along with grassland-specialist species, are used by generalist species from adjacent habitats (Parmenter and Van Devender 1995). Notably high diversity of many widespread animal groups, including invertebrates (grasshoppers, termites, and ants) and vertebrates (rodents) are associated with southwestern grasslands. The richness of these species found on southwestern grasslands is tied to the species composition, habitat structure, and productivity of the plant community (Arenz and Joern 1996, Lawton 1983).

Changes in the structure and function of grassland systems have been noted as the primary cause of the loss of native diversity within grasslands (Stacy 1995). Finch (2004) identified and summarized the major threats to grassland biodiversity as the loss of natural fire cycles, overgrazing, prairie dog eradication, exotic grasses, shrub encroachment, erosion, and habitat fragmentation. The Arizona Statewide Grasslands Assessment documented several of these factors as threats to low elevation grasslands on the Coconino National Forest. In particular, nearly all of the grasslands on the Coconino whose current condition were assessed are shrub invaded (restorable native or former condition) to some degree. Increases in shrub cover within grasslands can significantly affect species richness. While the diversity of some groups, such as birds, may actually increase due to increased vertical structure associated with shrubs or trees (Knopf and Scott 1990) these changes are generally associated with increases in habitat generalists and a sharp decline in grassland specialists (Knopf 1992).

The majority of low elevation grasslands on the Coconino National forest are in restorable native condition. A key characteristic of these grasslands is their restoration potential. The potential to restore shrub-invaded grasslands is affected by a complex web of interacting physical and biological factors that include climate, topography, grazing, introduced/invasive species, and fire. Shrub cover can be reduced with prescribed burns when sufficient fuels are present to carry a fire of adequate intensity (Gori and Backer 2005). Often, the fuels required to allow fires of adequate intensity to achieve this goal are lacking, and areas must be rested from grazing to allow fuels to accumulate. The number of growing seasons of rest needed to accumulate these fuels varies from site to site. Schussman and Gori (2004) estimated that 44% of sites in Arizona could be burned with three growing seasons or less of rest, while the remainder of grasslands would need longer periods of rest.

According to the Arizona Grasslands Assessment, approximately 11% of grasslands on the Coconino National Forest have exceeded a threshold of 35% shrub cover and have likely undergone a type conversion from grassland to shrubland. This transition can result in a likely permanent loss of grassland systems and the species that depend on them. Even given long periods (50 years) of grazing rest, it is unlikely that these former grasslands can be restored to open native conditions (Hennessey and others 1983). While increases in perennial grass cover may occur (Valone and others. 2002) at certain sites based upon soil type, erosion and shrub species composition, it is unlikely that these sites will accumulate sufficient fine fuels to carry a fire intense enough to reduce shrub cover and restore open grassland conditions.

Over 15% of the grasslands that occur on Region 3 National Forests in Arizona are found on the Coconino National Forest. The Red Rock and Peaks Ranger Districts, in particular, have significant areas of contiguous grasslands that are shrub invaded, but have significant potential for restoration. As noted by Finch (2004), maintaining grasslands at sufficient scales is vital for supporting grassland-dependent species, as habitat fragmentation has detrimental effects on grassland biodiversity. These grassland areas provide a valuable opportunity to manage grasslands on the Forest, and to partner with adjacent landowners, to restore grassland function and structure at sufficient scales to ensure the sustainability of species that are dependant on this system.

#### *Native Fish Assessment*

Aquatic systems are an important component of the diversity that exists on the Coconino National Forest. According to Arizona Freshwater Assessment, the Coconino has the most stream miles with native fish species occurrences and accounts for over 15% of all occupied stream miles within Region 3 National Forests in Arizona. Also, the Coconino has a high proportion (36%) of stream reaches with six more species, demonstrating the important aquatic diversity that exists within the Forest.

Based on Olden and Poff (2005), it is evident that native fish distributions within the Lower Colorado watershed and throughout the Southwest are dynamic, with the distribution of most native fishes declining. Interestingly, Olden and Poff (2005) found a significant relationship between distributional declines and probability of local extirpation for native fish species. Ten of 14 native fish species on the Coconino addressed by Olden and Poff (2005) were determined to have declining distributions. The declines in distributions for these species suggest an increased probability of extirpation from the Forest. The Freshwater Assessment identifies areas on the Coconino with occurrences of these native fish. Within a forest planning context, it may be important to consider the uses and activities that occur within these areas to assess their compatibility with maintaining the distribution and populations of native fish on the Coconino National Forest.

The causes of decline in native fish species 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.

### *Conservation Areas*

The Coconino National Forest has the largest proportion of overlap with ecoregional conservation areas of all National Forests within Region 3. All of the ranger districts on the Coconino are overlapped by multiple conservation areas. These conservation areas include 112 conservation targets, including 73 individual species. The specific locations where conservation areas overlap the Coconino 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 Coconino for sustaining this suite of species, ecological systems, and biological processes that are represented by the conservation targets associated with each conservation area that overlaps the Coconino National Forest.

### *Relevance to Forest Planning*

This analysis of existing regional assessment information identifies important biological and ecological characteristics of the Coconino 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 Coconino, identifying ecological characteristics that may be useful in defining desired future conditions, and identifying changes in management necessary to sustain biodiversity. For example, the analysis of ecosystem data demonstrates the variety of systems that occur on the Coconino, and identifies systems (and their associated species diversity) for which the Coconino has disproportionate responsibility within the context of Region 3, such as the ponderosa pine, pinyon-juniper forests, and Great Basin/ Colorado Plateau grassland and steppe. This analysis also demonstrates the importance of grasslands on the Coconino within a landscape context. The restoration of grasslands on the Coconino to open native grassland condition, including the ecological functions that support them, will help promote the large-scale sustainability of important grassland areas within the Southwest.

Ecoregional assessments provide a strategic, regional perspective on maintaining biodiversity at large, ecoregional 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 allowable land uses and activities within conservation areas and determine associated impacts to biodiversity. For example, a synthesis of conservation area overlap with designated wilderness areas and inventoried roadless areas on the Coconino demonstrates the wide variety of current management emphases and activities that occur within conservation areas. The largest proportion of conservation area overlap falls on areas that fall outside either of these categories, although significant areas also overlap wilderness areas. It is apparent that achieving biodiversity sustainability on the Coconino cannot be accomplished entirely within these areas, and must be accomplished within the varied uses and activities that occur on the Forest. For forest planning purposes, it may be useful to determine the compatibility of forest management and uses within conservation areas with desired biodiversity goals, and identify changes that may be needed to achieve sustainability within these areas.

It is important to note that conservation areas do not imply the need for special protections or blanket restriction 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 uses or activities in these areas.

For example, the Upper Verde River Watershed conservation area encompasses 770,400 acres, of which 260,000 (33.7%) acres overlap the Coconino National Forest, primarily on the Red Rock Ranger District. Sixty-four conservation targets, including 48 individual species and 16 communities, ecological systems, and features (see Appendix 8-C), are associated with the Upper Verde River Watershed 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 necessary, 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 activities can be assessed. For example, 35 (54.7%) targets within this conservation area are associated with aquatic/and riparian habitats. Several of the avian conservation targets (southwest willow flycatcher, western yellow-billed cuckoo, and belted kingfisher) within the conservation area are associated with riparian forests and streams. The habitats these species depend on are threatened by degradation from agricultural conversion stream channelization, stabilization, and flow management, livestock grazing, invasives, and groundwater pumping. It may be useful to evaluate plan components within this conservation area and if necessary, identify changes in allowed activities or uses that may reduce or mitigate these threats.

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**Appendix 8-A.** Plants and animals of the Coconino 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 database at [www.azconservation.org](http://www.azconservation.org).

NatureServe Scientific Name <sup>1</sup>	NatureServe Common Name <sup>A</sup>	Potential Species List <sup>2</sup>	G/T-rank	N-rank	AZ S-rank	ESA status <sup>3</sup>	AZ state status <sup>4</sup>	AZ CWCS <sup>5</sup>	Birds of Conserv. Concern <sup>6</sup>	Partners in Flight Watch List
<i>Ambystoma tigrinum</i>	Tiger Salamander		G5	N5	S5					
<i>Bufo cognatus</i>	Great Plains Toad		G5	N5	S5					
<i>Bufo microscaphus</i>	Arizona Toad	SOC	G3	N3N4	S3S4					
<i>Bufo punctatus</i>	Red-Spotted Toad	SOI	G5	N5	S5			X		
<i>Bufo woodhousii</i>	Woodhouse's Toad		G5	N5	S5					
<i>Hyla arenicolor</i>	Canyon Treefrog	SOI	G5	N5	S5			X		
<i>Hyla wrightorum</i>	Mountain Treefrog	SOI	G4	N4	S4			X		
<i>Pseudacris triseriata</i>	Western Chorus Frog	SOI	G5	N5	S5			X		
<i>Rana catesbeiana</i>	Bullfrog		G5	N5	SNA					
<i>Rana chiricahuensis</i>	Chiricahua Leopard Frog	TE	G3	N3	S3	T	WSC	X		
<i>Rana pipiens</i>	Northern Leopard Frog	SOI	G5	N5	S2		WSC	X		
<i>Rana yavapaiensis</i>	Yavapai Leopard Frog	SOI	G4	N4	S4		WSC	X		
<i>Spea bombifrons</i>	Plains Spadefoot	SOI	G5	N5	S3			X		
<i>Spea multiplicata</i>	New Mexico Spadefoot		G5	N5	S5					
<i>Accipiter cooperii</i>	Cooper's Hawk	SOI	G5	N5B	S4			X		
<i>Accipiter gentilis</i>	Northern Goshawk	SOI	G5	N4B	S3		WSC	X		
<i>Accipiter striatus velox</i>	Sharp-Shinned Hawk	SOI	T5	N5B				X		
<i>Actitis macularia</i>	Spotted Sandpiper	SOI	G5	N5B	S3S4			X		
<i>Aechmophorus clarkii</i>	Clark's Grebe	SOI	G5	N5B	S3		WSC	X		
<i>Aechmophorus occidentalis</i>	Western Grebe		G5	N5B	S3					
<i>Aegolius acadicus acadicus</i>	Northern Saw-Whet Owl	SOI	TU	NNR				X		
<i>Aeronautes saxatalis</i>	White-Throated Swift	SOI	G5	N5B	S5			X		X
<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	SOI	G5	N5	S5			X		
<i>Aix sponsa</i>	Wood Duck	SOI	G5	N5B	S2B S3N			X		
<i>Alectoris chukar</i>	Chukar	SOI	G5	NNA	SNA			X		

<sup>1</sup> NatureServe common and scientific names are used unless highlighted in bold.

<sup>2</sup> TE = Listed as Threatened or Endangered under the Endangered Species Act, SOC = potential species-of-concern, SOI = potential species-of-interest

<sup>3</sup> T = Threatened, E = Endangered, C = Candidate, PS = Partial status, PE = Proposed endangered

<sup>4</sup> HS = Highly Safeguarded, SR = Salvage Restricted, WSC = Wildlife of Special Concern

<sup>5</sup> Listed as priority species in the Arizona Comprehensive Wildlife Conservation Strategy

<sup>6</sup> Birds of Conservation Concern National Priority List

NatureServe Scientific Name <sup>1</sup>	NatureServe Common Name <sup>A</sup>	Potential Species List <sup>2</sup>	G/T-rank	N-rank	AZ S-rank	ESA status <sup>3</sup>	AZ state status <sup>4</sup>	AZ CWCS <sup>5</sup>	Birds of Conserv. Concern <sup>6</sup>	Partners in Flight Watch List
<i>Ammodramus savannarum ammolegus</i>	Arizona Grasshopper Sparrow	SOI	TU	N2	S2			X		
<i>Amphispiza belli</i>	Sage Sparrow	SOI	G5	N5	S4			X	X	
<i>Amphispiza bilineata</i>	Black-Throated Sparrow	SOI	G5	N5	S5			X		
<i>Anas acuta</i>	Northern Pintail	SOI	G5	N5B	S2B S5N			X		
<i>Anas americana</i>	American Wigeon	SOI	G5	N5B	S1B S5N			X		
<i>Anas clypeata</i>	Northern Shoveler	SOI	G5	N5B	S1B S5N					
<i>Anas crecca</i>	Green-Winged Teal	SOI	G5	N5B	S3B S5N			X		
<i>Anas cyanoptera</i>	Cinnamon Teal	SOI	G5	N5B	S5			X		
<i>Anas discors</i>	Blue-Winged Teal	SOI	G5	N5B	S2B S5N			X		
<i>Anas penelope</i>	Eurasian Wigeon	SOI	G5	N3N	S2N					
<i>Anas platyrhynchos</i>	Mallard	SOI	G5	N5B	S5			X		
<i>Anas strepera</i>	Gadwall	SOI	G5	N5B	S5			X		
<i>Anser albifrons</i>	Greater White-Fronted Goose	SOI	G5	N5B	S2N					
<i>Anthus rubescens</i>	American Pipit	SOI	G5	N5B	S2B S5N			X		
<i>Aphelocoma californica</i>	Western Scrub-Jay		G5	N5	S5					
<i>Aquila chrysaetos</i>	Golden Eagle	SOI	G5	N5B	S4			X		
<i>Archilochus alexandri</i>	Black-Chinned Hummingbird	SOI	G5	N5B	S5			X		
<i>Ardea alba egretta</i>	Great Egret	SOI	TNR	NNR			WSC	X		
<i>Ardea herodias</i>	Great Blue Heron		G5	N5B	S5					
<i>Asio flammeus</i>	Short-Eared Owl	SOI	G5	N5B	SNR			X		X
<i>Asio otus</i>	Long-Eared Owl	SOI	G5	N5B	S2B S3S4N					
<i>Athene cunicularia hypugaea</i>	Burrowing Owl	SOI	T4	N4	S3			X	X	
<i>Auriparus flaviceps</i>	Verdin		G5	N5	S5					
<i>Aythya affinis</i>	Lesser Scaup Duck	SOI	G5	N5B	S5N			X		
<i>Aythya americana</i>	Redhead	SOI	G5	N5B	S4			X		
<i>Aythya collaris</i>	Ring-Necked Duck	SOI	G5	N5B	S5			X		
<i>Aythya marila</i>	Greater Scaup Duck	SOI	G5	N5B	S1N			X		
<i>Aythya valisineria</i>	Canvasback Duck	SOI	G5	N5B	S1B S4N			X		
<i>Baeolophus ridgwayi</i>	Juniper Titmouse		G5	N5	S5					
<i>Baeolophus wollweberi</i>	Bridled Titmouse	SOI	G5	N4	S4			X		
<i>Bombycilla cedrorum</i>	Cedar Waxwing	SOI	G5	N5	S3S4N			X		
<i>Bombycilla garrulus</i>	Bohemian Waxwing		G5	N5B						

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<i>Botaurus lentiginosus</i>	American Bittern	SOI	G4	N4B	S1S2		WSC	X		
<i>Branta canadensis</i>	Canada Goose	SOI	G5	N5B	S4N			X		
<i>Bubo virginianus</i>	Great-Horned Owl		G5	N5	S5					
<i>Bubulcus ibis</i>	Cattle Egret	SOI	G5	N5B	S1B S4N			X		
<i>Bucephala albeola</i>	Bufflehead	SOI	G5	N5B	S5N			X		
<i>Bucephala clangula</i>	Common Goldeneye	SOI	G5	N5B	S5N			X		
<i>Bucephala islandica</i>	Barrow's Goldeneye	SOI	G5	N5B	S1N			X		
<i>Buteo albonotatus</i>	Zone-Tailed Hawk	SOI	G4	N4B	S4			X		
<i>Buteo jamaicensis</i>	Red-Tailed Hawk		G5	N5B	S5					
<i>Buteo lagopus</i>	Rough-Legged Hawk	SOI	G5	N5B	SNRN			X		
<i>Buteo lineatus</i>	Red-Shouldered Hawk	SOI	G5	N5B				X		
<i>Buteo nitidus maxima</i>	Northern Gray Hawk	SOC	T3	N3	S3		WSC			
<i>Buteo platypterus</i>	Broad-Winged Hawk	SOI	G5	N5B				X		
<i>Buteo regalis</i>	Ferruginous Hawk	SOI	G4	N4B	S2B S4N		WSC	X	X	
<i>Buteo swainsoni</i>	Swainson's Hawk	SOI	G5	N5B	S3			X		X
<i>Buteogallus anthracinus</i>	Common Black-Hawk	SOI	G4	N3B	S3		WSC	X	X	
<i>Butorides virescens</i>	Green Heron	SOI	G5	N5B	S4			X		
<i>Calamospiza melanocorys</i>	Lark Bunting	SOI	G5	N5B	S1B S5N			X	X	
<i>Calcarius mccownii</i>	Mccown's Longspur	SOI	G4	N4B	S2N			X		X
<i>Calcarius ornatus</i>	Chestnut-Collared Longspur	SOI	G5	N5B	S3N			X		
<i>Calidris alba</i>	Sanderling	SOI	G5	N4B, N5N	SNA			X		
<i>Calidris alpina</i>	Dunlin	SOI	G5	N5B	S2N			X		
<i>Calidris bairdii</i>	Baird's Sandpiper	SOI	G5	N4B	SNA			X		
<i>Calidris himantopus</i>	Stilt Sandpiper	SOI	G5	N3B				X	X	
<i>Calidris mauri</i>	Western Sandpiper	SOI	G5	N5B	S1N			X		
<i>Calidris melanotos</i>	Pectoral Sandpiper	SOI	G5	N5B	SNA			X		
<i>Calidris minutilla</i>	Least Sandpiper	SOI	G5	N5B	S5N			X		
<i>Calidris pusilla</i>	Semipalmated Sandpiper		G5	N5B						
<i>Callipepla gambelii</i>	Gambel's Quail		G5	N5	S5					
<i>Calypte anna</i>	Anna's Hummingbird	SOI	G5	N5	S5			X		
<i>Calypte costae</i>	Costa's Hummingbird	SOI	G5	N5B, N4N	S5			X		X
<i>Campylorhynchus brunneicapillus</i>	Cactus Wren		G5	N5	S5					

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<i>Caprimulgus vociferus</i>	Whip-Poor-Will	SOI	G5	N5B, NNRN	S4			X		
<i>Cardellina rubrifrons</i>	Red-Faced Warbler	SOI	G5	N4B	S4			X	X	X
<i>Cardinalis cardinalis</i>	Northern Cardinal		G5	N5	S5					
<i>Carduelis lawrencei</i>	Lawrence's Goldfinch	SOC	G3	N3N4	SNR			X		X
<i>Carduelis pinus</i>	Pine Siskin		G5	N5	S5					
<i>Carduelis psaltria</i>	Lesser Goldfinch	SOI	G5	N5	S5			X		
<i>Carduelis tristis</i>	American Goldfinch	SOI	G5	N5	S1B S5N					
<i>Carpodacus cassinii</i>	Cassin's Finch	SOI	G5	N5	S4			X		
<i>Carpodacus mexicanus</i>	House Finch	SOI	G5	N5	S5			X		
<i>Carpodacus purpureus</i>	Purple Finch	SOI	G5	N5B	S1S2N			X		
<i>Cathartes aura</i>	Turkey Vulture	SOI	G5	N5B	S5			X		
<i>Catharus guttatus</i>	Hermit Thrush	SOI	G5	N5	S5			X		
<i>Catharus ustulatus</i>	Swainson's Thrush	SOI	G5	N5B	S1			X		
<i>Catherpes mexicanus</i>	Canyon Wren	SOI	G5	N5	S5			X		
<i>Catoptrophorus semipalmatus</i>	Willet	SOI	G5	N5B	SNA			X		
<i>Certhia americana</i>	Brown Creeper	SOI	G5	N5	S5			X		
<i>Ceryle alcyon</i>	Belted Kingfisher	SOI	G5	N5B	S2B S5N		WSC	X		
<i>Chaetura vauxi</i>	Vaux's Swift	SOI	G5	N5B	SNA			X		
<i>Charadrius alexandrinus nivosus</i>	Western Snowy Plover	SOC	T3	N3B	S1		WSC	X		
<i>Charadrius semipalmatus</i>	Semipalmated Plover	SOI	G5	N5B	SNA			X		
<i>Charadrius vociferus</i>	Killdeer	SOI	G5	N5B	S5			X		
<i>Chen caerulescens</i>	Snow Goose	SOI	G5	N5B	S3N			X		
<i>Chen rossii</i>	Ross's Goose	SOI	G4	N4N	S2N			X		
<i>Chlidonias niger</i>	Black Tern	SOI	G4	N4B	SNA			X		
<i>Chondestes grammacus</i>	Lark Sparrow	SOI	G5	N5B	S5			X		
<i>Chordeiles acutipennis</i>	Lesser Nighthawk	SOI	G5	N5B	S5			X		
<i>Chordeiles minor</i>	Common Nighthawk	SOI	G5	N5B	S5			X		
<i>Cinclus mexicanus</i>	American Dipper	SOI	G5	N5	S3			X		
<i>Circus cyaneus</i>	Northern Harrier	SOI	G5	N5B	S1S2B S5N			X	X	
<i>Cistothorus palustris</i>	Marsh Wren	SOI	G5	N5B	S2B S3S4N			X		
<i>Clangula hyemalis</i>	Long-Tailed Duck	SOI	G5	N5B	S1N			X		

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<i>Coccothraustes vespertinus</i>	Evening Grosbeak	SOI	G5	N5	S3			X		
<i>Coccyzus americanus occidentalis</i>	Western Yellow-Billed Cuckoo	SOC	T2	N3B	S3	C	WSC	X	X	
<i>Colaptes auratus</i>	Northern Flicker	SOI	G5	N5B	S5			X		
<i>Columba livia</i>	Rock Dove		G5	NNA	SNA					
<i>Columbina inca</i>	Inca Dove		G5	N5	S5					
<i>Columbina passerina</i>	Common Ground-Dove		G5	N5	S4					
<i>Columbina talpacoti</i>	Ruddy Ground-Dove	SOI	G5	NNA	S1B S2N			X		
<i>Contopus cooperi</i>	Olive-Sided Flycatcher	SOI	G4	N4B	S4			X		X
<i>Contopus pertinax</i>	Greater Pewee	SOI	G5	N4B	S4			X	X	
<i>Contopus sordidulus</i>	Western Wood-Pewee	SOI	G5	N5B	S5			X		
<i>Corvus brachyrhynchos</i>	American Crow	SOI	G5	N5B	S5			X		
<i>Corvus corax</i>	Common Raven	SOI	G5	N5	S5			X		
<i>Cyanocitta stelleri</i>	Steller's Jay	SOI	G5	N5	S5			X		
<i>Cygnus columbianus</i>	Tundra Swan	SOI	G5	N5B	S1N			X		
<i>Cypseloides niger</i>	Black Swift	SOI	G4	N4B						X
<i>Cyrtonyx montezumae</i>	Montezuma Quail	SOI	G4	N4	S4			X		X
<i>Dendragapus obscurus</i>	Blue Grouse	SOI	G5	N5	S3			X		X
<i>Dendroica caerulescens</i>	Black-Throated Blue Warbler		G5	N5B						
<i>Dendroica coronata</i>	Yellow-Rumped Warbler	SOI	G5	N5B	S5			X		
<i>Dendroica graciae</i>	Grace's Warbler	SOI	G5	N5B	S5			X	X	X
<i>Dendroica nigrescens</i>	Black-Throated Gray Warbler	SOI	G5	N5B	S5			X	X	
<i>Dendroica occidentalis</i>	Hermit Warbler	SOI	G4	N4N5B , NNRN	SNA			X		X
<i>Dendroica petechia</i>	Yellow Warbler	SOI	G5	N5B	S4			X		
<i>Dendroica townsendi</i>	Townsend's Warbler	SOI	G5	N5B	SNA			X		
<i>Dolichonyx oryzivorus</i>	Bobolink	SOI	G5	N5B	S1		WSC			
<i>Dumetella carolinensis</i>	Gray Catbird	SOI	G5	N5B	S1		WSC	X		
<i>Egretta thula</i>	Snowy Egret	SOI	G5	N5B	S1B S4N		WSC	X		
<i>Elanus leucurus</i>	White-Tailed Kite	SOI	G5	N4	S2B S2S3N			X		
<i>Empidonax hammondi</i>	Hammond's Flycatcher	SOI	G5	N5B	S1B S2S3N			X		
<i>Empidonax oberholseri</i>	Dusky Flycatcher	SOI	G5	N5B	S4			X		



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<i>Empidonax occidentalis</i>	Cordilleran Flycatcher	SOI	G5	N5B				X		
<i>Empidonax traillii</i>	Willow Flycatcher	SOI	G5	N5B	S1		WSC	X		X
<i>Empidonax wrightii</i>	Gray Flycatcher	SOI	G5	N5B	S5			X		
<i>Eremophila alpestris</i>	Horned Lark	SOI	G5	N5B	S5			X		
<i>Eugenes fulgens</i>	Magnificent Hummingbird	SOI	G5	N4B	S4			X		
<i>Euphagus carolinus</i>	Rusty Blackbird	SOI	G4	N4B						X
<i>Euphagus cyanocephalus</i>	Brewer's Blackbird	SOI	G5	N5B	S5			X		
<i>Falco columbarius</i>	Merlin	SOI	G5	N4B	SNRN			X		
<i>Falco mexicanus</i>	Prairie Falcon	SOI	G5	N5B	S4			X		
<i>Falco peregrinus anatum</i>	American Peregrine Falcon	SOC	T3	N3B	S4		WSC	X	X	
<i>Falco sparverius</i>	American Kestrel	SOI	G5	N5B	S5			X		
<i>Fulica americana</i>	American Coot		G5	N5B	S5					
<i>Gallinago delicata</i>	Wilson's Snipe	SOI	G5	N5B	S1B S4N			X		
<i>Gallinula chloropus</i>	Common Moorhen		G5	N5B	S5					
<i>Gavia immer</i>	Common Loon	SOI	G5	N4B, N5N	S2N			X		
<i>Gavia pacifica</i>	Pacific Loon	SOI	G5	N5B, N4N5N	S1N			X		
<i>Gavia stellata</i>	Red-throated Loon		G5	N5B						
<i>Geococcyx californianus</i>	Greater Roadrunner		G5	N5	S5					
<i>Geothlypis trichas</i>	Common Yellowthroat	SOI	G5	N5	S4			X		
<i>Glaucidium gnoma californicum</i>	Northern Pygmy Owl		T4	N4N5						
<i>Grus canadensis</i>	Sandhill Crane	SOI	G5	N5B	S3N			X		
<i>Gymnorhinus cyanocephalus</i>	Pinyon Jay	SOI	G5	N5	S5					X
<i>Haliaeetus leucocephalus</i>	Bald Eagle	TE	G4	N5B	S2S3B S4N	T	WSC	X		
<i>Himantopus mexicanus</i>	Black-Necked Stilt	SOI	G5	N5B	S2					
<i>Hirundo rustica</i>	Barn Swallow	SOI	G5	N5B	S5			X		
<i>Icteria virens</i>	Yellow-Breasted Chat	SOI	G5	N5B	S4			X		
<i>Icterus bullockii</i>	Bullock's Oriole	SOI	G5	N5B	SNRB			X		
<i>Icterus parisorum</i>	Scott's Oriole	SOI	G5	N5B	S5			X		
<i>Ictinia mississippiensis</i>	Mississippi Kite	SOI	G5	N5B	S3		WSC	X		
<i>Ixobrychus exilis</i>	Least Bittern	SOI	G5	N5B	S3		WSC			
<i>Ixoreus naevius</i>	Varied Thrush	SOI	G5	N5	S1N					

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<i>Junco hyemalis</i>	Dark-Eyed Junco	SOI	G5	N5	S5			X		
<i>Junco phaeonotus</i>	Yellow-Eyed Junco	SOI	G5	N3	S3			X		
<i>Lampornis clemenciae</i>	Blue-Throated Hummingbird	SOI	G5	N3B	S4			X		
<i>Lanius ludovicianus</i>	Loggerhead Shrike	SOI	G4	N4	S4			X	X	
<i>Larus argentatus</i>	Herring Gull	SOI	G5	N5B	S2N					
<i>Larus californicus</i>	California Gull	SOI	G5	N5B	S3N			X		
<i>Larus delawarensis</i>	Ring-Billed Gull	SOI	G5	N5B	S5N			X		
<i>Larus philadelphia</i>	Bonaparte's Gull	SOI	G5	N5B	SNA			X		
<i>Larus pipixcan</i>	Franklin's Gull	SOI	G4	N4B	SNA			X		
<i>Leucosticte atrata</i>	Black Rosy Finch	SOI	G4	N4						X
<i>Limnodromus griseus</i>	Short-Billed Dowitcher	SOI	G5	N5B	SNA			X		
<i>Limnodromus scolopaceus</i>	Long-Billed Dowitcher	SOI	G5	N5B	S3S4N			X		
<i>Limosa fedoa</i>	Marbled Godwit	SOI	G5	N5B	SNA			X		
<i>Lophodytes cucullatus</i>	Hooded Merganser	SOI	G5	N5B	S2N			X		
<i>Loxia curvirostra</i>	Red Crossbill		G5	N5	S4					
<i>Megascops kennicottii</i>	Western Screech Owl	SOI	G5	N5	S5			X		
<i>Melanerpes formicivorus</i>	Acorn Woodpecker	SOI	G5	N5	S5			X		
<i>Melanerpes lewis</i>	Lewis's Woodpecker	SOI	G4	N4B	S4			X	X	X
<i>Melanerpes uropygialis</i>	Gila Woodpecker		G5	N5	S5					
<i>Melanitta fusca</i>	White-Winged Scoter Duck		G5	N5B						
<i>Melanitta perspicillata</i>	Surf Scoter	SOI	G5	N5B	S1N					
<i>Meleagris gallopavo</i>	Wild Turkey		G5	N5	S5					
<i>Melospiza georgiana</i>	Swamp Sparrow	SOI	G5	N5B	S2S3N			X		
<i>Melospiza lincolnii</i>	Lincoln's Sparrow	SOI	G5	N5B	S3B S5N			X		
<i>Melospiza melodia</i>	Song Sparrow	SOI	G5	N5	S5			X		
<i>Mergus merganser</i>	Common Merganser Duck	SOI	G5	N5B	S3S4			X		
<i>Mergus serrator</i>	Red-Breasted Merganser Duck	SOI	G5	N5B	S3N			X		
<i>Micrathene whitneyi</i>	Elf Owl	SOI	G5	N5B	S5			X	X	X
<i>Mimus polyglottos</i>	Northern Mockingbird	SOI	G5	N5	S5			X		
<i>Mniotilta varia</i>	Black-And-White Warbler	SOI	G5	N5B, N4N5N N4N5N	S1B S1N			X		
<i>Molothrus aeneus</i>	Bronzed Cowbird	SOI	G5	N5B	S5			X		

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<i>Molothrus ater</i>	Brown-Headed Cowbird	SOI	G5	N5	S5			X		
<i>Myadestes townsendi</i>	Townsend's Solitaire	SOI	G5	N5	S5			X		
<i>Myiarchus cinerascens</i>	Ash-Throated Flycatcher	SOI	G5	N5B	S5			X		
<i>Myiarchus tyrannulus</i>	Brown-Crested Flycatcher	SOI	G5	N4B	S4			X		
<i>Myioborus pictus</i>	Painted Redstart	SOI	G5	N4B	S4			X		
<i>Myiodynastes luteiventris</i>	Sulphur-Bellied Flycatcher	SOI	G5	N3B	S3			X		
<i>Nucifraga columbiana</i>	Clark's Nutcracker	SOI	G5	N5	S5			X		
<i>Numenius americanus</i>	Long-Billed Curlew	SOI	G5	N5B	S1B S3S4N				X	
<i>Numenius phaeopus</i>	Whimbrel	SOI	G5	N5B	S2M			X	X	
<i>Nycticorax nycticorax</i>	Black-Crowned Night Heron	SOI	G5	N5B	S3			X		
<i>Oporornis formosus</i>	Kentucky Warbler	SOI	G5	N5B					X	X
<i>Oporornis tolmiei</i>	Macgillivray's Warbler	SOI	G5	N5B	S4			X		
<i>Oreoscoptes montanus</i>	Sage Thrasher	SOI	G5	N5B	S5			X		
<i>Otus flammeolus</i>	Flammulated Owl	SOI	G4	N4B	S4			X	X	X
<i>Oxyura jamaicensis</i>	Ruddy Duck	SOI	G5	N5B	S5			X		
<i>Pandion haliaetus</i>	Osprey	SOI	G5	N5B	S2B S4N		WSC			
<i>Parabuteo unicinctus</i>	Harris's Hawk	SOI	G5	N5	S5			X		
<i>Parula americana</i>	Northern Parula	SOI	G5	N5B				X		
<i>Passer domesticus</i>	House Sparrow		G5	NNA	SNA					
<i>Passerculus sandwichensis</i>	Savannah Sparrow	SOI	G5	N5B	S5			X		
<i>Passerella iliaca</i>	Fox Sparrow	SOI	G5	N5B	S2N			X		
<i>Passerina amoena</i>	Lazuli Bunting	SOI	G5	N5B	S4			X		
<i>Passerina caerulea</i>	Blue Grosbeak	SOI	G5	N5B	S5			X		
<i>Passerina ciris</i>	Painted Bunting	SOI	G5	N5B				X		X
<i>Passerina cyanea</i>	Indigo Bunting	SOI	G5	N5B	S3			X		
<i>Patagioenas fasciata</i>	Band-Tailed Pigeon	SOI	G4	N4B	S5			X		X
<i>Pelecanus erythrorhynchos</i>	American White Pelican	SOC	G3	N3	S3N			X		
<i>Pelecanus occidentalis</i>	Brown Pelican	TE	G4	N4B	S1N	E		X		
<i>Petrochelidon pyrrhonota</i>	Cliff Swallow	SOI	G5	N5B	S5			X		
<i>Peucedramus taeniatus</i>	Olive Warbler	SOI	G5	N4B	S4			X	X	
<i>Phainopepla nitens</i>	Phainopepla	SOI	G5	N5	S5			X		
<i>Phalacrocorax auritus</i>	Double-Crested Cormorant	SOI	G5	N5B	S5			X		
<i>Phalaenoptilus nuttallii</i>	Common Poorwill	SOI	G5	N5B	S5			X		

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<i>Phalaropus lobatus</i>	Red-Necked Phalarope	SOI	G4	N4N5B	SNA			X		
<i>Phalaropus tricolor</i>	Wilson's Phalarope	SOI	G5	N5B	S1B S5N			X	X	
<i>Phasianus colchicus</i>	Ring-Necked Pheasant		G5	NNA	SNA					
<i>Pheucticus ludovicianus</i>	Rose-Breasted Grosbeak	SOI	G5	N5B				X		
<i>Pheucticus melanocephalus</i>	Black-Headed Grosbeak	SOI	G5	N5B	S5			X		
<i>Picoides dorsalis</i>	American Three-Toed Woodpecker	SOI	G5	N5	S3			X		
<i>Picoides pubescens</i>	Downy Woodpecker	SOI	G5	N5	S4			X		
<i>Picoides scalaris</i>	Ladder-Backed Woodpecker		G5	N5	S5					
<i>Picoides villosus</i>	Hairy Woodpecker		G5	N5	S5					
<i>Pinicola enucleator</i>	Pine Grosbeak	SOI	G5	N5	S1		WSC			
<i>Pipilo aberti</i>	Abert's Towhee	SOC	G3	N3N4	S3			X		X
<i>Pipilo chlorurus</i>	Green-Tailed Towhee		G5	N5B	S3B S4N					
<i>Pipilo erythrophthalmus</i>	Eastern Towhee		G5	N5						
<i>Pipilo fuscus</i>	Canyon Towhee		G5	N5	S5					
<i>Pipilo maculatus</i>	Spotted Towhee	SOI	G5	N5	S5			X		
<i>Piranga flava</i>	Hepatic Tanager	SOI	G5	N5B	S4			X		
<i>Piranga ludoviciana</i>	Western Tanager	SOI	G5	N5B	S5			X		
<i>Piranga rubra</i>	Summer Tanager	SOI	G5	N5B	S4			X		
<i>Plegadis chihi</i>	White-Faced Ibis	SOI	G5	N4B	SNRB S2S3N			X		
<i>Pluvialis squatarola</i>	Black-Bellied Plover	SOI	G5	N5B	SNA			X		
<i>Podiceps auritus</i>	Horned Grebe	SOI	G5	N5B	S2N			X		
<i>Podiceps nigricollis</i>	Eared Grebe	SOI	G5	N5B	S3B S5N			X		
<i>Podilymbus podiceps</i>	Pied-Billed Grebe	SOI	G5	N5B	S5			X		
<i>Poecile gambeli</i>	Mountain Chickadee	SOI	G5	N5	S5			X		
<i>Polioptila caerulea</i>	Blue-Gray Gnatcatcher	SOI	G5	N5B	S5			X		
<i>Polioptila melanura</i>	Black-Tailed Gnatcatcher		G5	N5	S5					
<i>Poocetes gramineus</i>	Vesper Sparrow	SOI	G5	N5B	S5			X		
<i>Porzana carolina</i>	Sora	SOI	G5	N5B	S4			X		
<i>Progne subis</i>	Purple Martin	SOI	G5	N5B	S4			X		
<i>Protonotaria citrea</i>	Prothonotary Warbler	SOI	G5	N5B					X	X
<i>Psaltriparus minimus</i>	Bushtit		G5	N5	S5					
<i>Pyrocephalus rubinus</i>	Vermilion Flycatcher	SOI	G5	N5B	S5			X		

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<i>Quiscalus mexicanus</i>	Great-Tailed Grackle	SOI	G5	N5	S5			X		
<i>Rallus limicola</i>	Virginia Rail	SOI	G5	N5B	S4			X		
<i>Rallus longirostris yumanensis</i>	Yuma Clapper Rail	TE	T3	N3	S3	E	WSC	X		
<i>Recurvirostra americana</i>	American Avocet	SOI	G5	N5B	S2			X		
<i>Regulus calendula</i>	Ruby-Crowned Kinglet	SOI	G5	N5B	S5			X		
<i>Regulus satrapa</i>	Golden-Crowned Kinglet	SOI	G5	N5	S3			X		
<i>Riparia riparia</i>	Bank Swallow	SOI	G5	N5B	SNR			X		
<i>Salpinctes obsoletus</i>	Rock Wren	SOI	G5	N5	S5			X		
<i>Sayornis nigricans</i>	Black Phoebe	SOI	G5	N5	S5			X		
<i>Sayornis saya</i>	Say's Phoebe	SOI	G5	N4N	S5			X		
<i>Seiurus noveboracensis</i>	Northern Waterthrush	SOI	G5	N5B	SNA			X		
<i>Selasphorus platycercus</i>	Broad-Tailed Hummingbird	SOI	G5	N5B	S5			X		
<i>Selasphorus rufus</i>	Rufous Hummingbird	SOI	G5	N5B	SNA			X		X
<i>Selasphorus sasin</i>	Allen's Hummingbird	SOI	G5	N5B	SNA			X		X
<i>Setophaga ruticilla</i>	American Redstart	SOI	G5	N5B	S1		WSC	X		
<i>Sialia currucoides</i>	Mountain Bluebird	SOI	G5	N5	S5			X		
<i>Sialia mexicana</i>	Western Bluebird	SOI	G5	N5	S5			X		
<i>Sitta canadensis</i>	Red-Breasted Nuthatch		G5	N5	S4					
<i>Sitta carolinensis</i>	White-Breasted Nuthatch		G5	N5	S5					
<i>Sitta pygmaea</i>	Pygmy Nuthatch		G5	N5	S5					
<i>Sphyrapicus nuchalis</i>	Red-Naped Sapsucker	SOI	G5	N5B	S4			X		
<i>Sphyrapicus thyroideus</i>	Williamson's Sapsucker		G5	N5B	S4					
<i>Sphyrapicus varius</i>	Yellow-Bellied Sapsucker	SOI	G5	N5B	S1N			X		
<i>Spiza americana</i>	Dickcissel	SOI	G5	N5B				X		X
<i>Spizella arborea</i>	American Tree Sparrow	SOI	G5	N5B	S1N					
<i>Spizella breweri</i>	Brewer's Sparrow	SOI	G5	N5B	S5			X		X
<i>Spizella pallida</i>	Clay-Colored Sparrow	SOI	G5	N4N5B	S1N			X		
<i>Spizella passerina</i>	Chipping Sparrow	SOI	G5	N5B	S5			X		
<i>Stelgidopteryx serripennis</i>	Northern Rough-Winged Swallow	SOI	G5	N5B	S5			X		
<i>Stellula calliope</i>	Calliope Hummingbird	SOI	G5	N5B	SNA			X		X
<i>Stercorarius longicaudus</i>	Long-tailed Jaeger		G5	N5B						
<i>Stercorarius parasiticus</i>	Parasitic Jaeger		G5	N5B						
<i>Sterna caspia</i>	Caspian Tern	SOI	G5	N4N5B	S1N			X		

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<i>Sterna forsteri</i>	Forster's Tern	SOI	G5	N4N N5B	S2N			X		
<i>Sterna hirundo</i>	Common Tern	SOI	G5	N5B				X		
<i>Streptopelia decaocto</i>	Eurasian Collared-Dove		G5	NNA	SNA					
<i>Strix occidentalis lucida</i>	Mexican Spotted Owl	TE	T3	N3	S3S4	T	WSC	X		
<i>Sturnella magna</i>	Eastern Meadowlark	SOI	G5	N5	S5			X		
<i>Sturnella neglecta</i>	Western Meadowlark	SOI	G5	N5	S5			X		
<i>Sturnus vulgaris</i>	European Starling		G5	NNA	SNA					
<i>Tachycineta bicolor</i>	Tree Swallow	SOI	G5	N5B	S3			X		
<i>Tachycineta thalassina</i>	Violet-Green Swallow	SOI	G5	N5B	S5			X		
<i>Thryomanes bewickii</i>	Bewick's Wren		G5	N5B	S5					
<i>Toxostoma bendirei</i>	Bendire's Thrasher	SOI	G4	N4B, NNRN	S4			X	X	X
<i>Toxostoma crissale</i>	Crissal Thrasher	SOI	G5	N5	S5			X	X	
<i>Toxostoma curvirostre</i>	Curve-Billed Thrasher		G5	N5	S5					
<i>Toxostoma rufum</i>	Brown Thrasher	SOI	G5	N5	S1N					
<i>Tringa flavipes</i>	Lesser Yellowlegs	SOI	G5	N5B	SNA			X		
<i>Tringa melanoleuca</i>	Greater Yellowlegs	SOI	G5	N5B	S3N			X		
<i>Tringa solitaria</i>	Solitary Sandpiper	SOI	G5	N4B, N5N	SNA			X		
<i>Troglodytes aedon</i>	House Wren	SOI	G5	N5B	S5			X		
<i>Troglodytes troglodytes</i>	Winter Wren	SOI	G5	N5	S2S3N			X		
<i>Turdus migratorius</i>	American Robin	SOI	G5	N5	S5			X		
<i>Tyrannus forficatus</i>	Scissor-tailed Flycatcher	SOI	G5	N5B				X	X	
<i>Tyrannus melancholicus</i>	Tropical Kingbird	SOI	G5	N3B	S3		WSC	X		
<i>Tyrannus verticalis</i>	Western Kingbird	SOI	G5	N5B	S5			X		
<i>Tyrannus vociferans</i>	Cassin's Kingbird	SOI	G5	N5B	S5			X		
<i>Tyto alba</i>	Barn Owl		G5	N5	S5					
<i>Vermivora celata</i>	Orange-Crowned Warbler	SOI	G5	N5B	S3B S5N			X		
<i>Vermivora luciae</i>	Lucy's Warbler	SOI	G5	N5B	S5			X		
<i>Vermivora ruficapilla</i>	Nashville Warbler	SOI	G5	N5B	SNA			X		
<i>Vermivora virginiae</i>	Virginia's Warbler	SOI	G5	N5B	S5			X		X
<i>Vireo bellii arizonae</i>	Arizona Bell's Vireo	SOI	T4	N4B	S4				X	
<i>Vireo cassinii</i>	Cassin's Vireo	SOI	G5	N3N,	S4N			X		

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				N5B						
<i>Vireo gilvus</i>	Warbling Vireo	SOI	G5	N5B	S5			X		
<i>Vireo griseus</i>	White-Eyed Vireo		G5	N5B						
<i>Vireo huttoni</i>	Hutton's Vireo		G5	N5	S5					
<i>Vireo olivaceus</i>	Red-Eyed Vireo	SOI	G5	N5B				X		
<i>Vireo plumbeus</i>	Plumbeus Vireo	SOI	G5	N5B	S5			X		
<i>Vireo vicinior</i>	Gray Vireo	SOI	G4	N4B	S4			X	X	X
<i>Wilsonia pusilla</i>	Wilson's Warbler	SOI	G5	N5B	SNA			X		
<i>Xanthocephalus xanthocephalus</i>	Yellow-Headed Blackbird	SOI	G5	N5B	S5			X		
<i>Xema sabini</i>	Sabine's Gull	SOI	G5	N5B	SNA			X		
<i>Zenaida asiatica</i>	White-Winged Dove	SOI	G5	N5	S5			X		
<i>Zenaida macroura</i>	Mourning Dove	SOI	G5	N5	S5			X		
<i>Zonotrichia albicollis</i>	White-Throated Sparrow	SOI	G5	N5B	S2S3N			X		
<i>Zonotrichia atricapilla</i>	Golden-Crowned Sparrow	SOI	G5	N5B	S1S2N			X		
<i>Zonotrichia leucophrys</i>	White-Crowned Sparrow	SOI	G5	N5B	S1B S5N			X		
<i>Zonotrichia querula</i>	Harris's Sparrow	SOI	G5	N5N	S1N			X		X
<i>Anodonta californiensis</i>	California Floater	SOC	G3	N3	S1S2			X		
<i>Catostomus clarki</i>	Desert Sucker	SOC	G3	N3N4	S3S4			X		
<i>Catostomus discobolus</i>	Bluehead Sucker	SOC	G4	N4	S3	PS		X		
<i>Catostomus insignis</i>	Sonora Sucker	SOC	G3	N3	S3			X		
<i>Catostomus sp. 3</i>	Little Colorado Sucker	SOC	G2	N2	S2		WSC	X		
<i>Cyprinus carpio</i>	Common Carp		G5	NNA	SNA					
<i>Gila intermedia</i>	Gila Chub	SOC	G2	N2	S2	PE	WSC	X		
<i>Gila nigra</i>	Headwater Chub	SOI	G1	N1	S1			X		
<i>Gila robusta</i>	Roundtail Chub	SOC	G3	N3	S2		WSC	X		
<i>Lepidomeda vittata</i>	Little Colorado Spinedace	TE	G1	N1N2	S1S2	T	WSC	X		
<i>Meda fulgida</i>	Spikedace	TE	G2	N2	S1	T	WSC	X		
<i>Oncorhynchus gilae</i>	Gila Trout	TE	G3	N3	SH	E	WSC	X		
<i>Ptychocheilus lucius</i>	Colorado Pikeminnow	TE	G1	N1	SH	E	WSC	X		
<i>Rhinichthys chrysogaster</i>	Longfin Dace	SOI	G4	N4	S3S4			X		
<i>Rhinichthys osculus</i>	Speckled Dace	SOI	G5	N5	S3S4			X		
<i>Xyrauchen texanus</i>	Razorback Sucker	TE	G1	N1	S1	E	WSC	X		
<i>Cicindela oregona maricopa</i>	Maricopa Tiger Beetle	SOC	T3	N3	S3					
<i>Daihinibaenetes arizonensis</i>	Arizona Giant Sand Treader	SOC	G2	NNR	S1S3					

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	Cricket									
<i>Ammospermophilus harrisi</i>	Harris' Antelope Squirrel		G5	N5	S5					
<i>Ammospermophilus leucurus</i>	White-Tailed Antelope Squirrel			N5	S5					
<i>Antilocapra americana</i>	Pronghorn	SOI	G5	N5	S5			X		
<i>Antrozous pallidus</i>	Pallid Bat	SOI	G5	N5	S4S5			X		
<i>Bassariscus astutus</i>	Ringtail	SOI	G5	N5	S5			X		
<i>Canis latrans</i>	Coyote	SOI	G5	N5	S5			X		
<i>Castor canadensis</i>	American Beaver	SOI	G5	N5	S4			X		
<i>Cervus canadensis nelsoni</i>	Rocky Mountain Elk		T5	N5	SNA					
<i>Chaetodipus hispidus</i>	Hispid Pocket Mouse	SOI	G5	N5	S5			X		
<i>Chaetodipus intermedius intermedius</i>	Rock Pocket Mouse	SOI	T5	N5	S5			X		
<i>Conepatus leuconotus</i>	White-backed Hog-Nosed Skunk	SOI	G4	N3	S4			X		
<i>Corynorhinus townsendii</i>	Townsend's Big-Eared Bat			N4	S3					
<i>Corynorhinus townsendii pallescens</i>	Pale Lump-nosed Bat		T4	N4	S3S4					
<i>Cynomys gunnisoni</i>	Gunnison's Prairie Dog	SOI	G5	N5	S5			X		
<i>Dipodomys ordii</i>	Ord's Kangaroo Rat	SOI	G5	N5	S5			X		
<i>Eptesicus fuscus</i>	Big Brown Bat		G5	N5	S4S5					
<i>Erethizon dorsatum</i>	North American Porcupine	SOI	G5	N5	S4S5			X		
<i>Idionycteris phyllotis</i>	Allen's Big-Eared Bat	SOC	G3	N3N4	S2S3					
<i>Lasionycteris noctivagans</i>	Silver-Haired Bat		G5	N5	S3S4					
<i>Lasiurus cinereus</i>	Hoary Bat		G5	N5	S4					
<i>Lepus californicus</i>	Black-Tailed Jack Rabbit		G5	N5	S5					
<i>Lynx rufus</i>	Bobcat	SOI	G5	N5	S5			X		
<i>Mephitis macroura</i>	Hooded Skunk	SOI	G5	N4	S4			X		
<i>Mephitis mephitis</i>	Striped Skunk	SOI	G5	N5	S5			X		
<i>Microtus longicaudus</i>	Long-Tailed Vole	SOI	G5	N5	S4			X		
<i>Microtus mogollonensis</i>	Mogollon Vole	SOI	G4	N5	S5			X		
<i>Microtus mogollonensis navaho</i>	Navajo Mexican Vole	SOC	T2	N2	S1		WSC	X		
<i>Mus musculus</i>	House Mouse		G5	NNA	SNA					
<i>Mustela frenata</i>	Long-Tailed Weasel		G5	N5	S3					
<i>Myotis auriculus</i>	Southwestern Myotis		G5	N4	S3					



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<i>Myotis californicus</i>	California Myotis Bat	SOI	G5	N5	S4S5			X		
<i>Myotis ciliolabrum</i>	Western Small-Footed Myotis Bat			N5	S3					
<b><i>Myotis ciliolabrum melanorhinus</i></b>	<b>Western Small Footed Myotis</b>									
<i>Myotis evotis</i>	Long-Eared Myotis Bat	G5	G5	N5	S3S4					
<b><i>Myotis evotis evotis</i></b>	<b>Long-eared Myotis</b>									
<i>Myotis occultus</i>	Occult Little Brn. Myotis Bat	SOC	G3	N3N4	S3			X		
<i>Myotis thysanodes</i>	Fringed Myotis Bat		G4	N4N5	S3S4					
<b><i>Myotis thysanodes thysanodes</i></b>	<b>Fringe-tailed Myotis</b>									
<i>Myotis velifer</i>	Cave Myotis Bat		G5	N4	S4					
<b><i>Myotis volans interior</i></b>	<b>Long-legged Myotis</b>									
<i>Myotis yumanensis</i>	Yuma Myotis Bat		G5	N5	S3S4					
<b><i>Myotis yumanensis yumanensis</i></b>	<b>Yuma Myotis Bat</b>									
<b><i>Neotamias minimus arizonensis</i></b>	<b>White Mountains Least Chipmunk</b>									
<i>Neotoma albigula</i>	Western White-Throated Woodrat	SOI	G5	N5	S5			X		
<i>Neotoma mexicana</i>	Mexican Wood Rat	SOI	G5	N5	S5			X		
<i>Neotoma stephensi</i>	Stephen's Woodrat	SOI	G5	N5	S5			X		
<i>Notiosorex crawfordi</i>	Crawford's Desert Shrew	SOI	G5	N5	S4S5			X		
<i>Odocoileus hemionus</i>	Mule Deer	SOI	G5	N5	S5			X		
<i>Odocoileus virginianus</i>	White-Tailed Deer	SOI	G5	N5	S5			X		
<i>Ondatra zibethicus</i>	Muskrat	SOI	G5	N5	S4			X		
<i>Onychomys leucogaster</i>	Northern Grasshopper Mouse		G5	N5	S5					
<i>Onychomys torridus</i>	Southern Grasshopper Mouse		G5	N5	S5					
<i>Pecari tajacu</i>	Collared Peccary		G5	N5	S5					
<i>Perognathus amplus</i>	Arizona Pocket Mouse	SOI	G5	N5	S5			X		
<i>Perognathus amplus cineris</i>	Wupatki Pocket Mouse	SOC	T3	N3	S3			X		
<i>Perognathus flavescens</i>	Plains Pocket Mouse		G5	N5	S4					
<i>Perognathus flavus</i>	Silky Pocket Mouse		G5	N5	S5					
<i>Peromyscus boylii</i>	Brush Mouse	SOI	G5	N5	S5			X		
<i>Peromyscus crinitus</i>	Canyon Mouse		G5	N5	S4					
<i>Peromyscus eremicus</i>	Cactus Mouse		G5	N5	S5					

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<i>Peromyscus leucopus</i>	White-Footed Mouse		G5	N5	S5					
<i>Peromyscus maniculatus</i>	Deer Mouse	SOI	G5	N5	S5			X		
<i>Peromyscus truei</i>	Pinyon Mouse		G5	N5	S5					
<i>Pipistrellus hesperus</i>	Western Pipistrelle	SOI	G5	N5	S5			X		
<i>Procyon lotor</i>	Northern Raccoon	SOI	G5	N5	S4			X		
<i>Puma concolor</i>	Puma	SOI	G5	N5	S4			X		
<i>Reithrodontomys megalotis</i>	Western Harvest Mouse	SOI	G5	N5	S5			X		
<i>Reithrodontomys montanus</i>	Plains Harvest Mouse	SOI	G5	N5	S2					
<i>Sciurus aberti</i>	Abert's Squirrel	SOI	G5	N5	S5			X		
<i>Sciurus arizonensis</i>	Arizona Gray Squirrel	SOI	G4	N4	S4			X		
<i>Sorex merriami leucogenys</i>	Merriam's Shrew	SOI	T5	N5				X		
<i>Sorex monticolus</i>	Montane Shrew		G5	N5	S4					
<i>Sorex nanus</i>	Dwarf Shrew	SOI	G4	N4	S1S2			X		
<i>Spermophilus lateralis</i>	Golden-Mantled Ground Squirrel			N5	S5					
<i>Spermophilus spilosoma</i>	Spotted Ground Squirrel	SOI	G5	N5	S4			X		
<i>Spermophilus variegatus</i>	Rock Squirrel	G5	G5	N5	S5					
<i>Spilogale gracilis</i>	Western Spotted Skunk		G5	N5	S5					
<i>Sylvilagus audubonii</i>	Desert Cottontail		G5	N5	S5					
<i>Sylvilagus floridanus</i>	Eastern Cottontail		G5	N5	S5					
<i>Tadarida brasiliensis</i>	Brazilian Free-Tailed Bat	SOI	G5	N5	S3S4			X		
<b><i>Tadarida brasiliensis mexicana</i></b>	<b>Mexican Free-tailed Bat</b>									
<i>Tamias cinereicollis</i>	Gray-Collared Chipmunk		G4	N4	S4					
<i>Tamias dorsalis</i>	Cliff Chipmunk		G5	N5	S5					
<i>Tamiasciurus hudsonicus</i>	Red Squirrel	SOI	G5	N5	S5			X		
<i>Taxidea taxus</i>	American Badger	SOI	G5	N5	S5			X		
<i>Thomomys bottae</i>	Botta's Pocket Gopher		G5	N5	S5					
<b><i>Thomomys talpoides kaibabensis</i></b>	<b>Kaibab Northern Pocket Gopher</b>									
<i>Urocyon cinereoargenteus</i>	Gray Fox	SOI	G5	N5	S5			X		
<i>Ursus americanus</i>	Black Bear	SOI	G5	N5	S5			X		
<i>Vulpes macrotis</i>	Kit Fox	SOI	G4	N4	S4			X		
<i>Actaea arizonica</i>	Arizona Bugbane	SOC	G2	N2	S2		HS			
<b><i>Adiantum andrewsii</i></b>										

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<i>Agave delamateri</i>	Tonto Basin Agave	SOC	G2	N2	S2		HS			
<b><i>Agave phillipsiana</i></b>										
<i>Arenaria aberrans</i>	Mt. Dellenbaugh Sandwort	SOC	G3	N2N3	SNR					
<i>Astragalus rusbyi</i>	A Milkvetch	SOC	G3	N3	S3					
<i>Botrychium crenulatum</i>	Crenulate Moonwort	SOC	G3	N3	SH					
<i>Brickellia floribunda</i>	Chihuahuan Desert Brickell-Bush	SOC	G3	NNR	SNR					
<i>Carex ultra</i>	Cochise Sedge	SOC	G3	N3	S2					
<i>Chrysothamnus molestus</i>	Arizona Rabbit-Brush	SOC	G3	N3	S3					
<i>Cirsium parryi</i>	Parry Thistle	SOI	G4	N4?	S1					
<i>Cirsium parryi</i> ssp. <i>mogollonicum</i>			T1	N1	S1		SR			
<i>Clematis hirsutissima</i> var. <i>hirsutissima</i>			T4	NNR	SNR					
<i>Crataegus rivularis</i>	Dotted Hawthorn	SOI	G5	NNR	S1					
<i>Desmodium metcalfei</i>	Metcalfe's Tick-Trefoil	SOC	G3	N3	SNR					
<i>Erigeron saxatilis</i>			G3	N3	S3					
<i>Eriogonum ericifolium</i> var. <i>ericifolium</i>	Heathleaf Wild Buckwheat	SOC	T2	N2	S2					
<i>Eriogonum ripleyi</i>	Ripley's Wild Buckwheat	SOC	G2	N2	S2		SR			
<i>Gentianopsis barbellata</i>	Perennial Fringed Gentian	SOC	G3	N3N4	S1					
<i>Hedeoma diffusa</i>			G3	N3	S3		SR			
<i>Helenium arizonicum</i>	SOC Arizona Sneezeweed	SOC	G3	N3	S3					
<i>Helianthus arizonensis</i>	Arizona Sunflower		G4	N4	SNR					
<i>Heuchera eastwoodiae</i>	Senator Mine Allum-Root	SOC	G3	N3	S3					
<i>Hymenopappus mexicanus</i>	Mexican Woolly-white	SOC	G3	NNR	SNR					
<i>Hymenoxys rusbyi</i>	Ruby's Bitterweed	SOC	G3	NNR	SNR					
<i>Ligusticum porteri</i>	SOC Porter's Lovage	SOC	G3	N3N4	SNR					
<i>Packera franciscana</i>	San Francisco Peaks Groundsel	TE	G1	N1	S1	T	HS			
<i>Pellaea lyngholmii</i>			G2	NNR	SNR					
<i>Penstemon clutei</i>	A Beardtongue	SOC	G2	N2	S2		SR			
<i>Penstemon nudiflorus</i>	SOC Flagstaff Beardtongue	SOC	G2	N2N3	S2S3					
<i>Penstemon ophianthus</i>	Arizona Beardtongue	SOC	G3	N3N4	S2					
<i>Phacelia serrata</i>	Serrate Phacelia	SOC	G3	N3	S3					
<i>Phacelia welshii</i>	A Phacelia	SOC	G2	N2	S2					

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<i>Phanerophlebia auriculata</i>	Eared Phanerophlebia		G4	NNR	SNR					
<i>Platanthera zothecina</i>	Alcove Bog Orchid	SOC	G2	N2	S2					
<i>Polygala rusbyi</i>	Rusby's Milkwort	SOC	G3	N3	S3					
<i>Porterella carnosula</i>	Western Porterella		G4	NNR	SNR					
<i>Purshia x subintegra</i>	Arizona Cliff Rose	TE	GNA	N1	S1	E	HS			
<i>Rumex orthoneurus</i>	Bloomer's Dock	SOC	G3	N3	S3		HS			
<i>Salvia dorrii ssp. mearnsii</i>			T3	N3	S3		SR			
<i>Senecio bigelovii var. bigelovii</i>	Nodding Ragwort	SOC	T3	NNR	SNR					
<i>Stachys rothrockii</i>	Rothrock's Hedge-nettle	SOC	G3	NNR	SNR					
<i>Talinum validulum</i>	Western Flame Flower	SOC	G3	N3	S3		SR			
<i>Apalone spinifera</i>	Spiny Softshell		G5	N5	SNA					
<i>Arizona elegans</i>	Glossy Snake	SOI	G5	N5	S5			X		
<i>Aspidoscelis exsanguis</i>	Chihuahuan Spotted Whiptail		G5	N5	S3					
<i>Aspidoscelis flagellicauda</i>	Gila Spotted Whiptail	SOI	G4	N4	S4			X		
<i>Aspidoscelis tigris</i>	Western Whiptail		G5	N5	S5					
<i>Aspidoscelis uniparens</i>	Desert Grassland Whiptail		G5	N5	S5					
<i>Aspidoscelis velox</i>	Plateau Striped Whiptail	SOC	G5	N5	S5					
<i>Chrysemys picta</i>	Northern Painted Turtle	SOI	G5	N5	S1S2			X		
<i>Coleonyx variegatus</i>	Western Banded Gecko		G5	N5	S5					
<i>Cophosaurus texanus</i>	Greater Earless Lizard		G5	N5	S5					
<i>Crotalus atrox</i>	Western Diamondback Rattlesnake	SOI	G5	N5	S5			X		
<i>Crotalus molossus</i>	Blacktail Rattlesnake	SOI	G5	N5	S5			X		
<i>Crotalus scutulatus</i>	Mojave Rattlesnake	SOI	G5	N5	S5			X		
<i>Crotalus viridis cerberus</i>	Arizona Black Rattlesnake	SOI	T5	N5	S5			X		
<i>Crotaphytus collaris</i>	Collared Lizard		G5	N5	S5					
<i>Diadophis punctatus</i>	Ringneck Snake		G5	N5	S4					
<i>Elgaria kingii nobilis</i>	Arizona Alligator Lizard		T4	N4	SNR					
<i>Eumeces multivirgatus epipleurotus</i>	Variable Skink		T5	N4N5	SNR					
<i>Eumeces obsoletus</i>	Great Plains Skink		G5	N5	S5					
<i>Gambelia wislizenii</i>	Longnose Leopard Lizard		G5	N5	S5					
<i>Heloderma suspectum suspectum</i>	Reticulate Gila Monster		T4	N4	S4					
<i>Holbrookia maculata</i>	Lesser Earless Lizard		G5	N5	S5					

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<i>Hypsiglena torquata</i>	Night Snake		G5	N5	S5					
<i>Kinosternon sonoriense</i>	Sonoran Mud Turtle	SOI	G4	N4	S4			X		
<i>Lampropeltis getula</i>	Common Kingsnake		G5	N5	S5					
<i>Lampropeltis pyromelana</i>	Sonoran Mountain Kingsnake	SOI	G5	N4	S4			X		
<i>Lampropeltis triangulum</i>	Milk Snake	SOI	G5	N5	S2					
<i>Leptotyphlops humilis segregus</i>	Trans-Pecos Blind Snake		T5	N5	SNR					
<i>Masticophis bilineatus</i>	Sonoran Whipsnake		G5	N5	S5					
<i>Masticophis flagellum</i>	Coachwhip		G5	N5	S5					
<i>Masticophis taeniatus</i>	Striped Whipsnake		G5	N5	S4					
<i>Micruroides euryxanthus</i>	Arizona Coral Snake	SOI	G5	N5	S5			X		
<i>Phrynosoma hernandesi</i>	Short-Horned Lizard	SOI	G5	N5	S2			X		
<i>Phyllorhynchus browni lucidus</i>	Maricopa Leafnose Snake	SOC	T2	N2	S2					
<i>Pituophis catenifer</i>	Gopher Snake		G5	N5	S5					
<i>Rhinocheilus lecontei</i>	Longnose Snake		G5	N5	S5					
<i>Salvadora hexalepis</i>	Western Patchnose Snake		G5	N5	S5					
<i>Sauromalus obesus</i>	Chuckwalla		G5	N5	S4					
<i>Sceloporus clarkii</i>	Clark's Spiny Lizard		G5	N5	S5					
<i>Sceloporus magister</i>	Desert Spiny Lizard		G5	N5	S5					
<i>Sceloporus undulatus</i>	Fence/ Prairie/ Plateau Lizard		G5	N5	S5					
<i>Sonora semiannulata</i>	Ground Snake		G5	N5	S5					
<i>Tantilla hobartsmithi</i>	Southwestern Black-Headed Snake	SOI	G5	N5	S5			X		
<i>Thamnophis cyrtopsis</i>	Western Blackneck Garter Snake	SOI	G5	N5	S5			X		
<i>Thamnophis elegans</i>	Western Terrestrial Garter Snake			N5	S5?					
<i>Thamnophis eques megalops</i>	Mexican Garter Snake	SOC	T3	N2N3	S2S3		WSC	X		
<i>Thamnophis rufipunctatus</i>	Narrowhead Garter Snake	SOC <sub>G5</sub>	G3	N3	S3		WSC	X		
<i>Trimorphodon biscutatus</i>	Western Lyre Snake		G5	N5	S5					
<i>Urosaurus ornatus</i>	Tree Lizard		G5	N5	S5					
<i>Uta stansburiana</i>	Side-Blotched Lizard		G5	N5	S5					
<i>Xantusia arizonae</i>	Arizona Night Lizard	SOC	G3	N3	S3			X		
<i>Pyrgulopsis morrisoni</i>	Page Springsnail	SOC	G1	N1N2	S1	C		X		
<i>Pyrgulopsis simplex</i>	Fossil Springsnail	SOC	G1	N1N2	S1			X		

**Appendix 8-B.** Conservation targets (N=112), by target type, that occur on one or more of nine conservation areas that overlap the Coconino National Forest in Arizona.

Target Type / Scientific Name	Common Name	Habitat Type	# of Conservation Areas	Conservation Areas <sup>A</sup>
<b>Amphibians</b>				
<i>Bufo microscaphus microscaphus</i>		Aquatic/Riparian	3	1,3,7
<i>Hyla wrightorum</i>	Mountain Treefrog	Aquatic/Riparian	5	1,3,4,6,7
<i>Rana chiricahuensis</i>	Chiricahua Leopard Frog	Aquatic/Riparian	3	1,3,7
<i>Rana pipiens</i>	Northern Leopard Frog	Aquatic/Riparian	1	7
<i>Rana yavapaiensis</i>	Yavapai Leopard Frog	Aquatic/Riparian	3	3,6,7
<b>Birds</b>				
<i>Accipiter gentilis</i>	Northern Goshawk	Terrestrial	5	1,3,4,6,7
<i>Buteogallus anthracinus</i>	Common Black-Hawk	Aquatic/Riparian	1	7
<i>Ceryle alcyon</i>	Belted Kingfisher	Aquatic/Riparian	1	7
<i>Coccyzus americanus occidentalis</i>	Western Yellow-Billed Cuckoo	Aquatic/Riparian	1	7
<i>Empidonax traillii extimus</i>	Southwest Willow Flycatcher	Aquatic/Riparian	1	7
<i>Falco peregrinus anatum</i>	American Peregrine Falcon	Terrestrial	1	7
<i>Haliaeetus leucocephalus</i>	Bald Eagle	Terrestrial	1	7
<i>Strix occidentalis lucida</i>	Mexican Spotted Owl	Terrestrial	5	1,3,4,6,7
<b>Fish</b>				
<i>Agosia chrysogaster</i>	Longfin Dace	Aquatic/Riparian	1	7
<i>Catostomus clarki</i>	Desert Sucker	Aquatic/Riparian	2	3,7
<i>Catostomus insignis</i>	Sonora Sucker	Aquatic/Riparian	2	3,7
<i>Catostomus sp 3</i>	Little Colorado Sucker	Aquatic/Riparian	2	1,3
<i>Gila intermedia</i>	Gila Chub	Aquatic/Riparian	1	7
<i>Gila robusta</i>	Roundtail Chub	Aquatic/Riparian	4	1,3,6,7
<i>Lepidomeda vittata</i>	Little Colorado Spinedace	Aquatic/Riparian	1	3
<i>Meda fulgida</i>	Spikedace	Aquatic/Riparian	1	7
<i>Poeciliopsis occidentalis occidentalis</i>	Gila Topminnow Intraspecific.	Aquatic/Riparian	1	7
<i>Rhinichthys osculus</i>	Speckled Dace	Aquatic/Riparian	2	1,7
<b>Insects</b>				
<i>Abedus herberti</i>	Giant Water Bug	Aquatic/Riparian	1	7
<i>Aquanothrus sp nov</i>		Aquatic/Riparian	1	9
<i>Cicindela oregona maricopa</i>	Maricopa Tiger Beetle	Aquatic/Riparian	2	3,7

Target Type / Scientific Name	Common Name	Habitat Type	# of Conservation Areas	Conservation Areas <sup>A</sup>
<i>Cylloepus parkeri</i>	Parker's Cylloepus Riffle Beetle	Aquatic/Riparian	1	7
<i>Metrichia volada</i>		Aquatic/Riparian	2	6,7
<b>Mammals</b>				
<i>Antilocapra americana</i>	Pronghorn	Terrestrial	1	7
<i>Cynomys gunnisoni</i>	Gunnison's Prairie Dog	Terrestrial	1	4
<i>Mustela frenata arizonensis</i>		Terrestrial	3	1,4,6
<i>Myotis lucifugus occultus</i>		Terrestrial	4	1,4,6,7
<i>Myotis thysanodes</i>	Fringed Myotis Bat	Terrestrial	1	7
<i>Nyctinomops macrotis</i>	Big Free-Tailed Bat	Terrestrial	1	7
<i>Sciurus arizonensis</i>	Arizona Gray Squirrel	Terrestrial	1	7
<i>Sorex nanus</i>	Dwarf Shrew	Terrestrial	1	4
<i>Ursus americanus</i>	Black Bear	Terrestrial	1	7
<b>Mollusks</b>				
<i>Pyrgulopsis montezumensis</i>	Montezuma Well Springsnail	Aquatic/Riparian	1	7
<i>Pyrgulopsis morrisoni</i>	Page Springsnail	Aquatic/Riparian	1	7
<i>Pyrgulopsis simplex</i>	Fossil Springsnail	Aquatic/Riparian	1	7
<i>Pyrgulopsis sola</i>	Brown Springsnail	Aquatic/Riparian	1	7
<b>Reptiles</b>				
<i>Cnemidophorus flagellicaudus</i>	Gila Spotted Whiptail	Terrestrial	1	3
<i>Lampropeltis pyromelana</i>	Sonoran Mountain Kingsnake	Terrestrial	2	3,6
<i>Thamnophis eques megalops</i>	Mexican Garter Snake	Aquatic/Riparian	2	6,7
<i>Thamnophis rufipunctatus</i>	Narrowhead Garter Snake	Aquatic/Riparian	3	3,6,7
<b>Plants-Vascular</b>				
<i>Agave delamateri</i>	Tonto Basin Agave	Terrestrial	1	7
<i>Astragalus troglodytus</i>		Terrestrial	3	4,6,8
<i>Botrychium crenulatum</i>	Crenulate Moonwort	Terrestrial	2	1,4
<i>Carex ultra</i>	Cochise Sedge	Aquatic/Riparian	1	7
<i>Chrysothamnus molestus</i>	Arizona Rabbit-Brush	Terrestrial	1	4
<i>Cimicifuga arizonica</i>	Arizona Bugbane	Aquatic/Riparian	2	3,6
<i>Cirsium parryi ssp mogollonicum</i>		Terrestrial	2	3,5
<i>Erigeron anchana</i>		Terrestrial	1	7
<i>Erigeron saxatilis</i>		Terrestrial	3	3,4,6
<i>Eriogonum apachense</i>		Terrestrial	1	7

Target Type / Scientific Name	Common Name	Habitat Type	# of Conservation Areas	Conservation Areas <sup>A</sup>
<i>Eriogonum ripleyi</i>	Ripley's Wild Buckwheat	Terrestrial	1	7
<i>Gentiana barbellata</i>	Perennial Fringed Gentian	Terrestrial	1	4
<i>Hedeoma diffusum</i>		Terrestrial	2	1,6
<i>Heuchera eastwoodiae</i>	Senator Mine Allum-Root	Terrestrial	2	3,6
<i>Hymenoxys helenioides</i>		Terrestrial	1	4
<i>Hymenoxys jamesii</i>		Terrestrial	1	7
<i>Penstemon clutei</i>	A Beardtongue	Terrestrial	1	4
<i>Penstemon nudiflorus</i>	Flagstaff Beardtongue	Terrestrial	1	7
<i>Phacelia serrata</i>	Serrate Phacelia	Terrestrial	2	4,9
<i>Phacelia welschii</i>	A Phacelia	Terrestrial	1	9
<i>Pinus aristata</i>		Terrestrial	1	4
<i>Potentilla multifoliolata</i>		Terrestrial	6	1,3,4,5,6,8
<i>Psoralea thompsoniae</i> var. <i>whitingii</i>		Terrestrial	1	9
<i>Purshia subintegra</i>	Arizona Cliff Rose	Terrestrial	1	7
<i>Rumex orthoneurus</i>	Bloomer's Dock	Aquatic/Riparian	2	3,7
<i>Salvia dorrii</i> ssp. <i>mearnsii</i>		Terrestrial	2	6,7
<i>Senecio franciscanus</i>	San Francisco Peaks Groundsel	Terrestrial	2	1,4
<i>Talinum validulum</i>	Western Flame Flower	Terrestrial	3	4,6,7
<b>Communities</b>				
Cienega		Aquatic/Riparian	1	7
Douglas Fir Forest Community (specific)		Terrestrial	1	4
Ponderosa Pine Forest Community (specific)		Terrestrial	6	1,2,3,4,5,6
Subalpine Forest Community (specific)		Terrestrial	1	3
White Fir Forest Community (specific)		Terrestrial	1	3
<b>Ecological Systems</b>				
Alpine Tundra		Terrestrial	1	4
Apachean Grassland and Savanna Condition Class A		Terrestrial	1	7
Apachean Grassland and Savanna Condition Class A&B		Terrestrial	1	7
Apachean Grassland and Savanna Condition Class B		Terrestrial	1	7
Apachean Shrubland		Terrestrial	1	7
Aspen Forest		Terrestrial	2	1,4
Desert Grassland And Shrub-Steppe		Terrestrial	2	1,9
Desert Wash		Aquatic/Riparian	1	7
Greasewood Shrubland		Terrestrial	1	9
Interior Chaparral		Terrestrial	1	7



Target Type / Scientific Name	Common Name	Habitat Type	# of Conservation Areas	Conservation Areas <sup>A</sup>
Little Colorado River Headwater and creek, low and intermediate, intermittent		Aquatic/Riparian	2	1,9
Little Colorado River Headwater and creek, low and intermediate, perennial		Aquatic/Riparian	1	1
Little Colorado River Headwater and creek, montane and above, intermittent		Aquatic/Riparian	2	1,9
Little Colorado River Large and extra large river, low and intermediate, perennial		Aquatic/Riparian	1	9
Little Colorado River Small and medium river, low and intermediate, intermittent		Aquatic/Riparian	1	9
Little Colorado River Small and medium river, low and intermediate, perennial		Aquatic/Riparian	1	9
Madrean Encinal		Terrestrial	1	7
Mixed Salt Desert Scrub		Terrestrial	1	9
Montane Mixed Forest		Terrestrial	4	1,3,4,7
Montane Riparian Woodland and Shrubland		Aquatic/Riparian	1	7
Pinyon-Juniper Woodland		Terrestrial	2	1,7
Playa		Aquatic/Riparian	1	7
Ponderosa Pine Forest and Woodland		Terrestrial	2	1,7
Riparian Woodland		Aquatic/Riparian	1	7
Scrub Oak		Terrestrial	1	1
Semi-desert grassland		Terrestrial	1	9
Sonoran Desert Scrub		Terrestrial	1	7
<b>Features</b>				
Lake and wetland habitat for migratory waterfowl, shorebirds		Aquatic/Riparian	1	1
Natural Lakes		Aquatic/Riparian	1	5
Pronghorn summer range		Terrestrial	1	1
Riparian habitat and watershed, springs.		Aquatic/Riparian	2	3,8
Sagebrush Steppe		Aquatic/Riparian	1	9
Springs		Aquatic/Riparian	1	2
Wetland, grassland mosaic. Ephemeral.		Aquatic/Riparian	1	1

1 = Anderson/Diablo Canyons, 2 = Dry Beaver Creek, 3 = Mogollon Canyons Complex, 4 = San Francisco Peaks, 5 = Stoneman Lake, 6 = Sycamore & Oak Creek Canyons, 7 = Upper Verde River Watershed, 8 = Wet Beaver Creek, 9 = Wupatki/Painted Desert

**Appendix 8-C.** Conservation targets associated with nine conservation areas that overlap the Coconino National Forest in Arizona.

Conservation Area/ Target Type	Scientific Name	Common Name	Habitat Type	Global Rank	ESA Status
<b>Anderson/Diablo Canyons</b>					
Amphibian	<i>Bufo microscaphus microscaphus</i>		Aquatic/Riparian	G3	
	<i>Hyla wrightorum</i>	Mountain Treefrog	Aquatic/Riparian	G4	
	<i>Rana chiricahuensis</i>	Chiricahua Leopard Frog	Aquatic/Riparian	G3	LT
Bird	<i>Accipiter gentilis</i>	Northern Goshawk	Terrestrial	G5	
	<i>Strix occidentalis lucida</i>	Mexican Spotted Owl	Terrestrial	G3	LT
Fish	<i>Catostomus sp 3</i>	Little Colorado Sucker	Aquatic/Riparian	G2	SC
	<i>Gila robusta</i>	Roundtail Chub	Aquatic/Riparian	G3	PS
	<i>Rhinichthys osculus</i>	Speckled Dace	Aquatic/Riparian	G5	PS
Mammal	<i>Mustela frenata arizonensis</i>		Terrestrial	GU	
	<i>Myotis lucifugus occultus</i>		Terrestrial	G3	
Plant-Vascular	<i>Botrychium crenulatum</i>	Crenulate Moonwort	Terrestrial	G3	
	<i>Hedeoma diffusum</i>		Terrestrial	G3	
	<i>Potentilla multifoliolata</i>		Terrestrial	G4	
	<i>Senecio franciscanus</i>	San Francisco Peaks Groundsel	Terrestrial	G1	LT
		Ponderosa Pine Forest Community (7 specific types)		Terrestrial	GU
Community Ecological System	Aspen forest		Terrestrial	GU	
	Desert grassland and shrub-steppe		Terrestrial	GU	
	Little Colorado River Headwater and creek, low and intermediate, intermittent		Aquatic/Riparian	GU	
	Little Colorado River Headwater and creek, low and intermediate, perennial		Aquatic/Riparian	GU	
	Little Colorado River Headwater and creek, montane and above, intermittent		Aquatic/Riparian	GU	
	Montane Mixed Forest		Terrestrial	GU	
	Pinyon-Juniper Woodland		Terrestrial	GU	
	Ponderosa Pine Forest and Woodland		Terrestrial	GU	
	Scrub Oak		Terrestrial	GU	
	Feature	Lake and wetland habitat for migratory waterfowl, shorebirds		Aquatic/Riparian	G4
Pronghorn summer range			Terrestrial	G4	
Wetland, grassland mosaic. Ephemeral.			Aquatic/Riparian	G4	
<b>Dry Beaver Creek</b>					
Feature	Springs	Springs	Aquatic/Riparian	G4	
<b>Mogollon Canyons Complex</b>					
Amphibian	<i>Bufo microscaphus microscaphus</i>		Aquatic/Riparian	G3	

Conservation Area/ Target Type	Scientific Name	Common Name	Habitat Type	Global Rank	ESA Status
	<i>Hyla wrightorum</i>	Mountain Treefrog	Aquatic/Riparian	G4	
	<i>Rana chiricahuensis</i>	Chiricahua Leopard Frog	Aquatic/Riparian	G3	LT
	<i>Rana yavapaiensis</i>	Yavapi Leopard Frog	Aquatic/Riparian	G4	
Bird	<i>Accipiter gentilis</i>	Northern Goshawk	Terrestrial	G5	
	<i>Strix occidentalis lucida</i>	Mexican Spotted Owl	Terrestrial	G3	LT
Fish	<i>Catostomus clarki</i>	Desert Sucker	Aquatic/Riparian	G3	SC
	<i>Catostomus insignis</i>	Sonora Sucker	Aquatic/Riparian	G3	SC
	<i>Catostomus sp 3</i>	Little Colorado Sucker	Aquatic/Riparian	G2	SC
	<i>Gila robusta</i>	Roundtail Chub	Aquatic/Riparian	G3	PS
	<i>Lepidomeda vittata</i>	Little Colorado Spinedace	Aquatic/Riparian	G1	LT
Insect	<i>Cicindela oregona maricopa</i>	Maricopa Tiger Beetle	Aquatic/Riparian	G3	
Reptile	<i>Cnemidophorus flagellicaudus</i>	Gila Spotted Whiptail	Terrestrial	G4	
	<i>Lampropeltis pyromelana</i>	Sonoran Mountain Kingsnake	Terrestrial	G5	
	<i>Thamnophis rufipunctatus</i>	Narrowhead Garter Snake	Aquatic/Riparian	G3	
Plant-Vascular	<i>Cimicifuga arizonica</i>	Arizona Bugbane	Aquatic/Riparian	G2	
	<i>Cirsium parryi ssp mogollonicum</i>		Terrestrial	G1	
	<i>Erigeron saxatilis</i>		Terrestrial	G3	
	<i>Heuchera eastwoodiae</i>	Senator Mine Allum-Root	Terrestrial	G3	
	<i>Potentilla multifoliolata</i>		Terrestrial	G4	
	<i>Rumex orthoneurus</i>	Bloomer's Dock	Aquatic/Riparian	G3	
Community	Ponderosa Pine Forest Community (7 specific types)		Terrestrial	GU	
	Subalpine Forest Community (specific)		Terrestrial	GU	
	White Fir Forest Community (6 specific types)		Terrestrial	GU	
Ecological System	Montane Mixed Forest		Terrestrial	GU	
Feature	Riparian habitat and watershed, springs.		Aquatic/Riparian	G4	
<b>San Francisco Peaks</b>					
Amphibian	<i>Hyla wrightorum</i>	Mountain Treefrog	Aquatic/Riparian	G4	
Bird	<i>Accipiter gentilis</i>	Northern Goshawk	Terrestrial	G5	
	<i>Strix occidentalis lucida</i>	Mexican Spotted Owl	Terrestrial	G3	LT
Mammal	<i>Cynomys gunnisoni</i>	Gunnison's Prairie Dog	Terrestrial	G5	
	<i>Mustela frenata arizonensis</i>		Terrestrial	GU	
	<i>Myotis lucifugus occultus</i>		Terrestrial	G3	
	<i>Sorex nanus</i>	Dwarf Shrew	Terrestrial	G4	
Plant-Vascular	<i>Astragalus troglodytus</i>		Terrestrial	G2	
	<i>Botrychium crenulatum</i>	Crenulate Moonwort	Terrestrial	G3	
	<i>Chrysothamnus molestus</i>	Arizona Rabbit-Brush	Terrestrial	G3	
	<i>Erigeron saxatilis</i>		Terrestrial	G3	

Conservation Area/ Target Type	Scientific Name	Common Name	Habitat Type	Global Rank	ESA Status
	<i>Gentiana barbellata</i>	Perennial Fringed Gentian	Terrestrial	G3	
	<i>Hymenoxys helenioides</i>		Terrestrial	G3	
	<i>Penstemon clutei</i>	A Beardtongue	Terrestrial	G2	
	<i>Phacelia serrata</i>	Serrate Phacelia	Terrestrial	G3	
	<i>Pinus aristata</i>		Terrestrial	G3	
	<i>Potentilla multifoliolata</i>		Terrestrial	G4	
	<i>Senecio franciscanus</i>	San Francisco Peaks Groundsel	Terrestrial	G1	LT
	<i>Talinum validulum</i>	Western Flame Flower	Terrestrial	G3	
Community	Douglas Fir Forest Community (specific)		Terrestrial	GU	
	Ponderosa Pine Forest Community (8 specific types)		Terrestrial	GU	
Ecological System	Alpine Tundra		Terrestrial	G4	
	Aspen Forest		Terrestrial	GU	
	Montane Mixed Forest		Terrestrial	GU	
<b>Stoneman Lake</b>					
Plant-Vascular	<i>Cirsium parryi ssp mogollonicum</i>		Terrestrial	G1	
	<i>Potentilla multifoliolata</i>		Terrestrial	G4	
Community	Ponderosa Pine Forest Community (specific)		Terrestrial	GU	
Feature	Natural Lakes		Aquatic/Riparian	G4	
<b>Sycamore &amp; Oak Creek Canyons</b>					
Amphibian	<i>Hyla wrightorum</i>	Mountain Treefrog	Aquatic/Riparian	G4	
	<i>Rana yavapaiensis</i>	Yavapi Leopard Frog	Aquatic/Riparian	G4	
Bird	<i>Accipiter gentilis</i>	Northern Goshawk	Terrestrial	G5	
	<i>Strix occidentalis lucida</i>	Mexican Spotted Owl	Terrestrial	G3	LT
Fish	<i>Gila robusta</i>	Roundtail Chub	Aquatic/Riparian	G3	PS
Insect	<i>Metrichia volada</i>		Aquatic/Riparian	GU	
Mammal	<i>Mustela frenata arizonensis</i>		Terrestrial	GU	
	<i>Myotis lucifugus occultus</i>		Terrestrial	G3	
Reptile	<i>Lampropeltis pyromelana</i>	Sonoran Mountain Kingsnake	Terrestrial	G5	
	<i>Thamnophis eques megalops</i>	Mexican Garter Snake	Aquatic/Riparian	G3	
	<i>Thamnophis rufipunctatus</i>	Narrowhead Garter Snake	Aquatic/Riparian	G3	
Plant-Vascular	<i>Astragalus troglodytus</i>		Terrestrial	G2	
	<i>Cimicifuga arizonica</i>	Arizona Bugbane	Aquatic/Riparian	G2	
	<i>Erigeron saxatilis</i>		Terrestrial	G3	
	<i>Hedeoma diffusum</i>		Terrestrial	G3	

Conservation Area/ Target Type	Scientific Name	Common Name	Habitat Type	Global Rank	ESA Status
Community	<i>Heuchera eastwoodiae</i>	Senator Mine Allum-Root	Terrestrial	G3	
	<i>Potentilla multifoliolata</i>		Terrestrial	G4	
	<i>Salvia dorrii ssp mearnsii</i>		Terrestrial	G3	
	<i>Talinum validulum</i>	Western Flame Flower	Terrestrial	G3	
	Ponderosa Pine Forest Community (5 specific types)		Terrestrial	GU	
Upper Verde River Watershed					
Amphibian	<i>Bufo microscaphus microscaphus</i>		Aquatic/Riparian	G3	
	<i>Hyla wrightorum</i>	Mountain Treefrog	Aquatic/Riparian	G4	
Bird	<i>Rana chiricahuensis</i>	Chiricahua Leopard Frog	Aquatic/Riparian	G3	LT
	<i>Rana pipiens</i>	Northern Leopard Frog	Aquatic/Riparian	G5	
	<i>Rana yavapaiensis</i>	Yavapi Leopard Frog	Aquatic/Riparian	G4	
	<i>Accipiter gentilis</i>	Northern Goshawk	Terrestrial	G5	
	<i>Buteogallus anthracinus</i>	Common Black-Hawk	Aquatic/Riparian	G4	
	<i>Ceryle alcyon</i>	Belted Kingfisher	Aquatic/Riparian	G5	
	<i>Coccyzus americanus occidentalis</i>	Western Yellow-Billed Cuckoo	Aquatic/Riparian	G3	C
	<i>Empidonax traillii extimus</i>	Southwest Willow Flycatcher	Aquatic/Riparian	G2	LE
	<i>Falco peregrinus anatum</i>	American Peregrine Falcon	Terrestrial	G3	
	<i>Haliaeetus leucocephalus</i>	Bald Eagle	Terrestrial	G4	PS
Fish	<i>Strix occidentalis lucida</i>	Mexican Spotted Owl	Terrestrial	G3	LT
	<i>Agosia chrysogaster</i>	Longfin Dace	Aquatic/Riparian	G4	SC
	<i>Catostomus clarki</i>	Desert Sucker	Aquatic/Riparian	G3	SC
	<i>Catostomus insignis</i>	Sonora Sucker	Aquatic/Riparian	G3	SC
	<i>Gila intermedia</i>	Gila Chub	Aquatic/Riparian	G2	PE
	<i>Gila robusta</i>	Roundtail Chub	Aquatic/Riparian	G3	PS
	<i>Meda fulgida</i>	Spikedace	Aquatic/Riparian	G2	LT
	<i>Poeciliopsis occidentalis occidentalis</i>	Gila Topminnow Intraspecific.	Aquatic/Riparian	G3	LE
	<i>Rhinichthys osculus</i>	Speckled Dace	Aquatic/Riparian	G5	PS
	Insect	<i>Abedus herberti</i>	Giant Water Bug	Aquatic/Riparian	GU
<i>Cicindela oregona maricopa</i>		Maricopa Tiger Beetle	Aquatic/Riparian	G3	
<i>Cylloepus parkeri</i>		Parker's Cylloepus Riffle Beetle	Aquatic/Riparian	G1	
Mammal	<i>Metrichia volada</i>		Aquatic/Riparian	GU	
	<i>Antilocapra americana</i>	Pronghorn	Terrestrial	G5	
	<i>Myotis lucifugus occultus</i>		Terrestrial	G3	
	<i>Myotis thysanodes</i>	Fringed Myotis Bat	Terrestrial	G4	
	<i>Nyctinomops macrotis</i>	Big Free-Tailed Bat	Terrestrial	G5	
	<i>Sciurus arizonensis</i>	Arizona Gray Squirrel	Terrestrial	G4	

Conservation Area/ Target Type	Scientific Name	Common Name	Habitat Type	Global Rank	ESA Status
	<i>Ursus americanus</i>	Black Bear	Terrestrial	G5	
Mollusk	<i>Pyrgulopsis montezumensis</i>	Montezuma Well Springsnail	Aquatic/Riparian	G1	
	<i>Pyrgulopsis morrisoni</i>	Page Springsnail	Aquatic/Riparian	G1	C
	<i>Pyrgulopsis simplex</i>	Fossil Springsnail	Aquatic/Riparian	G1	
	<i>Pyrgulopsis sola</i>	Brown Springsnail	Aquatic/Riparian	G1	
Reptile	<i>Thamnophis eques megalops</i>	Mexican Garter Snake	Aquatic/Riparian	G3	
	<i>Thamnophis rufipunctatus</i>	Narrowhead Garter Snake	Aquatic/Riparian	G3	
Plant-Vascular	<i>Agave delamateri</i>	Tonto Basin Agave	Terrestrial	G2	
	<i>Carex ultra</i>	Cochise Sedge	Aquatic/Riparian	G3	
	<i>Erigeron anchana</i>		Terrestrial	G2	
	<i>Eriogonum apachense</i>		Terrestrial	G1	
	<i>Eriogonum ripleyi</i>	Ripley's Wild Buckwheat	Terrestrial	G2	
	<i>Hymenoxys jamesii</i>		Terrestrial	G2	
	<i>Penstemon nudiflorus</i>	Flagstaff Beardtongue	Terrestrial	G2	
	<i>Purshia subintegra</i>	Arizona Cliff Rose	Terrestrial	G1	LE
	<i>Rumex orthoneurus</i>	Bloomer's Dock	Aquatic/Riparian	G3	
	<i>Salvia dorrii ssp mearnsii</i>		Terrestrial	G3	
	<i>Talinum validulum</i>	Western Flame Flower	Terrestrial	G3	
Community	Cienega		Aquatic/Riparian	GU	
	Cienega		Aquatic/Riparian	GU	
Ecological System	Apachean Grassland and Savanna Condition Class A		Terrestrial	GU	
	Apachean Grassland and Savanna Condition Class A&B		Terrestrial	GU	
	Apachean Grassland and Savanna Condition Class B		Terrestrial	GU	
	Apachean Shrubland		Terrestrial	GU	
	Desert Wash		Aquatic/Riparian	GU	
	Interior Chaparral		Terrestrial	GU	
	Madrean Encinal		Terrestrial	GU	
	Montane Mixed Forest		Terrestrial	GU	
	Montane Riparian Woodland and Shrubland		Aquatic/Riparian	GU	
	Pinyon-Juniper Woodland		Terrestrial	GU	
	Playa		Aquatic/Riparian	GU	
	Ponderosa Pine Forest and Woodland		Terrestrial	GU	
	Riparian Woodland		Aquatic/Riparian	GU	
	Sonoran Desert Scrub		Terrestrial	GU	
Wet Beaver Creek					
Plant-Vascular	<i>Astragalus troglodytus</i>		Terrestrial	G2	

Conservation Area/ Target Type	Scientific Name	Common Name	Habitat Type	Global Rank	ESA Status
Feature	<i>Potentilla multifoliolata</i>		Terrestrial	G4	
	Riparian habitat and watershed, springs.		Aquatic/Riparian	G4	
Wupatki/Painted Desert					
Insect	<i>Aquanothrus sp nov</i>		Aquatic/Riparian	GU	
Plant-Vascular	<i>Phacelia serrata</i>	Serrate Phacelia	Terrestrial	G3	
	<i>Phacelia welshii</i>	A Phacelia	Terrestrial	G2	
Ecological System	<i>Psorothamnus thompsoniae var.</i>				
	<i>Whitingii</i>		Terrestrial	G2	
	Desert grassland and shrub-steppe		Terrestrial	GU	
	Greasewood shrubland		Terrestrial	GU	
	Little Colorado River Headwater and creek, low and intermediate, intermittent		Aquatic/Riparian	GU	
	Little Colorado River Headwater and creek, montane and above, intermittent		Aquatic/Riparian	GU	
	Little Colorado River Large and extra large river, low and intermediate, perennial		Aquatic/Riparian	GU	
	Little Colorado River Small and medium river, low and intermediate, intermittent		Aquatic/Riparian	GU	
	Little Colorado River Small and medium river, low and intermediate, perennial		Aquatic/Riparian	GU	
	Mixed salt desert scrub		Terrestrial	GU	
Feature	Semi-desert grassland		Terrestrial	GU	
	Sagebrush steppe		Aquatic/Riparian	GU	