

Chapter 8:
Ecological & Biological Diversity of the Coconino
National Forest
In
Ecological and Biological Diversity of National Forests
in Region 3

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SAVING THE LAST GREAT PLACES ON EARTH

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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.

Potential Natural Vegetation Type	Total Area (Acres)	Percent of Total Area (%)
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	12.0
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	15.8
Ponderosa Pine	814,600	44.4
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
Total	1,833,000	

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 nonnative 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	% ^A	Acres	% ^A	Acres	% ^A	Acres	% ^B
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	47,000	4.3	70,800	65.5	32,600	30.2	108,100	36.1
Total	47,000	1.6	261,800	87.5	32,600	10.9	299,100	100.0

^A Percent of total grasslands on each ranger district in that grassland condition type

^B 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) 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 spinedace 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 ^A	% Change in Distribution ^B
	Mogollon Rim	Red Rock			
Apache Trout	11	25	36	16.3	-26.9
Burhead Sucker	3	0	3	1.4	-8.3
Colorado Minnow	0	25	25	23.6	-100.0
Desert Sucker	11	147	158	19.6	-18.5
Gila Chub	0	36	36	43.9	-15.9
Gila Topminnow	0	51	51	54.3	-35.3
Headwater Chub	0	3	3	4.4	12.0
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
Ranachoda Sucker	0	33	33	12.5	-49.7
Rainbow Trout	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

^A Percent of all stream reaches with occurrences on National Forests

^B 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 ^A

^A 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 ^A	Occupied Habitat (miles)	Number of Native Fish Species ^B
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

^ALetters following stream names differentiate multiple streams with identical names elsewhere within Arizona.

^BThe 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.

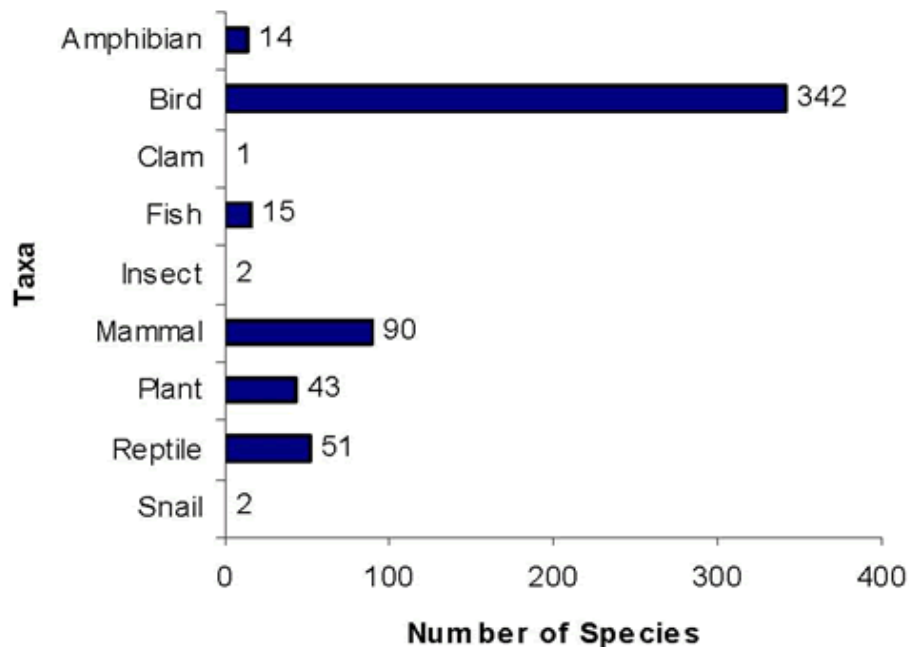


Figure 8-6. Number of species, by taxon, that inhabit the Coconino National Forest according to the R3 Species Database. The R3 Species Database includes all known terrestrial vertebrates and native fishes, but only invertebrates and plants of management concern. Because of the limitations of the R3 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	9
N2	0	1	0	3	0	1	9	2	0	16
N3	2	18	1	4	1	4	17	2	0	49
N4	2	42	0	2	0	10	2	6	0	64
N5	10	272	0	1	0	66	0	41	0	390
NH	0	0	0	0	0	0	0	0	0	0
NNA	0	7	0	1	0	1	0	0	0	9
NNR	0	2	0	0	1	0	10	0	0	13

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	57
S2	1	30	0	3	0	2	10	4	0	50
S3	3	40	0	5	1	12	11	3	0	75
S4	2	45	0	0	0	21	0	7	0	75
S5	7	122	0	0	0	42	0	32	0	203
SH	0	0	0	2	0	0	1	0	0	3
SNA	1	30	0	1	0	2	0	1	0	35
SNR*	0	6	0	0	0	0	13	3	0	22

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).

Other Conservation Rankings

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 of the U.S. Fish and Wildlife Service Birds of Conservation Concern list that inhabit the Coconino National Forest.

Diurnal Raptors

Swainson's Hawk (P)
 American Peregrine Falcon* (CC)
 Ferruginous Hawk* (CC)
 Northern Harrier (CC)
 Common Black-Hawk* (CC)

Shorebirds

Long-Billed Curlew (CC)
 Stilt Sandpiper (CC)
 Whimbrel (CC)
 Wilson's Phalarope (CC)

Cuckoos and Allies

Western Yellow-Billed Cuckoo* (CC)

Upland Game Birds

Blue Grouse (P)
 Montezuma Quail (P)

Pigeons and Doves

Band-Tailed Pigeon (P)

Owls

Burrowing Owl (CC)
Elf Owl
Flammulated Owl
 Short-Eared Owl (P)

Goatsuckers and Swifts

Black Swift (P)
 White-Throated Swift (P)

Hummingbirds

Allen's Hummingbird (P)
 Calliope Hummingbird (P)
 Costa's Hummingbird (P)
 Rufous Hummingbird (P)

Woodpeckers

Lewis's Woodpecker

Flycatchers

Greater Pewee (CC)
 Olive-Sided Flycatcher (P)
 Scissor-tailed Flycatcher (CC)
 Willow Flycatcher* (P)

Shrikes and Vireos

Arizona Bell's Vireo (CC)

Gray Vireo

Loggerhead Shrike (CC)

Jays, Crows, and Allies

Pinyon Jay (P)

Mimids - Catbirds, Mockingbirds, Thrashers

Bendire's Thrasher

Crissal Thrasher (CC)

Wood Warblers

Black-Throated Gray Warbler (CC)

Grace's Warbler

Hermit Warbler (P)

Kentucky Warbler

Olive Warbler (CC)

Prothonotary Warbler

Red-Faced Warbler

Virginia's Warbler (P)

Blackbirds, Orioles, and Allies

Rusty Blackbird (P)

Emberizine Sparrows and Allies

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)

Finches and Old World Sparrows

Black Rosy Finch (P)
 Lawrence's Goldfinch (P)

(P) Bird species on the Partners in Flight Watch list

(CC) USFWS Bird of Conservation Concern

* AZ G&F Wildlife of Special Concern (WSC)

Species in bold appear on both lists

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.

Taxa	Endangered	Threatened
Amphibian		Chiricahua Leopard Frog
Bird	Brown Pelican	Bald Eagle
	Yuma Clapper Rail	Mexican Spotted Owl
	Gila Trout	
Fish	Colorado Pikeminnow	Little Colorado Spinedace
	Razorback Sucker	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/Trunks 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
Amphibians					
	<i>Bufo microscaphus</i>	Arizona Toad	G3		
Birds					
	<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		
Clams					
	<i>Anodonta californiensis</i>	California Floater	G3		
Fish					
	<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		
Insects					
	<i>Cicindela oregona maricopa</i>	Maricopa Tiger Beetle	T3		
		Arizona Giant Sand Treader			
	<i>Daihinibaenetes arizonensis</i>	Cricket	G2		
Mammals					
	<i>Idionycteris phyllotis</i>	Allen's Big-Eared Bat	G3		
	<i>Microtus mogollonensis navaho</i>	Navajo Mexican Vole	T2		
	<i>Myotis occultus</i>	Occult Little Brn. Myotis Bat	G3		
	<i>Perognathus amplus cineris</i>	Wupatki Pocket Mouse	T3		
Plants					
	<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</i> ssp. <i>mogollonicum</i>		T1		
	<i>Desmodium metcalfei</i>	Metcalf's Tick-Trefoil	G3		

Taxa	Scientific Name	Common Name	G/T-rank	ESA status	Recently delisted
	<i>Erigeron saxatilis</i>	Rock Fleabane	G3		
	<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		
Reptiles					
	<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		
Snails					
	<i>Pyrgulopsis morrisoni</i>	Page Springsnail	G1	Candidate	
	<i>Pyrgulopsis simplex</i>	Fossil Springsnail	G1		

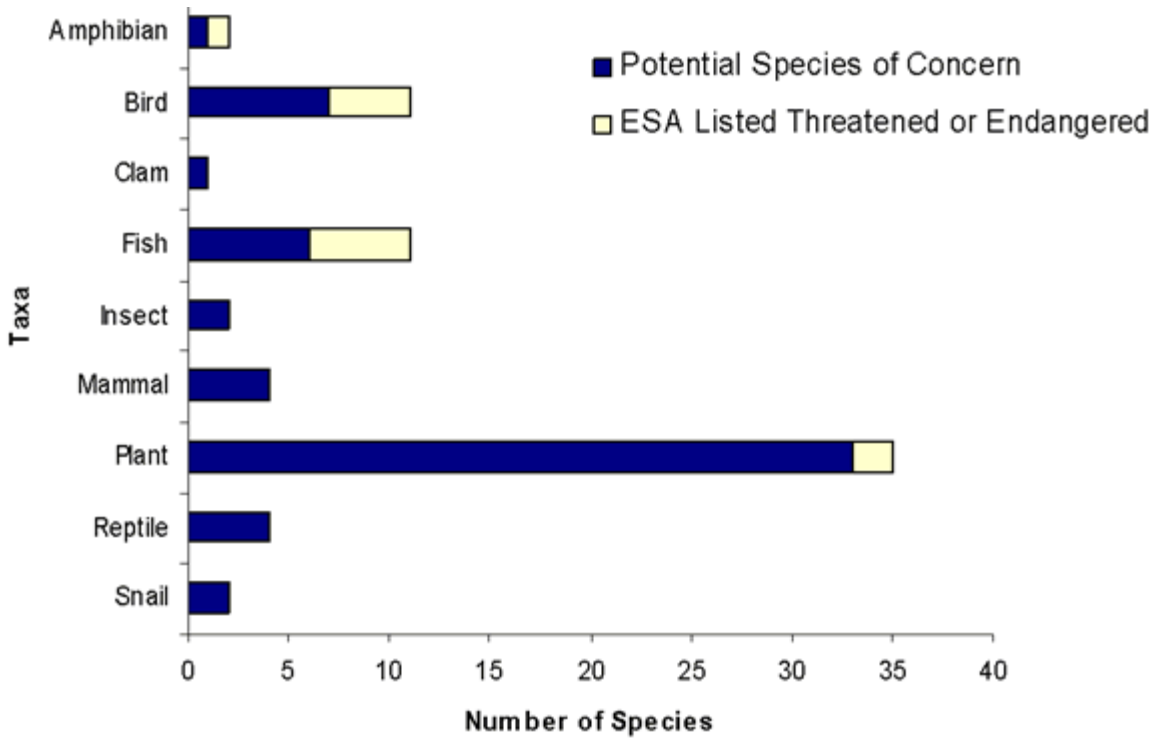


Figure 8-7. The number of potential species-of-concern (in blue) and federally listed endangered and threatened species (yellow) by taxon that currently inhabit the Coconino National Forest. According to the published Forest Service draft directives (70 Fed. Reg. 14637), species are considered potential 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.

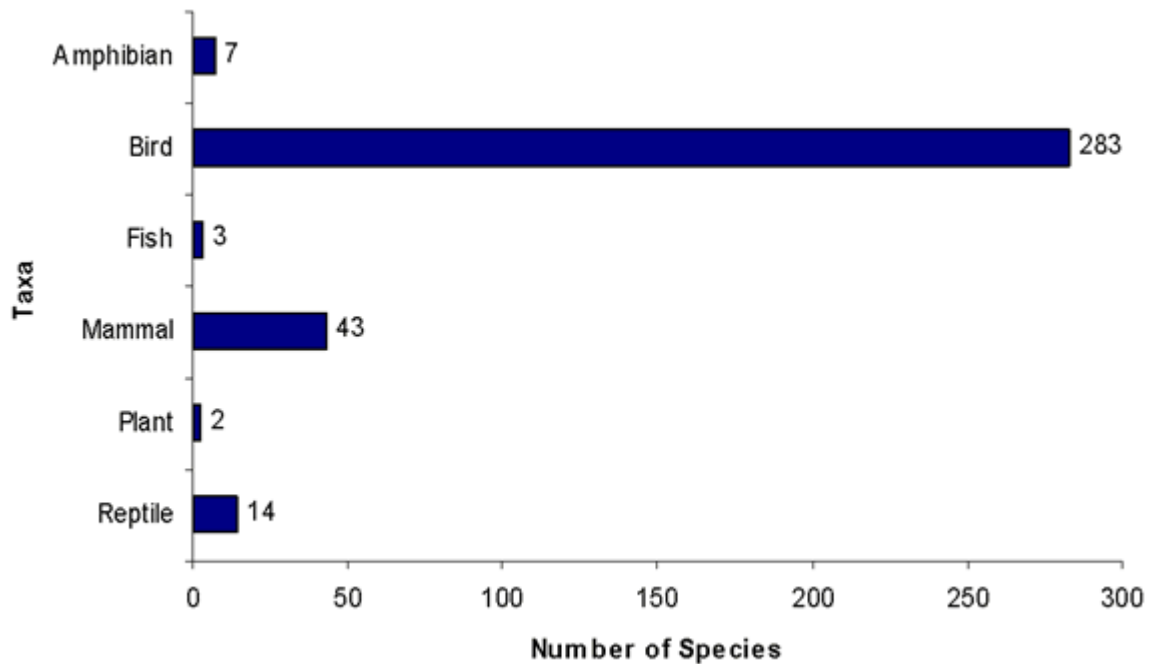


Figure 8-8. The number of potential species-of-interest, by taxa, that currently inhabit the Coconino National Forest. Species were considered potential species-of-interest if they fell into one or more of the following categories: special state conservation status (WSC, HS, and SR in Arizona); listed 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
Total	12	2.1	60	10.7	352	62.9	136	24.3	560

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 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. 8-32

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

Conservation Area	Ranger Districts ^A	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

^AMR = 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 ^A	1,389,700	69.2

^ASeveral 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

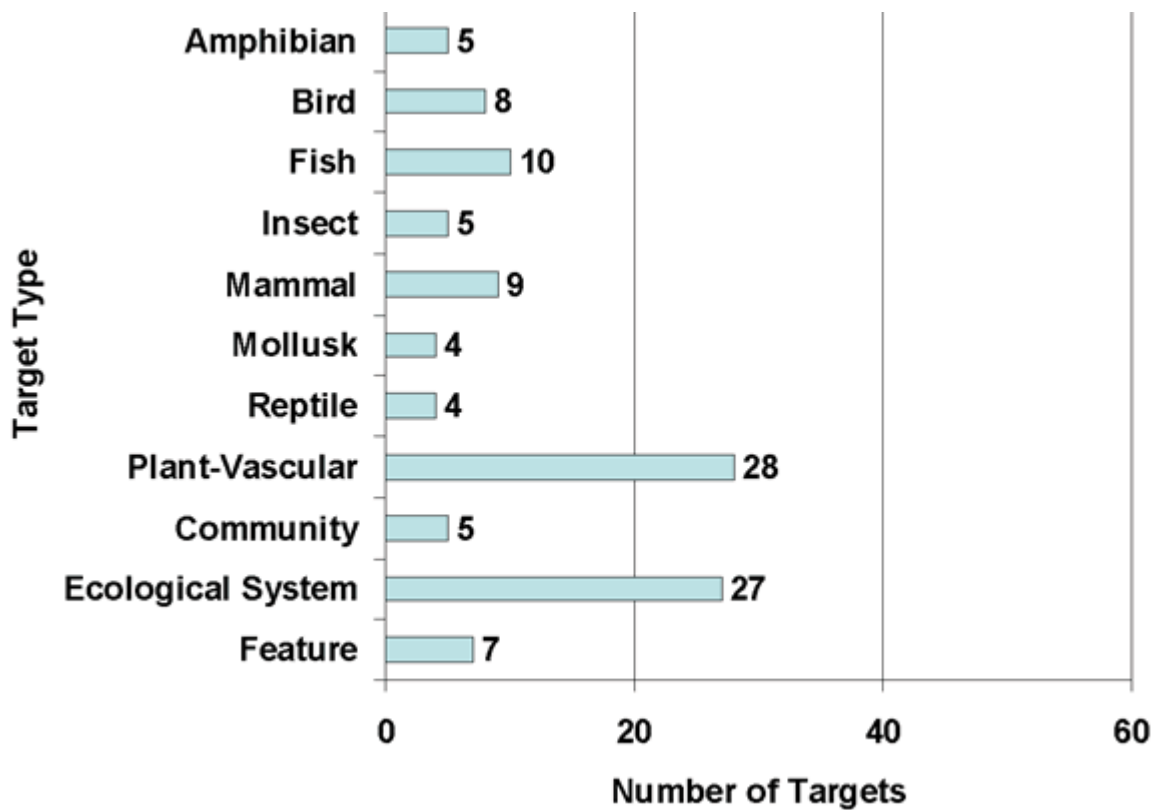


Figure 8-10. Number of conservation targets, by type, that occur on nine conservation areas overlapping the Coconino National Forest in Arizona.

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
Inventoried Roadless Areas	31,300	2.3	62.0
Neither Category	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 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 groundwater 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 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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