Chapter 12:

Ecological & Biological Diversity of the Tonto National Forest

In

Ecological and Biological Diversity of National Forests in Region 3

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Introduction

The Tonto National Forest is one of 11 National Forests of the U.S. Forest Service (USFS) Southwestern Region (Region 3) and comprises approximately 13% of the total area of Region 3 Forests, not including the Cibola National Grasslands. This Forest is the second largest in Region 3 and encompasses approximately 2,967,895 acres (1,201,107 hectares) in central Arizona. It is bordered by the Mogollon Rim to the north, with elevation on the Forest ranging from approximately 1,300 ft. (396 m) to nearly 8,000 ft. (2,440 m).

The proximity of the Tonto National Forest to the Mogollon Rim provides a diverse set of vegetation systems and elevation zones. Vegetation ranges from Sonoran Desert communities in the lower elevations of the Forest, through interior chaparral to pine-oak woodlands at higher elevations. The Forest also includes significant portions of the Salt and Verde Rivers, two major river systems in the Southwest. These river systems, along with others in the area, are of critical conservation concern because of the diverse communities they support, many of which are imperiled in 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 Tonto National Forest and highlight information that may be pertinent to forest planning. Information from three assessments was synthesized for the Forest, including:

- Distribution and extent of potential natural vegetation types (PNVTs)
- Distribution and condition of grassland systems
- Distribution of native fish species
- Plant and animal species richness and their conservation statuses (Not included in this draft)
- 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 Tonto National Forest to other major landowners in the Southwest (Arizona and New Mexico) and National Forests in Region 3 is provided in Chapter 3. It is important to note that the information in this chapter has not been reviewed by Tonto National Forest staff.

Results

I. Potential Natural Vegetation Types within the Tonto 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 Tonto 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 Tonto National Forest were summarized, as well as the proportion of each PNVT within Region 3 that occurs on the Tonto. More detailed information on the data and methods used in this analysis can be found in Chapter 2, and information comparing PNVTs on the Tonto to other major landowners in the Southwest, including National Forests within Region 3 is available in Chapter 3.

Sixteen PNVTs were identified on the Tonto National Forest (Figure 12-1). Of these, five comprise 93% (2,668,900 acres) of the total area of the Tonto (Table 12-1). These five PNVTs include desert communities (26.9%), semi-desert grasslands (21.2%), interior chaparral (19.0%), Madrean encinal woodlands (13.9%), and Madrean pine-oak woodlands (12.0%). The remaining 11 PNVTs cover 7% of the Tonto National Forest.

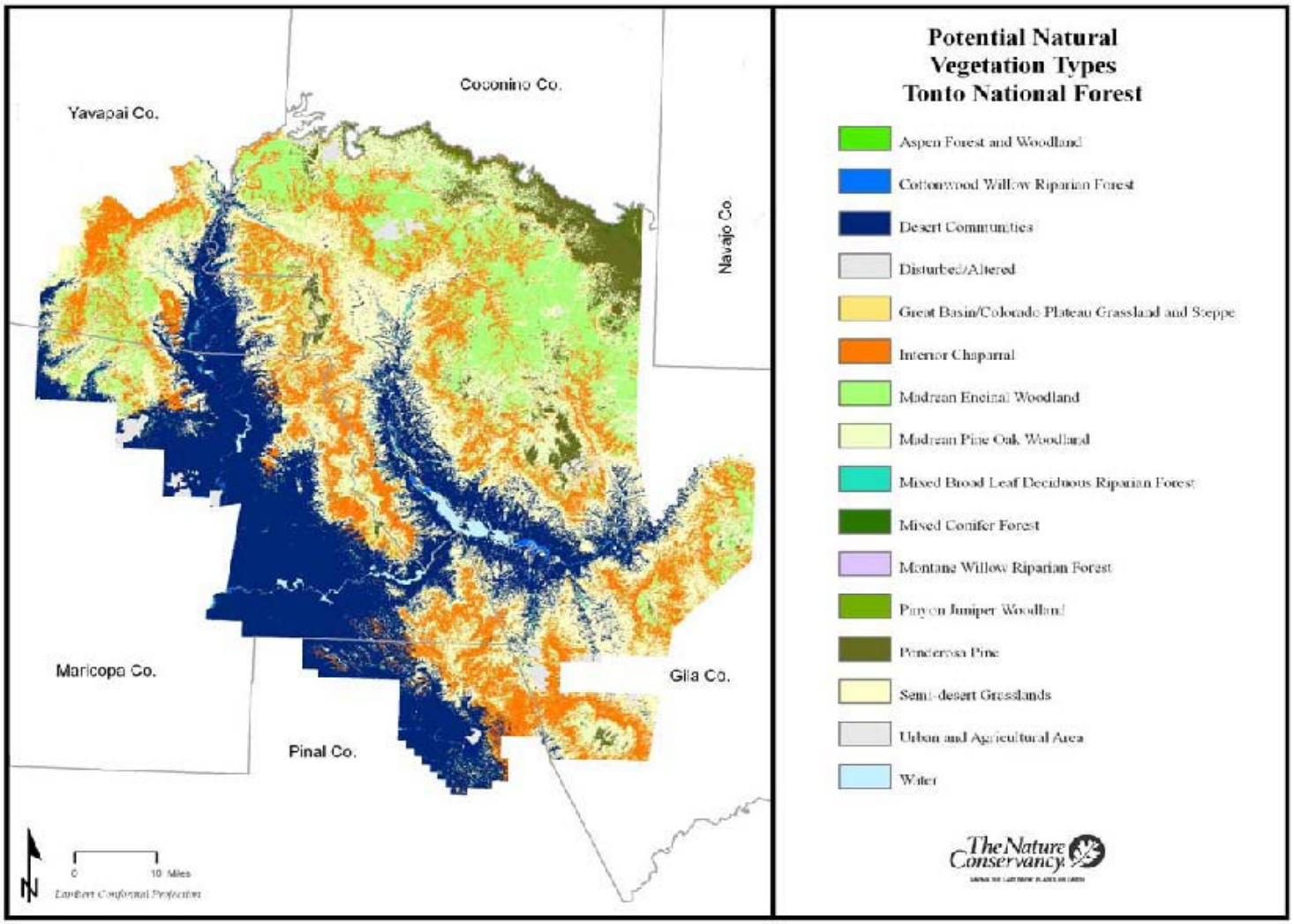

Figure 12-1. Distribution of potential natural vegetation types on the Tonto National Forest. Map was created using data from the Southwest Regional Gap Analysis Project (SWReGAP; U.S. Geological Survey National Gap Analysis Program, 2004). SWReGAP vegetation type were aggregated and converted to potential 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 scales.

Table 12-1. Approximate area (in acres) and percent of total area of each potential natural vegetation type on the Tonto National Forest. Areas were calculated using data from the Southwest Regional Gap Analysis Project (SWReGAP). SWReGAP land cover types were aggregated and converted to potential natural vegetation types. See Chapter 2 for more details on methods utilized.

Potential Natural Vegetation Type	Total Area (acres)	Percent of Total Area (%)
Aspen Forest and Woodland	100	<0.1
Cottonwood Willow Riparian Forest	7,900	0.3
Desert Communities	771,900	**26.9**
Disturbed/Altered (quarries and mines)	5,900	0.2
Great Basin/ Colorado Plateau Grassland and Steppe	9,400	0.3
Interior Chaparral	543,900	**19.0**
Madrean Encinal Woodland	399,700	**13.9**
Madrean Pine-Oak Woodland	344,800	**12.0**
Mixed Broadleaf Deciduous Riparian Forest	9,800	0.3
Mixed Conifer Forest	5,100	0.2
Montane Willow Riparian Forest	6,200	0.2
Pinyon-juniper Woodland	3,300	0.1
Ponderosa Pine	130,100	4.5
Semi-desert Grassland	608,600	**21.2**
Urban and Agricultural Area	4,400	0.2
Water	17,700	0.6
Total	**3,868,800**	

The Tonto National Forest is responsible for managing large proportions of several PNVTs on Region 3 National Forest lands. The Tonto National Forest manages more than half (76%) of desert communities on Region 3 National Forest lands. Also, 41% of cottonwood willow riparian forest and Madrean pine-oak woodland, 40% of interior chaparral, 37% of semi-desert grassland, 23% of mixed broad-leaf deciduous riparian forest, 20% of montane willow riparian forest, and 15% of Madrean encinal woodlands on Region 3 National Forest lands are found on the Tonto National Forest. Within all landowners in Arizona and New Mexico, 24% of Madrean pine-oak and 17% of interior chaparral are found on the Tonto National Forest.

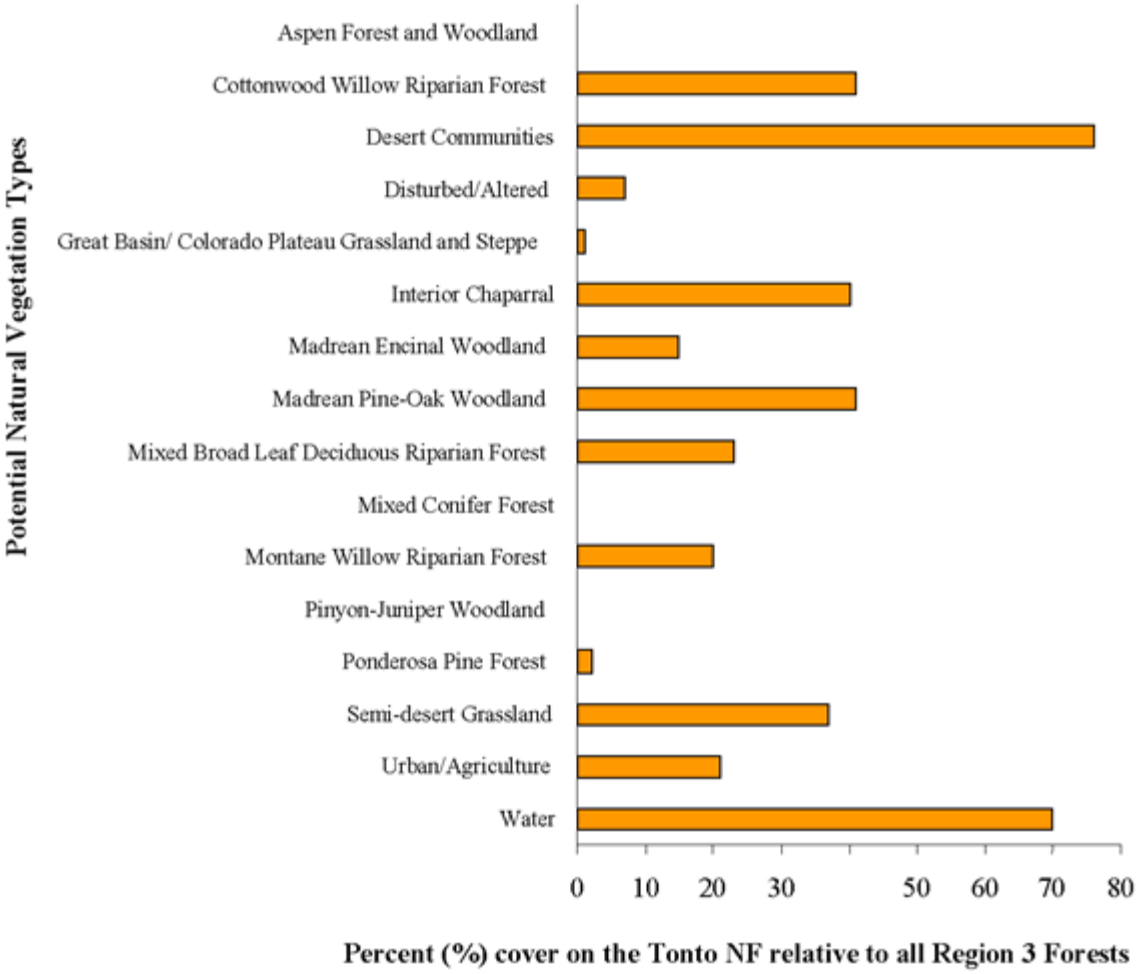

Figure 12-2. Percent area of cover of each potential natural vegetation type that occurs on the Tonto National Forest in relation all Region 3 National Forests combined. Analysis was conducted using data from the Southwest Regional Gap Analysis Project (SWReGAP). See Chapter 2 for information regarding the limitations of SWReGAP.

II. Distribution and Condition of 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 Tonto 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 2-1 in Chapter 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 Tonto to other major landowners and National Forests within Region 3 is available in Chapter 3.

The Arizona Grassland Assessment identified approximately 120,900 acres of extant and historic grasslands on the Tonto National Forest (Table 12-2), representing 4.1% of the Forest. Overall, the Tonto National Forest manages 5.6% of all grasslands, 6.9% of open native grasslands, 8.1% of restorable grasslands, and 2.5% of former grasslands that occur on National Forests in Arizona. The majority (72.3%) of grasslands on the Tonto are in restorable native condition, with the remainder in open native (22.4%) or former (5.3%) grassland condition (Table 12-2). The largest proportions of identified grasslands occur on the Payson (46.2%) and Globe (22.8%) Ranger Districts and the largest proportion of open native grasslands (68.5%) is found within the Cave Creek district (Table 12-2).

Table 12-2. Acres of low elevation grasslands in three condition types occurring on five ranger districts (no grasslands were identified on the Mesa Ranger District) on the Tonto National Forest in Arizona (from Schussman and Gori 2004, Gori and Enquist 2003).

	Grassland Type							
	Open Native		Restorable Native		Former		Total	
District	Acres	%	Acres	%	Acres	%	Acres	%
Cave Creek	12,400	68.5	5,700	31.5	0	0	18,100	15.0
Globe	1,900	6.9	22,800	82.6	2,900	10.5	27,600	22.8
Payson	8,000	14.3	44,500	79.7	3,300	5.9	55,800	46.2
Pleasant Valley	800	25,8	2,300	74.2	0	0	3,100	2.6
Tonto Basin	4,000	24.5	12,100	74.2	200	1.2	16,300	13.5
Total	27,100	22.4	87,400	72.3	6,400	5.3	120,900	100

[A]Percent of total grasslands on each ranger district in that grassland condition type
[B]Percent of total grasslands on Tonto NF on each ranger district

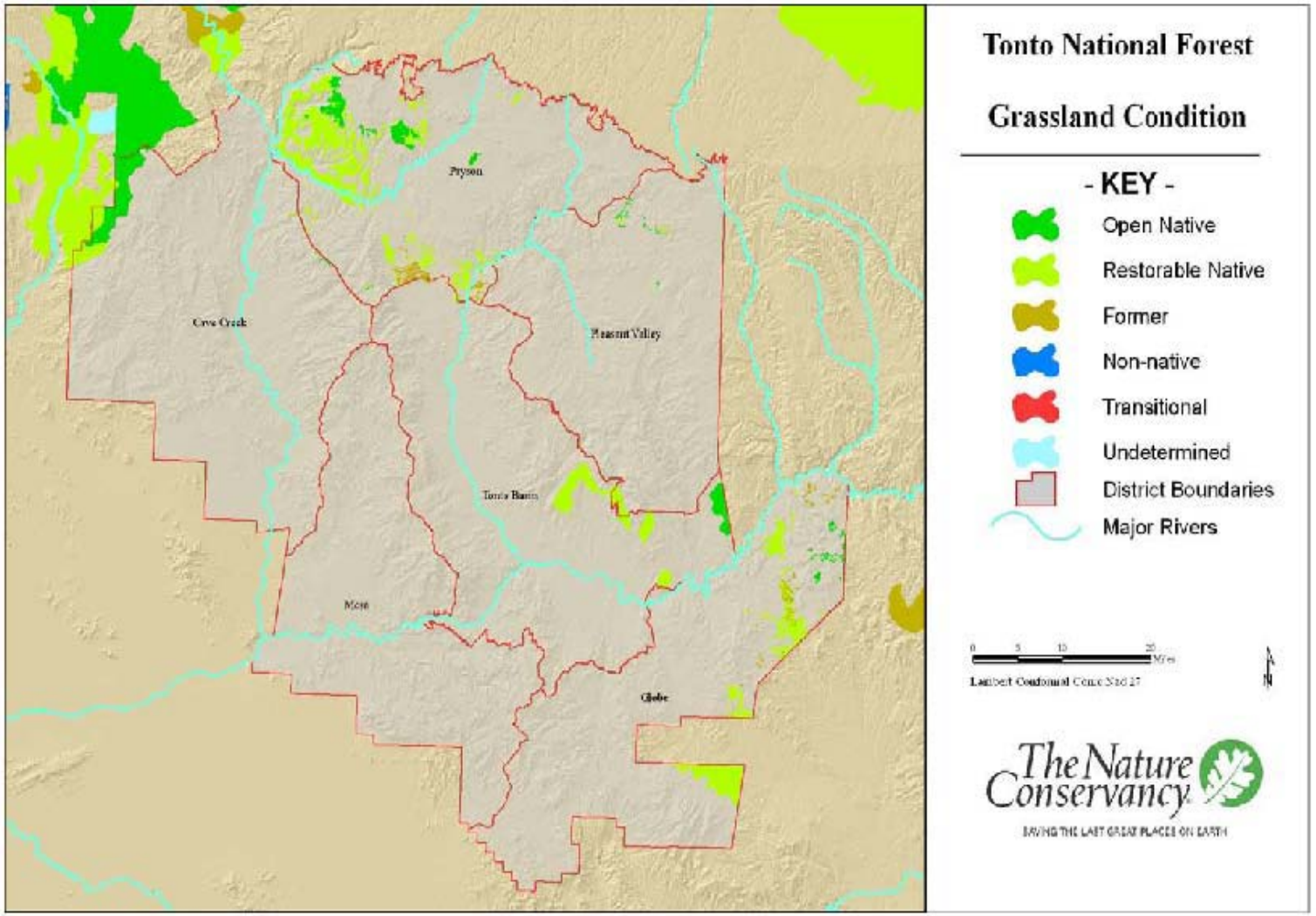

Figure 12-3. Grassland types, based on condition, on six ranger districts on the Tonto National Forest in Arizona (from Schussman and Gori 2004, Gori and Enquist 2003).

III. Riparian and Freshwater Systems and Species

The Arizona Statewide Freshwater Assessment (Turner and List, *In Prep;* available at www.azconservation.org) was used to summarize the occurrence and distribution of stream reaches with native fishes across major landowners (Chapter 3) 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 Tonto 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 Tonto to other landowners in the Southwest and National Forests within Region 3 is available in Chapter 3.

According to the Arizona Freshwater assessment, 12 native fish species have occurrences on one or more stream reaches on the Tonto National Forest (Table 12-3; see Table 2-2 for scientific names). Together, these 12 species have occurrences on approximately 407 miles (72.7%) of the 560 miles of perennial streams that exist on the Tonto (Table 12-3). Overall, the Tonto accounts for 30.1% of the perennial streams and 32.0% of the stream reaches with native fish occurrences that exist on National Forests in Arizona.

The desert sucker, longfin dace, Sonora sucker, and roundtail chub have the largest distribution of occurrences on the Tonto National Forest, while the Gila trout and desert pupfish have very limited distributions (Table 12-3). All occurrences of the desert pupfish in streams on National Forests in Arizona are on the Tonto National Forest. In addition, within National Forests in Arizona, over one-half of the stream reaches with occurrences of headwater chub (55.6%) and roundtail chub (51.2%) occur on the Tonto (Table 12-3).

Olden and Poff (2005) characterized the temporal trends in native fish distributions within the Lower Colorado River basin, including all 12 native fish species on the Tonto. Nine of these 12 species (75.0%) have undergone declines in distribution across Lower Colorado River basin, with the remaining three showing slight increases (Table 12-3). While these declines do not indicate specific trends in species distribution on the Tonto National Forest, they are indicative of ongoing changes in these species distributions in the Southwest.

Within National Forests in Arizona, 39.0% of stream reaches with occurrence of 5 or more native fish species occur on the Tonto National Forest. Nearly all ranger districts on the Tonto National forest have stream lengths with 5 or more species. (Figure 12-4). Cave Creek and Payson Ranger Districts, in particular, have significant stream lengths with more than 5 species. These two districts also have the largest lengths of streams with native fish species occurrences, as well as the highest number of total species occurring (11 and 10 respectively; Table 12-4). According to the Arizona Freshwater Assessment, 33 stream reaches (ranging from less than one to 75 miles in length) on the Tonto National Forest have occurrences of native fish species, with the number of species on each reach ranging from 1 to 7 (Table 12-5, Figure 12-5).

Table 12-3. Number of stream miles with occurrences of 12 native fishes on six ranger districts on the Tonto National Forest in Arizona based on the Arizona Freshwater Assessment (Turner and List, In Prep).

	Ranger District								
Species	Cave Creek	Globe	Mesa	Payson	Pleasant Valley	Tonto Basin	Total	% of AZ Forests[A]	% Change in Distribution[B]
Colorado Pikeminnow	41	0	0	3	0	0	44	41.5	-100.0
Desert Pupfish	<1	2	0	0	0	0	2	100.0	-100.0
Desert Sucker	78	24	29	105	56	38	330	40.8	-13.5
Gila Chub	<1	0	0	45	0	2	47	26.7	-15.9
Gila Topminnow	11	0	0	0	0	3	14	14.9	-36.8
Gila Trout	0	0	0	2	0	0	2	28.6	-84.0
Headwater Chub	2	0	0	8	0	0	10	55.6	12.6
Longfin Dace	63	24	26	109	33	43	298	40.5	11.4
Razorback Sucker	61	0	0	34	0	17	112	42.3	-49.7
Roundtail Chub	65	21	10	1	62	33	282	51.2	-6.2
Sonora Sucker	72	21	25	93	32	46	289	39.5	8.2
Speckled Dace	15	21	<1	109	59	40	244	28.4	-16.5

[A]Percent of all stream reaches with occurrences on National Forests
[B]Based on Olden and Poff (2005)

Table 12-4. 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 six ranger districts on the Tonto National Forest in Arizona based on the Arizona Freshwater Assessment (Turner and List, In Prep).

Ranger District	Perennial Flow (Miles)	Occupied Habitat (Miles)	Number of Native Fish Species
Cave Creek	107	99	11
Globe	39	26	6
Mesa	70	35	5
Payson	158	120	10
Pleasant Valley	74	64	5
Tonto Basin	112	62	8
Total	560	407	12[A]

[A]Total number of native fish species with occurrences on the Tonto National Forest. Several species occur on multiple ranger districts.

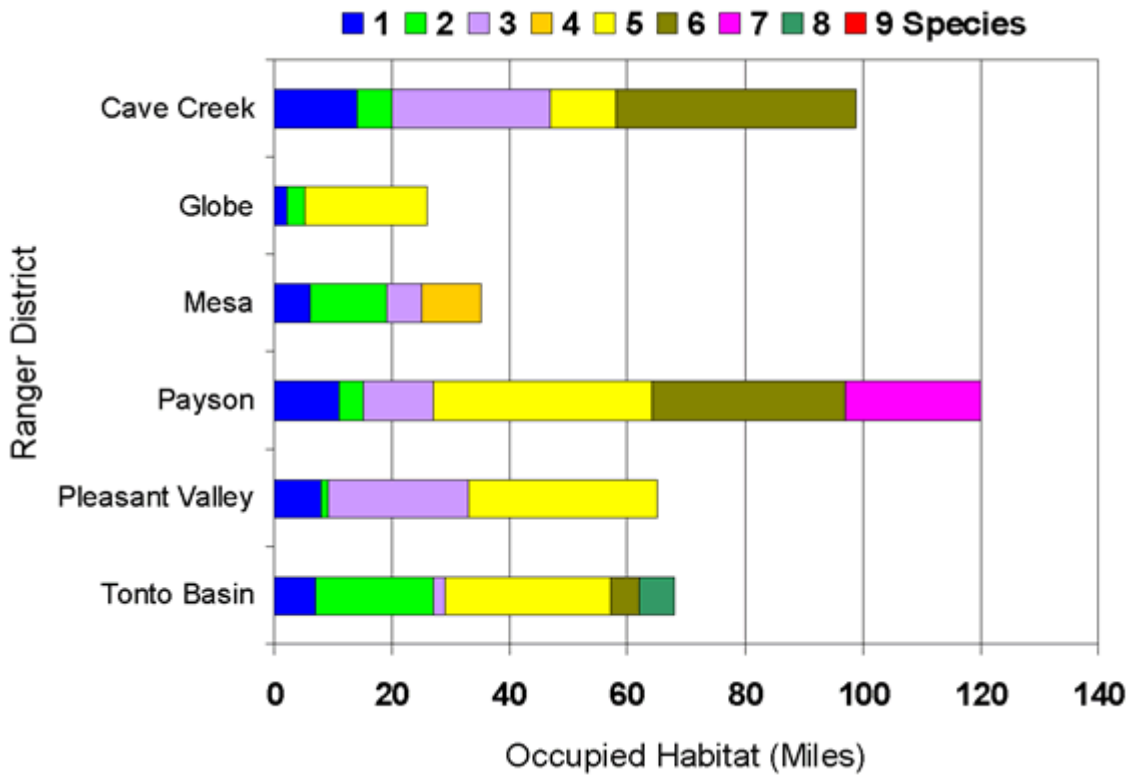

Figure 12-4. Number of stream miles with varying native fish species richness based on occurrences from 1975 to present (Turner and List, In Prep) for six district on the Tonto National Forest, Arizona.

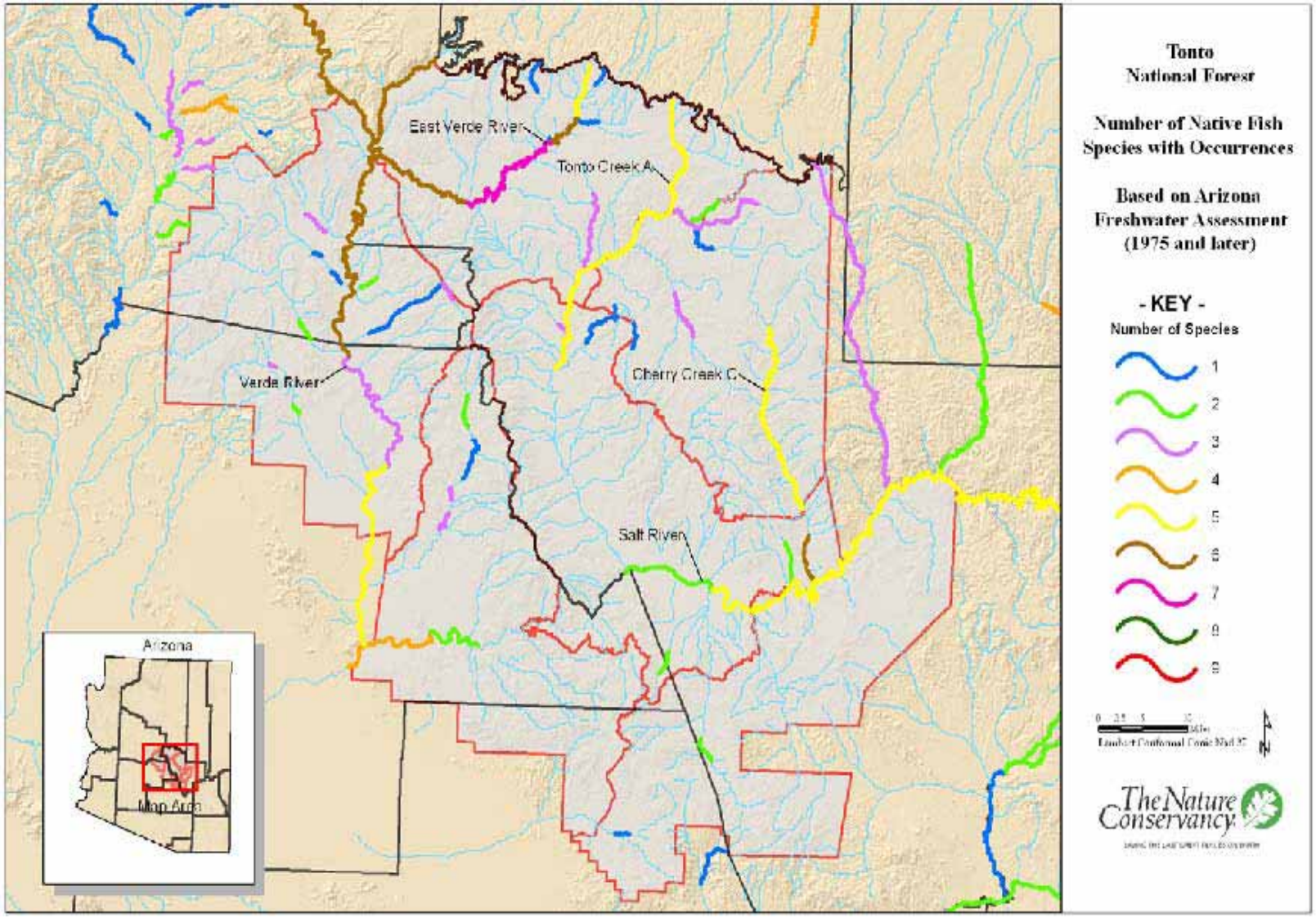

Figure 12-5. Perennial stream reaches with varying numbers of native fish species with occurrences on six ranger districts on the Tonto National Forest in Arizona. Only major river and stream systems are labeled.

Table 12-5. Stream systems, number of native fish species with occurrences, and the total stream reach length with native fish occurrences for 33 stream systems with native fishes on the Tonto National Forest in Arizona.

Stream Name[A]	Occupied Habitat (miles)	Number of Native Fish Species[B]
Camp Creek B	1	2
Campaign Creek	3	2
Canyon Creek C	5	3
Cherry Creek C	32	6
Cibecue Creek	<1	2
Coon Creek A	5	2
Deadman Creek	11	1
Dude Creek	2	1
East Verde River	52	7
Ellison Creek B	3	1
Fossil Creek	8	6
Gordon Canyon Creek	5	2
Gun Creek	10	1
Haigler Creek	15	3
Houston Creek C	10	3
Joes Hill 1	<1	2
Lime Creek	3	2
Marsh Creek	5	1
Pinto Creek	3	2
Queen Creek	2	1
Red Creek A	4	3
Rye Creek	2	3
Salt River	71	6
Seven Springs Wash B	1	3
Silver Creek B	<1	3
South Fork Deadman Creek	2	3
Spring Creek H	6	3
Sycamore Creek E	16	3
Sycamore Creek I	2	2
Tangle Creek	3	1
Tonto Creek A	44	5
Verde River	75	7
Webber Creek	6	2

[A]Letters following stream names differentiate multiple streams with identical names within Arizona.
[B]Maximum number of species. Some portions of the reach may have less.

IV. Plant and Animal Species Richness

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

Fifteen individual conservation areas from ecoregional assessments overlap the Tonto National Forest (Figure 12-6, Table 12-6), totaling 1,373,900 acres, or 46.3% of the Forest. Conservation area overlap on individual districts ranged from 35.1% on the Globe Ranger District to 59.9% on the Payson Ranger District (Table 12-7). Overall, 41.2% of the total area of these 15 conservation areas overlaps the Tonto National Forest. For six of the 15 overlapping conservation areas, the entire conservation area lies within the Tonto National Forest (Table 12-6). The majority (>50%) of four additional conservation areas overlaps the Forest, indicating that the Forest has primary responsibility for the management that takes place in these areas.

Nearly two-thirds (66.5%) of the area of the Tonto National Forest overlapped by conservation areas is not designated wilderness area or inventoried roadless area (Table 12-9), while approximately27.4% is designated wilderness area and 6.2% is roadless area. A higher percentage of wilderness area (63.6%) and inventoried roadless area (49.6%) are overlapped by conservation areas than areas that do not have these designations (41.2).

Conservation targets were summarized for all 15 conservation areas that overlap the Tonto National Forest. A total of 132 conservation targets occur within these conservation areas (Figure 12-7). Of these, 24 (18.2%) are coarse filter targets (ecological systems, communities or features), while 108 (81.8%) are individual species. Sixty-one (46.2%) targets are associated with riparian and aquatic systems, while 71 (53.8%) are associated with terrestrial habitats (Table 12-8). A complete listing of all conservation targets by taxonomic group for the Tonto is provided in Appendix 12-B and conservation targets for each conservation area are provided in Appendix 12-C.

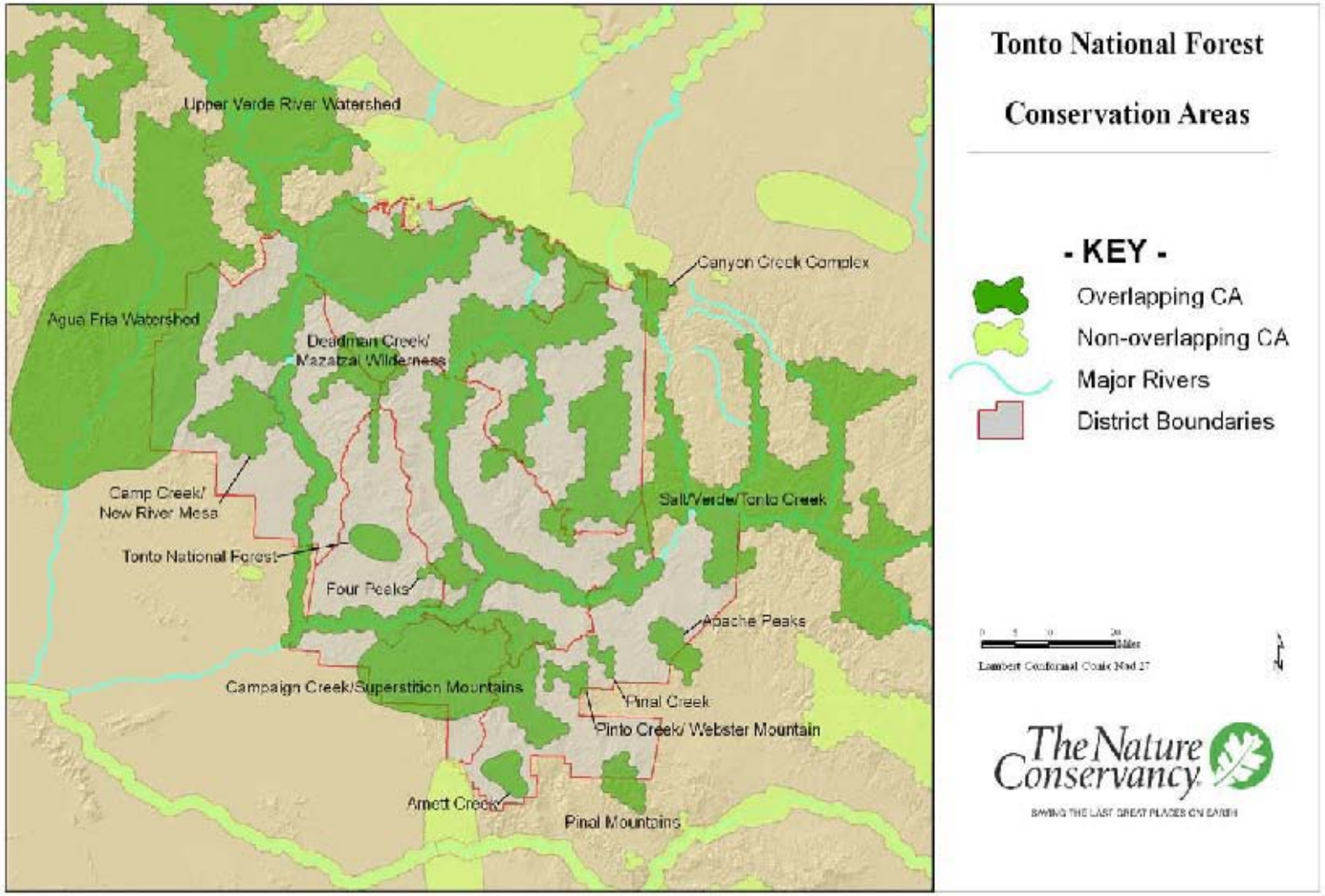

Figure 12-6. Conservation areas (N=15) that overlap the Tonto National Forest in Arizona.

Table 12-6. Conservation areas (N=15) that overlap six ranger districts on the Tonto National Forest in Arizona.

Conservation Area	Ranger Districts[A]	Overlap (Acres)	% of Conservation Area
Agua Fria Watershed	CC	92,900	14.0
Apache Peaks	G	14,800	59.9
Arnett Creek	G	18,700	100.0
Camp Creek/ New River Mesa	CC	54,400	100.0
Campaign Creek/Superstition Mountains	G,M.TB	220,900	94.2
Canyon Creek Complex	PV	7,600	30.5
Deadman Creek/ Mazatzal Wilderness	CC,M.P,TB	54,400	100.0
Four Peaks	M,TB	19,800	100.0
Mogollon Canyons Complex	P,PV	4,000	1.2
Pinal Creek	G	7,400	100.0
Pinal Mountains	G	9,200	39.1
Pinto Creek/ Webster Mountain	G	13,200	97.1
Salt/Verde/Tonto Creek	CC,G,M,P,PV,TB	589,100	55.4
Tonto National Forest	M	19,900	100.0
Upper Verde River Watershed	CC,P	246,100	31.9

[A]CC=Cave Creek, G=Globe, M=Mesa, P=Payson, PV = Pleasant Valley, TB = Tonto Basin

Table 12-7. Extent of overlap between 15 ecoregional conservation areas and six ranger districts on the Tonto National Forest in Arizona.

District	Number of Conservation Areas	Overlap (Acres)	Percent of District
Cave Creek	5	288,100	47.1
Globe	7	165,100	35.1
Mesa	5	211,000	47.5
Payson	4	277,500	59.9
Pleasant Valley	3	219,700	50.7
Tonto Basin	4	212,500	39.4
Tonto N.F Total	15[A]	1,373,900	46.3

[A]Several conservation areas overlap more than one ranger district

Table 12-8. Number of conservation targets associated with aquatic/riparian and terrestrial habitats for 15 conservation areas that overlap the Tonto National Forest in Arizona.

Conservation Area	Habitat Type		Total
	Aquatic/Riparian	Terrestrial	
Agua Fria Watershed	20	20	40
Apache Peaks	0	10	10
Arnett Creek	7	3	10
Camp Creek/ New River Mesa	8	8	16
Campaign Creek/Superstition Mountains	6	15	21
Canyon Creek Complex	9	7	16
Deadman Creek/ Mazatzal Wilderness	9	11	20
Four Peaks	2	8	10
Mogollon Canyons Complex	14	23	37
Pinal Creek	0	5	5
Pinal Mountains	2	13	15
Pinto Creek/ Webster Mountain	5	3	8
Salt/Verde/Tonto Creek	41	47	88
Tonto National Forest	3	2	5
Upper Verde River Watershed	35	29	64

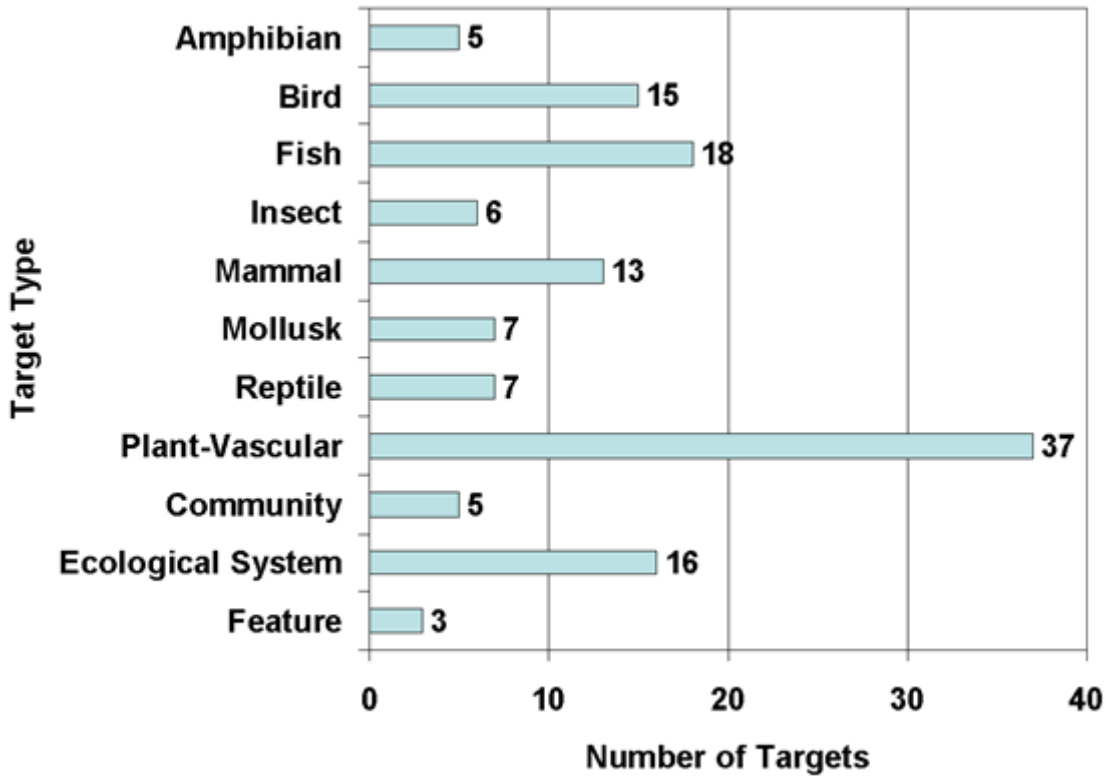

Figure 12-7. Number of conservation targets, by type, that occur on 15 conservation areas overlapping the Tonto National Forest in Arizona.

Table 12-9. Overlap between conservation areas designated wilderness areas, and inventoried roadless areas on the Tonto National Forest in Arizona.

Designation	Acres within Conservation Areas	% of Conservation Areas	% of Designated Areas
Wilderness Areas	374,000	27.4	63.6
Roadless Areas	84,400	6.2	49.6
No Designation	908,400	66.5	41.2

Discussion

Systems Diversity

According to data from the Southwest Regional Gap Analysis Project (SWReGAP; USGS National Gap Analysis Program 2004), the Tonto National Forest includes a variety of potential natural vegetation types. Unlike many forests that are dominated by one or two major vegetation system, the Tonto National Forest is dominated by five PNVTs, which each make up a significant portion of the Forest and together make up over 90% of the vegetation systems.

At lower elevations, desert communities and semi-desert grasslands predominate. Within all Region 3 Forests, the Tonto National Forest is responsible for three-quarters of the deserts communities and over one-third of the semi-desert grasslands that exist. Interior chaparral occurs at elevations above the desert and grassland communities and makes up approximately 20% of the Forest. Interior chaparral is a highly fire adapted system dominated by shrubland vegetation, including a variety of oaks, mahogany, and manzanita, that are adapted to the fairly frequent stand-replacing fires that are associated with this vegetation system. The Tonto National Forest includes 40% of interior chaparral within Region 3 Forests, and 17% of all interior chaparral that occurs in Arizona and New Mexico.

The Tonto National Forest also includes significant areas of Madrean encinal (13.9%) and pine-oak (12.0%) woodlands. Within the United States, the distributions of these two systems are limited to the Southwest, where they are considered to be at the northern limit of their distribution. These systems also depend on low intensity frequent fires that require an open stand structure. Within Region 3 Forests, the Tonto National Forest has 41% of Madrean pine-oak woodlands and 15% of Madrean encinal. Also, the Forest manages 24% of all pine-oak woodlands in Arizona and New Mexico. In addition to these upland types, the Tonto National Forest also has several significant riparian systems. Over 20% of the mixed broad-leaf deciduous riparian forest and montane willow riparian forests within Region 3 occur on the Tonto National Forest.

The variety of PNVTs that exist on the Forest provide significant challenges and opportunities for sustaining a broad range of biodiversity. Each of these systems is associated with a unique suite of ecological process and disturbance regimes that support the vegetation composition and structure, as well as a variety of animal species that depend on them. Understanding the historic range of conditions for these systems, and how they function to sustain the diversity that depends on them, may be a useful tool in forest planning for developing desired conditions for the

vegetation systems and identifying management strategies. Because of the number of PNVTs with widespread distributions on the Forest, the Tonto National Forest has the ability and responsibility to develop strategies to sustain a broad variety of ecological systems and species.

Grasslands

Grasslands in the Southwest typically maintain high levels of diversity for both plants and animals. In part, the blending of several biogeographical regions (Parmenter and others 1995) results in a mixing of species from northern and southern regions. Also, southwestern grasslands 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). This is particularly true on the Tonto, where altitudinal gradients lead to a blending of low and mid-elevation communities. Notably high diversity of many widespread animal groups, including invertebrates (e.g. grasshoppers, termites, and ants) and vertebrates (e.g. rodents), is associated with southwestern grasslands. The richness of these species found on southwestern grasslands is tied to the natural 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 by livestock, prairie dog eradication, exotic grasses, shrub encroachment, erosion, and habitat fragmentation. The Arizona Statewide Grasslands Assessment documented shrub encroachment as a threat on the Tonto National Forest, as over 70% of grasslands on the Tonto where current condition was assessed are shrub invaded. Increases in shrub cover within grasslands can significantly affect richness of associated species. While the diversity of some groups, such as certain species of 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).

A key characteristic of shrub-invaded grasslands is its 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 (Brunson and others 2001). 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, a small proportion (5.3%) of grasslands on the Tonto National Forest have exceeded a threshold of 35% shrub cover that indicates 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 levels 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.

Riparian and Aquatic Species and Systems

Aquatic and Riparian systems are obviously an important component of the diversity that exists on the Tonto National Forest. According to the Arizona Freshwater Assessment, the Tonto National Forest includes 32% of all occupied stream miles within Region 3 National Forests in Arizona, and 39% of stream reaches with occurrences of 5 or more species. More than half of the stream segments within National Forests in Arizona with occurrences of desert pupfish, headwater chub, and roundtail chub occur on the Tonto National 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. Olden and Poff (2005) also found a significant relationship between distributional declines and probability of local extirpation for native fish species. Olden and Poff (2005) determined that nine of 12 native fish species on the Tonto have declining distributions, which suggests an increased probability of local extirpations these species. The Freshwater Assessment clearly identifies occurrences of these native fish on the Tonto National Forest. 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 Tonto National Forest.

The many causes of native fish decline vary over time and space. Demands placed upon the region's limited water supplies are increasing as Arizona's population continues to grow. This and other activities occurring outside Forest boundaries may threaten 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.

Species Richness and Conservation Status

As habitat loss and degradation is a major threat for many species of conservation concern, maintaining healthy vegetation systems that support these species should be an important component in sustaining viable populations of species of conservation concern on the Tonto National Forest. The assessments discussed in this report provide important information on the systems, and their locations on the Forest, that are important for maintaining system and species diversity. For instance, the analysis of PNVTs highlighted the important vegetation systems that occur on the Tonto, which include desert communities, semi-desert grasslands, interior chaparral,

Madrean encinal, and Madrean pine-oak woodland. In addition, conservation areas, identified through ecoregional assessments, identify and delineate areas on the landscape that provide the greatest opportunity for sustaining these systems and the species they support.

All of the ranger districts on the Tonto are overlapped by one or more conservation areas. These conservation areas include 132 conservation targets, including 108 individual species. The specific locations where conservation areas overlap the Tonto highlight important places for the conservation of ecosystem and species diversity on the Forest. While these areas are not the only places where important species occur, these areas of overlap represent the most viable locations on the Tonto for sustaining the important species, ecological systems, and biological processes that are key to insuring sustainability on the Forest.

Relevance to Forest Planning

This analysis of existing regional assessment information identifies important biological and ecological characteristics of the Tonto 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 Tonto, identifying ecological characteristics that may be useful in defining desired future conditions, and identifying areas where changes in management may be necessary to sustain biodiversity. For example, the analysis of ecosystem data demonstrates the variety of systems that occur on the Tonto, and identifies systems (and their associated species diversity) for which the Tonto has disproportionate responsibility within the context of Region 3 Forests, such as the desert communities and interior chaparral.

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 its 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. As an example, a synthesis of conservation area overlap with designated wilderness and inventoried roadless areas on the Tonto demonstrates the variety of current management emphases and activities that occur within conservation areas. For forest planning purposes, it may be useful to determine the compatibility of current forest structure and ecological processes within these overlap areas with biodiversity goals, and identify management actions that may be needed to achieve sustainability. It is apparent that achieving biodiversity sustainability on the Gila must be accomplished within the varied uses and activities that occur on the Forest. Regardless of the types of land use considered, conservation areas provide a means to prioritize consideration of

areas based on their importance to biodiversity sustainability.

While the above example focused on wilderness and roadless areas, it is important to note that conservation areas do not imply the need for special protections or blanket 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 Arnett Creek conservation area encompasses 18,700 acres and lies completely within the Tonto National Forest. Ten conservation targets, including 9 individual species and 1 feature (streams, springs and sinks; see Appendix 10-C), are associated with the Arnett Creek 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 aquatic systems and communities within this conservation area, identify threats to their sustainability, and identify potential changes in management that would mitigate these potential threats.

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