Terrestrial Wildlife

This section includes key effects and conclusions for terrestrial and plant threatened, endangered, and proposed species and critical habitat listed under the Endangered Species Act of 1973, as amended, Forest Service Southwestern Region Sensitive Species, forest management indicator species, and migratory birds. The Terrestrial Wildlife Report (Schofer et al. 2018) and Botany and Weeds Report (Crisp 2018) are incorporated by reference. Aquatic species were analyzed separately in the Aquatics Report (Coleman 2018).

See the specialist reports (project record) for detailed information on methodology, analysis assumptions, best available science and data, habitats, populations, and effects that are not repeated in this section.

Affected Environment

Vegetation Cover Types Within the Project Area

The cover types in the Rim Country project area possess key habitat features outside of the natural range of variation (NRV). These forests have less structural diversity due to more acres occurring as even-aged forest compared to historical conditions (see Silviculture Report). Structure is also limited by the abundance of young and mid-aged trees and the decrease in mature and old-growth trees. These conditions do not meet forest plan direction for the ratio of age-classes interspersed across the landscape.

Ponderosa pine commonly grows in pure stands and is currently found in even-aged and uneven-aged structural conditions across the area. The open park-like stands characteristic of the reference conditions for ponderosa pine forests promoted greater diversity and fire resilience than the dense stands of today. Ponderosa pine forests within the project are generally denser and more continuous than in reference conditions and accumulations of forest litter and woody debris are much higher than would have occurred under the historic disturbance regime (Brown et al, 2003). Lack of fire disturbance has led to increased tree density and fuel loads that increase the risk of uncharacteristically intense wildfire and drought-related mortality. When fires occur under current conditions, they tend to kill a lot of trees, including the large and old trees. These trees take longer to replace, moving the forest further from desired conditions, and increasing the time it would take to return to desired conditions. There is a high risk of insect and/or disease outbreak, which is also a function of increased tree density. The abundance of younger, continuous forest reduces canopy gaps. The loss of solar radiation reaching the forest floor, along with infilling of meadows, savannas, and grasslands, reduces understory vegetation. Habitat structure within the project area can determine the presence or absence of wildlife species.

Many wildlife species select habitat provided by large and old trees, including bark gleaners (e.g., pygmy nuthatches and hairy woodpeckers which are both MIS), cavity nesters (e.g., MSO which is a threatened species and can nest in cavities or other nest substrates), communal roosting species (e.g., Allen’s lappet-browed bats, a sensitive species), and larger/heavier nesting species (e.g., northern goshawks, a MIS and sensitive species). Simplifying structure and declines of habitat features like aspen, Gambel oak, and the herbaceous community reduce habitat for an array for wildlife species from multiple trophic levels, including invertebrate communities and larger carnivores.

Springs, Riparian Areas, and Stream Channels

Approximately 360 springs have been inventoried by the Spring Stewardship Institute within the Rim Country Project analysis area. Of these 360 springs, 214 have survey information, 138 are unverified, and 8 were verified. Information regarding historic flow or water quality from these springs is minimal.

Many riparian streams in the Rim Country project area, particularly within the Rodeo-Chediski Fire area, are currently non-functioning or functioning-at-risk, with accelerated erosion and increased peak flows.

There are approximately 360 miles of fish-bearing streams in the Rim Country project area. These streams provide habitat for 12 native fish and two gartersnakes, including seven federally-listed species and four Regional Forester sensitive species (see the Aquatics specialist report).

Desired conditions for riparian streams are that they are capable of filtering sediment, capturing and/or transporting bedload (aiding floodplain development, improving flood-water retention, improving or maintaining water quality), and providing ground water recharge within their natural potential. Their necessary physical and biological components provide habitat for a diverse community of plant and wildlife species including cover, forage, available water, microclimate, and nesting/breeding/transport habitat. Stream habitats and aquatic species depend upon perennial streams or reaches and their habitat is maintained by the watershed, soil, and riparian conditions within the ecosystem.

All proposed riparian treatments would also improve or maintain stream habitat by restoring watershed function or resiliency. Upland treatments in watersheds may also improve water infiltration rates and increase subsurface flows higher in the stream system that provide cool perennial water to streams and help to maintain stream temperatures.

Desired conditions for streams and aquatic habitats are to support native fish and other aquatic species, providing the quantity and quality of aquatic habitat within the natural range of variation. This includes increasing habitat complexity such as pools and large woody debris, reducing downcutting and sedimentation, improving riparian areas that provide channel stability and leaf litter, and providing stream shading to maintain water temperatures.

Assumptions and Methodology

Best Available Science

This analysis is based on best available scientific information. Data sources include research and life history literature and technical reports (see Literature Cited section), forest plan standards and guidelines, participation of researchers and managers from other agencies (as cited in this report), approved survey protocols, professional judgment, and the integration of other specialist reports for this project (Silviculture, Fire and Air Quality, Soils and Watershed, and Transportation) to determine effects on wildlife species and their habitats (see project record for additional information). The Rim Country interdisciplinary team developed spatially-defined databases for use in a Geographic Information System (GIS) from which the majority of the data and information contained in this report were derived. This database includes variables related to forest structure and forest health (i.e., wildlife habitat such as snags, downed logs, tree density, size classes, and species, old trees, wildlife habitat classifications, and understory biomass index (see project record for additional information)). See the Silviculture and Fire Ecology and Air Quality Reports for details on the metrics used in this report and their respective modeling approaches, definitions, and assumptions.

Climate Change

The Climate Change Vulnerability Assessment (CCVA) for the Coconino National Forest and Rim Country project area (USDAFS 2017) identifies that 60 percent of the Rim Country project area is at moderate vulnerability, and 13 percent is at high vulnerability. At the ERU level, 50 percent of the mixed conifer was rated as very high vulnerability or risk of type conversion. Eighty-eight percent of the ponderosa pine ERUs were rated as high vulnerability.

The change in understory structure and palatability affects a wide array of wildlife from elk to arthropods, including a suite of prey species for goshawks and MSO. Climate change is predicted to lead to changes in fire patterns, increased evaporation and drought stress, reduced snowpack, and alters hydrologic timing and quantity (Marlon et al. 2009, NFWPCAP 2012).

Certain habitats are more vulnerable to a changing climate. For example, springs are a valuable natural water source for a variety of birds and mammals, particularly in arid environments. These areas may offer critical refugia for rare and narrow endemic species. However, many springs in the Rim Country project area are sensitive to variable precipitation and likely to dry up during prolonged drought. Along with increases in summer temperatures, climate change effects may make it harder for some riparian and wetland species to survive and challenge efforts to reintroduce some species into their historic range (Committee on Environment and Natural Resources 2008).

Climate change represents a clear threat to the ponderosa pine forests of northern Arizona. The uncharacteristic structure now common in these forests exacerbates these risks. By managing for resistant and resilient ecosystems, promoting landscape connectivity, and implementing concepts of adaptive management, land and resource managers can respond to new information and changing conditions related to climate change (Furniss et al. 2010). Endangered, threatened, candidate, and sensitive species in the Rim Country area are at particular risk. The Forest Service Southwestern Region and the 4FRI National Forests have developed guidance for addressing climate change which is broad and general in scope and which relies on adaptive management as climate change science evolves. Recent work locally that focused on the 4FRI landscape supported these findings. Implementation of the proposed Rim Country activities would be in alignment with these recommendation.

Spatial and Temporal Scales

Effects on species and their habitats were evaluated at multiple scales. Depending on the species and specific analysis, this could include the site (based on stand data), watershed, ERU, and/or individual forest. Data used was generated from modeling identified in the Silviculture Report. The timeframe for short-term effects is after treatment (2029), representing conditions after all tree cutting and tree removal occurs, followed by prescribed fire in 2029 and 2039. The timeframe for short-term effects associated with aspen treatment is 2019 (when tree cutting is complete) and 2029 (when one prescribed fire has been conducted). The timeframe for long-term effects is 30 years after treatment, or 2049.

Details on modeling to evaluate the potential for undesirable fire behavior and effects and the departure from historical fire regimes can be found in the Fire Ecology and Air Quality Report. Details regarding habitat associated with springs and riparian restoration are in the Soils and Watershed Report.

Whenever possible, species-specific habitat and locality data were used. Additionally, data queried by potential natural vegetation type (PNVT) and forest plan management area (Tonto

NF) or desired conditions (Coconino and Apache Sitgreaves NF's) were used to help with analysis of effects on species' habitats.

Data is typically rounded to the nearest 10 acres, mile, or percentage. Most values have been rounded from their actual decimal values. Totals were calculated before any values were rounded in order to give the most accurate sum. Any apparent inconsistency between the total values reported in a table and a sum resulting from adding up individual values in a table typically accounts for a discrepancy of about 1 percent in the case of rounding percentages or miles, and fewer than 2 acres in the case of rounding acres. Similarly, rounding may have been applied to text discussions and calculated variables reported in tables.

Analysis Methods to Evaluate Environmental Consequences from Alternatives on Mexican Spotted Owl Habitat

Key features of MSO habitat described in the Recovery Plan include key habitat variables of protected and recovery habitat important to the MSO such as:

1. A range of tree sizes and ages with a preponderance of trees greater than 12 inches in diameter,
2. basal area and density of pine and Gambel oak,
3. Canopy cover and structure,
4. Tree sizes suggestive of uneven-aged management, and
5. Large dead trees (snags) with a diameter of 12 inches or greater.

MSO populations are influenced by prey availability. Key features of prey habitat include:

1. High volume of fallen trees (mid-point diameter of 12 inches or greater) and other woody debris
2. Plant species richness, including woody species
3. Residual plant cover to maintain fruits, seeds, and regeneration to provide needs of MSO prey species, and
4. Other improvements to prey habitat
5. Primary Constituent Elements Related to Canyon Habitat (one or more of the following):
6. Presence of water (often providing cooler air temperature and often higher humidity than surrounding areas.
7. Clumps or stringers of mixed conifer, pine-oak, pinyon-juniper, and/or riparian vegetation:
8. Canyon walls containing crevices, ledges, or caves: and.
9. High percentage of ground litter and woody debris.

From The MSO Recovery Plan Table C.2 Generalized description of key habitat variables important to the MSO and their desired condition:

- Patchsize heterogeneity
- Horizontal and vertical habitat heterogeneity

- Tree species diversity
- diverse composition of vigorous native herbaceous and shrub species
- Opening sizes between 0.04-1 ha (0.1-2.5 acres)
- canopy cover (40%PO 60% MC)
- diversity of tree sizes with a goal of having trees ≥ 16” DBH contributing ≥ 50 % of the stand BA

These forest structure elements are reflected in the evaluation criteria and are used to describe the existing condition of the habitat and the effects of the proposed activities according to FVS modeling over a thirty-year period from the existing condition in 2019, to 2029 and 2049.

1. Acres treated and improved by habitat/vegetation type by alternative within MSO habitat type (protected and recovery habitats (2 categories: nest-roost and foraging.dispersal), and critical habitat).
2. Changes in basal area by tree size-classes to show effects from uneven-aged management by alternative within MSO habitats.
3. Changes in Quadratic Mean Diameter in inches, trees per acre, Stand Density Index, Canopy Cover, and Basal Area Average by alternative in MSO habitats.

To analyze the effects of alternatives on snags, downed logs, and coarse woody debris the following habitat variables were modeled and reviewed:

1. Change in number of snags per acre with a diameter of 12 inches and greater by alternative in MSO habitats (average number of snags 12-18 inches, 18-24 inches, and greater than 24 inches in diameter).
2. Change in tons per acre of coarse woody debris surface fuel three inches or greater.

To analyze the effects of alternatives on understory to provide MSO prey habitat measures in MSO Habitats the following variables were modeled and reviewed:

1. Snags per acre > 12” (average of snags 12-18”, 18-24”, and greater than 24”) and coarse woody debris in MSO habitats.
2. Changes in tons per acre of shrub and herbaceous biomass (to maintain fruits, seeds, and regeneration to provide needs of MSO prey species) in MSO habitats.

To analyze the effects of fire by alternative in MSO habitats the following variables were modeled and reviewed:

1. Changes in tons per acre by alternative of total surface fuel.
2. Changes in potential fire behavior (fire hazard index) by alternative in MSO habitats.
3. Changes in risk of crown fire by alternative and MSO habitats.

Uncertainty and Risk

The practice of prescribed fire has evolved over time and it is commonly used as a tool to reduce surface fuels while also maintaining forest structure/wildlife habitat components such as snags, logs, and coarse woody debris. However, prescribed fire is not a precise tool and there is inherent uncertainty and so potential risk with fire management. There is also risk and uncertainty in not addressing uncharacteristic surface fuel loads in fire-adapted ecosystems.

Monitoring data from the Coconino NF has documented loss of key habitat components from prescribed fire. Microhabitat monitoring from burns implemented on the Happy Jack Urban Interface Project on the Mogollon Rim Ranger District through late 2004 showed an eight percent loss of trees greater than 18 inches in diameter, a 21 percent loss of snags, a 71 percent loss of down logs, and a 47 percent loss of Gambel oak trees greater than five inches in diameter. In addition, prescribed burns conducted along Highway 87 and Forest Highway 3 (2005-2006) appear to have incurred loss of canopy cover and basal area. These projects did not include PACs and did not have a list of design features developed to minimize loss of key habitat components. Perhaps most important is that the projects being compared had a fuels reduction emphasis rather than the comprehensive restoration goals in the Rim Country Project.

Prescribed burning is expected to reduce the risk of future high-severity fire by reducing accumulations of fuels and raising canopy base height, both of which can benefit wildlife habitat in both the short and long term. However, it can also remove key habitat components for wildlife. Based upon the sheer number of acres proposed for burning each year, and because the intention is to apply prescribed fire to nearly all PACs and nest/roost replacement recovery acres, there is a likelihood that more key habitat components could be unintentionally lost to fire than modeling indicates. Some degree of unintended fire behavior could improve wildlife habitat by creating canopy gaps and enriching soils. However, effects on habitat could also create adverse effects.

Wildlife Species Analyzed in This Report

A diverse assemblage of wildlife were identified for analysis for the proposed Rim Country Project, including species listed under the ESA, Forest Service sensitive species, MIS, and migratory birds. Species that are evaluated here are ones known to occur within or have habitat within or adjacent to the project area. Each species from the above groups (i.e., ESA, MIS, etc.) that occurs or has the potential to occur within the project area was analyzed according to the applicable law, regulation, or policy. In some cases, surveys for these species have confirmed their presence in or near the project area. In cases where a species has not been detected, the presence of suitable habitat indicates they could be present and therefore their presence was assumed under this analysis. Aquatic threatened, endangered, and sensitive species and MIS are addressed in the Aquatics Report, except for frogs. Sensitive plant species are addressed in the Botany Report. The effects on MSO are also analyzed in a separate Biological Assessment for the purpose of ESA Section 7 consultation with the FWS.

The following list of federally threatened, endangered, and proposed species is adopted from the USFWS web page (http://www.fws.gov/southwest/es/arizona), accessed on March 22, 2017). This list includes all federally threatened, endangered, candidate, and proposed species in the counties in the Rim Country project area. For the purpose of this analysis, only those federally-listed threatened, endangered, and candidate species and their critical habitat are analyzed. In addition, Forest Service sensitive species that are known to or have the potential to occur within the Rim Country project area are also analyzed. Species that are not present or do not have potential habitat in the project area were dismissed from further analysis as the project would have no effects on these species (Table 3-**).

Table 1. Threatened, Endangered, and Forest Service Sensitive (TES) Species Evaluated

Common Name	Scientific Name	Status[1]
Amphibians		
Chiricahua leopard frog	Rana chiricahuensis	T
Northern leopard frog	Lithobates pipiens	S
Lowland leopard frog	Lithobates yavapaiensis	S
Birds		
Mexican spotted owl	Strix occidentalis lucida	T
Western yellow-billed cuckoo	Coccyzus americanus occidentalis	T
Bald eagle	Haliaeetus leucocephalus	S
Northern goshawk	Accipiter gentilis	S
American peregrine falcon	Falco peregrinus anatum	S
Burrowing owl (western)	Athene cunicularia hypugaea	S
Mammals		
Mexican wolf	Canis lupus baileyi	E/10j
Navajo Mogollon vole	Microtus mexicanus Navaho	S
Western red bat	Lasiurus blossevillii	S
Spotted bat	Euderma maculatum	S
Allen’s lappet-browed bat	Idionycteris phyllotis	S
Pale Townsend’s big-eared bat	Corynorhinus townsendii pallescens	S

1. Status: E = Federally Endangered; T = Federally Threatened; E/10j population = Endangered/Experimental population (section (10)(j) of the ESA; Eagle Protection Act = Bald and Golden Eagle Protection Act; S = Forest Service Sensitive.

Table 2. Threatened, Endangered, Candidate, Sensitive, and Management Indicator Species Not Addressed in this Analysis.

Common Name	Scientific Name	Rationale for Dropping	Status[1]
Birds (3)			
Southwestern willow flycatcher	Empidonax traillii extimus	Neither the species nor its habitat occurs in the project area	E
Yuma clapper rail	Rallus longirostris yumanensis	Neither the species nor its habitat occurs in the project area	E
Reptiles (2)			
Narrow-headed gartersnake[2]	Thamnophis rufipunctatus	Not Addressed in the Terrestrial Wildlife Species Report	T
Northern Mexican gartersnake[2]	Thamnophis eques megalops	Not Addressed in the Terrestrial Wildlife Species Report	T
California condor	*Gymnogyps californianus*	Neither the species nor its habitat occurs in the project area	E
Mammals (2)			
New Mexico meadow jumping mouse	Zapus hudsonius luteus	Neither the species nor its habitat occurs in the project area	E
Springerville silky pocket mouse	Perognathus flavus goodpasteri	Neither the species nor its habitat occurs in the project area	S
Insects (1)			
Aquatic insects[2]	Various species	Not Addressed in the Terrestrial Wildlife Species Report	S/MIS

1. Status: E = Federally Endangered; T = Federally Threatened; E/10j population = Endangered/Experimental population (section (10)(j) of the ESA; P = Federally Proposed; S = Forest Service Sensitive; MIS= Management Indicator Species;

2. Analyzed in the Aquatics Specialist Report.

Federally-listed Threatened, Endangered, Proposed and Candidate Species and Critical Habitat

Chiricahua Leopard Frog (CLF)

Listing Status

The Chiricahua leopard frog (*Lithobates [Rana] chiricahuensis*) was listed as threatened without critical habitat on June 13, 2002 (USFWS 2002). A recovery plan for the species was finalized in 2007 (USFWS 2007). Critical habitat was determined in March, 2012. The Rim Country Project Area occurs in Recovery Units 5 and 6.

Range and Life History

The historical range of the Chiricahua leopard frog included portions of west-central and southwestern New Mexico, and central and southeastern Arizona (in addition to portions of Mexico). The number of populations in much of the species' range has declined drastically over the past 20 years.

Within the species' range, aquatic habitats historically and/or currently used by the frogs include a variety of natural and human-constructed waters between elevations of 3,281 and 8,890 feet (1,000 and 2,710 meters), including rivers, permanent streams and permanent pools in intermittent streams, beaver ponds, cienegas (i.e., wetlands), springs, and earthen livestock tanks. They are occasionally found in livestock drinkers, irrigation sloughs or acequias, wells, abandoned swimming pools, ornamental ponds, and mine adits (USFWS 2007: 17).

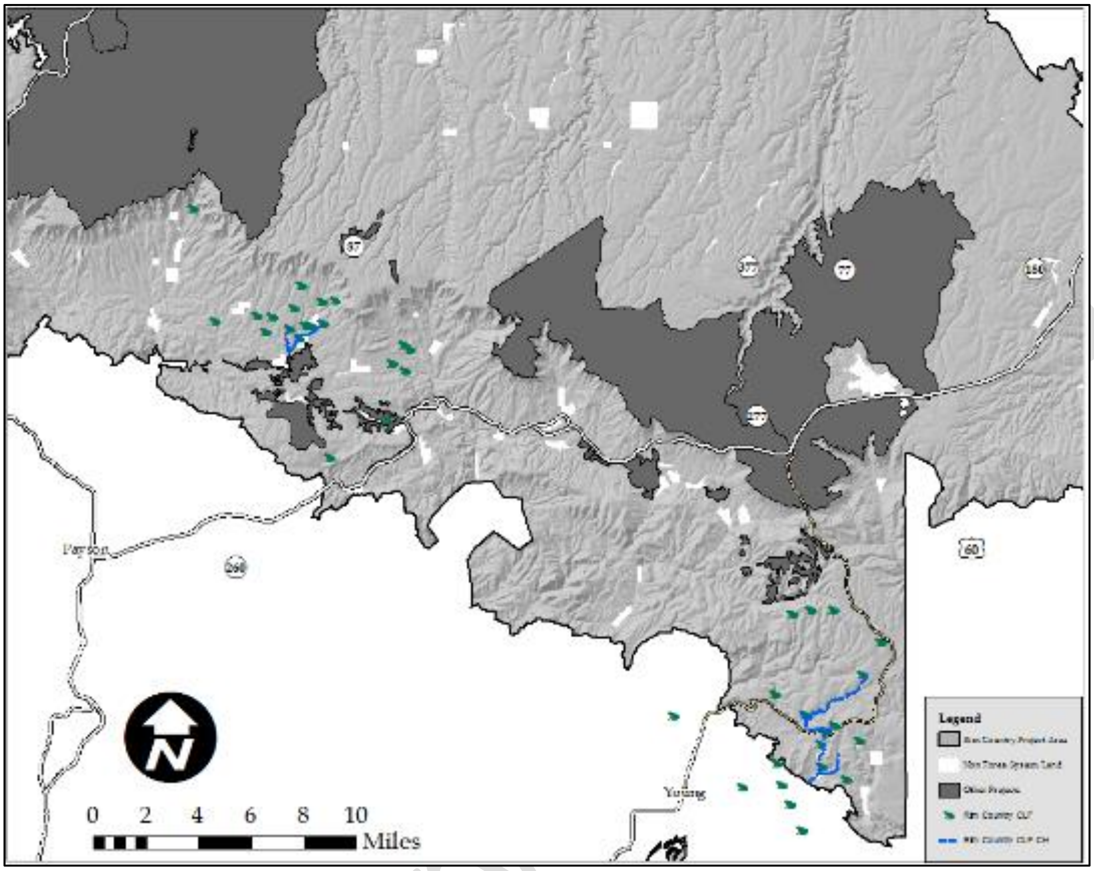
Chiricahua leopard frogs have a complex life cycle consisting of eggs and larvae that are entirely aquatic and adults that are primarily aquatic (USFWS 2007: 11). Each stage of the frogs' life history has its own set of environmental or habitat requirements that influence its susceptibility to changes in its habitat, but in general Chiricahua leopard frogs need permanent to semi-permanent water that is free, or nearly so, of non-native aquatic predators (USFWS 2007: 18, 50). However, frogs are known to move among aquatic sites and can be found in upland sites, roadside puddles, and habitats that only hold water briefly during these movements.

Species Distribution in the Project Area

Chiricahua Leopard Frog (CLF) populations have been detected at various times and locations since 1995 in the action area. Ellison and Lewis Creek in the Upper Verde Management Area (MA) is NE of Payson, AZ. Crouch, Gentry, and Cherry Creeks, and Parallel Canyon in the Gentry Creek MA is NE of Young, AZ. Both areas have CLF populations within and near these drainages (Figure 4). During 2010-2016, observers detected frogs at 19 sites in the Upper East Verde MA because of favorable monsoons, although water permanency has decreased. Also, 2011 had the most significant monsoon. Recovery activities by state and federal agencies contributed to frog detections throughout those years. (Akins 2018, pers. Comm). Since then, recent on-the-ground recovery actions by the Local Recovery Group and documentation of natural dispersal to new sites have contributed to maintaining occupied sites across the management area; this includes six populations in designated critical habitat locations.

In the Gentry Creek Management Area since 1982, 12 lentic or lotic sites within the action area have been occupied by CLFs at one point in time, however, only eight are currently occupied or have had frogs within the last five years. Further, there are numerous sites located just outside the action area (project area); that make up the Naegelin-Cherry Creek metapopulation.

Figure 1. Occupied CLF Habitat Within the Project Area



The CLF Recovery Plan identifies suitable habitat to include all perennial waters within: 1) elevational range of the frog (3,400 to 9,000 feet), 2) a mixture of aquatic and perimeter vegetation to provide oviposition sites, thermoregulation, and refuge from predators, 3) absence or low densities of nonnative aquatic species, and 4) a variety in substrate and range of shallow to deeper water for potential hibernacula (USFWS 2007).

Critical Habitat and Primary Constituent Elements in the Project Area

To accommodate the various habitat requirements at each stage in the species' life history the following habitat features (Primary Constituent Elements are likely important to maintain a reproducing population of Chiricahua leopard frogs (USFWS 2007: 18-19, 49-50, E-5).

1. Permanent or nearly permanent water that is free or relatively free from non-native predators
2. Within-site habitat diversity, including:
    1. Shallow water with emergent and perimeter vegetation that provide egg deposition, tadpole and adult thermoregulation sites, and foraging sites;
    2. Deeper water, root masses, undercut banks that provide refuge from predators and potential hibernacula during the winter;
    3. Substrate that includes some mud that allows for the growth of alga and diatoms (food for tadpoles) and to allow for hibernacula;

4. Relatively clean water not overly polluted by livestock excrement or chemical pollutants.
5. A diversity or complex of nearby aquatic sites including a variety of lotic and lentic aquatic habitats, to provide habitat for breeding, post-breeding, and dispersing individuals. In these situations, a metapopulation may be established, enhancing the likelihood of the frogs' continued existence.

Based on observations of various ranids in Arizona and New Mexico (USFWS 2007: 14-15), reasonable dispersal distances for the species are: (1) one mile overland, (2) three miles along intermittent drainages, and (3) five miles along permanent water courses (USFWS 2007: D-2, 3). In 2012, the FWS designated 10,348 acres in Arizona, New Mexico, and Mexico as CLF critical habitat. This critical habitat falls within eight recovery units (RUs) and is made of 39 units of critical habitat. Two are in the project area. The Ellison and Lewis Creek Unit encompasses a small portion of the westernmost portion of the A-S NFs and also portions of the Tonto and Coconino NFs. The Crouch, Gentry and Cherry Creeks and Parallel Canyon Unit is on the Tonto National Forest.

Mexican Spotted Owl (MSO)

Listing Status

The MSO was listed as a threatened species under the ESA in March 1993 (USDI FWS 1993). A detailed account of the taxonomy, biology, and reproductive characteristics of the MSO is found in the Final Rule listing the MSO as a threatened species (USDI FWS 1993), in the Recovery Plan (USDI FWS 1995), and in the Revised Recovery Plan (USDI FWS 2012). Information on MSO in the Upper Gila Mountain Recovery Unit (UGM) is also summarized in Ganey et al. (2011). The information provided in these documents is incorporated here by reference as summarized below.

The FWS recommends recovery actions concentrate on recovery units with the highest owl populations (USDI FWS 2012). The UGM supports over half the known population of MSOs (Ganey et al. 2011). Owls appear to be more continuously distributed in the UGM, relative to other Recovery Units, and the central location of the UGM within the overall range of the MSO facilitates gene flow across their range (Figure 8). Therefore this Ecosystem Management Unit is important to the overall range-wide stability of MSOs. The FWS also recommends recovery actions concentrate on recovery units where significant threats exist and that management should emphasize alleviating the greatest threats and be tailored to the needs of the area under analysis (USDI FWS 2012). The UGM is at significant risk of uncharacteristically high-severity wildfire (USDI FWS 2012). Lands managed by the Forest Service account for 42 percent of the UGM, putting the agency in a position to aid in the recovery of the species in part by decreasing the threat of high-severity fire in MSO habitatModeling and Habitat Evaluation

The 2012 Revised Recovery Plan and individual forest plans describe the different levels of MSO habitat management, including protected, recovery, and other forest and woodland types. The stated objectives for managers are to ensure a sustained level of owl nest/roost habitat well distributed across the landscape and create replacement owl nest/roost habitat where appropriate while achieving a diversity of stand conditions across the landscape to ensure habitat for a diversity of prey species.

Protected areas include: PACs established around all known MSO sites located during surveys and management activities since 1989 and reserved lands which include wilderness, research natural areas, wild and scenic rivers, and congressionally recognized wilderness study areas. Prescribed fire is allowed in these areas where appropriate. PACs are 600 acres or more and typically include one or more nest sites. Core areas are 100 acres or larger, designated to encompass known nest or roost sites or the best nesting and roosting habitat available within PACs. In the absence of a known nest, the activity center should be defined as a roost grove commonly used during breeding. In the absence of a known nest or roost, the activity center should be defined as the best nest/roost habitat.

Recovery habitats include all mixed-conifer, pine-oak, and riparian forests outside of protected areas. Recovery areas should be managed to ensure a sustained level of owl nest/roost habitat well distributed across the landscape. Replacement nest/roost habitat should be created where appropriate within recovery habitat while still providing a variety of stand conditions across the landscape to ensure habitat for a diversity of prey species.

While the respective forest plans provide managers with guidelines for achieving the objectives of designated MSO habitat, readers must turn to the Recovery Plan itself for the biological and ecological intent of these designations. The latter provides the context for applying the guidelines and informs management planners and decision makers as to the intended function of the habitat. Treatments in MSO habitat under Rim Country were designed to meet Forest Plan direction, as amended. Accordingly, much of the following discussion on existing conditions and the environmental effects of proposed Rim Country activities in MSO habitat follow the detail and context described in the Mexican Spotted Owl Recovery Plan; that is, forest plan direction would be met by design, but the effects on owls are assessed relative to the biology and ecology of the species as described in the Recovery Plan.

Species Distribution in the Project Area

Delineating MSO Habitat in the Rim Country Project Area

Following Recovery Plan direction, individual forest plans direct managers to conduct a districtwide or larger landscape analysis to ascertain whether minimum recommendations for nest/roost habitat exist across the forest. One of the strengths of landscape-scale planning is the ability to compare habitat across ecological scales as encouraged in the Recovery Plan.

Working closely with the FWS and wildlife biologists from the three national forests, we reviewed recovery habitats in the greater Rim Country area. Meetings held among wildlife biologists from the FWS, each NF, and members of the Rim Country team began in October, 2016. We placed emphasis on developing future nesting and roosting habitat on all three of the Rim Country NF's, which support some of the highest numbers of resident owl pairs in the Region.

A new recovery layer was created within the Rim Country project area, including designation of recovery nest/roost and foraging habitat as described in the Recovery Plan. This landscape-scale approach better meets the goal of providing continuous replacement nesting and roosting habitat over space and time, as described in the Recovery Plan.

Pine-oak habitat on the Tonto contains mostly ponderosa pine-Gambel oak to the east and pine – evergreen oak to the west. PACs and recovery habitats on the Tonto NF could not all be characterized as pine-oak or mixed conifer and so required queries using additional criteria.   A geophysical model (GM) was used to identify recovery habitats based on slope and aspect. We also assumed that most canyons and drainages would contain some ponderosa pine.

The results of the queries were reviewed in meetings with biologists with on-the-ground familiarity of the Tonto, Coconino and A-S NFs. This review was to ensure that stands also provided the best functional habitat; for example, stands were dropped from consideration when:

- Remotely-sensed data was found to misidentify juniper as oak in the understory (this was a problem on the Payson Ranger District).
- Small bubbles of isolated habitat were identified.

The strategy in designating recovery foraging and nest/roost habitat was to provide well-distributed habitat to aid in dispersal and seasonal movements of owls across the landscape, including strategically located blocks that could potentially function as future PACs (i.e., "ensure a sustained level of owl nest/roost habitat" and "[c]reate replacement owl nest/roost habitat where appropriate" per the amended forest plans). Blocks of habitat were also designated with the intent of providing "stepping-stones" to facilitate owl dispersal and connect areas capable of supporting future nesting and roosting habitat, per the Recovery Plan, to support landscape connectivity for MSOs. Some small, scattered stands of isolated habitat occurring in a matrix of non-MSO habitat would not be expected to support nesting owls or provide connectivity and were dropped from further consideration. In other words, results from the above criteria were assessed in terms of ecological function in addition to meeting query criteria.

Proximity to PAC habitat was also an evaluation criterion. We sought to either augment PAC habitat or designate recovery habitat in previously undesignated pine-oak stands. Fire potential was also considered in developing the spatial configuration of MSO habitat on the landscape. Predominant winds are from the southwest, so we rarely identified additional owl habitat southwest of existing PACs unless stands were on northerly aspects. Because of the fire potential, areas southwest of PACs were revaluated for treatments that would reduce the risk of high-severity fires entering PACs. A final emphasis was placed on removing stands misclassified as recovery habitat.

Habitat criteria for nest/roost habitat was met for 39,461acres and 188,533 acres was designated as other recovery habitat as defined in the Recovery Plan (Table 49). All of the mixed conifer in the project area is recovery habitat.

Table 3. Acres of Mexican Spotted Owl (MSO) Habitat

MSO Habitat	Habitat Acres by Forest			
	A-S	Coconino	Tonto	Total
Protected Habitat				
Protected Activity Center	35,081 acres (56 PACs)	48,310 Acres (94 PACs)	27,498 Acres (46 PACs)	110,890 Acres (196 PACs)
Recovery Habitat – Pine Oak				
Nest/roost	4,180	11,033	5,513	20,726
Foraging/Non-Breeding	33,139	61,971	30,107	125,217
Recovery Habitat – Mixed Conifer				
Nest/roost	6,700	6,019	1,688	14,407
Foraging/Non-Breeding	8,923	18,837	3,285	31,045
Recovery Habitat – Geo Phys Model				
Nest/roost	NA	NA	4,328	4,328
Foraging/Non-Breeding	NA	NA	32,271	32,271
% Geo Phys Model Recovery Nest/Roost	NA	NA	11%	11%
Total MSO Recovery Acres	52,942	97,860	77,192	227,994
Total MSO Habitat Acres	88,023	146,170	104,690	338,884

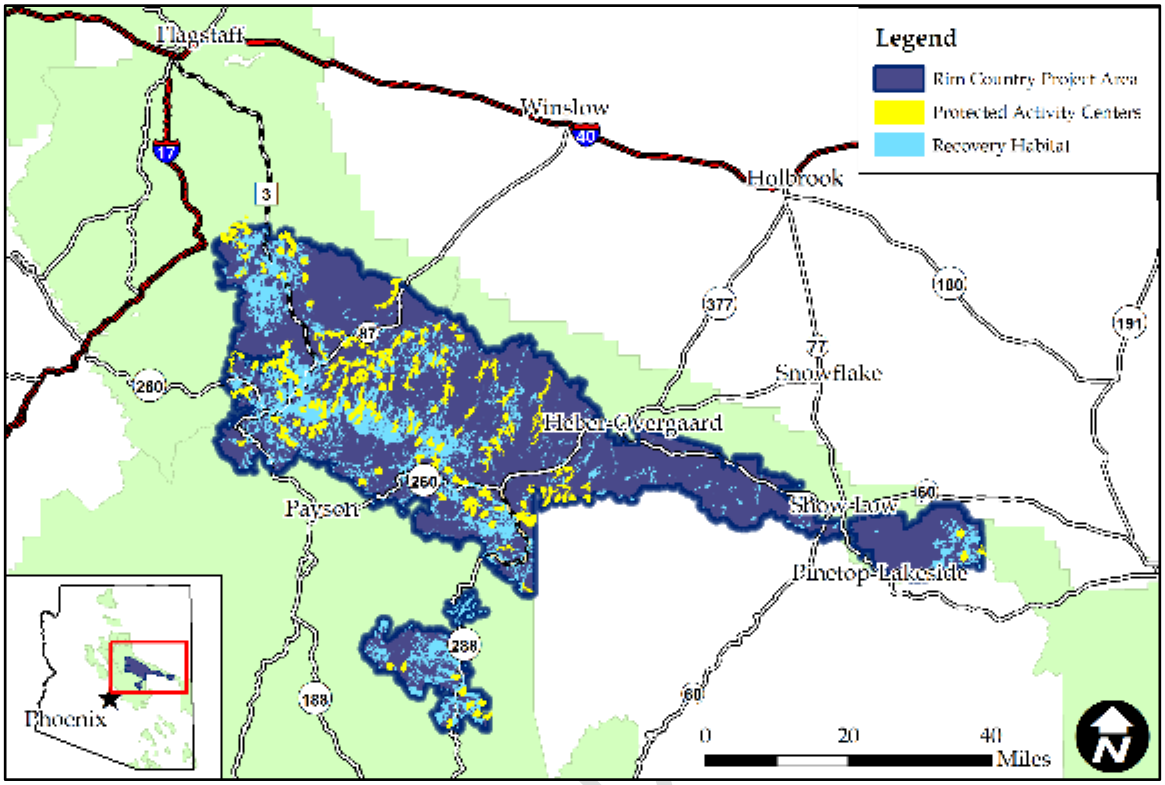
A similar process was initiated to consider the potential for specialized treatments inside PACs. A total of 196 PACs (110,890 acres) occur in the Rim Country project area, with 94 on the Coconino, 56 on the Apache-Sitgreaves NF's and 46 PACs on the Tonto NF. An additional 39,748 acres either fall outside of the Rim Country boundary area (11,269 acres) or occur in other project areas (28,479 acres). These 39,748 acres will be treated as those projects planned and consulted with FWS. Twenty nine of these PACs would have some other type of restoration (riparian, wet meadow, grassland, aspen, etc. see Actions common to Alternatives 2 and 3 below). In the 4 FRI Rim Country project area up to 82,411 acres are proposed for other thinning and/or burning, or other restoration activities in Alternatives 2 and 3 (see Effects Analysis sections below). Working closely with the FWS and wildlife biologists from all three national forests, we reviewed each PAC for treatment needs. PACs were assessed in terms of dominant forest type (e.g., pine-oak, mixed conifer, or canyons), habitat structure, available demographic data (based on ongoing occupancy surveys or past research), topographic attributes (e.g., aspect and slope), human access, designated wilderness boundaries, recent and ongoing projects affecting PAC habitat, fire history, status of current habitat, and whether mechanical treatments could move the habitat toward the desired conditions described in the Recovery Plan. It was agreed no mechanical treatments would occur in core areas.

Once the status of the PAC was determined, potential mechanical treatments were considered in terms of whether they could:

1. Decrease the amount of time required for growing/increasing tree height and diameter;
2. Decrease overall tree density while maintaining the density of large trees, and
3. Increase canopy base height to improve flight zone (i.e., improve owl foraging ability) and also reduce the threat of surface fires becoming crown fires.

It was determined that 12 of the 196 PACs assessed did not need mechanical treatments, and that mechanical treatments were possible in 22,306 acres of PACs. One hundred and seventy-one (171) miles of stream restoration, 2,881 acres of riparian restoration, and 489 acres of grassland/meadow restoration were identified in PACs. PACs were not considered for treatment if they were treated in previous projects, or if their habitat was not suitable for Rim Country treatments (some occur in designated wilderness or canyons, were previously burned, have conditions inside and outside the PAC that do not need active management, or there is not enough information to identify a need for treatment). Prescribed fire only was recommended for 49,930 acres in PACs, including using prescribed fire in core areas.

Figure 2. Mexican spotted owl habitat

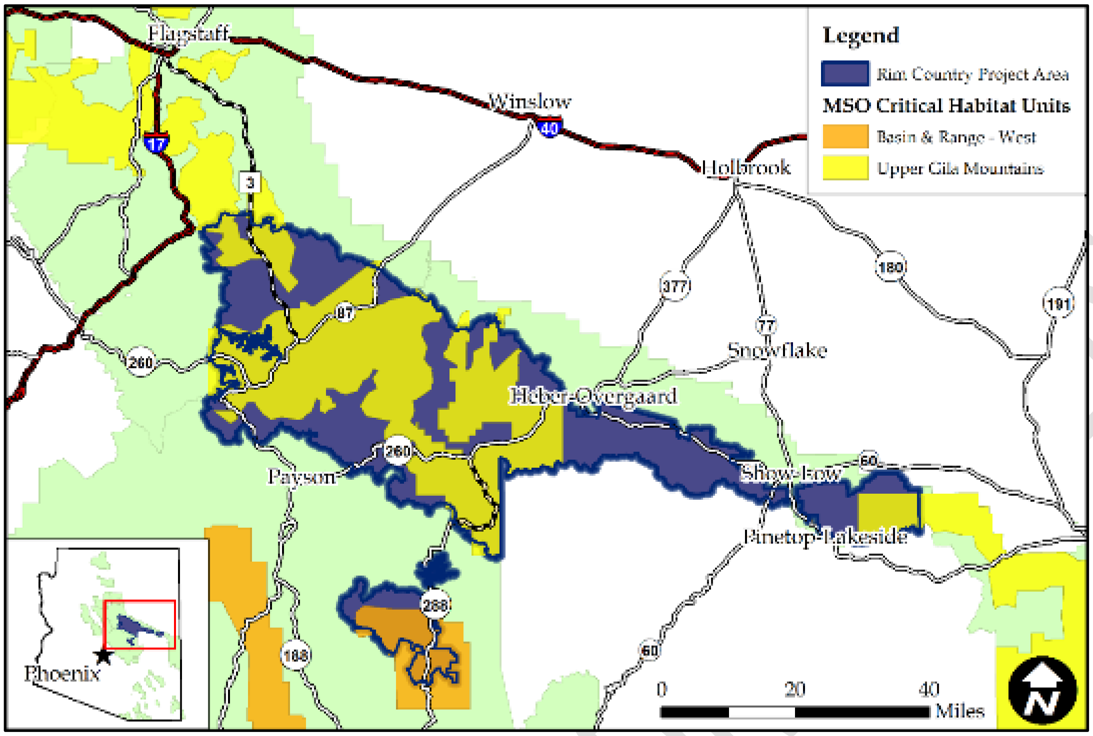


Critical Habitat and Primary Constituent Elements in the Project Area

MSO critical habitat was designated by the FWS in 2004 (USDI FWS 2004). Critical habitat is defined as protected and recovery habitats within designated areas which contain the primary constituent elements (PCEs) necessary for conservation of the species (USDI FWS 2004). Critical habitat can include non-MSO habitat, including federally-managed lands that do not function as owl habitat and private and state lands. Protected and recovery MSO habitat within designated critical habitat must be managed to maintain or enhance primary constituent habitat elements. PCEs in pine-oak forest provide for MSO habitat needs including, but not limited to nesting, roosting, foraging, dispersing, and elements of prey habitat (USDI FWS 2004). A detailed list of PCEs can be found in the Evaluation Criteria section below.

Two critical habitat units occur partially or completely within the Rim Country project area (Figure 3-**). They encompass 488,974 acres of Forest Service land, including mixed-conifer forest, but do not include state, private, Naval Observatory, or certain wildland-urban interface areas. A total of 266,149 acres of MSO habitat occurs within the critical habitat units in the Rim Country project area. In addition, non-MSO habitat occurs within critical habitat units and designated MSO habitat occurs outside of critical habitat units (72,735 acres).

Figure 3. Mexican Spotted Owl Critical Habit Units



Western Yellow-billed Cuckoo (WYBCU)

Listing Status

The western distinct population segment of the yellow-billed cuckoo was listed as a threatened species under the ESA on October 3, 2014 (USFWS 2013, 2014b; 78 FR 61622, 79 FR 59992). Within the population segment (see Figure 1 at 79 FR 59994, in the final listing rule (79 FR 59992; October 3, 2014)), the habitat areas used by the species for nesting are located from southern British Columbia, Canada, to southern Sinaloa, Mexico, and may occur from sea level to 7,000 feet (ft.) (2,154 meters (m)) in elevation (or slightly higher in western Colorado, Utah, and Wyoming). Critical habitat for the yellow-billed cuckoo population segment was proposed on August 15, encompassing 546,335 acres across the western United States (USFWS 2014a; 79 FR 48548). The discussions of the status of this species in these documents are incorporated herein by reference. A revised proposed rule that may include additional proposed critical habitat is under development.

Range and Life History

In Arizona, the species was a common resident in the (chiefly lower) Sonoran zones of southern, central, and western Arizona (Phillips et al. 1964). The yellow-billed cuckoo now nests primarily in the central and southern parts of the state, as well as at revegetation sites along the lower Colorado River (MacFarland and Horst 2015; USFWS 2013, 2014a, 2014b, McNeil et al. 2013). In the Southwest, the Western yellow-billed cuckoo (WYBC) usually occurs in association with large blocks of mature riparian cottonwood-willow woodlands and dense mesquite associations (USFS 2011a). Habitat features of the WYBC indicate a preference for areas with a closed canopy and a sub-canopy layer (USFS 2011a). Dense understory foliage appears to be an important factor in nest site selection, while cottonwood trees are an important foraging habitat in areas where the species has been studied in California (USFS 2011a). Nesting west of the Continental Divide occurs almost exclusively close to water (USFWS 2001).

Species Distribution in the Project Area

The western distinct population of the yellow-billed cuckoo is not known to occur in the project area. No critical habitat areas have been identified within the Rim Country project area for the cuckoo, though proposed critical habitat units are seven miles east and south of the project area.

There have been no systematic surveys for the WYBCU on the ASNFs; however, there are some incidental known occurrences, all of them on the Apache side. The cottonwood-willow riparian forest cover type occurrence on the Sitgreaves side of the ASNFs is not likely to provide habitat extensive enough for nesting. On the Tonto NF, in previous years there have been detections of cuckoos in Rye Creek on the Payson-Tonto Basin border near Rye and Gisela creeks. For example there were several detections including protocol level surveys along Lower Tonto Creek (2017, 2018) and it is feasible that birds may move up to the Gisela area as some suitable habitat occurs there and the species has breeding pairs lower down on the creek (Tony Bush, personal communication, 11/28/2018). Cuckoos have also been found along the Verde River and Cherry Creek (Tonto Basin portion). It is possible that cuckoos could be present in some of the drainages in the Rim Country footprint. While many of these riparian reaches are narrow, it is possible that birds are using these areas. Narrow drainages with linear or scattered reaches of riparian trees can be cuckoo habitat. Intermittent and ephemeral reaches with water for at least part of the summer may also be cuckoo habitat (Susan Sferra USFWS, Personal Communication, 2018).

Proposed Critical Habitat and Primary Constituent Elements in the Project Area

The 4 FRI Rim Country Project area does not contain proposed critical habitat for Yellow-billed Cuckoos, but it is likely that the species does occur here. Critical habitat Unit 19, Beaver Creek, is approximately seven miles east of the project area and Unit 22 (Tonto Creek) is approximately seven miles southeast of the project area.

1. Primary Constituent Element 1—Riparian woodlands. Riparian woodlands with mixed willow cottonwood vegetation, mesquite-thorn forest vegetation, or a combination of these that contain habitat for nesting and foraging in contiguous or nearly contiguous patches that are greater than 325 ft. (100 m) in width and 200 ac (81 ha) or more in extent. These habitat patches contain one or more nesting groves, which are generally willow dominated, have above average canopy closure (greater than 70 percent), and have a cooler, more humid environment than the surrounding riparian and upland habitats.

2. Primary Constituent Element 2—*Adequate prey base*. Presence of a prey base consisting of large insect fauna (for example, cicadas, caterpillars, katydids, grasshoppers, large beetles, dragonflies) and tree frogs for adults and young in breeding areas during the nesting season and in post-breeding dispersal areas.

3. Primary Constituent Element 3—*Dynamic riverine processes*. River systems that are dynamic and provide hydrologic processes that encourage sediment movement and deposits that allow seedling germination and promote plant growth, maintenance, health, and vigor (e.g. lower gradient streams and broad floodplains, elevated subsurface groundwater table, and perennial rivers and streams). This allows habitat to regenerate at regular intervals, leading to riparian vegetation with variously aged patches from young to old. Because the

species exists in disjunct breeding populations across a wide geographical and elevational range and is subject to dynamic events, the river segments described below are essential to the conservation of the western yellow-billed cuckoo, because they maintain stability of subpopulations, provide connectivity between populations and habitat, assist in gene flow, and protect against catastrophic loss. The occupied rivers and streams that are proposed for designation contain physical and biological features that are representative of the historic and geographical distribution of the species. All river segments proposed as western yellow-billed cuckoo critical habitat are within the geographical area occupied by the species as defined by the species' DPS at the time of listing (i.e., currently) and contain the features essential to the conservation of the species. The features essential to the conservation of the species and refined primary constituent elements are present throughout the river segments selected, but the specific quality of riparian habitat for nesting, migration, and foraging will vary in condition and location over time due to plant succession and the dynamic environment in which they exist.

Mexican Wolf

Listing Status

The Mexican wolf, *Canis lupus baileyi*, is an endangered subspecies of gray wolf protected by the Endangered Species Act (80 FR 2488, January 16, 2015) (ESA). On January 12, 1998, the U.S. Fish and Wildlife Service published an Endangered Species Act section 10(j) rule for the Mexican wolf that provided for the designation of specific populations of listed species in the United States as "experimental populations". The Mexican wolf has been reintroduced on national forests in Arizona and New Mexico. These wolves have been designated as a non-essential experimental population, pursuant to section 10(j) of the Endangered Species Act as amended.

Wording from the USFWS 2014 EIS for the proposed revision to the Regulations for the Non essential experimental population of the Mexican Wolf.

Disturbance-causing land-use activity means any activity on Federal lands within a 1-mi (1.6-km) radius around release pens when Mexican wolves are in them, around active dens between April 1 and July 31, and around active Mexican wolf rendezvous sites between June 1 and September 30, that the Service determines could adversely affect reproductive success, natural behavior, or persistence of Mexican wolves. Such activities may include, but are not limited to—timber or wood harvesting, prescribed fire, mining or mine development, camping outside designated campgrounds, livestock husbandry activities (e.g. livestock drives, roundups, branding, vaccinating, etc.), off-road vehicle use, hunting, and any other use or activity with the potential to disturb wolves. The following activities are specifically excluded from this definition:

(i) Lawfully present livestock and use of water sources by livestock;

(ii) Livestock drives if no reasonable alternative route or timing exists;

(iii) Vehicle access over established roads to non-Federal land where legally permitted activities are ongoing if no reasonable alternative route exists;

(iv) Use of lands within the National Park or National Wildlife Refuge Systems as safety buffer zones for military activities and Department of Homeland Security border security activities;

(v) Fire-fighting activities associated with wildfires; and

(vi) Any authorized, specific land use that was active and ongoing at the time Mexican wolves chose to locate a den or rendezvous site nearby.

Thinning and burning projects have the potential to affect wolves, especially when reproduction and denning activities are disrupted. The Forest Service will work closely with the wolf field team to identify sensitive areas and avoid temporal disruptions that could negatively affect Mexican wolves.

Range and Life History

The Mexican wolf is a top predator native to the southwestern United States and Mexico that lives in packs and requires large amounts of forested terrain with adequate ungulate (deer and elk) populations to support the pack. Predator eradication programs in the mid to late 1800's to mid-1900's resulted in the near extinction of the Mexican wolf. Extinction was averted with the inception of a captive breeding program founded with seven Mexican wolves.

In the United States, Mexican wolves were reintroduced to the wild in 1998 in the Mexican Wolf Experimental Population Area, an area designated for Mexican wolf reintroduction in Arizona and New Mexico. The Mexican wolf population in this population area has exhibited robust growth in recent years. As of December 31, 2016, a population of at least 113 wild Mexican wolves inhabited the population area, the largest population size reached to date (USFWS 2017b).

The threats to the Mexican wolf have generally remained consistent over time, including human-caused mortality and related legal protections, extinction risk due to small population size, and loss of genetic diversity (USFWS 2017).

Species Distribution in the Project Area

Figure 3-** shows areas of potential wolf habitat and includes parts of the Rim Country planning area classified as high quality. Radio-collard wolves on the Black Mesa District of the Apache-Sitgreaves NF have recently been located within the Rim Country boundary (USFS 2017), before returning to the east. In 2018, another lone male passed through Rim Country from the Gila Wilderness in NM to the Kaibab NF west of Flagstaff. Also in 2018, uncollared wolves were confirmed in the Heber/Overgaard area. Given wolves' capacity for long-distance dispersals (Mech et al 1995), we could reasonably predict that more individuals could occur within the Rim Country project area during the planning and implementation of the project. Coordination between the Forest Service and the Inter-Agency Field Team (IFT) will occur before phases of implementation to verify wolf occurrences in projects area.

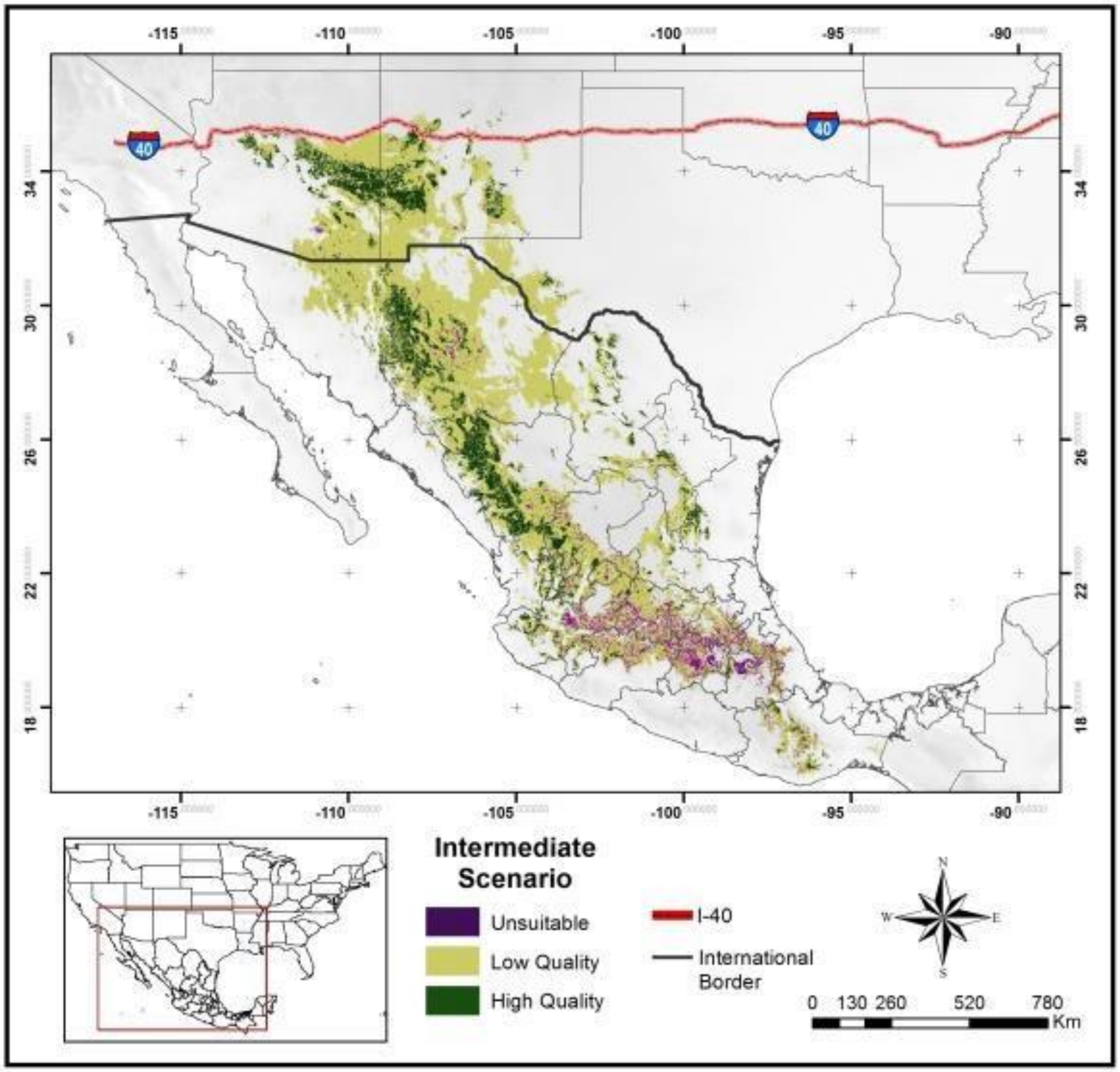


Figure 4. Focal area for Mexican wolf recovery strategy, including the MWEPA in the United States, and the Sierra Madre Occidental in Mexico

Figure from Martínez-Meyer et al. 2017, Figure 19. Reclassified intermediate habitat suitability scenario for the Mexican wolf based on the combination of climatic suitability, land cover use, human population density, and road density.

Forest Service Sensitive Species

Sensitive species are defined as "those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by: (a) significant current or predicted downward trends in population numbers or density, or (b) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (FSM 2670.5(19))." It is the policy of the Forest Service regarding sensitive species to: (1) assist states in achieving their goals for conservation of endemic species; (2) as part of the National

Environmental Policy Act process, review programs and activities, through a biological evaluation, to determine their potential effect on sensitive species; (3) avoid or minimize effects on species whose viability has been identified as a concern; (4) if effects cannot be avoided, analyze the significance of potential adverse effects on the population or its habitat within the area of concern and on the species as a whole (the line officer, with project approval authority, makes the decision to allow or disallow effects, but the decision must not result in loss of species viability or create significant trends toward Federal listing); and (5) establish management objectives in cooperation with the state when projects on National Forest System lands may have a significant effect on sensitive species population numbers or distributions. Establish objectives for Federal candidate species, in cooperation with the FWS and state of Arizona (FSM 2670.32).

The most recent Regional Forester's Sensitive Species list was transmitted to Forest Supervisor's in September 2013 and is the basis for the species used for this analysis. If survey information was not available, the assumption was made that potential habitat was occupied. The presence of species carried forward for analysis was determined by consulting forest records, results of surveys conducted on the forest, and use of the FAAWN database (Patton 2011).

Northern Goshawk (NOGO)

This analysis addresses policy requirements and responds to key issues raised by the public including Issue 2, Treatments in Goshawk Habitat and Issue 3, Large Tree Retention. Indicators include changes in the amount and/or quality of goshawk nesting and post-fledging family area (PFA) habitat. Specific measures include:

1. Acres treated by habitat/vegetation type by alternative in PFAs and areas outside of PFAs.
2. Changes in tree size-classes by alternative in PFAs and areas outside of PFAs.
3. Percent canopy cover by alternative in PFAs and areas outside of PFAs.
4. Number per acre of snags logs, and tons per acre coarse woody debris in PFAs and areas outside of PFAs.
5. Changes in percent shrub and herbaceous biomass (to maintain fruits, seeds, and regeneration to provide needs of goshawk prey species) in PFAs and areas outside of PFAs.
6. Changes in potential fire behavior (Fire Hazard Index) by alternative in PFAs.
7. Changes in risk of crown fire by alternative in PFAs.

This report utilizes and incorporates by reference the vegetation cover type and vegetation existing condition information provided in the Silviculture Report and the respective forestwide MIS reports.

Forest Plan Compliance and Analysis Framework

Forest plan direction for northern goshawks applies to goshawk habitat outside of Mexican spotted owl habitat. In ponderosa pine forest, one or the other set of guidance applies and Mexican spotted owl guidance takes precedence in areas of overlap.

Habitat Strata and Scales of Analysis

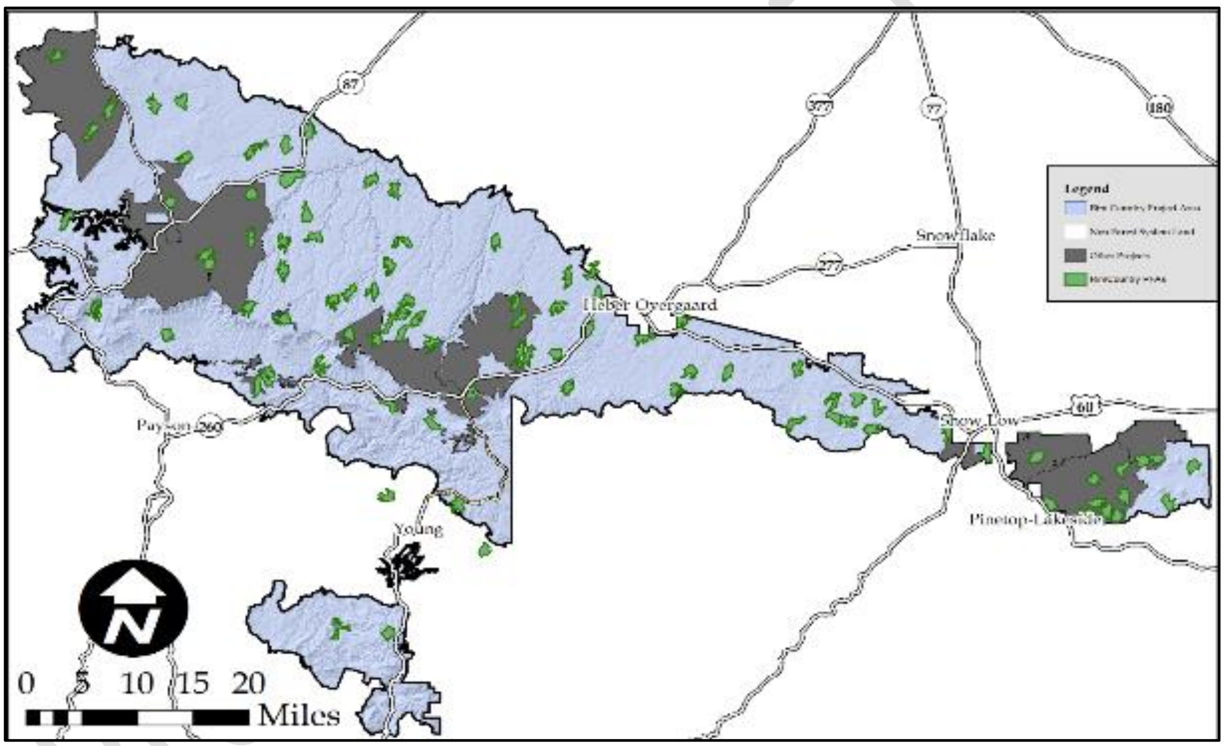
PFAs are about 600 acres in size (including the nest areas, replacement nest areas, and habitat most likely to be used by fledglings during early development). PFAs were considered occupied.

The Coconino Revised Forest Plan (2018), Tonto Forest Plan (1985), and A-S Revised Forest Plan (2015) have direction to include a minimum of six nest areas and replacement nest areas within each PFA. Nest areas would be about 25 to 30 acres in size (minimally 30 acres (Coconino NF)), and based on active nest sites followed by the most recently used historical nest sites.

Goshawks and Rim Country

There are 106 PFAs on the Coconino, Tonto, and A-S National Forests, totaling 60,180 acres in the Rim Country project area. Of these acres, 22,320 are within other project areas (Figure 3-**). Approximately 37,860 acres of PFA habitat would be treated with mechanical thinning and/or prescribed fire in the proposed action. A PFA was only counted once if a portion of that PFA occurs on more than one forest. Figure 3-** shows the distribution of goshawk PFAs in the Rim Country project area. The Rim Country Flexible Toolbox Approach for Mechanical Treatments identifies PFAs as areas where special prescriptions will promote habitat variables needed by this species.

Figure 5. Goshawk PFAs



Lowland Leopard Frog

The Lowland leopard frog shares habitats and threats similar to those of the Northern leopard frog (see description below).

Lowland leopard frogs are only known to occur in Fossil Creek, Walker Creek, and possibly in Oak Creek Canyon (only tadpoles observed) on the Coconino NF. Off the forest, lowland leopard frogs are currently known to occur in Spring Creek but only on the private land parcel, Josephine Tunnel (private land), Page Springs Fish Hatchery (state land), and Soda Springs (private land). They are also located 10 miles south of the project area boundary on the Tonto NF in House Spring adjacent to the Fort Apache Indian Reservation. T elevational range of the species is 1,810 meters. There are not numerous suitable habitat locations below the Mogollon rim in 4FRI footprint. Historic records for lowland leopard frogs are from Spring Creek, Verde River, Josephine Tunnel (private land), Oak Creek including the canyon, and Fossil Creek. Unsurveyed but suitable locations below the rim are numerous and include perennial streams (Red Tank Draw), various springs (Russell, Holly), and numerous earthen livestock tanks below the rim.

Northern Leopard Frog (NLF)

The northern leopard frog is a smooth-skinned green, brown, or sometimes yellow-green frog covered with large, oval dark spots, each of which is surrounded by a lighter halo. Adult body lengths range from 2 to 4.5 inches.

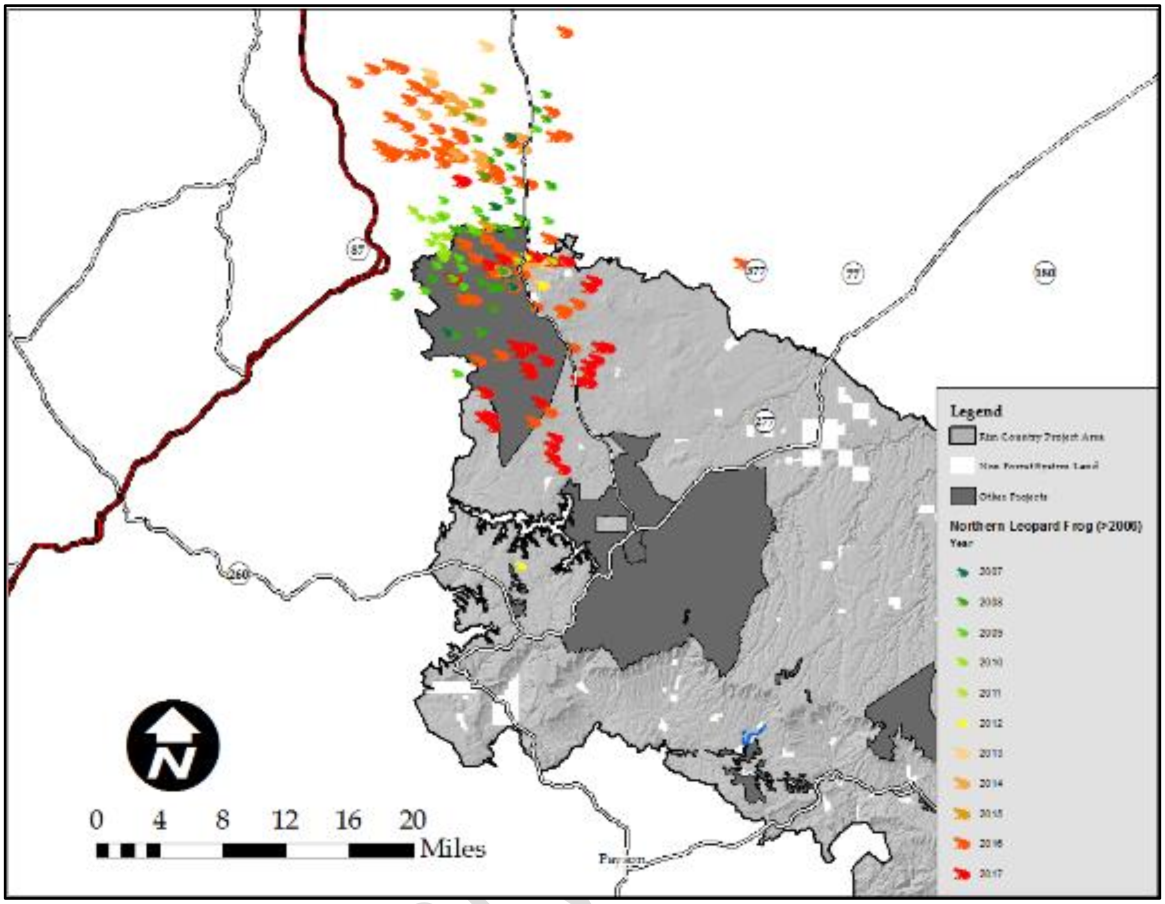
The northern leopard frog requires a mosaic of habitats to meet the requirements of all of its life stages, and breeds in a variety of aquatic habitats including slow-moving or still water along streams and rivers, wetlands, permanent or temporary pools, beaver ponds, and human-constructed habitats such as earthen stock tanks and borrow pits. Subadult northern leopard frogs typically migrate to feeding sites along the borders of larger, more permanent bodies of water, and recently-metamorphosed frogs will move up and down drainages and across land in an effort to locate new breeding areas.

Species Distribution in the Rim Country project area

Historically, the northern leopard frog was well-distributed across northern and central Arizona, including wetlands in wooded areas and meadows above and below the Mogollon Rim, as well as in more open and arid country on the Colorado Plateau. Northern leopard frogs have declined, often dramatically, across the western United States and southwestern Canadian Provinces. Arizona is no exception. On the Apache-Sitgreaves NF, historic sightings show observations from the 1990s in various stock tanks five to 10 miles south of Heber. In 2004 a NLF was observed in Black Canyon. This was the last NLF observed on the Black Mesa Ranger District of the A-S NF. Northern leopard frogs were reintroduced by AZGFD to Turkey Creek on Black Mesa September 2018.

The last known stronghold of the species in Arizona is a complex of cattle tanks (33 occupied by NLF in 2017 in the project area) and a lake below the Mogollon Rim Ranger District of the Coconino National Forest, approximately 5 miles north of the project area (Figure 3-**).

Figure 6. Occupied Northern leopard frog habitat



These occupied sites are within or near the northwest corner of the 4FRI Rim Country project area. Few other populations exist. In 2006, it was reestablished to four refugia sites in the House Rock Valley. In the White Mountains on and near the Apache-Sitgreaves National Forest, a refugia population was established at the AZGFD office in Pinetop. Reintroduction efforts are underway using frogs from Lyman Lake, a site where frogs were thought to be extirpated but were observed with a subset captured and placed in the refugia in 2014. This population disappeared from the refugia in 2018. The AZGFD released NLFs to Turkey Creek on the A-S in 2018. Historic sites lack any shoreline cover, are gone, or have unacceptable water quality. Other sites being considered include the Double Cabin area and near Wiggins Crossing. Other sites are also being considered and no final decision has been made. Northern leopard frogs were reintroduced by AZGFD to Turkey Creek on the Black Mesa Ranger District in September 2018. The biggest challenges are water availability and horse effects. Some tanks that used to be suitable for frogs may have been impacted by horses but there are other sites in the horse territory that have not been impacted and are still suitable. In 2018 frogs were translocated from the House Rock Wildlife Area north of the Colorado River and east of the Kaibab Plateau. AZGFD also translocated frogs to the Pinetop Wetlands in hopes they will breed during the spring of 2019 (Groebner, personal communication, 12/13/2018).

Bald Eagle

The FWS removed the bald eagle in the lower 48 States of the United States from the Federal List of Endangered and Threatened Wildlife as of August 8, 2007 (USDI FWS 2007d). Eagles are currently protected under the Golden and Bald Eagle Protection Act and are a Forest Service sensitive species.

The FWS recommends using the Conservation Assessment and Strategy for Bald Eagles in Arizona (Driscoll et al. 2006) in conjunction with the Bald Eagle National Management Guidelines (USDI FWS 2007e) to protect bald eagles in Arizona. These guidelines were incorporated into the Rim Country as design features or mitigation.

Bald eagles in central Arizona prefer to nest on cliff ledges or pinnacles or in tall trees (USDI FWS 1982). Bald eagles are habitat generalists and opportunistic feeders, typically taking the easiest and most abundant prey, regardless of whether it is dead or alive (Joshi 2009). They mainly forage on waterfowl and fish found along major streams; however, they do hunt in the uplands and forage on various mammal species, especially in the winter.

Nesting

Bald eagle numbers in Arizona have increased since 2008, with the number of breeding areas recorded increasing from 56 in 2008 to 85 in 2017. Active breeding areas increased from 44 in 2008 to 60 in 2017. The number of young fledged has increased from 53 in 2008 to 63 in 2017. Nesting success is partially attributed to the AZGFD Bald Eagle Nest Watch Program and to Forest Service closures around nest sites (Show Low Lake and Chevelon Canyon on the Apache-Sitgreaves NF).

There are Seven nesting pairs of bald eagles within or near the project area.

Table 4. Bald eagle nests

Breeding Area	Location: Forest/Ranger District	Status in 2018/Recent Nesting History
Fool Hollow Lake	A-S, Lakeside	Active Nest in 2018.
Chevelon Canyon Lake	A-S, Black Mesa	Unknown. Successful nest in 2016, 2 fledged.
76	Tonto, Tonto Basin RD	Active. Successful nest in 2016, 2 fledged.
Silver Creek	Private, Adjacent to Tonto NF, Payson	Active. 2 fledged in 2015. Active nest in 2018.
Show Low Lake	A-S, Lakeside	Active.
Woods Canyon	A-S, Black Mesa	Active. 1 fledged in 2016, 1 fostered from Show Low Lake. Fledged 1 in 2018.
O.W. / Canyon Creek	Tonto, Pleasant Valley	Unknown. First nest attempt in 2018, nest failed.

Wintering

Bald eagles occurring on the Coconino and Apache-Sitgreaves NFs are primarily winter visitors. Bald eagles overwintering in northern Arizona are primarily migratory individuals that breed in the northern U.S. and Canada (Grubb et al. 1989). There is a wintering population of eagles at the Buckhead Mesa Landfill which is leased by the Tonto NF. They are often seen scavenging on carrion, including large and small mammals, or around some of the waters supporting fish and waterfowl. The AZGFD provided important wintering bald eagle habitat areas to consider for the 4FRI Rim Country analysis. These included the Lakeside Ranger District of the A-S's various lakes: Mogollon Plateau: Lower Lake Mary Road; Rattlesnake Canyon: Lake Mountain, Verde River Valley, Wingfield Mesa, Mogollon Plateau, Jack's Canyon; Mogollon Plateau: Slim Jim Ridge; Mogollon Rim: West Chevelon Canyon; Chevelon Canyon Lake; Mogollon Rim: Cottonwood Wash; Sierra Anchas: Dupont Canyon; Willow Springs Lake; and the Buckhead Mesa Landfill. Small to moderate-sized groups of bald eagles (typically two to 48) roost in clumps of large trees in protected locations such as drainages and hillsides (Grubb and Kennedy 1982, Dargan 1991, Grubb 2003). Bald eagle winter night roosts typically consist of clumps of large (average d.b.h. of 30 inches) trees on steep slopes that tend to occur on east-facing aspects (Joshi 2009). Group sites are typically in stands of ponderosa pine trees of less than an acre up to 43 acres, most often on north or northeast-facing slopes close to daytime foraging areas (Dargan 1991). Day roosts are often trees or snags near water or roadways. Bald eagles are highly mobile in the winter and can fly great distances in search of aquatic or terrestrial prey and suitable nighttime roosting habitat.

Golden Eagle

There is a golden breeding site observed in 2016, 0.3 miles from the project area in the Hells Gate Wilderness on Pleasant Valley Ranger District of the Tonto NF. Golden Eagle nesting within the Rim Country project area has also been recorded on the eastern boundary on the Verde River, outside of the project area on Deadman's Mesa and approximately 2 miles north of the project area on the Tonto NF, Pleasant Valley Ranger District. South of the project area in the Sierra Anchas, 7 Golden Eagle historic and active nest sites are within 1-3 miles of the project area. Approximately three miles north of Rim Country on the A-S NF, Black Mesa District there is an active nest site (2015) North of Heber, AZ. in Black Canyon and another NE of Chevelon Crossing. There is a historic nest site from the late 1990s on the Lakeside Ranger District.

American Peregrine Falcon

The essential habitat for peregrine falcons includes rock cliffs for nesting and a large foraging area. Suitable nesting sites on rock cliffs have a mean height of 200 to 300 feet. The subspecies *anatum* breeds on selected isolated cliff ledges and is a permanent resident in the project area. Peregrines prey mainly on birds found in wetlands, riparian areas, meadows, parklands, croplands, mountain valleys, and lakes within a 10 to 20-mile radius from the nest site. There are 25 confirmed nesting pairs of peregrine falcons within the project area Known nest locations, tall cliffs, open waters, and meadows provide potential habitat within the project area. Forest plan guidelines prohibit activities that can potentially disturb peregrine falcons in the vicinity of occupied nesting habitat between March 1 and August 15.

Western Burrowing Owl

Burrowing owls are found in flat, open, low-stature grasslands, sparsely vegetated desert shrub, and edges of human disturbed land. These owls take over burrows of prairie dogs and ground squirrels, and dens of coyote, fox and badger. They are also known to use artificial burrows. These owls also need perches, such as mounds and fence posts. They primarily eat insects and small mammals, but are known to take other small-sized species. Breeding Bird Atlas surveys confirmed nesting from approximately 100 feet elevation near Gladsden to 6,600 feet elevation in a prairie dog colony near Flagstaff however burrowing owls have not been confirmed within the project area. Similar to prairie dogs, burrowing owls are associated with the Great Basin/Colorado Plateau grassland and steppe, montane subalpine, and semi-desert grasslands. There are 31,293 acres of grassland habitat within the project area that provide potential habitat for prairie dogs and consequently, burrowing owls. There is no specific forest plan direction for burrowing owls or prairie dogs; however, guidelines for mountain grassland are to evaluate the need to maintain and improve meadows by eliminating competing conifers, stabilizing gullies to restore waters tables, and reseeding with desirable species.

Sulphur-bellied Flycatcher

These flycatchers primarily nest (in snags) in the sky islands of SE AZ, but have been found as far west as the Baboquivari Mountains and locally north to the Sierra Anchas. E-Bird shows one record from Pine Creek, which is adjacent to the project area. There is a 1997 breeding record from as far north as Oak Creek Canyon near West Fork. They typically nest from 4,500 to 6,000 feet in elevation (Corman and Wise-Gervais 2005).

Navajo Mogollon Vole

Hoffmeister (1986) delineated the range for this vole from the Navajo Mountain southward to the western part of the Mogollon Plateau, extending from near Mormon Lake westward toward the town of Williams and up to the Tusayan Ranger District. They live in a variety of habitats from 3,800 to 9,700 feet in elevation, including ponderosa pine forest and montane subalpine grasslands. Whether or not Navajo Mogollon voles are found in forests, shrublands, or grasslands, they are associated with grassy vegetation (Hoffmeister 1971). They select drier habitats than long-tailed voles, which typically occupy moister habitats (Hoffmeister 1971). They occur within open forests and in larger grassland areas such as Garland and Government Prairies on the Williams Ranger District (Ganey and Chambers 2011). They typically nest underground with runways leading from the burrow entrance out to their foraging areas. They preferentially forage on cool season or C-3 photosynthesis grasses (Chambers and Doucett 2008, Ganey and Chambers 2011). Other grasses can also provide food and voles rely on other herbaceous species for cover. In a study evaluating understory vegetative cover, clumpy tree distribution, decreased pine basal area and snags greater than 16 inches in diameter were identified as strong drivers for Mogollon vole occupancy (Kalies et al. 2010). There are over 689,503 acres of ponderosa pine and 31,293 acres of grassland within the project area.

Western Red Bat

The western red bat is thought to be a summer resident of northern Arizona. It primarily occurs along riparian corridors among oaks, sycamores, and cottonwoods at low elevations, but may occur up to 7,200 feet where it roosts in dense clumps of foliage. In the Grand Canyon, Hoffmeister (1971) reports they were only known from the bottom of the canyon near Phantom Ranch and along Bright Angel Creek. Summer habitat associations include coniferous forest (Western Bat Working Group 2005a). Although generally solitary, western red bats forage in close association with one another in summer and may migrate in groups. They typically feed along forest edges or in small openings. Large lepidopterons are considered main prey items, but homopterans, coleopterans, hymenopterans, and dipterans have also been reported in their diets (Western Bat Working Group 2005a). On rare occasion, red bats have been documented near Kachina Village, upper West Clear Creek Wilderness, and Page Springs Fish Hatchery. The latter two locations are outside of the project area. One bat was radio-tracked near Kachina Village within the project area and roosted in a clump of Gambel oak in dry ponderosa pine forest (Chambers personal comm. 2010). They roost primarily in the foliage of trees or shrubs but occasionally use caves. Given they are an uncommon summer resident on the Coconino NF, they could conceivably be a rare visitor on the Apache-Sitgreaves and Tonto NF as well. Recent (2018) NaBAT data has confirmed red bat recordings on the Tonto inside the project area.

Forest plan guidelines state rare and unique features (e.g., talus slopes, cliffs, canyon slopes, caves, fens, bogs, sinkholes) should be protected from damage or loss in order to retain their distinctive ecological functions and maintain viability of associated species.

Both caves and abandoned mines are available for roosting bats, reducing the potential for displacement, abandonment of young, and possible mortality. Caves and abandoned mines that are used by bats should be managed to prevent disturbance to species and spread of disease (e.g., white-nose syndrome).Potential foraging habitat within the project area includes 689,503 acres of ponderosa pine and 31,923 acres of grassland. Roosting habitat may occur along the 777 miles of riparian habitat.

Allen's Lappet-browed Bat

Allen's lappet-browed bat is known to occur in a wide variety of habitats in the southwestern U.S. and Mexico. They are known to occur within the Rim Country area (Patton 2011). In Arizona, Allen's lappet-browed bats have been found in ponderosa pine, pinyon-juniper, Mexican woodland, white-fir forests, and Mohave Desert scrub. They are often associated with water. Hoffmeister (1986) documents Allen's lappet-browed bats occupying mine shafts or rocky areas and cliffs for roosts. A study conducted within the project area documented lappet-browed bats using snags for maternity roosts. It appears that males segregate during the maternity season and use cliff habitat, while females typically select taller snags with sloughing bark closer to forest roads for raising their pups (Solvesky and Chambers 2009). While snags are not a long-lasting form of forest structure, snags with sloughing bark are even more ephemeral. Female roosts were all within ponderosa pine forest. Allen's lappet-browed bats feed on flying insects, often over open waterbodies (including stock tanks) and wetlands where flying insects are abundant. However, foraging habitat can be diverse and includes ponderosa pine forest, forest openings, wet soils, and diverse herbaceous ground cover. They occur across the ponderosa pine belt on the Tonto, Coconino and Apache-Sitgreaves NFs and have been documented in the project area. Potential habitat within the project area is 689,503 acres of ponderosa pine and 114,753 acres of pinyon-juniper.

Pale Townsend's Big-eared Bat

Townsend's big-eared bat occurs across a broad range in western North America. A 2007 bat roost inventory and monitoring project documented Townsend's big-eared bats on both the Apache-Sitgreaves and Coconino NFs (Solvesky and Chambers 2007). The Tonto NF has records from the 1990s but they are outside the project area, and 2018 recordings from NaBAT near the project area. Pale Townsends are known to occur near and likely within the project area. They use a wide range of habitats, including ponderosa pine forest. Townsend's big-eared bats typically roost in rock structures (e.g., caves, mines, and lava tubes), and abandoned buildings, but will also use hollow trees. Pale Townsend's big-eared bats are apparently secure, although loss of cave and mine habitat may be causing a decline in numbers and there is concern over loss of genetic variability within populations (Western Bat Working Group 2005b). Townsend's big-eared bats are sensitive to disturbance and roost sites have been abandoned because of human recreation. They feed on flying insects and often forage over waterbodies and wetlands where flying insects are abundant. The species is a moth specialist with over 90 percent of their diet composed of lepidopterans. They travel long distances while foraging and use edge habitat adjacent to or within forest habitat (Western Bat Working Group 2005b). Habitat features potentially benefiting prey species include pools, stock tanks, wet ground, herbaceous ground cover, and edge habitat. Potential habitat includes 689,503 acres of ponderosa pine and 31,293 acres of grassland within the project area.

Spotted Bat

Historic records suggest that the spotted bats are widely distributed, rare across their range, but can be locally abundant. The historic range of the spotted bat includes Mexico and the Southwest and north up to Canada. In Arizona, spotted bats commonly roost singly in crevices in rocky cliffs and they have also been found in caves (Chambers, pers. comm. 2009). Cliff habitat and surface water are characteristic of localities where they occur. Spotted bats are lepidopteran specialists and will forage in upland meadows. Meadows, openings, and open forests with diverse herbaceous ground cover provide habitat for prey species. There are 689,503 acres of ponderosa pine and 31,293 acres of grassland within the project area.

Forest Service Management Indicator Species

The current Tonto NF Plan identifies 28 wildlife MIS, with 18 species known or assumed to occur within the Rim Country project area (Tonto NF MIS Report 2005).

The proposed project would affect ponderosa pine, mixed conifer, aspen, pinyon-juniper, grassland/savannah, ephemeral streams, and spring habitats. MIS or their respective habitat components that do not occur within the proposed Rim Country project area will not be analyzed in this report. The presence of species carried forward for analysis was determined by surveys conducted on the forests and the FAAWN (Forest Attributes and Wildlife Needs) database (Patton 2011).

Eighteen MIS whose distribution across the Rim Country on the Tonto NF encompasses part or all of the project area are included in the terrestrial effects analysis (Table 3-**). The analysis is also based on forest plan direction and projected changes in quality habitat under the alternatives.

Table 5. Terrestrial Management Indicator Species (MIS) or Focal Species Analyzed

Management Indicator Species	Forest(s)	Key MIS Habitat Component Indicator	Habitat within Project Area
Northern goshawk (*Accipiter gentilis*)	Tonto	Late-seral ponderosa pine	Ponderosa pine
Pygmy nuthatch (*Sitta pygmaea*)	Tonto	Late-seral ponderosa pine	Ponderosa pine
Turkey (Meleagris gallopavo merriami)	Tonto	Late-seral ponderosa pine, mixed conifer	Ponderosa pine
Rocky Mountain elk (Cervus elaphus)	Tonto	Early seral ponderosa pine, mixed conifer, and spruce-fir	Ponderosa pine, mixed conifer
Hairy woodpecker (Picoides villosus)	Tonto	Snags in ponderosa pine, mixed conifer and spruce-fir	Snags in ponderosa pine
Abert's squirrel (Sciurus aberti)	Tonto	Early seral ponderosa pine	Ponderosa pine
Violet green swallow (Tachycineta thalassina)	Tonto	Ponderosa pine; mixed conifer cavities	Ponderosa pine; Mixed conifer
Ash-throated flycatcher (Myiarchus cinerascens)	Tonto	Pinyon-juniper woodland	Pinyon-juniper
Gray vireo (Vireo vicinior)	Tonto	Pinyon-juniper woodland	Pinyon-juniper
Townsend's solitaire (Myadestes townsendi)	Tonto	Pinyon-juniper woodland	Pinyon-juniper
Juniper (Plain) titmouse	Tonto	Pinyon-juniper woodland	Pinyon-juniper

Management Indicator Species	Forest(s)	Key MIS Habitat Component Indicator	Habitat within Project Area
(Baeolophus ridgwayi)			
Northern (Common) Flicker (Colaptes auratus)	Tonto	Pinyon-Juniper woodland (snags)	Pinyon-Juniper
Arizona gray squirrel (Sciuris arizonensis)	Tonto	Riparian-High Elevation (3000 ft. plus)	General Riparian
Westerm bluebird (Sialia mexicana)	Tonto	Forest openings in ponderosa pine/mixed conifer type	Ponderosa pine-oak, mixed conifer
Western wood peewee (Contopus sordidulus)	Tonto	Riparian-High Elevation	Riparian tall overstory
Black hawk (Buteogallus anthracinus)	Tonto	Riparian-High Elevation	Riparian tall overstory

Information on species, their population trends, and habitat trends presented in this report is incorporated by reference here. Analysis the 2005Tonto NF MIS report (USDA FS 2005) is also incorporated by reference (USDA FS 2005).

Determining MIS presence and associated trend uses data from the annual songbird surveys conducted on each of the three NFs. The Bird Conservatory of the Rockies, a non-government organization and a leader in avian population sampling and analysis, took over the sampling effort and associated data analysis in 2007. Habitat recommendations for wildlife, including game species, were provided by the AZGFD for the Rim Country. These recommendations for individual species and initial assessment of Rim Country-related effects on each species are incorporated into this MIS analysis.

The Forest Vegetation Simulator (FVS) tree growth model was used to determine changes in forest stand dynamics by alternative (for more information on FVS see the Silviculture Report). This information was used to estimate changes in ponderosa pine seral stages. Where available, data on forestwide vegetation was taken from the forestwide reports for MIS species.

Management Indicator Species for the Tonto NF

The following species accounts and trend information are taken directly from the draft document titled *2016MISRevision-TNF*; author(s) unknown.

Rocky Mountain Elk

In the 1986 Tonto Forest Land Management Plan (Forest Plan), elk were selected as an MIS for the ponderosa pine and mixed conifer vegetation types (Appendix G, Tonto Forest Plan) and were considered to be an indicator of general forest conditions.

The Tonto NF relies on survey data collected by AZGFD for population numbers and trend analysis of all game species (CFR 219.19(6)). The Forest Plan specifically states (p. 211) that, for elk, turkey, and Abert's squirrel, population trend will be established using AZGFD harvest data records, hunter questionnaires, and supplemented by currently acceptable field sampling techniques as necessary. AZGFD uses this data to set harvest regulations and population goals for the species under their jurisdiction.

Tonto NF Population Trend: On the Tonto NF, populations of elk have increased since implementation of the Forest Plan in 1985. Wintering populations have probably exceeded expected increases, with populations continuing to expand into suitable habitat.

Merriam's Turkey

In the Tonto Forest Plan, Merriam's turkey was selected as an MIS for the ponderosa pine and mixed conifer vegetation types (Appendix G, Tonto Forest Plan) and was considered to be an indicator of vertical diversity and the general forest mix. In 1985, turkey were a popular, but not necessarily widely spread, game species. Populations are influenced by weather (Wakeling 1991). For the most part, turkey numbers are currently held in check by hunting, both sport and depredation.

Tonto NF Population Trend: Merriam turkey populations increased after 1985, but have decreased overall since their peak due to drought. Based on the Breeding Bird Survey, AZGFD harvest data, Audubon data, and habitat trends in the ponderosa pine and mixed conifer vegetation types, the Merriam's turkey population trend appear to be stable on the Tonto NF. There is insufficient information to display any relationship between changes in habitat trend and fluctuations in population changes.

Abert's Squirrel

In the Tonto Forest Plan, Abert's squirrel was selected as an MIS of successional stages within the ponderosa pine vegetation type (Appendix G, Tonto Forest Plan). Since other MIS were used as indicators of mature and old growth ponderosa pine, the Abert's squirrel was selected because dense pole stands provide an important forage component for the species. The best squirrel habitat has some mature ponderosa pine trees with canopy cover exceeding 60 percent. Mature trees often produce the most cones, and abundant truffle foods are often associated with young pine stands with canopy cover greater than 65 percent. Patton (1984) and States et al. (1988) agree that prime habitat for this species comprises stands with a combination of tree age-classes whose size, density, and grouping provide all the necessary seasonal foods, cover and nesting sites needed.

Tonto NF Population Trends: Population trends for the Abert squirrel on the Tonto NF based on AZGFD surveys indicates increases in some parts of the forest and decreases in others. On TNF there are three game management units that have viable populations of Abert squirrel and are hunted. With the warmer than average temperatures for the past several winter's, squirrel numbers are good. Abert squirrels can be found throughout the pine covered portion of Game Management Units 22 and 23 and, to a limited extent, 24A (AZGFD 2004).

In addition, the data compiled from AZGFD surveys for Arizona show a stable to increasing trend from 1988-1999. AZGFD game surveys do not have survey count data for tree squirrels, just hunter harvest information. The data for tree squirrels include red squirrels, but the vast majority of the tree squirrels harvested are tassel-eared squirrels (Dodd, 2002). However, more recent information shows tassel-eared squirrel populations in the southwest to be quite depressed from several years of drought conditions that have reduced juvenile recruitment. This was exacerbated by substantial snow-induced mortality during 2001- 2002. Densities from the North Kaibab, Camp Navajo, and northern New Mexico are all low. This situation is indicative of the current status of tassel-eared squirrels across the southwest (Dodd 2003). Population cycles may be related to cyclic variation in the biomass of the pine seed crops (Mejia 2001). There is no data specific to the Tonto NF but, based on drought conditions and sub-optimal habitat conditions, population trends are likely similar to the rest of the southwest and are in a declining trend.

Arizona Gray Squirrel

Arizona gray squirrel was selected as an MIS for general riparian condition of High Elevation (greater than 3,000 feet) Riparian (USDA FS 1985).

Tonto NF Population Trends: Gray squirrels can be found on the Tonto NF in Game Management Units 22, 23, and 24A where they are limited to pines, mixed hardwoods, and high-elevation riparian habitats. The population trend for the gray squirrel on the Tonto NF appears to be stable based on statewide AZGFD hunter harvest information and apparent trends in high-elevation riparian habitat. Population trend at the forest level is not conducted by AZGFD due to difficulties in surveying this species.

Common Black Hawk

The common black hawk was selected as an MIS for streamside conditions for the cottonwood-willow vegetation type in Low Elevation Riparian areas (less than 1,200 meter elevation) and the cottonwood-willow and mixed broadleaf vegetation types in High Elevation Riparian areas (greater than 1,100 meter elev.) (Appendix G, Tonto Forest Plan). On the Tonto NF, the common black hawk is an "obligate riparian nester." It is generally dependent on mature broadleaf trees along perennial streams for nest sites, although a few nests are situated along intermittent watercourses where small impoundments may persist through the breeding season.

Tonto NF Population Trend: In a conservation assessment prepared for the Tonto NF, Boal and Mannan (1996) determined that the common black hawk appears to be stable in the Southwest. The rehabilitation and protection of many riparian areas has made the common black-hawk population more secure, but it is at risk from a reversal of those management policies. Further degradation of riparian habitat would be detrimental to the species and place the population at increased risk. At least one known territory in the headwaters of Canyon Creek was lost during the Chediski Fire in 2002. It is also likely that one or more nest territories were lost in the Dude Fire, which burned several drainages under the Mogollon Rim. The drought appears to be killing large numbers of mature and over-mature cottonwoods along Tonto Creek and may be affecting perennial water and prey in other streams. No specific surveys have been conducted on the forest to locate active common black hawk nests. However, MIS surveys in 2003 on the Tonto Basin District detected common black hawks in three different survey points along Hardt Creek.

No monitoring has been conducted by forest personnel to determine reproductive success or long-term nest territory fidelity.

Ash-throated Flycatcher

The Tonto Forest Plan Appendix G) designated the ash-throated flycatcher as an MIS for ground cover in the piñon-juniper woodland vegetation type (USDA FS 1985). In 2000, the Tonto NF and AZGFD conducted a review of the forest’s MIS species. In that process, it was felt that the ash-throated flycatcher was not a particularly good indicator of ground cover for the pinyon-juniper vegetation type, since it doesn’t forage or nest on the ground, and it uses a wide variety of habitat other than simply pinyon-juniper.

Tonto NF Population Trend: Two current Breeding Bird Survey transects on the Tonto NF indicate that this species is commonly counted during surveys. Regionally, this species continues to expand or remain at current levels according to the National Audubon Society 2005. Number of birds detected during surveys appears to have stabilized after 2000-2001 up to the present. Transects conducted in 2003 on the Tonto Basin District indicate that this species was observed 256 times over approximately 20 visits at thirteen predetermined points. Based on this data it appears that this species is stable on the Tonto NF.

Gray Vireo

The gray vireo was selected as an MIS for the Tonto NF (Appendix G, Tonto Forest Plan) for tree density in the pinyon-juniper woodland type.

Tonto NF Trend: Two current Breeding Bird Survey routes suggest that this species is uncommon in established survey routes. Statewide Christmas Bird Count surveys also indicate that this species is uncommon. On the Tonto Basin Ranger District in 2003, gray vireos were documented 54 times on 14 different days (Plank 2005). However, based on regional data population trends, it appears that this species’ population is declining due to drought-related effects on habitat.

Hairy Woodpecker

The hairy woodpecker was selected as an MIS for the Tonto NF for snags and cavities in ponderosa pine/mixed conifer and high-elevation riparian habitats.

Tonto NF Population Trend: Potentially, due to large fires and a large number of acres killed by bark beetles in 2002, hairy woodpecker populations should increase significantly due to the availability of snags and nesting sites. The Tonto Village Breeding Bird Survey Route is the only transect on the forest that is located in hairy woodpecker habitat and documentation is inconsistent, but low. A statewide Christmas Bird Count survey suggests that population trends remain relatively unchanged since 1985. In 2003 on the Tonto Basin Ranger District, hairy woodpeckers were detected 12 times on seven different days (Plank 2005). Populations are considered stable on the Tonto NF.

Juniper Titmouse

The juniper titmouse was selected as an MIS (Appendix G, Tonto Forest Plan) for general woodland conditions in the pinyon-juniper woodland type. The juniper titmouse is most often associated with late-succession pinyon-juniper with open canopies and associated riparian woodlands. It can be found in all structural stages within the pinyon-juniper type, but old-growth pinyon-juniper appears to be the primary nesting habitat utilized (Towry 1984).

Tonto NF Population Trend: Two Breeding Bird Survey routes indicate that this species is documented at very low densities on the forest. Statewide, the species is documented regularly in Christmas Bird Count surveys from 1997 to the present. In 2003 on the Tonto Basin Ranger District, this species was documented four times on two transects (Plank 2005). Habitat conditions for the pinyon-juniper habitat type remain relatively static since 1985 and therefore populations on the Tonto NF are considered stable.

Northern Goshawk

The northern goshawk was selected as an MIS for vertical diversity within the ponderosa pine and mixed conifer vegetation types (Appendix G, Tonto Forest Plan). It is a habitat generalist that uses a variety of forest types, forest ages, structural conditions, and successional stages.

Goshawks typically nest in larger trees that occur in clumps with fairly closed canopies, and forage over large areas to prey on a wide variety of small- to medium-sized birds and mammals.

Tonto NF Population Trend: Forest Service biologists, technicians, contract biologists, and AZGFD biologists have conducted surveys for this species on the forest utilizing the protocol developed by Kennedy and Stahlecker (1991) for the Southwestern Region of the Forest Service. Inventory survey forms, maps, and reports are maintained at district offices. At present, the forest has established 13 management territories based on these surveys, but other data on population status is not available. Large stand-replacing fires since 1985 in the ponderosa pine and mixed conifer habitat types is likely contributing to declining habitat and population trends for this species.

Northern Flicker

The Northern flicker was selected as an MIS (Appendix G, Tonto Forest Plan) for snag conditions in the pinyon-juniper woodland type. A panel of biologists knowledgeable of forest conditions has suggested that the juniper titmouse may be a better indicator of snags in this vegetation type.

Tonto NF Population Trend: There are three Breeding Bird Survey routes on the Tonto NF: Bartlett Reservoir, Tonto Village, and Aztec Peak. Survey results for Aztec Peak are included, although the dates of the surveys are prior to the completion of the 1986 Tonto Forest Plan. Drought conditions the last several years have increased the number of dead standing trees that are used for cavity nests and will likely improve nesting success and the snag component. Based on this information, populations on the Tonto NF are considered stable.

Pygmy Nuthatch

The Pygmy nuthatch was selected as an MIS for the ponderosa pine and mixed conifer vegetation types (Appendix G, Tonto Forest Plan), specifically the old growth component (USDA Forest Service 1985). It is found primarily in mature and old-growth ponderosa pine forest (Towry 1984) and lightly disturbed areas (Hall et al. 1997), preferring open parklike forests (Degraff et al. 1991). It has also been reported as using pinyon-juniper woodlands (Phillips et al. 1984), aspen, and cottonwoods (Thomas et al. 1979).

Tonto NF Population Trend: The Tonto Village Breeding Bird Survey route is the only route that includes habitat for the Pygmy nuthatch. Christmas Bird Count survey results for the state of Arizona indicate that the population trend is stable. Due to modest declines in old-growth stands in the ponderosa pine and mixed conifer habitat types, populations on the Tonto NF are considered to be declining.

Townsend’s Solitaire

The Townsend’s solitaire was selected as an MIS for the pinyon-juniper woodland vegetation type, as an indicator of juniper berry production (see Appendix G, Tonto Forest Plan). Coniferous forest, with canopies dominated by pine (Pinus spp.), hemlock, (Tsuga), fir (Abies), and spruce (Picea), rocky cliffs, and adjacent brushy areas and thickets are considered typical habitat. Townsend’s solitaires prefer relatively open stands, including areas thinned by light burns or selective logging, usually with little shrub layer or ground cover (ibid.). Winter habitat includes piñon (Pinus edulis)-juniper woodland, which provides their main winter food, juniper berries.

Tonto NF Population Trend: No Breeding Bird Survey routes detected this species during survey efforts on the Tonto NF. Statewide Christmas Bird Count indicates that this species is abundant throughout the state from 1985 to the present. In addition, statewide Breeding Bird Survey results that exclude routes on the Tonto NF suggest that populations are increasing over the last ten-year period. Because fire suppression has allowed the pinyon-juniper vegetation type to expand, it would be plausible that this species is stable on Tonto NF.

Violet-green Swallow

The violet-green swallow was selected as an MIS for cavity- nesting habitat in the ponderosa pine and mixed conifer vegetation types. Habitat consists of open deciduous, coniferous, and mixed woodlands, including ponderosa pine (Pinus ponderosa) and quaking aspen (Populus tremuloides). These swallows share breeding habitat with tree swallows (Tachycineta bicolor), but are usually in more open habitat,

Tonto NF Population Trend: Only the Tonto Village Breeding Bird Survey route has documented this species on the forest. Statewide Christmas Bird Count surveys suggest that this species is well represented throughout the state and may have benefited from drought and increases in snags used for nest sites. On the Tonto Basin Ranger District in 2003, this species was documented on four occasions in one transect. Drought conditions and wildfire have led to increases in snag densities in the ponderosa pine and mixed conifer habitat types and have likely improved nesting habitat parameters. Based primarily on regional data, this species appears to be stable on the Tonto NF.

Western Bluebird

The western bluebird was selected as an MIS species for forest openings in the ponderosa pine and mixed conifer vegetation types. Western bluebirds normally occupy open woodland or edge habitat, with exposed perches and fairly sparse ground cover (Pinkowski 1979). They are frequent drifters in pinyon-juniper woodlands in winter; density depends on availability of mistletoe (Phoradendron spp.) and juniper berries. Szaro and Balda (1982) listed western bluebirds as preferring lightly or moderately-disturbed areas in northern Arizona ponderosa pine communities.

Tonto NF Population Trend: The Tonto Village Breeding Bird Survey transect is the only location where this species is detected during survey efforts. Data suggest this species is encountered at low densities. Statewide Christmas Bird Counts suggests that this species is commonly documented during winter months. Based on this information, this species is considered stable on the Tonto NF.

Western Wood Peewee

The western wood pewee was selected as an MIS for the High Elevation (greater than 3,000 feet) Riparian vegetation type (Appendix G, Tonto Forest Plan) and was considered to be an indicator for medium riparian overstory. In 2000, the Tonto NF and AZGFD cooperatively conducted a review of the forest's MIS. In that process, it was noted that this species is also common in pine stands adjacent to riparian corridors (Pollock, Tonto NF unpublished). "Important habitat components may include large tree diameters, open understory, edge characteristics, and dead trees or trees with dead limbs" (Kilgore 1971, Flack 1976, Ryser 1985).

Tonto NF Population Trend: Breeding Bird Survey data for the Tonto Village route suggest that this species occurs at low densities. Other routes do not exhibit the necessary habitat parameters to support this species. Statewide Christmas Bird Counts suggest that this species occurs at low densities throughout the state. On the Tonto Basin Ranger District in 2003, this species was documented 55 times on seven different days on four survey routes (Plank 2005). Precipitous declines in this species may be related to declines in high-elevation riparian habitat that is used for breeding habitat. Based on this information, populations for this species appear to be declining on the Tonto NF.

Migratory Birds and Important Bird Areas

Affected Environment

For the 4FRI Rim Country project area three sources were used to identify priority species: (1) Partners in Flight Landbird Conservation Plan (Rosenberg et al. 2016), (2) Birds of Conservation Concern 2008 (U.S. Fish and Wildlife Service 2008), and (3) Arizona's State Wildlife Action Plan: 2012-2022 (Arizona Game and Fish Department 2012). Life History of individual species used information from the Cornell lab of Ornithology web site: http://www.birds.cornell.edu/.

This analysis considered high priority bird species from the Partners in Flight, U.S. Fish and Wildlife Service, and AZGFD birds of conservation concern. The Coconino, Apache-Sitgreaves, and Tonto NFs occur within two bird conservation regions (BCRs): the Southern Rockies/Colorado Plateau (BCR 16) and Sierra Madre Occidental (BCR 34). For the Tonto NF, the project area only occurs within BCR 34.

1215 Table 6. Priority Bird Species Analyzed under the Migratory Bird Treaty Act.

APIF High Priority Species USFS and FWS Birds of Conservation Concern1 by Habitat	Important Habitat Features and Life History Considerations
Ponderosa Pine Forest (includes Ponderosa pine- Gambel oak)	
Northern goshawk	See “Sensitive Species” section for effects on pine habitat and to the species.
Flammulated owl	Secondary cavity nester. Most closely associated with open ponderosa pine forest. Almost exclusively insectivorous.
Olive-sided flycatcher	Also found in mixed conifer. Multi-level, mature forest, fairly open canopy, prefers tree “groupiness” that creates forest edges and openings. Dead branches are used for perches while foraging. Often occur at edge of early post-burned areas for foraging and singing. Live mature pines for nesting. Snags are an important habitat feature.
Cordilleran flycatcher	Prefers moist and shaded forest for breeding habitat. Nest sites include rock crevices, hollows formed by scars in trunks, exposed tree roots, cavities in small trees, and in forks of small branches. Most abundant in stands with greater than 50 percent canopy cover. Habitat strategy is to maintain dense canopy closure in mid- to late-successional stages of dense, shady forest with an understory of oak and sufficient dead and down trees for nesting.
Grace’s warbler	Prefers ponderosa pine forest, sometimes with a scrub oak component. Considered a mature pine obligate. Feeds in the upper portions of robust pines on branches; nests found in trees from 20 to 60 feet (6 to 18 meters) above the ground. Prefers mature ponderosa pine savanna; open meadow; and uneven-aged ponderosa pine, including other tree species with an oak understory. Research notes pine forests that mimic naturally open parklands with stands of large, mature trees, will eventually benefit this species.

APIF High Priority Species USFS and FWS Birds of Conservation Concern1 by Habitat	Important Habitat Features and Life History Considerations
Olive warbler	Found primarily in open ponderosa pine forest, including those forests with a Gambel oak component. Distribution extends along the Mogollon Rim, but also occur in southeastern Arizona.
Lewis's woodpecker	Uses open pine savanna habitat. Breeding habitat includes open canopy, bushy understory offering ground cover, dead or down woody material, available perches and abundant insects. Logged or burned pine forests are also preferred habitat for breeding. Diet varies with seasonal abundance of food items, primarily selects free-living (non-wood boring) insects, acorns and other nuts, and fruit.
Purple martin	Open canopy; often prefers habitat near open water; nests in tree cavities excavated by woodpeckers Open mid-story cover and open understory cover. Prefers high snag density and tall snags adjacent to open areas.
Cassin's finch	Nesting preference is for open coniferous forests. Dry, relatively open mature ponderosa pine forest. Nests tend to be placed greater than 16 feet above ground, often out on lateral branches or near the trunk within about 3 feet of tree tops.
Mixed Conifer	
Olive-sided flycatcher	Multi-level, mature forest, fairly open canopy, prefers tree "groupiness" that creates forest edges and openings. Dead branches are used for perches while foraging. Often occur at edge of early post-burned areas for foraging and singing. Live mature pines for nesting. Snags are an important habitat feature.
Aspen	
Red-naped sapsucker	Preferred nest sites are live trees with heart-rot, which facilitates excavation and leaves the nest cavity enclosed in harder surrounding wood. Will also use dead trees for nesting. Minimum d.b.h. for nest tree is 10 inches and minimum height is usually 15 feet. Manage for groups of aspen stands of different age classes, in a larger forest complex, to ensure continual availability of older trees and

APIF High Priority Species USFS and FWS Birds of Conservation Concern1 by Habitat	Important Habitat Features and Life History Considerations
	snags for nesting. Use fire or silvicultural treatments to ensure continual regeneration of new stands.
Pinyon-Juniper Woodland	
Gray vireo	Uses open mature pinyon-juniper woodlands, typically with a broadleaf shrub component. Nests low in a small tree or shrub 2 to 6 feet above ground. Fire can be used to maintain existing habitat matrix and to prevent stands from becoming too dense.
Pinyon jay	Pinyon cone crop is important factor for successful breeding. Needs mature trees for cone production Nests are typically 3 to 26 feet high and tend to be south-facing. Pairs will re-nest up to 5 times in a breeding season if earlier nesting attempts fail.
Juniper titmouse	Recovery to pinyon-juniper woodlands. Uses late successional pinyon-juniper woodlands. Tends to favor areas with a high density of dead limbs and high degree of ground cover. An obligate secondary cavity nester. Nest cavity height ranges from 4 to 15 feet above ground. Nest tree d.b.h. ranges from 5 to 18 inches.
Black-throated gray warbler	Primarily associated with pinyon pine and juniper woodlands in northern Arizona. Canopy cover of 13 to 26 percent in mid to late successional woodlands. Breeding habitat is frequently characterized by a brushy undergrowth of scrub oak, ceanothus, manzanita, or mountain mahogany. Nests are typically placed on a horizontal tree branch or near the main stem of a shrub. Nest height varies from 2 to 15 feet above ground.
Gray Flycatcher	Most common in larger and taller stands of pinyon pine and/or juniper with open understory.

APIF High Priority Species USFS and FWS Birds of Conservation Concern1 by Habitat	Important Habitat Features and Life History Considerations
	May need some ground cover to support insect populations for foraging.
	Nests are placed primarily 2 to 11 feet high in a shrub or crotch of a juniper or pinyon pine.
High Elevation or Semidesert Grasslands	
	Stick nests constructed in scattered, lone trees within grasslands. Typical nest trees in Arizona are cottonwood, juniper, mesquite, ironwood and oak.
Swainson's hawk	Primary feeds on insects. They also eat small mammals, lizards, and snakes, especially during breeding season.
	Prefer open grassland for foraging, shrubs/brushy areas are not preferred habitat.
Ferruginous hawk	Ferruginous Hawks nest in isolated trees or small groves of trees, and on other elevated sites such as rock outcrops, buttes, large shrubs, haystacks, and low cliffs. Nests are situated adjacent to open areas such as grassland or shrub steppe. These hawks are closely associated with prairie dog colonies, especially in winter.
Burrowing owl	See "Sensitive Species" section for effects on nesting habitat and to the species.
	Prefers pure grassland habitat without trees or woody shrubs. Requires abundant thatch and dry grass for concealment. Apparent low site-fidelity. May avoid recently burned grassland sites for greater than or equal to 2 years after burning.
Grasshopper sparrow	Nests are often partially domed with dry grass and placed in a depression on the ground at the base of vegetation so the rim is nearly flush to the ground. This species often raises two broods per year.
	Primarily feeds on insects during the breeding seasons. Grass seeds are important in colder months when insect activity is low.
Bendire's thrasher	Prefers relatively open grassland with large scattered shrubs and/or trees (cholla, junipers, or sagebrush are usually present); may use dense vegetated washes or riparian areas.

APIF High Priority Species USFS and FWS Birds of Conservation Concern1 by Habitat	Important Habitat Features and Life History Considerations
	Breeds in relatively open, degraded grasslands with a moderate to dense shrub component. Nests below 6,000 feet elevation, typically 2 to 5 feet above ground in semi-desert shrubs, cacti, or trees.
Chestnut-collared Longspur	Primary Habitat: Semidesert Grassland. Breeds on short-grass plains and prairies. Winters in open cultivated fields. This species is a winter resident only (non-breeding) in Arizona.
Lark Bunting	Primary Habitat: Semidesert Grassland, Desert Communities. Habitat is plains, prairies, meadows and sagebrush. This species only winters and migrates in Arizona in cultivated lands, brushy areas, and desert.
Cottonwood Willow Riparian Forest	
Common black-hawk	Wooded streams. Almost always found near water. In United States, breeds in tall trees (especially cottonwoods) along streams with more or less permanent water flow and with relative lack of human disturbance.
Bell's Vireo	Primary Habitat: Cottonwood Willow Riparian Forest. Habitat is dense, low, shrubby vegetation, generally early successional stages in riparian areas, brushy fields, young second-growth forest or woodland, scrub oak, coastal chaparral, and mesquite brushlands, often near water in arid regions. Nest is an open bag-like or basket-like cup of grass, straw-like stems, and plant fibers, Suspended from forks of low branches of small trees or shrubs.
Elf Owl	Primary Habitat: Cottonwood Willow Riparian Forest. The Elf Owl is the smallest owl in the world and perhaps the most abundant raptor in upland deserts of Arizona and Sonora, Mexico. Holes in Arizona sycamores (Platanus wrightii) are used most often (81% of 32 nests) in canyon riparian habitat, Arizona. Bent, A. C. 1938b. Life histories of North American Birds of Prey (Part 2). Orders Falconiformes and Strigiformes. Bull. U.S. Nat. Mus. (170):viii-482. CloseLigon, J. D. 1968d. The biology of the Elf Owl (). Misc. Publ., Mys. Zool., Univ. Mich. no. 136. Close
Lucy’s Warbler	Primary Habitat: Cottonwood Willow Riparian Forest.Breeds in riparian mesquite woodlands. Nest in cavity, well woven of twigs, weed stalks, straw, mesquite leaf stems, lined with fine bark, plant fibers, hair, and

APIF High Priority Species USFS and FWS Birds of Conservation Concern1 by Habitat	Important Habitat Features and Life History Considerations
	feathers. Nest placed behind loose bark of tree or in cavities in trees or cactus. Also in abandoned Verdin nests.
Yellow Warbler	Primary Habitat: Cottonwood Willow Riparian Forest; Mixed Deciduous Riparian Forest. Yellow Warblers spend the breeding season in thickets and other disturbed or regrowing habitats, particularly along streams and wetlands. Yellow Warblers build their nests in the vertical fork of a bush or small tree such as willow, hawthorn, raspberry, white cedar, dogwood, and honeysuckle.
Montane Willow Riparian Forest	
Lincoln's Sparrow	Primary Habitat: Montane Willow Riparian Forest (breeding). In mountainous regions during the summer months, Lincoln's Sparrows are most common in wet meadows dotted with dense patches of willows, alders, sedges, and corn lily. At lower elevations they use patches of aspens, cottonwoods, and willows as well as shrubby areas near streams. Lincoln's Sparrows are ground nesters. The female builds a nest on the ground or just above the ground inside a willow or birch shrub that is surrounded by a thick cover of sedges and flowering plants such as corn lily and buttercup.
MacGillivray's Warbler	Primary Habitat: Montane Willow Riparian Forest, Aspen and Maple, Mixed Conifer. Habitat is in clear-cuts in coniferous forest, mixed deciduous forest, and riparian areas and thickets. Requires dense understory. Nest is an open cup of coarse grass and other plant fiber, placed at or near ground level under dense shrub cover.
Brewer’s Blackbird	Primary Habitat: Wetlands, Montane/Subalpine Grasslands, Montane Willow Riparian Forest. Brewer’s Blackbirds live across the western half of North America, from below sea level in southern California to more than 8,000 feet in the Rocky Mountains. They occur in a huge variety of natural habitats – grasslands, marshes, meadows, woodland, coastal scrub, chaparral, and sagebrush – as well as many human-created habitats. Brewer’s Blackbirds nest in colonies of a few to more than 100 pairs. In some years this means you might find colonies in low shrubs; other years the same birds might nest in treetops. The birds typically nest in shrubs or trees near water, but may also nest in reeds and cattails or, occasionally, on the ground or in tree cavities.

APIF High Priority Species USFS and FWS Birds of Conservation Concern1 by Habitat	Important Habitat Features and Life History Considerations
Wood Duck	Primary Habitat: Cottonwood Willow Riparian Forest. Wood Ducks thrive in bottomland forests, swamps, freshwater marshes, and beaver ponds. In Arizona they are winter migrants only.
Desert Communities	
Phainopepla	Primary Habitat: Desert Communities. Habitat is desert, riparian woodlands, and chaparral. Nest is a small, shallow, woven cup of twigs and fibers, placed on a tree limb or fork, or in a clump of mistletoe, typically 2-5 m (6.6-16.4 ft.) above ground.
Open Habitats	
Savannah Sparrow	Primary Habitat: Open habitats project-wide. On both their summer and winter ranges, Savannah Sparrows live in grasslands with few trees, including meadows, pastures, grassy roadsides, sedge wetlands, and cultivated fields planted with cover crops like alfalfa. Savannah Sparrows hide their nests amid a thick thatch of the prior season's dead grasses in densely vegetated areas. The nest is usually on the ground or low in grasses, goldenrod, saltmarsh vegetation, or low shrubs such as blueberry, blackberry, rose, and bayberry.
Shrub Species	
Virginia's Warbler	Primary Habitat: Many; shrub component important. Virginia's Warblers breed in open pinyon-juniper and oak woodlands often on steep slopes with shrubby ravines throughout most of their range. They also use dense thickets of mountain mahogany in southern Idaho and mixed-evergreen forests on the Mogollon Rim in Arizona. Typically they select a nest spot on the ground beneath a root or rock, or at the base of clumps of grass, oaks, or New Mexico locusts to provide concealment. They frequently nest on a steep slope, placing the nest on the downslope side of a clump of vegetation.

1. APIF = Arizona Partners in Flight; FWS = U.S. Fish and Wildlife Service

The following habitats would be affected by management activities in the project area. Not all bird species described have been located within the project area, but they have the potential of occurring there. While riparian habitat, cliffs, and rock habitats are found in the project area, the proposed activities will not affect these habitat types in any potentially adverse way for these species. Design features to reduce effects from proposed treatments were included for the Rim Country Project (Appendix C).

Mixed Conifer with Aspen and w/ Frequent Fire

It is estimated that 1,216,300 acres of Mixed Conifer occur in New Mexico and Arizona. The Tonto (58,829 acres), A-S (325,900), and Coconino (86.738 acres) National Forests represent 471,467 acres (1/3 of Mixed Conifer in NM and AZ). Priority breeding birds that use mixed conifer as primary habitats are Olive-sided Flycatcher, Evening Grosbeak, Red-faced Warbler, and Band-tailed Pigeon. Desired for mixed conifer conditions describe a mosaic of forest conditions, with old growth well-distributed throughout. Snags and downed logs are numerous. Composition, structure and function are resilient to disturbances and climate variability. MCFF is more open than MCA. The project area contains approximately 2,506 acres of MCA and 47,993 acres of MCFF. Together these acres represent 50,549 acres or approximately 6 percent of the Mixed Conifer PNVT on the Coconino, Apache-Sitgreaves, and Tonto NFs.

Ponderosa Pine Habitat Type

In the context of Arizona Partners in Flight data, pine forest refers to northern Arizona ponderosa pine forests, including pure ponderosa pine and pine with Gambel oak (Latta et al. 1999). It is estimated that approximately 3,680,000 acres of ponderosa pine forest exists in Arizona, representing approximately five percent of the total land area of the state. It occupies much of the mountain and plateau country above 6,500 feet in elevation, replaced by mixed conifer forest above 8,500 feet (Latta et al. 1999). Priority birds for ponderosa pine are the Northern Goshawk, Flammulated Owl, Olive-sided Flycatcher, Cordilleran Flycatcher, Grace's Warbler, Olive Warbler, Lewis's Woodpecker, Purple Martin, Cassin's Finch, Common Nighthawk, and Mexican Whip-poor-will. The project area contains approximately 689,503 acres of ponderosa pine habitat. The project area is approximately 14 percent of the ponderosa pine habitat in Arizona and 14 percent of the ponderosa pine forest cover type on both the Coconino and Apache-Sitgreaves NFs.

Aspen Habitat Type

In some areas, aspen forms extensive pure stands. In others, aspen is a minor component of the forest landscape, and can be found in ponderosa pine, and mixed conifer stands (Latta et al 1999). It is estimated that approximately 79,000 acres of aspen exist in Arizona. Aspen stands typically have a maximum life span of 200 years. Without a substantial disturbance such as high-severity fire or overstory removal to stimulate early seral renewal, the aspen will die out as it becomes dominated by conifers (Latta et al 1999). The priority bird for this habitat type is the red-faced Sapsucker. The project area contains approximately 1,436 acres of aspen habitat. The project area is approximately 2 percent of the aspen habitat in Arizona and 4 percent of the aspen on both the Coconino and Apache-Sitgreaves NFs

Pinyon-Juniper Habitat Type

It is estimated that there is approximately 13,167,460 acres of pinyon-juniper forest in Arizona. Pinyon-juniper is a cold-adapted evergreen woodland situated above desert or grassland vegetation and below ponderosa pine forests. The habitat is characterized by varying co-dominance of juniper species and pinyon pine. Typically, pinyon-juniper exhibits an open woodland arrangement with well-spaced trees. However, depending on site variables, pinyon-juniper may range from an openly spaced savanna to closed woodland (Latta et al. 1999). The priority birds for the pinyon-juniper habitat type are Gray Vireo, Pinyon Jay, Juniper Titmouse, Black-throated-gray Warbler, and Gray Flycatcher. The project area contains approximately 114,753 acres of pinyon-juniper habitat. The project area is less than one percent of the pinyon-juniper habitat on both the Coconino and Apache-Sitgreaves NFs.

Chaparral

Desired conditions describe chaparral as being in a constant state of transitions between young and old stages as a result of fires. Young stages have more of a grass and forb component. Older stages are very dense. Fire hazard is reduced in the wildland-urban interface. Ground cover protects soils from compaction and erosion, and biological soil crusts improve nutrient cycling.

Desired conditions on the Coconino NF provide for habitat diversity within chaparral vegetation. Small amounts of this habitat type could be treated through facilitative operations. Therefore, there will be few effects, plus or minus, to Virginia's warbler and black-chinned and sage sparrows and their habitat. The priority species for the chaparral habitat type is the Black-chinned Sparrow.

High Elevation Grasslands Habitat Type

The high elevation grassland habitat type is defined by Arizona Partners in Flight as subalpine-alpine grasslands/montane meadows and Plains/Great Basin grasslands. Upland grasslands in northern Arizona comprise all grass-dominated sites from the lower limits of the montane zone up to alpine tundra. There are an estimated 20,230 acres of upland grasslands in the state. Plains/Great Basin grasslands occur in northern Arizona; while they cover a much larger area than upland grasslands, there are no current estimates for acreage (Latta et al. 1999). Priority birds that use high elevation grasslands are Brewer's Blackbird, Common Nighthawk, and Ferruginous Hawk. Priority species that use semi-desert grassland habitat for breeding are Bendire's Thrasher and Phainopepla. Additionally, the Chestnut-collared Longspur, Grasshopper Sparrow, and Lark Bunting use these habitats for overwintering. The project area contains approximately 31,293 acres of grassland habitat. The project area is approximately 10 percent of the grassland habitat on both the Coconino and Apache-Sitgreaves NFs.

Riparian - High Elevation (Montane Willow and Mixed Broadleaf) and Low Elevation (Cottonwood Willow)

It is estimated that less than 10 percent of Arizona's original riparian acreage remains in its natural form. These habitats are considered Arizona's most rare natural communities. Priority bird species that use high elevation riparian habitat are Brewer's Blackbird, Common Black-Hawk, Lincoln's Sparrow, MacGillivray's Warbler, Red-faced Warbler, and Yellow-Warbler. Species that use low elevation riparian are Bell's Vireo, Elf Owl, Lucy's Warbler, Wood Duck, and Yellow Warbler. The action alternatives propose to restore 14,730 acres of riparian areas for aquatic stream habitat. The action alternatives also propose to restore function and habitat in up to 777 miles of streams, including stream reaches with habitat for threatened, endangered, and sensitive aquatic species.

Desert Communities and Semi-Desert Grasslands

Priority species that use these habitats for breeding are Bendire's Thrasher and Phainopepla. Additionally, the Chestnut-collared Longspur, Ferruginous Hawk, Grasshopper Sparrow, and Lark Bunting use these habitats for overwintering. This habitat type occurs in small numbers in the project area, with minimal or very low proposed treatments.

Open Habitats

A number of priority bird species that only occur in the project area in the winter can be found in open habitats in the Verde Valley (e.g. Chestnut-collared Longspur, Grasshopper Sparrow, Savannah Sparrow, and Lark Bunting).

Important Bird Areas

The Mogollon Rim Snowmelt Draws Important Bird Area is the only one within the project area. It covers approximately 72,162 acres and encompasses drainages located within eight kilometers of the edge of the Mogollon Rim, an abrupt cliff that represents the southern extension of the Colorado Plateau. This edge of the Rim has a narrow band of moist vegetation (especially maples) associated with greater precipitation formed by the upward deflection of air at the rim face. The habitat of this bird area includes ponderosa pine, white fir, Douglas fir, southwestern white pine, quaking aspen, and Gambel oak. Young plants of these canopy trees, plus canyon maple and New Mexico locust, dominate the understory woody species.

See the Arizona Important Bird Areas Program website for more information at http://aziba.org.

About 45,673 acres of habitat would be treated within the project area, equaling about 61 percent of the Important Bird Area. While most acres proposed for treatment are within ponderosa pine habitat, treatments in the Important Bird Area would also occur in mixed conifer, aspen and oak/maple habitats. In addition, road decommissioning, restoration of springs, and over 30 miles of riparian restoration activities are proposed within the area.

Other Species of Concern

Locally Important Species

The Forest Plans of the 4FRI Rim Country forests provide desired conditions and guidelines for the protection of locally important species on each of the forests. Most of the terrestrial species considered rare and endemic on the forests are outside the Rim Country project area. No further documentation is required for the following species except for the Arizona black rattlesnakes and Arizona toad (Table 53).

Table 7. Forest Rare and Narrow Endemic Species

Species	Rare	Locally Important	Found in the Rim Country Project Area	Comment
Arizona black rattlesnake		X	Yes	Additional analysis provided
Arizona toad		X	Yes	Additional analysis provided

Arizona Black Rattlesnake

The following behavior and natural history was extracted from Bergamini et al. (2014): The Arizona black rattlesnake is almost exclusively endemic to Arizona. This species occurs at elevations ranging from about 2,900 to 9,900 feet. Its range roughly follows the Mogollon Rim, extending from mountains in central Mojave County, to the southern portion of Coconino County south of the San Francisco Peaks, to the White Mountains in Apache County and south to the spatially isolated mountain ranges in Cochise, Graham, Pima and Pinal counties. Populations exhibit a patchy distribution in isolated canyons and mountain ranges; the patchiness of their distribution is likely associated concomitantly with favorable habitat and suitable hibernacula.

The Arizona black rattlesnake is usually found in mesic habitats but also dry rocky slopes and rock slides. Volcanic rock outcrops and talus slopes appear to provide hibernacula at elevations between about 6,900 and 9,850 feet. The species is also strongly associated with downed woody debris, and this association may be more important than tree species associations

Arizona black rattlesnakes individually or communally den in hibernacula during cold, winter months, but emerge from dens and become active from late April or May to October. Ingress into dens at these sites occur in early October; however, Arizona black rattlesnakes have been observed inside or near the opening of dens in March and in November.

In Coconino County, home ranges for males averaged 67 acres with a range of 52 to 225 acres Schofer 2017). Females appear to have much smaller ranges than males, perhaps slightly less than 10 percent of a male's range.

Arizona Toad

This species has been petitioned for listing under the Endangered Species Act. While AZGFD does not have population data, opportunistic data from AZGFD biologists and scientific collecting permits suggest that populations continue to persist across their historical range in Arizona. Within and adjacent to the Rim Country boundary, AZGFD has observational data of Arizona toads from 2003 to 2015 from Chevelon, East Clear, Cherry, Webber, Crouch and Canyon Creeks and some of their their tributaries, as well as the East Verde River. Additionally, several occurrences on the Tonto have been reported from earthen stock tanks. The species breeds in shallow springs and backwater areas void of fish.

Environmental Consequences

Environmental consequences consist of species analyses, beginning with federally threatened and endangered species followed by Forest Service sensitive species, management indicator species, migratory birds, and effects on Important Bird Areas. Following the analysis of direct and indirect effects for each species group is a review of cumulative effects.

Effects from Climate Change

Alternative 1

Alternative 1 would not prevent, delay, or ameliorate predicted effects from climate change. The dense forest conditions resulting from Alternative 1 are at a high risk to density-related and bark beetle mortality and have limited resilience to survive and recover from potential large-scale fire events and the interactions of these influences with climate change. Under drier and warmer weather conditions, the potential effects of these risks on the ecosystem would be increased. Individual tree growth would be limited to the point of stagnation. As tree density increases, many areas would experience higher mortality. Species requiring closed canopy forest conditions or old or large tree, snag, and log structure would be negatively affected in the long term. Patches of open forest, savanna, and meadow and grassland habitats would potentially increase in the long term as groups of dense forest succumb to the above mortality agents.

Alternatives 2 and 3

Risks associated with dense forest conditions would be reduced and resilience to the effects from large-scale disturbance under drier and warmer conditions would be improved by implementing the proposed treatments. Individual tree growth rates would improve, creating and retaining more large and old trees. Habitat elements associated with closed canopy forest conditions would be reduced, but would be more sustainable. Risk from insects, fire, and their interactions with climate would be reduced. Because of law, regulation, and policy, more closed canopy habitat would be available than what likely occurred historically. Ensuring the growth and retention of large trees would maintain large snag and log structure across the forest over time. Open forest, meadow, savanna, and grassland habitats would be enhanced and habitat effectiveness increased as encroaching trees were removed and habitat for grassland and pollinator species became less fragmented. These habitats would remain stable in the long term. The increased acres of mechanical and prescribed fire under Alternative 2 would realize the most benefit in terms of forest health and resiliency. The limited acres of treatment under Alternative 3 would be expected to maintain higher fuel loadings, resulting in more limited gains in forest resiliency due to increased flame lengths, lower canopy base height, and persistent ladder fuels. Alternative 3 would retain the densest forests and therefore achieve the least in terms of large tree growth rates and resilience.

Federally Listed Threatened, Endangered, Proposed, and Candidate Species and Critical Habitat

Chiricahua Leopard Frog (CLF)

Existing Condition

Riparian and aquatic habitat in the project area is heavily affected by recreation and past management activities. The purpose and need of the 4FRI Rim Country Project includes improvement of aquatic species habitat and improvement of the condition and function of streams and springs.

The Rim Country Project occurs within 142 subwatersheds. Of these, 38 have less than five percent of their total area inside the project boundary. Overall, ponderosa pine cover types are dominant in functional-at-risk 6th code watersheds (about 451,500 acres, or 46 percent of the project area), several impaired watersheds (about 316,800 acres, or 32 percent of the project area), and a few properly functioning watersheds (about 220,400 acres, or 22 percent of the project area).

Alternative 1 (No Action)

Under Alternative 1, habitat conditions for wildlife would largely remain in their current condition. Thinning and prescribed fire would still occur in RU 5 as a result of current and reasonably foreseeable projects. However, the landscape would continue to move away from desired conditions (see Affected Environment above and the Silviculture and Fire Ecology and Air Quality Reports). Alternative 1 would have no direct effect on Chiricahua leopard frogs; however there would be substantial indirect effects. Dense forest conditions would still occur and the high fire hazard potential would persist. Large crown-wildfires could adversely affect potential habitat by destroying understory and overstory vegetation. As a result, overland flow would increase, and soil erosion would increase, with potentially high sediment loads. Water quality and riparian conditions would be adversely affected on a wide-scale basis (see Water and Riparian Resource Report), resulting in indirect adverse effects.

With Alternative 1, there would be no restoration of springs and riparian areas. These areas would continue to exhibit downward trends in functional condition or remain in static condition for the foreseeable future (see Water and Riparian Resource Report), resulting in degradation of potential habitat for frogs.

Denser forest conditions produce lower values in understory biomass (pounds per acre). Under Alternative 1, understory biomass would continue to decline over the next 40 years. Limited cover around tanks and riparian areas, as well as the limited herbaceous understory across the project area, would continue to reduce the likelihood that frogs would successfully disperse and feed while traveling between waters. The limited cover would also leave frogs vulnerable to predation.

Cumulative Effects

The area analyzed for cumulative effects for northern leopard frogs is RU 5 within the project area and a 0.25-mile buffer outside of the project boundary, along RU 5 to include current and potential breeding sites. Cumulative effects include the effects from Alternative 1. This alternative would continue to result in indirect effects on Chiricahua leopard frogs. Degradation of habitat facilitated by this alternative would cumulatively combine with other forest activities, high-impact recreational use, livestock grazing, and habitat loss and degradation on private lands. Synergistic effects from climate change would continue to fragment key aquatic and dispersal habitat.

Critical Habitat

Two critical habitat management area units are within the action area: the Ellison and Lewis Creek management area and the Crouch, Gentry, Cherry Creeks, and Parallel Canyon management area (Figures 3-** and 3-** above). No change is expected to occur in these management area units under the no action alternative.

Determination of Effect

Alternative 1 may affect and is likely to adversely affect the Chiricahua leopard frog and its designated critical habitat.

Effects Common to All Action Alternatives

Alternatives 2 and 3 would allow discharge from springs to resume flow through their historic spheres of discharge. Restoration implementation would increase riparian vegetation increasing availability of food and reproductive sites for this species over the long term, resulting in direct beneficial effects on habitat. Restoration would improve cover and water flow that provides escape from predators and prevents water loss for migrating leopard frogs.

Alternative 2 – Modified Proposed Action

Direct and Indirect Effects

Leopard frogs dispersing overland could be directly affected if they are inadvertently run over by mechanical equipment or if they could not find refugia during prescribed fire activities. All suitable habitat would be surveyed prior to restoration activities. Design features (see below and Appendix 5 of the wildlife specialist report) would reduce the likelihood of direct effects on frogs from mechanical thinning, temporary road construction, spring and riparian restoration, road decommissioning, and prescribed fire.

Under the proposed action, dense forest conditions and surface fuel loading in RU 5 would be reduced. The likelihood of large crown wildfires adversely affecting potential habitat by destroying understory and overstory vegetation would be reduced from 327,867 acres (59 percent) of all ponderosa pine to 129,762 acres (23 percent). Fire hazard index in grasslands would also be greatly reduced, from 5,000 acres to 138 acres). As a result, overland flow would be stable, and soil erosion would not have the high sediment loading potential. Water quality would not be adversely affected on a wide scale, resulting in indirect beneficial effects.

Under Alternative 2, spring and riparian restoration is proposed only in unoccupied habitat or with coordination with USFW. An important consideration for restoration of springs is to restore discharge from the spring source except where prescribed by existing adjudicated water rights. Alternative 2 would allow discharge from springs to resume flow through their historic spheres of discharge. Restoration implementation would increase riparian vegetation increasing availability of food and reproductive sites for this species over the long term, resulting in direct beneficial effects on habitat. Restoration would improve cover and water flow that provides escape from predators and prevents water loss for migrating leopard frogs.

Decommissioning unauthorized roads in RU 5 would improve the quality of the habitat in those areas where the roads are decommissioned. While the physical structure and features of the habitat may not measurably change along the former road alignment, eliminating disturbance along the roadway would be expected to improve the quality of habitat and reduce the potential for frogs to be crushed by vehicles using these roads. With each mile of road affecting approximately three acres of habitat, many acres of forested habitat may be improved within Chiricahua leopard frog breeding and dispersal habitat. Long-term effects would include habitat improvements over current conditions.

Constructing temporary roads would disturb vegetation and reduce habitat quality for leopard frogs. These effects may affect individuals but are expected to be short term, occurring only during project implementation. Temporary roads would be decommissioned to eliminate use and vegetation would be restored over the long term.

Implementation of the proposed action could increase the risk of spread of Chytrid fungus across the project area. Machinery and equipment used during implementation could transfer Chytrid fungus between waterbodies, increasing the occurrence of the pathogen in leopard frog habitats across the project area. Potential effects from Chytrid fungus that is spread by machinery and equipment would be minimized by requiring decontamination procedures to be followed when activities take place within wetted areas or the moist perimeter of a tank or ephemeral stream and then immediately moving to another wetted area (see design features in Appendix C). Therefore, minimal potential for spread would exist.

Under the proposed action, surface disturbance within proximity of suitable habitats would increase. The use of heavy machinery and increased levels of human activity and traffic are likely to increase sedimentation in the earthen livestock tanks in the vicinity, especially in those located downslope from treatment areas. Effects from sedimentation on leopard frog habitats are extensive and varied. They include alterations in water quality and vegetation structure that ultimately have detrimental effects on leopard frogs by decreasing rate of development, increasing vulnerability to predators, and reducing food availability.

Prescribed burning direct impacts are not likely, as most often, short term indirect impacts could occur due to sedimentation and increased ash flow. Prescribed burns where the majority of critical breeding sites occur would be coordinated with a wildlife biologist to insure protections for migrating frogs.. In coordination with AZGFD, occupied, critical breeding, and potential breeding sites have been identified and mapped and will be included in the individual task order map with a protected water designation. Project design features (see below and Appendix 5 of the Wildlife Specialist Report) have been developed to reduce the potential effects on these important breeding sites and frogs using and moving between these sites. Implementation of best management practices would curtail soil erosion and minimize the potential for inflow into potential Chiricahua leopard frog habitat.

Critical Habitat

Effects on the primary constituent elements (PCE) of critical habitat are similar to the effects on suitable Chiricahua leopard frog habitat as described above. No long-term changes are expected to occur to any primary element from implementing the proposed action. Short-term effects on primary elements are possible related to water quality if precipitation follows directly after a burn, but these effects would be temporary and characteristics would return to pre-burn conditions. The proposed action would not significantly alter any of the characteristics of critical habitat primary constituent elements for the Chiricahua leopard frog.

PCE 1 – Aquatic breeding habitat and immediately adjacent uplands: Thinning and prescribed fire would only occur in riparian areas or near important aquatic habitat with coordination with a wildlife biologist. Thinning and prescribed fire would not remove or reduce standing bodies of water within the action area. In the unlikely event that water is needed for fire abatement, it would not be drawn from any suitable or designated critical habitat but instead taken from an external source. Treatments under controlled conditions would reduce future sedimentation potential. Temporary roads needed to access areas for thinning would follow design features to mitigate soil and watershed damage. Prescribed fire would be managed to ensure lower-severity fire behavior, allowing for fuel reduction without soil damage. These actions would reduce the potential for sedimentation, ash accumulation, and the influx of pollutants that may degrade the water quality of important aquatic sites. It is unlikely for emergent or aquatic vegetation to be completely removed by back-burning fire because of moisture levels in riparian plants, burning techniques (back-burning), and the time in which prescribed burning would take place around frog populations. Some upland vegetation could be removed but this disturbance is expected to be short term and rebound during the following growing season.

Any effects that may occur as a result of the proposed action are anticipated to be insignificant given design features to reduce effects from implementation have been added to the proposed action (see Appendix C). These measures are in place to ensure that the proposed action would not contribute to the spread of nonnative predators and chytridiomycosis.

PCE 2 – Dispersal and nonbreeding habitat: Thinning and prescribed fire would only occur in riparian areas or near important aquatic habitat with coordination with a wildlife biologist. The proposed action would have no effect on CLF movement. Most structural features within dispersal habitat would be maintained (boulders, rocks, large downed logs, small mammal burrows); however, short-term effects on organic debris and leaf litter would occur. Overall, thinning, prescribed fire, and aquatic restoration implementation would have long-term beneficial effects by restoring habitat and protecting designated critical habitat from stand-replacing wildfires.

Cumulative Effects

The area analyzed for cumulative effects for Chiricahua leopard frogs is RU 5 within the Rim Country project area and a 0.25-mile buffer outside of the project boundary along RU 5 to include current and potential breeding sites. This alternative would result in short-term direct and indirect effects on Chiricahua leopard frogs (see above). Restoration of aquatic habitats facilitated by this alternative would slow the combined cumulative effects from other forest activities, high-impact recreational use, livestock grazing, and habitat loss and degradation on private lands. Cumulatively, restoration implementation of key aquatic and dispersal habitat would link, rather than fragment, these habitats allowing for the needs of breeding and dispersing leopard frogs.

Determination of Effect

Implementation of Alternative 2 **may affect, and is likely to adversely affect** Chiricahua leopard frogs and its critical habitat.

Alternative 3 – Focused Alternative

Direct and Indirect Effects

Direct and indirect effects from Alternative 3 would be similar to Alternative 2. Alternative 3 includes the same miles and acres of riparian restoration, while reducing the total number of acres thinned and treated with prescribed burning. Potential effects from chytrid fungus that is spread by machinery and equipment would be minimized by requiring decontamination procedures to be followed when activities take place within wetted areas or the moist perimeter of a tank or ephemeral stream. Therefore, minimal potential for spread would exist.

Alternative 3 treats fewer forested acres in Rim Country. Additional meadow and grassland treatments are scattered throughout the project area and would occur in most of the area, increasing the likelihood that frogs would successfully forage around and migrate between available habitats due to decreased risk of predation. Project design features have been developed (see Appendix C) to reduce the potential of effects on important breeding sites and the frogs using and moving between these sites.

Critical Habitat

Same as Alternative 2.

Cumulative Effects

Same as Alternative 2.

Determination of Effect

Implementation of Alternative 3 **may affect, and is likely to adversely affect** the Chiricahua leopard frog and its critical habitat.

Mexican Spotted Owl (Threatened)

Existing Condition

Fire

Fire Hazard Index

Changes in potential fire behavior (Fire Hazard Index) in MSO habitat types (Table 3-**), was modeled by the fire ecologist (see Fire Ecology and Air Quality Report) under existing conditions in 150 PACs. Forty-six (46) PACs were not modeled because they are in other project areas or in areas where no treatment is planned. Of this 120,976 acres modeled, 91,617 acres (76 percent) are in need of treatment as they have a higher potential for high-severity wildfire. The High and Extreme Need for Treatment categories of Fire Hazard Index constitute 49,888 or 41 percent of all PACs modeled in the project area, expected to experience high-severity wildfire.

In Nest/Roost Recovery habitat, the fire hazard index modeled 10,288 acres, with 7,609 acres (74 percent) in need of treatment as they have the potential of experiencing high-severity wildfire. The High and Extreme Need for Treatment categories of Fire Hazard Index constitute 4,174 acres (41 percent) of all nest/roost recovery habitat in the project area are expected to experience high-severity wildfire.

In Foraging/Non-Breeding Recovery habitat, the fire hazard index modeled 41,878 acres, with 24,947 acres (59 percent) in need of treatment as they have the potential of experiencing high-severity wildfire. The High and Extreme Need for Treatment categories of Fire Hazard Index constitute 10,717 acres (25 percent) of all foraging-other recovery habitat in the project area are expected to experience high-severity wildfire.

The potential for wildfire activity that would result in more severe effects on ecosystem components than that which should occur in a natural fire regime is illustrated by this analysis. The fire hazard index would be greatly reduced in the action alternatives (see the Analysis for the MSO by Alternatives section).

Table 8. Fire hazard index modeled in MSO habitat types

MSO Habitat Type	Very Low Need For Treatment	%	Moderate Need for Treatment	%	Low Need for Treatment	%	High Need for Treatment	%	Extreme Need For Treatment	%
Protected PAC	29,277	24	19,049	16	22,760	19	32,865	27	17,023	14
Recovery Nest/Roost	2,678	26	2,054	20	1,381	13	2,112	21	2,062	20
Recovery Foraging/Non-Breeding	16,930	41	7,828	19	6,402	15	7,237	17	3,480	08

Crown Fire

Risk of crown fires in MSO habitat types (Table 3-** and Figure 3-**) were also modeled under existing conditions in PACs by the fire ecologist. One hundred fifty (150) PACs were modeled, totaling 122,403 acres. Of this 56,325 acres, 79 percent could experience crown fire. Active crown fire potential in PACs totals 43,630 acres (36 percent) of this habitat type in the project area that would experience high-severity crown fire.

In Nest/Roost Recovery habitat, risk of crown fire modeled 28,235 acres, with 22,260 acres (80 percent) in need of treatment as they are at a higher risk of stand-replacement crown fire potential modeled at 10,288 acres, with 8,165 acres (80 percent) that have the potential to experience crown fire. Active crown fire in Nest/Roost Habitat totals 3,773 acres (37 percent) of this habitat type that would experience high-severity crown fire.

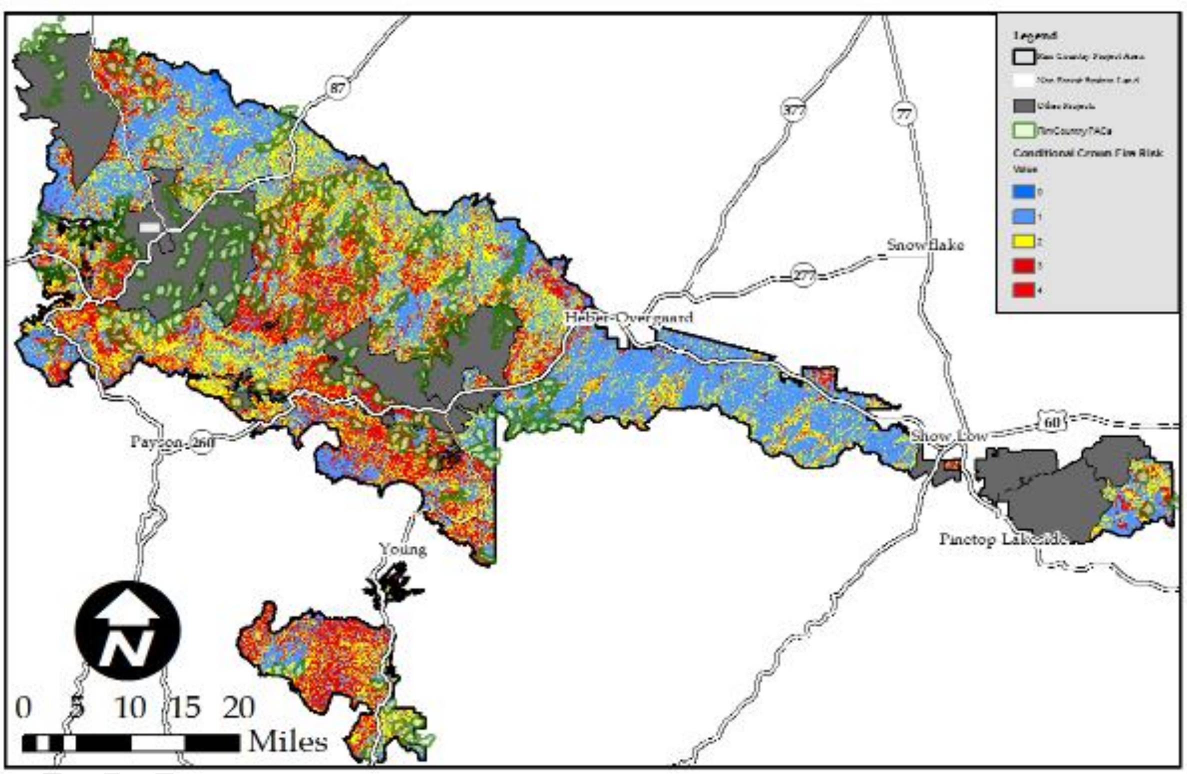
In Foraging/Non-Breeding habitat, crown fire potential modeled 41,878 acres, with 31,629 acres (85 percent) that could experience high-severity crown fire. Active crown fire in Foraging-Other Recovery Habitat totals 10,210 acres (24 percent) of this habitat type that would experience high-severity crown fire.

As with the fire hazard index analysis above, the potential for wildfire activity that would result in more severe effects on ecosystem components than that which should occur in a natural fire regime is illustrated by this analysis. The risk of crown fire would be greatly reduced in the action alternatives (see Analysis for the MSO by Alternatives section below).

Table 9. Risk of crown fire modeled in MSO habitat types

MSO Habitat Type	Active Crown Fire Acres	%	Conditional	%	Passive	%
Protected PAC	43,630	36	14,613	12	37,352	31
Recovery Nest/Roost	3,773	37	1,029	10	3,363	33
Recovery Foraging-Non-Breeding	10,210	23.5	4,879	12	16,540	40

Figure 7. Risk of crown fire in MSO PACs



Alternative 1 – No Action

This alternative proposes no restoration treatments, but habitat variables are modeled the same as for Alternatives 2 and 3 (Table 3-**). The no action alternative includes no new mechanical treatments or prescribed fire in Rim Country in any habitat, including ponderosa pine, pine-oak, aspen, meadows, springs, riparian areas, and streams. No road construction, maintenance, or decommissioning would occur within the project area. None of the associated wildlife habitats would be restored or moved toward restoration.

Table 10. FVS Modeled Effects on Key Habitat Variables in PACs from No Action Alternative

PACs MC = 16,481 Acres Modeled PO = 56,180	Existing Condition	No Action 2029	No Action 2039
Avg of Trees per Acre MC	1291	1170	1057
Avg of Trees per Acre PO	1276	1130	990
Avg of Basal Area MC	173	185	196
Avg of Basal Area PO	144	155	163
Avg of Stand Density Index MC	398	414	425
Avg of Stand Density Index PO	339	353	362
Avg of Quadratic Mean Diameter in Inches MC	6	6	7
Avg of Quadratic Mean Diameter in Inches PO	6	6	7
Avg of SNAG 12-18 MC	4	3	3
Avg of SNAG 12-18 PO	2	3	3
Avg of SNAG 18-24 MC	2	1	1
Avg of SNAG 18-24 PO	1	1	1
Avg of SNAG ≥24 MC	1	1	1
Avg of SNAG ≥24 PO	0	0	0
Percent CANCOV Regression from BA MC	74	76	78
Percent CANCOV Regression from BA PO	69	71	73
Avg of Surface Fuel tons per acre MC	29	33	35
Avg of Surface Fuel tons per acre PO	20	23	25
Avg of Coarse Woody Debris 3”+ tons per acre MC	10	12	14
Avg of Coarse Woody Debris 3”+ tons per acre PO	8	9	10
Avg of Herbaceous tons per acre MC	0.21	0.21	0.20
Avg of Herbaceous tons per acre PO	0.21	0.21	0.21
Average of Shrubs tons per acre MC	0.40	0.37	0.34
Average of Shrubs tons per acre PO	0.23	0.23	0.23
Avg of ALL BA1 0-1” MC	1	1	1
Avg of ALL BA1 0-1” PO	1	1	1

Avg of ALL BA2 1-5" MC	15	15	14
Avg of ALL BA2 1-5" PO	13	16	18
Avg of ALL BA3 5-12" MC	49	51	52
Avg of ALL BA3 5-12" PO	47	47	47
Avg of ALL BA4 12-18" MC	51	52	56
Avg of ALL BA4 12-18" PO	42	46	48
Avg of ALL BA5 18-24" MC	30	38	43
Avg of ALL BA5 18-24" PO	22	25	28
Avg of ALL BA6 24" + MC	26	29	32
Avg of ALL BA6 24" + PO	18	20	22

Table 11.

PACs	Existing Condition	2029	2049
Avg Trees per Acre	1343.63	1204.93	972.22
Avg Basal Area	149.37	154.59	158.14
Avg Stand Density Index	351.91	355.23	348.22
Avg Quadratic Mean Diameter in Inches	5.79	6.23	6.95
Avg SNAG 12-18	2.25	3.48	5.10
Avg SNAG 18-24	0.99	1.32	1.95
Avg SNAG ≥ 24	0.55	0.61	0.90
Avg Canopy Cover %	49.20	50.67	51.64
Avg Surface Fuel tons per acre	18.70	21.10	27.04
Avg Coarse Woody Debris	5.68	6.62	10.51
Avg Downed Logs ≥12"	1.18	1.63	3.38
Avg Herbaceous tons per acre	0.20	0.20	0.20
Avg Shrubs tons per acre	0.31	0.31	0.32
Avg ALL BA1 0-1"	1.13	0.91	0.68
Avg ALL BA2 1-5"	13.56	15.23	16.76

Avg ALL BA3 5-12”	48.71	47.11	45.17
Avg ALL BA4 12-18”	41.81	44.09	44.44
Avg ALL BA5 18-24”	23.14	25.38	27.97
Avg ALL BA6 24” +	21.00	21.87	23.11

Protected Habitat

Forest Structure

Under Alternative 1, large trees in PACs would not be replaced due to the stagnant growth rates. FVS modeling in PACs for Alternative 1 (table 27) shows trees per acre would only slightly decrease, from the existing 1,291 MC and 1,276 P-O to 1,170 MC and 1,130 P-O in 2029 and 1,057 MC and 990 P-O in 2039. Quadratic mean diameter would only increase by one inch over 20 years (from six to seven inches), indicating a system that would not be growing large trees greater than 12 inches in diameter. The average of all basal areas, from the sapling Size Class 1 to old forest Size Class 6 shows that intermediate-sized trees (Size Class 3 with a basal area of 5 to12 inches and Size Class 4 with a basal area of 12 to 18 inches) would be predominant on the landscape and vastly departed from the natural range of variation and would not be lowered to the desired condition, a result of no treatments through 2039.

Snags

With no action, PACs would show an increase in coarse woody debris and snags greater than 12 inches in diameter (table 26). While creation of large snags would continue, the decreasing numbers of large trees through time would maintain a deficit of large snags beyond the year 2039. Pulses of large snag creation may occur at any time as a result of fire, insects, and disease. Increases in large snags as an outcome of stochastic events would result in decreases of large trees.

Coarse Woody Debris and Understory

Small mammal habitat would be maintained through time in terms of logs and coarse woody debris (cover for prey species) under this alternative. However, accumulated coarse woody debris could decrease MSO habitat effectiveness (Roberts et al. 2010). Herbaceous biomass in tons per acre (food for prey species) and shrub biomass in tons per acre (cover for prey species) would not change in both the short term and long term under Alternative 1 (table 26). However, canopy development combined with a lack of fire and increased needle accumulation would cause a continued decline in understory through time. The continued loss and fragmentation of understory vegetation would limit invertebrate populations, including pollinators. If this pattern continued over time, a cascading effect could occur as arthropod species richness and abundance declines, increasing the rate of decline in understory biomass and potentially causing an additive effect to MSO prey species. Combined decreases in understory vegetation and associated arthropod communities could affect MSO directly (lack of flying insects as prey) and indirectly (food availability for prey species such as mice, voles, birds, and bats). Understory vegetation would remain at low levels of productivity and would continue to decrease through time, except in areas where fire, insect, or disease opened the canopy.

Fire Effects

Maintaining the current trajectory for forest conditions would maintain the increasing risk of uncharacteristic fire. Ponderosa pine ecosystems would become increasingly departed from desired conditions under Alternative 1, increasing risks to ecosystem structure, pattern, composition, and function. Fire hazard index and risk of crown fire (modeling shown in the existing condition section) are greatly increased in the No Action Alternative compared to the action alternatives.

Surface fuel loading in protected habitat, including litter, duff, and coarse woody debris greater than three inches, would be high under Alternative 1, moving from an existing condition of 18.7 tons per acre to 27.04 tons per acre in 2049 (Table 3-**. Fire Hazard Index Modeled in MSO Habitat Types). Crown fire would be more likely if surface fuel build-up continues, leading to increased flame lengths. High surface fuel loadings can negatively affect MSO prey populations by altering the understory vegetation response, negatively affecting food resources for prey species.

Fire Hazard Index high and extreme need for treatment categories are increased under Alternative 1 from 49,889 acres (41 percent of the PACs in the project area in need of treatment) in existing condition to 57,191 acres (47 percent) of all PACs in the project area are expected to experience high-severity wildfire. In Recovery Nest/Roost habitat 4,175 acres (41 percent) of Nest/Roost Recovery habitat in the project area) with high and extreme need for treatment in the existing condition goes to 4,991 acres (49 percent) in Alternative 1. Foraging/Non-breeding Recovery habitat goes from 10,717 acres (26 percent) with high and extreme need for treatment in the existing condition to 14,337 acres (34 percent) in Alternative 1.

Table 12. Fire Hazard Index Modeled in MSO Habitat Types for Alternative 1

MSO Habitat Type	Very Low Need For Treatment in Acres	%	Moderate Need for Treatment in Acres	%	Low Need for Treatment in Acres	%	High Need for Treatment in Acres	%	Extreme Need for Treatment in Acres	%
Protected PAC 120,970 Acres Modeled	22,027	18	16,920	14	24,830	21	35,358	29	21,833	18
Recovery Nest/Roost 10,288 Acres Modeled	1,522	15	1,598	15	2,175	21	2,643	26	2,348	23
Recovery Foraging/Non-Breeding 41,879 Acres Modeled	10,966	26	5,483	13	11,093	27	10,378	25	3,959	9

The potential for active and conditional crown fire would be increased in the No Action Alternative compared to the existing condition, from 58,243 acres (48 percent of the PACs in the project area) to 61,606 acres (51 percent) that would experience high-severity crown fire in Alternative 1. Both types of recovery habitat would also have increased risk of crown fire from the existing condition with Alternative 1 (Table 3-**).

Table 13. Potential for Crown Fire Modeled in MSO Habitat Types for Alternative 1

MSO Habitat Type	Active Crown Fire Acres	%	Conditional Crown Fire Acres	%	Passive Crown Fire Acres	%	Surface Fire Acres	%
Protected PAC	42,151	52	1,404	2	26,744	34	11,396	14
Recovery Nest/Roost	5,414	53	92	1	3,712	36	1,078	10
Recovery Foraging-Non-Breeding	18,102	43	358	1	19,130	46	4,262	10

Maintaining current forest conditions would maintain a high fire hazard index (83 percent at risk of stand-replacing fire conditions and increased risk of crown fire). Over 73 percent of MSO PACs would likely burn with crown fire under Alternative 1. The likelihood of high-severity fire and the size of wildfires producing undesirable effects would continue to increase. Alternative 1 would not follow Recovery Plan guidance for retaining management flexibility for abating the risk of high-severity fire in PACs (USDI FWS 2012b).

Ponderosa pine-oak habitat in the Rim Country project area does not meet desired conditions relative to fire behavior. The risk of undesirable fire behavior and effects would continue in 2029 with no management. Maintaining a landscape in high density tree groups would lead to density-dependent mortality and increased risk of stochastic events such as uncharacteristic fire or outbreaks of forest pathogens (see the Fire Ecology and Air Quality and Silviculture Reports).

Alternative 1 does not meet the purpose and need for the Rim Country Project. Forest structure and health in MSO habitat would continue to degrade over time. Development of the large tree component would continue to be compromised by density-dependent competition and mortality. Understory development would be maintained at uncharacteristically low levels and continue to decline. Other specialty habitats important to prey species such as riparian areas, meadows, aspen, springs, and stream channels would continue to degrade or be lost entirely over the long term. MSO habitats would be on a trajectory moving away from desired conditions as described in the Coconino, Tonto and Apache-Sitgreaves Forest Plans.

Nest/Roost Recovery Habitat

Forest Structure

Under Alternative 1, No Action, FVS modeling (Table 3-**.) in MSO Nest/Roost Recovery Habitat shows that over time trees per acre are reduced, but not to within the natural range of variation. Trees per acre in the existing condition (1,100 mixed conifer, 1,280 pine-oak, and 1,351 GM on the Tonto) would change to 873 mixed conifer, 1,052 pine-oak and 1,134 GM on the Tonto in 2039). Stand density index would remain high, from 420 mixed conifer, 369 pine-oak, and 441 GM on the Tonto n the existing condition, to 438 mixed conifer, 380 pine-oak, and 445 GM in 2039. The quadratic mean diameter would only increase two inches in mixed conifer and one inch in pine-oak over 20 years.

Table 14. FVS Modeled Effects on Key Habitat Variables in Recovery Nest/Roost Habitat from No Action Alternative

NR Recovery MC = 11,065 Acres Modeled PO = 13,539 Acres Modeled GM. = 3,940 Acres Modeled on Tonto NF	Existing	No Action 2029	No Action 2039
Avg of Trees per Acre MC	1100	982	873
Avg of Trees per Acre PO	1280	1167	1052
Avg of Trees per Acre GM	1351	1231	1134
Avg of Basal Area MC	188	199	209
Avg of Basal Area PO	164	172	178
Avg of Basal Area GM	190	196	199
Avg of Stand Density Index MC	420	431	438
Avg of Stand Density Index PO	369	377	380

NR Recovery MC = 11,065 Acres Modeled PO = 13,539 Acres Modeled GM. = 3,940 Acres Modeled on Tonto NF	Existing	No Action 2029	No Action 2039
Avg of Stand Density Index GM	441	444	445
Avg of Quadratic Mean Diameter in Inches MC	6	7	8
Avg of Quadratic Mean Diameter in Inches PO	7	7	8
Avg of Quadratic Mean Diameter in Inches GM	6	6	6
Average of SNAG 12-18” MC	4	4	4
Average of SNAG 12-18” PO	3	4	4
Average of SNAG 12-18” GM	3	4	3
Average of SNAG 18-24” MC	1	1	2
Average of SNAG 18-24” PO	1	1	1
Average of SNAG 18-24” GM	1	1	1
Average of SNAG ≥ 24” MC	1	1	1
Average of SNAG ≥ 24” PO	0	0	0
Average of SNAG ≥ 24” GM	0	0	0
Percent CANCOV MC	76	78	79
Percent CANCOV PO	73	74	76
Percent CANCOV GM	77	77	78
Avg of Surface Fuel tons per acre MC	30	34	37
Avg of Surface Fuel tons per acre PO	19	23	26
Avg of Surface Fuel tons per acre GM	23	27	29
Avg of Coarse Woody Debris 3”+ tons per acre MC	10	12	14
Avg of Coarse Woody Debris 3”+ tons per acre PO	6	8	9

NR Recovery MC = 11,065 Acres Modeled PO = 13,539 Acres Modeled GM. = 3,940 Acres Modeled on Tonto NF	Existing	No Action 2029	No Action 2039
Avg of Coarse Woody Debris 3”+ tons per acre GM	10	12	13
Avg of Herbaceous tons per acre MC	0.21	0.20	0.20
Avg of Herbaceous tons per acre PO	0.21	0.21	0.21
Avg of Herbaceous tons per acre GM	0.20	0.20	0.20
Average of Shrubs tons per acre MC	0.40	0.37	0.34
Average of Shrubs tons per acre PO	0.22	0.22	0.22
Average of Shrubs tons per acre GM	0.25	0.24	0.25
Avg of ALL BA1 0-1” MC	1	1	0
Avg of ALL BA1 0-1” PO	1	1	0
Avg of ALL BA1 0-1” GM	1	1	1
Avg of ALL BA2 1-5” MC	12	12	13
Avg of ALL BA2 1-5” PO	10	11	13
Avg of ALL BA2 1-5” GM	14	15	16
Avg of ALL BA3 5-12” MC	39	40	39
Avg of ALL BA3 5-12” PO	41	40	38
Avg of ALL BA3 5-12” GM	54	53	51
Avg of ALL BA4 12-18” MC	61	59	58
Avg of ALL BA4 12-18” PO	54	54	54
Avg of ALL BA4 12-18” GM	61	62	63
Avg of ALL BA5 18-24” MC	43	52	57
Avg of ALL BA5 18-24” PO	37	44	47
Avg of ALL BA5 18-24” GM	31	36	38
Avg of ALL BA6 24” + MC	32	36	42

NR Recovery MC = 11,065 Acres Modeled PO = 13,539 Acres Modeled GM. = 3,940 Acres Modeled on Tonto NF	Existing	No Action 2029	No Action 2039
Avg of ALL BA6 24” + PO	21	23	25
Avg of ALL BA6 24” + GM	28	29	31

Snags

Snags greater than 12 inches in diameter show no change in any cover type under Alternative 1 (table 30). While creation of large snags would be maintained, the decreasing numbers of large trees through time could maintain a deficit of large snags beyond the year 2039.

Coarse Woody Debris and Understory

Downed logs and course woody debris (cover for prey species) would increase over time as a result of no action. Herbaceous biomass in tons per acre (food for prey species) would not change under Alternative 1 over the 20 years modeled (0.21 tons per acre existing condition in mixed conifer and pine-oak cover types, and 0.20 in GM acres on the Tonto, is maintained through 2039). Shrub biomass in tons per acre (cover for prey species) would decrease in mixed conifer and would be maintained in pine-oak under Alternative 1, moving from 0.4 tons per acre in mixed conifer to 0.3 tons per acre in 2039 (Table 3-**).

Fire Effects

Surface fuel loading in MSO Nest/Roost Recovery habitat, including litter, duff, and coarse woody debris greater than three inches, would be high under Alternative 1, moving from an existing condition of 30 tons per acre in mixed conifer, 19 in pine-oak to 37 tons per acre in mixed conifer, 26 in pine-oak in 2039 (Table 3-**).

Fire Hazard Index would be increased from 8,035 acres (78 percent of the Nest/Roost Recovery habitat in the project area in need of treatment) to 9,150 acres (89 percent). The highest and greatest hazard categories of Fire Hazard Index in Nest/Roost Recovery habitat total 5,594 acres (50 percent) of all Nest/Roost Recovery habitat in the project area and are expected to experience high-severity wildfire.

Potential for crown fire is expected to increase in the No Action Alternative, from 8,290 acres (81 percent) to 9,218 acres (90 percent). Active crown fire in Nest/Roost Recovery habitat totals 5,414 acres (53 percent) of this habitat type in the project area that would experience high-severity crown fire.

Foraging/Non-Breeding Recovery Habitat

Forest Structure

Under Alternative 1, No Action, FVS modeling (Table 3-**) shows that trees per acre in Foraging/Non-Breeding MSO Recovery Habitat would be reduced, but not to within the natural range of variability (from 1,398 in mixed conifer, 1,192 in pine-oak, and 1,443 GM on the Tonto NF, to 1,101 in mixed conifer, 952 in pine-oak, and 1,196 GM on the Tonto NF in 2039). Stand density index would remain high, from 376 in mixed conifer, 329 in pine-oak, and 407 GM on the Tonto NF, to 182 in mixed conifer, 158 in pine-oak, and182 GM on the Tonto NF in 2039. The quadratic mean diameter would only increase by one inch over 20 years.

Table 15. FVS Modeled Effects on Key Habitat Variables in Foraging/Non-breeding MSO Recovery Habitat from No Action Alternative

Foraging/Non-breeding Recovery MC = 21,220 Acres Modeled PO = 85,458 Acres Modeled GM = 31,659 Acres Modeled on Tonto NF	Existing	No Action 2029	No Action 2039
Average of Tpa MC	1398	1242	1101
Average of Tpa PO	1192	1067	952
Average of Tpa GM	1443	1308	1196
Average of BA MC	157	170	182
Average of BA PO	140	150	158
Average of BA GM	170	177	182
Average of SDI MC	376	394	406
Average of SDI PO	329	343	351
Average of SDI GM	407	414	416
Average of QMD MC	5	6	6
Average of QMD PO	6	6	7
Average of QMD GM	5	6	6
Average of SNAG 12-18” MC	3	3	3
Average of SNAG 12-18” PO	2	2	3
Average of SNAG 12-18” GM	2	2	2
Average of SNAG 18-24” MC	1	1	1
Average of SNAG 18-24” PO	1	1	1
Average of SNAG 18-24” GM	1	0	0
Average of SNAG ≥ 24” MC	1	1	0
Average of SNAG ≥ 24” PO	0	0	0

Foraging/Non-breeding Recovery MC = 21,220 Acres Modeled PO = 85,458 Acres Modeled GM = 31,659 Acres Modeled on Tonto NF	Existing	No Action 2029	No Action 2039
Average of SNAG ≥ 24” GM	0	0	0
Percent CANCOV MC	71	74	75
Percent CANCOV PO	69	70	72
Percent CANCOV GM	74	75	76
Average of Surface Fuel TPA MC	24	28	32
Average of Surface Fuel TPA PO	16	20	22
Average of Surface Fuel TPA GM	19	22	24
Average of CWD 3”+ TPA MC	8	10	12
Average of CWD 3”+ TPA PO	5	6	8
Average of CWD 3”+ TPA GM	6	7	9
Average of Surface Herb TPA MC	0.21	0.20	0.20
Average of Surface Herb TPA PO	0.21	0.21	0.21
Average of Surface Herb TPA GM	0.19	0.19	0.19
Average of Surface Shrub TPA MC	0.29	0.28	0.26
Average of Surface Shrub TPA PO	0.22	0.23	0.23
Average of Surface Shrub TPA GM	0.27	0.26	0.26
Average of ALL_BA1 MC	1	1	1
Average of ALL_BA1 PO	1	1	1
Average of ALL_BA1 GM	1	1	1
Average of ALL_BA2 MC	15	18	19
Average of ALL_BA2 PO	11	13	14
Average of ALL_BA2 GM	16	17	18
Average of ALL_BA3 MC	47	46	45
Average of ALL_BA3 PO	48	47	46

Foraging/Non-breeding Recovery MC = 21,220 Acres Modeled PO = 85,458 Acres Modeled GM = 31,659 Acres Modeled on Tonto NF	Existing	No Action 2029	No Action 2039
Average of ALL_BA3 GM	64	64	62
Average of ALL_BA4 MC	48	51	54
Average of ALL_BA4 PO	44	49	50
Average of ALL_BA4 GM	49	52	54
Average of ALL_BA5 MC	28	34	39
Average of ALL_BA5 PO	22	26	30
Average of ALL_BA5 GM	22	24	27
Average of ALL_BA6 MC	17	20	23
Average of ALL_BA6 PO	13	15	16
Average of ALL_BA6 GM	17	19	20

Snags

Foraging/Non-Breeding Recovery Habitat under Alternative 1 would have an increase in coarse woody debris and snags greater than 12 inches in diameter (Table 3-**). While creation of large snags would continue, the decreasing numbers of large trees through time could maintain a deficit of large snags beyond the year 2039.

Coarse Woody Debris and Understory

Downed logs and coarse woody debris (cover for prey species) would increase over time as a result of no action. Herbaceous biomass in tons per acre (food for prey species) would not change under Alternative 1 over the 20 years modeled (0.21 tons per acre in mixed conifer and pine-oak maintained through 2039). Shrub biomass in tons per acre (cover for prey species) would show little change in both the short term and long term under Alternative 1, moving from an average 0.25 tons per acre to 0.28 tons per acre in 2039 (Table 3-**).

Fire Effects

Surface fuel loading in MSO Foraging/Non-Breeding Recovery Habitat, including litter, duff, and coarse woody debris greater than three inches, would be high under Alternative 1, moving from an existing as high as 24 tons per acre to 32 tons per acre in 2049 (Table 3-**).

Fire Hazard Index is expected to increase from 10,717 acres (26 percent of the Foraging-Other Recovery habitat modeled as in need of treatment) to 14,337 acres (34 percent). The potential for crown fire would be increased with no action, from 15,090 acres (36 percent) to 16,302 acres (39 percent).

Other Habitat Effects

Springs, Riparian and Stream Habitat, Grasslands, Savannas, Meadows, and Aspen. No springs or riparian habitat would be restored. One hundred eighty-four (184) springs and associated prey habitat would remain in degraded condition within the project area, with many included in PACs. Similarly, wildlife habitat associated with almost 171 miles of riparian stream channels would remain in degraded condition within MSO habitat. The grasses, forbs, and shrubs that could potentially occupy these sites would remain absent or limited in both species richness and abundance.

No grassland, savanna, or meadow treatments would occur, resulting in nearly 350 acres in PACs and over 60,390 acres (proposed in Alternative 2) of this important habitat continuing to degrade as a result of pine tree encroachment in MSO habitat. This would represent a decline in the quantity and quality of habitat for grassland associated species, including obligate migratory and sensitive avian species. As food and cover decline for small mammals, potential source populations of important MSO prey species would be expected to decline in the long term. Overall, the landscape would move toward homogeneity as ponderosa pine continued to compromise or eliminate these key sources of heterogeneity.

Unique wildlife habitat features associated with 1,230 acres of aspen would decline or vanish as losses continued. Conifer trees would gradually succeed aspen trees through competition for space, light, and water, which is a major cause of aspen decline (Johnson 2010). Associated declines in regional avifauna would occur as a result of habitat loss (Griffis-Kyle and Beier 2003). The rate of avian decline could increase as habitat changes favored nest predators (Johnson 2010). Understory biomass, which provides the food and cover to support MSO prey species (e.g., small mammals, birds, and arthropods), would decrease exponentially as conifer cover increased (Stam et al. 2008).

The effects of these microhabitats are greater than their combined total acres. This is particularly relevant when these patches of heterogeneity occur in PACs where MSOs disproportionately forage during the nesting season.

Roads. Under the no action alternative, no new restoration activities would take place and no additional use of existing roads would occur. Current rates of public and administrative use would continue. Maintenance to provide public and administrative access would continue, contingent upon funding. No increase in road maintenance to accommodate restoration activities would occur. No temporary roads would be constructed, but also no road decommissioning, unless they are analyzed under separate NEPA analysis.

Direct and Indirect Effects

With no treatments occurring, there would be no direct increase or decrease in habitat quality of MSO protected, recovery, or critical habitat in the short term. In the long term, MSO habitat quality would decrease as a result of declines in forest health and resiliency.

The lack of mechanical thinning and low-severity prescribed fire would allow the current forest trajectory to continue. Dense forests would maintain closed canopy conditions but continue to exhibit reduced growth rates. The abundance of young and mid-aged forest would continue to dominate the landscape because of stagnating growth rates and competition-induced mortality of large trees. Gambel oak, aspen, and meadows would decline as pine encroachment continued. Spring function would decline as would reaches of riparian habitat channels. Competition for limited water and nutrients would continue and would increase in time as snow pack decreased with developing climate change.

This alternative would not reduce the threat of high-severity fire, which is a primary concern for the recovery of this species. Surface fuels would continue to increase and understory vegetation decrease or remain the same. Alternative 1 would not contribute to improving forest health or vegetation diversity and composition, sustaining old forest structure over time, or moving forest structure toward the desired conditions.

No additional disturbance from noise, smoke, or other aspects of implementation activities would occur under this alternative.

Effects Common to Both Action Alternatives

Environmental consequences are described by MSO habitat type (e.g., protected and recovery) and designated critical habitat. Proposed treatments are similar across MSO habitat types, although the degree to which they are implemented would vary depending on specific stand conditions. Modeled results are based on stand-specific outputs and represent the variability in treatment implementation. The objectives of the treatments are to increase tree growth rates, retain large pine and oak trees, and increase forest resiliency. Recovery nest/roost habitat would be managed to maintain or achieve nest/roost conditions sooner than if they were not treated. Forest conditions in nest/roost habitat would remain at or above nest/roost values after treatments as shown in Table C.3 of the Recovery Plan.

The objective of the Rim Country treatments in MSO habitat is to improve forest structure for owls as defined in the Recovery Plan per the Flexible Toolbox Approach for Mechanical Treatments (Appendix 2). This is different from an emphasis on fuels reduction. Large trees would be retained, and targeting mid-aged trees would improve the health, growth rates, and sustainability of large trees. Certain habitat and stand structures warrant additional consideration. For example, some MSO habitat and certain stand conditions require consideration of additional management constraints before prescribing treatments. PACs exhibit a variety of topographic and forest conditions and occupied PACs can already be considered successful nesting habitat. Mechanical treatments in PACs would be designed to maintain or improve the characteristics that make each PAC effective at providing habitat while also making them resilient to disturbance. Consideration should be given to:

1. increasing the number of large trees
2. creating additional foraging habitat for MSO
3. the fire hazard index in the PAC and whether it is in wildland-urban interface (WUI)
4. restoration and protection of other resource values nearby, such as perennial water
5. protecting other values at risk

Treating areas near PACs should be considered in order to improve resiliency in the PACs themselves. PACs should be treated with consideration of the larger landscape and not just separate entities. Specific treatments in PACs would be determined prior to implementation and in coordination with U.S. Fish and Wildlife Service (FWS) personnel. In nest/roost recovery habitat, the Flexible Toolbox Approach for Mechanical Treatments (Appendix D) states that, though recovery nest/roost habitat is distinct from PACs, their management objectives are similar. Any treatment proposed in MSO nest/roost recovery habitat should be designed specifically to maintain or accelerate the trajectory of these stands towards desired habitat conditions in the foreseeable future. Achieving management objectives within MSO foraging or other recovery habitat can be addressed with the flexible toolbox approach. Stands in recovery habitat would be assigned a treatment using the decision matrices; however, additional management direction would be applied such as maintaining increased basal area (40-110 BA for pine-oak and 40-135 BA for mixed conifer). This additional guidance is included in the project design features to ensure resource protection (see Appendix C).

Habitat Restoration in MSO Habitat

A total of 196 PACs (110,890 acres) occur in the Rim Country project area. An additional 39,748 acres either fall outside of the Rim Country boundary area (11,269 acres) or occur in other project areas (28,479 acres). These 39,748 acres will be treated as those projects planned and consulted with FWS. Twenty-nine PACs would have some other type of restoration (riparian, wet meadow, grassland, aspen, etc. see Actions common to Alternatives 2 and 3 below). In the 4FRI Rim Country project area, up to 82,411 acres of protected MSO habitat are proposed for thinning and/or burning, or other habitat restoration with Alternatives 2 and 3. Various restoration activities could occur under Alternatives 2 and 3 in MSO habitat. These activities include grassland and meadow restoration, spring restoration, riparian stream and stream channel restoration, stream habitat restoration, and aspen restoration. Acres and miles for other restoration activities were calculated for PACs (Table 3-**). Recommended design features to minimize effects on wildlife for all restoration activities proposed in PACs were reviewed and would not result in additional effects that are not already disclosed (Appendix 5). These activities would be implemented in recovery habitat types under both Alternatives 2 and 3: however, design features intended to improve stand and habitat quality would also be applied to achieve restoration success (see Appendix C). The restoration of these habitat types within recovery habitat would contribute to the mosaic treatment effect desired in the MSO Recovery and Forest Plans.

Table 16. Acres of Restoration Treatments Proposed in MSO PACs

Treatment	PAC Acres
Mechanical Vegetation Treatments Total	**24,873**
Aspen Restoration	28
Facilitative Operations	298
PAC – Mechanical	18,371
Severe Disturbance Area Treatments	3,609
Grasslands Restoration	72
Riparian Restoration	2,142
Riparian/Wet Meadow Restoration (Overlap)	98
Wet Meadow Restoration	256
Prescribed Fire Total	**82,411**
Prescribed Fire Only	49,066
Facilitative Operations Prescribed Fire Only	7,875
Mechanical and Prescribed Fire Treatment	24,873
Riparian Restoration within Core Areas	610
Riparian/Wet Meadow Restoration (Overlap) within Core Areas	31
Wet Meadow Restoration within Core Areas	33
Stream Restoration (in miles)	**171**

Aspen Restoration

All aspen restoration activities in PACs would happen outside of the breeding season. Recommended design features for aspen restoration are included so that aspen restoration activities would not result in additional effects that are not already disclosed. Currently, one PAC on the Coconino NF was identified for aspen restoration treatment (28 acres), the Schell Spring PAC.

Facilitative Operations

Facilitative operations may be needed in non-target cover types (such as pinyon-juniper) to support treatments in target cover types (ponderosa pine types). Within four PACs, approximately 300 acres could receive mechanical facilitative operations. Within 71 PACs, about 7,880 acres could be treated using prescribed fire facilitative operations. Design features have been added to mitigate disturbance to MSO from these activities.

Severe Disturbance Areas

Restoration treatments in severe disturbance areas would include combinations of reforestation, prescribed fire, lopping/scattering, mastication, and other mechanical methods, with the objective of identifying treatments that would be effective in restoring the fuel structure that produces the types of fire to which ponderosa pine is adapted. Thirty-three PACs (about 10,070 acres) could have severe disturbance restoration activities associated with them. Twelve PACs would have grassland restoration activities on approximately 72 acres. Twenty-seven PACs would have wet meadow restoration on approximately 420 acres. Design features (see Appendix 5, Appendix C) have been included to mitigate disturbances to MSO from these activities.

Grassland and Wet Meadow Restoration

Twelve PACs would have grassland restoration activities on approximately 72 acres. Twenty-seven PACs would have wet meadow restoration on approximately 420 acres. Design features (see Appendix 5, Appendix C) have been included to mitigate disturbances to MSO from these activities.

Stream and Riparian Restoration

A total of nearly 171 miles of stream restoration, with approximately 2,880 acres of riparian restoration, could occur in 127 PACs in the Rim Country project area. All restoration activities in PACs would happen outside of the breeding season. Spring and riparian stream channel and habitat restoration would also occur in MSO recovery habitat across the project area. See the Flexible Toolbox Approach for Aquatic and Watershed Restoration Activities for a complete description of restoration activities proposed (Appendix 3). Design features have been included to minimize effects on MSO, to promote primary constituent elements in MSO habitat, and to avoid disturbance to MSO from implementation.

Skid Trails, Excaline, and or Tracked Harvesters

Skid trails could be needed in PACs and recovery habitats in order to accomplish thinning treatments; however, all would be rehabilitated after harvesting. Ground disturbance from skid trails can cause indirect effects from the loss of vegetation through compaction and rutting and exposure of bare mineral soil. Harvest activities with skid trails could adversely affect the prey base on a short-term basis by affecting individuals of prey species due to disturbance of prey species' habitat. As analyzed by the Rim Country soil scientist,

"Mechanical thinning of the ponderosa pine forests of Arizona has been occurring since the 1980s mainly through whole tree harvesting on slopes less than 40 percent. Typical equipment used for such harvesting includes rubber-tired feller bunchers and rubber-tired skidders with tracked dozers used for piling of slash. The amount of disturbance as a percentage of a typical harvest unit (i.e., area included in a thinning contract) affected by compaction, rutting, and/or exposure of bare mineral soil from this type of harvesting has been estimated to be roughly 15 percent associated with feller-buncher and skidding operations, three percent associated with machine piling of slash, three percent associated with landings, and three percent associated with temporary roads (MacDonald 2013)."

Design features have been incorporated to minimize disturbance from heavy machinery operations, and thus would generally minimize compaction, rutting, and/or exposure of bare mineral soil in these areas.

Of the 24,873 acres of ground-based harvest methods in MSO PAC habitat, 5,223 acres (21 percent) could be affected by compaction, rutting, and/or exposure of bare mineral soil from mechanical thinning operations. No temporary roads are needed if skid trail lengths are increased as described in the roads section below, adding an additional 10 acres. This represents four percent of the total PAC acres (122,158 acres) in the 4FRI Rim Country project area. Effects are short term, dispersed across the landscape, with rehabilitation efforts incorporated through best management practices to reduce effects to MSO habitat.

Roads

Alternative 2 and 3 are the same in terms of roads proposed to haul material. The main difference is that in Alternative 3 temporary roads would be reduced from 330 to 170 miles. It is assumed that nearly all, if not all system roads within the project area could be utilized at some point in time to carry out restoration activities.

Road Maintenance- Roads that would be utilized for restoration work and hauling of forest products would likely see pre-haul maintenance if needed to make the roads passable to truck traffic, as well as maintenance during hauling and post haul maintenance. This maintenance would be in additional to a forest's regular schedule of maintenance.

Road Decommissioning- Under this alternative up to 200 miles of system road on the Coconino and Apache-Sitgreaves NFs could be decommissioned. The Tonto NF Travel Management EIS has identified approximately 290 miles of road within the Rim Country project area for decommissioning. In addition to system road decommissioning, up to 800 miles of unauthorized roads on all three forests may be decommissioned under this alternative.

Temporary Roads - Under Alternative 2 up to 330 miles of temporary road could be utilized to facilitate harvest activities. Under Alternative 3 up to 170 miles of temporary road could be utilized to facilitate harvest activities. These temporary roads may be new construction or also utilize existing unauthorized roads. Temporary roads would be decommissioned when harvesting and related restoration work is completed in the area that they access.

On June 11 2018, the Forest Operation Specialist met with the 4FRI Wildlife Biologist and GIS Specialist to conduct analysis of the need for temporary roads to mechanically treat proposed acres in PACs. Of the 150 PACs in the 4FRI Rim Country project area, 111 of these have areas greater than 1,250 feet from an existing road. Twenty (20) of these (Table 3-**) have greater than 20 acres of habitat proposed for thinning. It was determined that, due to topography, ecological concerns (for the MSO, soils, and hydrology), and a small number of acres receiving treatment, these limited treatments would merit increased skidding lengths instead of temporary road construction. Therefore it was determined that no new temporary roads would be created in PACs in the 4FRI Rim Country project area.

Increased skid trail lengths for these acres were calculated with the hydrologist's recommendation to determine the acreage of these longer skid trails. As the table below shows, these increased skid trail lengths would affect an additional 10 acres of MSO Protected habitat.

Table 17. Proposed Thinning Acres and Skid Trail Lengths in MSO PACs

PAC Name	Acres Proposed for Mechanical Treatment	Approximate Skid Trail Length in Feet
Horton Canyon	145	2,640
Oak Springs	135	1,800
West Weber	132	1,250
Wolf Mountain	116	1,200
Pine Mountain	100	3,000
Colcord	99	2,000
Wingfield	88	1,200
Turkey Peak NW	80	2,000
Cove	72	1,800
Yellowjacket	63	1,800
Deer Lake	61	2,500
Colcord Canyon	54	2,600
Maintenance Yard	45	1,600
Wishbone	45	2,500
Pivot Rock Canyon	38	1,600
South Alder	34	1,500
Meadow Canyon	32	1,500
Turkey Peak NE	29	2,000
260 Trailhead	24	3,960
Maxwell	21	2,500

Smoke from Prescribed Fire

Smoke from broadcast and pile-burning could temporarily disturb MSOs. Pile burning occurs during the winter and would not be expected to have direct effects on nesting owls. Burning would be managed to minimize the accumulation of smoke in PACs during the breeding season. Short-term effects from smoke would be reduced by coordinating the timing and type of burning with wind direction, topography, time of year, and distance to PACs. Initial entry burning would not occur in nest cores during the breeding season and burning would be restricted during the breeding season in areas that may create smoke effects on occupied PACs. Prevailing southwest winds and the topography of the area typically act to lift smoke, carrying it away from ignitions sites. Areas selected to protect PACs by thinning and burning outside of the PAC were developed in conjunction with the 4FRI Rim Country team and with the USFWS. With this information in mind, along with the concept that the species presumably adapted and evolved with smoke from wildland fire, smoke-related effects from maintenance burning would not be substantial.

The use of prescribed fire brings inherent uncertainty. While this would be minimized through the use of ignition and control techniques, the sheer number of acres and discrete applications of fire (i.e., all or parts of 156 different PACs) increases the risk of fire burning out of prescription. While individual trees or pockets of torching could improve habitat conditions by adding diversity in dense, relatively homogeneous stands of pine-oak, the same action in other stands or larger areas of torching could create long-term adverse effects on MSO habitat. Adverse effects would only happen if burning exceeded prescription, therefore the degree of risk is unknown, unquantifiable, but remains a risk.

Smoke may have an adverse effect if predicted weather conditions change during burn operations. Smoke tends to settle into low-lying areas, including canyons which serve as owl habitat. Lung damage could occur if smoke settles into PACs with incubating adult or nestling MSOs for continuous days and nights. Lung damage could result from continuous exposure to high smoke levels. MSOs could be forced to alter foraging behavior as a result of extended smoke. Altered foraging behavior could leave owls vulnerable to predators. Under these circumstances, smoke settling into PACs could cause adverse effects. The risk of this is low due to the design features specifically developed to minimize this threat. However, some risk remains although it is considered low and is unquantifiable.

Wildfire

Fire hazard index and crown fire assessment was modeled for MSO and wildlife habitat types proposed for treatments. Fire modeling includes one treatment and two prescribed burns through the year 2029. After this period, maintenance burning is expected to maintain desired conditions across the project area or until further planning is needed. Fire hazard index and risk of crown fire was modeled for 120,975 acres in PACs, 10,288 acres in Nest/Roost recovery habitat, and 41,878 acres in foraging/non-breeding MSO recovery habitat. Tables 3-** and 3-** show the amount of each habitat type with risk ratings of Low, High, and Extreme by alternative. The existing condition shows that 49,889 acres, or 41 percent of all PACs within the project area, are at risk of high-severity wildfire. Alternative 2 reduces this risk to 29 percent of PACs, six percent of Nest/Roost recovery habitat, and one percent of Foraging/non-breeding habitat.

Table 18. Fire Hazard Index Modeled in MSO Habitat Types-- Existing Condition (Alternative 1)

MSO Habitat Type	Very Low Need For Treatment in Acres	%	Moderate Need for Treatment in Acres	%	Low Need for Treatment in Acres	%	High Need for Treatment in Acres	%	Extreme Need for Treatment in Acres	%
Protected PAC 120,970 Acres Modeled	29,277	24	19,049	16	22,761	19	32,865	27	17,024	14
Recovery Nest/Roost 10,288 Acres Modeled	2,678	26	2,054	20	1,381	13	2,112	21	2,063	20
Recovery Foraging/Non-Breeding 41,879 Acres Modeled	16,931	41	7,828	19	6,402	15	7,237	17	3,480	08

Table 19. Amount of Fire Hazard Index Modeled for Habitat by Alternative

Fire Hazard Index	Existing	Alternative 1	Alternative 2	Alternative 3
PAC	49,889 (41%)	57,191 (47%)	33,410 (28%)	33,105 (30%)
Nest/Roost Recovery	4,175 (41%)	4,992 (49%)	588 (06%)	778 (08%)
Foraging-other Recovery	10,717 (26%)	14,337 (34%)	372 (01%)	1,845 (04%)

The modeled potential for active and conditional crown fire (with percentages of each habitat type in the project area that could experience these categories of crown fire) is shown in Table 3-**. The action alternatives greatly reduce these risk categories of crown fire across MSO habitat types (Table 3-**). For example the risk of active and conditional crown fire in PACs is reduced to 28 percent in Alternative 2 from 50 percent in Alternative 1. Risk of active and conditional crown fire in Nest/Roost recovery habitat is reduced to just 407 acres (four percent) in Alternative 2, from 16,032 acres (50 percent) in Alternative 1. The risk of crown fire in Foraging/Non-breeding recovery habitat is reduced to 350 acres (one percent) in Alternative 2.

Table 90. Potential for Crown Fire Modeled in MSO Habitat Types in the Existing Condition

MSO Habitat Type	Active Crown Fire Acres	%	Conditional Crown Fire Acres	%	Passive Crown Fire Acres	%	Surface Fire Acres	%	Non-Burnable Acres	%
Protected PAC 122,222 Acres Modeled	43,630	36	14,613	12	37,352	31	24,996	20	1,632	1
Recovery Nest/Roost 10,289 Acres Modeled	3,773	37	1,029	10	3,363	33	2,103	20	20	>1
Recovery Foraging-Non-Breeding 41,879 Acres Modeled	10,210	24	4,879	12	16,540	40	10,043	24	206	>1

Mechanical Thinning and Prescribed Burning

Alternatives 2 and 3 would follow forest plan direction, including implementing guidelines from the revised MSO Recovery Plan (USDI FWS 2012). Cover types may have all or some of the direction for MSO habitats, depending on location and stand structure. The objective of Rim Country treatments in MSO habitat is to improve forest structure for owls as defined in the Recovery Plan and in the Flexible Toolbox Approach for Mechanical Treatments (Appendix 2).

In MSO PACs: Potentially thin and burn to improve structure, maintain and develop large trees, and reduce risk of high-severity fire in PACs. No mechanical treatments, but fire may be implemented, in 100-acre core areas. Outside core areas, trees may be thinned and/or prescribed fire implemented where feasible to improve forest structure and minimize undesirable fire effects. Promote irregular tree spacing to create canopy gaps more conducive to treatment with prescribed fire, retain old growth attributes, protect large oaks, and ensure snags and coarse woody debris post-fire. Develop treatments in coordination with FWS.

In MSO Recovery Habitat: Follow Table C3 in revised MSO Recovery Plan for potential future nest/roost habitat and provide for owl daily movements, dispersal, and foraging habitat.

In MSO Recovery Habitat outside of potential future Nest/Roost: follow forest plan guidance. Intent is to continue to develop replacement Nest/Roost where possible, otherwise treat to develop a diverse mix of heterogeneous stand structures and densities to provide for owl dispersal and foraging. Design Features have been added to mitigate disturbance to the MSO from these activities (Appendix C).

Because of planning and timing restrictions, noise disturbance to owls is not expected in PAC habitat where the majority of foraging is done by nesting owls. Owls foraging outside PACs during nesting season could potentially be displaced by thinning activities and increased truck traffic. Owls could also be displaced by harvest activities and increased truck traffic outside the nesting season. Displaced owls could be more vulnerable to predation.

Vehicular traffic would not simultaneously increase across the entire implementation area, but harvest-related traffic increases would occur in localized areas somewhere on the landscape for every year of implementation. Most traffic is expected to occur during diurnal hours when MSO activity would be minimal. However, hauling of materials from harvest locations to highways could occur at night when owls are active. Once harvest activities are complete, traffic is expected to return to pre-harvest levels.

The amount of traffic increases the risk of collisions between owls and trucks. There have been documented instances of spotted owls being hit by vehicles on paved and unpaved roads. Although little information is available on the frequency or conditions related to the risk of collisions, the assumption is being made that, because of the scale of increase in truck traffic, the risk of collisions with owls would increase. The threat of collisions would be reduced below existing conditions in the long-term as a result of road decommissioning.

Treatments in MSO habitat were modeled using FVS (see Vegetation Report). Tables 3-** to 3-** display the habitat variables important to the MSO and the modeled effects on them in 2019, 2029, and 2039.

MSO Protected Habitat

Table 21. FVS Modeled Effects on Key Habitat Variables in MSO Protected Habitat

PACs MC = 16,481 Acres Modeled PO = 56,180 Acres Modeled	Existing	No Action 2029	No Action 2039	Alt 2 2029	Alt 2 2039	Alt 3 2029	Alt 3 2039
Average of Tpa MC	1291	1170	1057	392	227	531	379
Average of Tpa PO	1276	1130	990	369	232	496	368
Average of BA MC	173	185	196	131	127	131	130
Average of BA PO	144	155	163	110	106	117	117
Average of SDI MC	398	414	425	253	218	262	235
Average of SDI PO	339	353	362	215	191	237	223
Average of QMD MC	6	6	7	9	12	9	12
Average of QMD PO	6	6	7	9	11	9	10
Average of SNAG 12-18” MC	4	3	3	8	5	7	5
Average of SNAG12-18” PO	2	3	3	5	5	5	4
Average of SNAG18-24” MC	2	1	1	3	2	2	2
Average of SNAG18-24” PO	1	1	1	1	1	1	1
Average of SNAG ≥ 24” MC	1	1	1	1	1	1	1
Average of SNAG ≥ 24” PO	0	0	0	1	1	1	1
Average of CANCOV MC	74	76	78	67	66	67	67
Average of CANCOV PO	69	71	73	62	61	64	64
Average of Surface Fuel TPA MC	29	33	35	28	27	27	27
Average of Surface Fuel TPA PO	20	23	25	18	19	19	20
Average of CWD 3”+ TPA MC	10	12	14	12	13	12	12
Average of CWD 3”+ TPA PO	8	9	10	8	9	9	9
Average of Surface Herb TPA MC	0.21	0.21	0.20	0.24	0.26	0.24	0.24
Average of Surface Herb TPA PO	0.21	0.21	0.21	0.23	0.23	0.22	0.22

PACs MC = 16,481 Acres Modeled PO = 56,180 Acres Modeled	Existing	No Action 2029	No Action 2039	Alt 2 2029	Alt 2 2039	Alt 3 2029	Alt 3 2039
Average of Surface Shrub TPA MC	0.40	0.37	0.34	0.63	0.73	0.55	0.65
Average of Surface Shrub TPA PO	0.23	0.23	0.23	0.24	0.24	0.24	0.25
Average of ALL_BA1 MC	1	1	1	0	0	0	0
Average of ALL_BA1 PO	1	1	1	0	0	0	0
Average of ALL_BA2 MC	15	15	14	7	3	8	5
Average of ALL_BA2 PO	13	16	18	5	3	8	7
Average of ALL_BA3 MC	49	51	52	28	23	31	26
Average of ALL_BA3 PO	47	47	47	27	22	30	27
Average of ALL_BA4 MC	51	52	56	37	36	36	37
Average of ALL_BA4 PO	42	46	48	35	35	37	37
Average of ALL_BA5 MC	30	38	43	31	33	30	33
Average of ALL_BA5 PO	22	25	28	23	25	23	25
Average of ALL_BA6 MC	26	29	32	28	31	26	29
Average of ALL_BA6 PO	18	20	22	19	21	19	21

In PACs, modelling shows that Trees per Acre is reduced in the action alternatives (2 and 3) as larger trees occupy more of this habitat type through time. The stand density index is also reduced as competition is lowered by treatments in PACs. A linear regression from basal area was used to estimate canopy cover. These estimates indicate that treatments will align with MSO Recovery Plan recommendations in mixed conifer with canopy cover higher than 60 percent and in pine oak, with canopy cover much higher than the recommended 40 percent, measuring above 60 percent in the action alternatives. The overall effect of treatments in PACs would be to increase large trees, as the quadratic mean diameter in inches is increased in Alternatives 2 and 3. Further, the current condition is maintained for the basal area average of all trees greater than 18-24 inches in diameter and the average of all trees greater than 24 inches in diameter in Alternatives 2 and 3. Shrub and herbaceous biomass would also be maintained or increase in Alternatives 2 and 3. Maintaining the current condition in PACS, while reducing risk of crown fire and the fire hazard index (decreasing fuel loading), and increasing coarse woody debris, downed logs, and snags of all size classes, are desired effects from treatments on MSO protected habitat.

Nest/Roost Recovery Habitat

Though these areas are distinct from PACs, their management objectives are similar. Any treatment proposed within MSO nest/roost recovery habitat should be designed specifically to maintain or accelerate the trajectory of these stands towards desired habitat conditions in the foreseeable future. Achieving management objectives within MSO recovery habitat can be addressed with the flexible toolbox approach. Stands in recovery habitat would be assigned a treatment using the decision matrices in the Flexible Toolbox Approach for Mechanical Treatments and with associated design features (Appendix C).

Table 3-** shows the modeled effects from vegetation treatments by alternative to key MSO habitat variables in MSO Nest/Roost Recovery Habitat. As within PACs, the results of the action alternatives in MSO Nest/Roost Recovery habitat are that, while slightly reducing some variables in PACs, the treatments would maintain or increase most variables while treating and ultimately conserving these conditions over time.

Preserving MSO habitat by using thinning and burning treatments, while promoting large trees and reducing risk of fire hazard index and crown fire, is one of the main objectives of the action alternatives in Rim Country (returning resiliency to the forested ecosystem). Reducing trees per acre and the stand density index would greatly reduce competition in stands which, in conjunction with silvicultural prescriptions, would promote growth of large trees. These estimates indicate that treatments will align with MSO Recovery Plan recommendations, staying above 60 percent canopy cover in mixed conifer and well above 40 percent in pine oak. As with PACs, reducing the overall basal area average and canopy cover is not a desired outcome of treatment; however, reducing trees per acre and the stand density index would greatly reduce competition in stands which, in conjunction with silvicultural prescriptions, would promote growth of large trees. The quadratic mean diameter in inches would increase with the action alternatives, showing that this trend toward larger trees would be achieved. Increases in snags of all size classes and increases in shrub and herbaceous biomass are desired outcomes from treatments. Reductions in surface fuel and creation of interspaces and uneven-aged management would conserve MSO Nest/Roost Recovery habitat over time. Fire hazard index and risk of crown fire would be greatly reduced as a result of treatment (see Fire Ecology section for effects from the action alternatives).

Table 22. FVS Modeled Effects on Key Habitat Variables in MSO Nest/Roost Recovery Habitat

NR Recovery MC = 11,065 Acres Modeled PO = 13,539 Acres Modeled GM. = 3,940 Acres Modeled on Tonto NF	Existing	No Action 2029	No Action 2039	Alt 2 2029	Alt 2 2039	Alt 3 2029	Alt 3 2039
Avg of Trees per Acre MC	1100	982	873	167	116	204	155
Avg of Trees per Acre PO	1280	1167	1052	217	137	521	432
Avg of Trees per Acre GM	1351	1231	1134	161	109	231	176

NR Recovery MC = 11,065 Acres Modeled PO = 13,539 Acres Modeled GM. = 3,940 Acres Modeled on Tonto NF	Existing	No Action 2029	No Action 2039	Alt 2 2029	Alt 2 2039	Alt 3 2029	Alt 3 2039
Avg of Basal Area MC	188	199	209	126	127	122	124
Avg of Basal Area PO	164	172	178	114	112	127	127
Avg of Basal Area GM	190	196	199	107	102	109	106
Avg of Stand Density Index MC	420	431	438	208	197	208	199
Avg of Stand Density Index PO	369	377	380	200	183	243	231
Avg of Stand Density Index GM	441	444	445	182	164	195	179
Avg of Quadratic Mean Diameter in Inches MC	6	7	8	14	16	13	15
Avg of Quadratic Mean Diameter in Inches PO	7	7	8	12	14	11	13
Avg of Quadratic Mean Diameter in Inches GM	6	6	6	12	14	12	6
Average of SNAG 12-18” MC	4	4	4	5	3	5	3
Average of SNAG 12-18” PO	3	4	4	5	4	5	4
Average of SNAG 12-18” GM	3	4	3	6	4	6	4
Average of SNAG 18-24” MC	1	1	2	2	2	2	2
Average of SNAG 18-24” PO	1	1	1	2	2	1	2
Average of SNAG 18-24” GM	1	1	1	2	1	1	1
Average of SNAG ≥ 24” MC	1	1	1	1	1	1	1
Average of SNAG ≥ 24” PO	0	0	0	1	1	1	1
Average of SNAG ≥ 24” GM	0	0	0	1	1	1	1
Percent CANCOV MC	76	78	79	66	66	65	65

NR Recovery MC = 11,065 Acres Modeled PO = 13,539 Acres Modeled GM. = 3,940 Acres Modeled on Tonto NF	Existing	No Action 2029	No Action 2039	Alt 2 2029	Alt 2 2039	Alt 3 2029	Alt 3 2039
Percent CANCOV PO	73	74	76	64	62	66	66
Percent CANCOV GM	77	77	78	61	60	62	61
Avg of Surface Fuel tons per acre MC	30	34	37	24	23	23	22
Avg of Surface Fuel tons per acre PO	19	23	26	17	18	19	19
Avg of Surface Fuel tons per acre GM	23	27	29	19	18	20	19
Avg of Coarse Woody Debris 3”+ tons per acre MC	10	12	14	10	10	10	10
Avg of Coarse Woody Debris 3”+ tons per acre PO	6	8	9	8	8	8	8
Avg of Coarse Woody Debris 3”+ tons per acre GM	10	12	13	11	11	11	11
Avg of Herbaceous tons per acre MC	0.21	0.20	0.20	0.26	0.26	0.25	0.26
Avg of Herbaceous tons per acre PO	0.21	0.21	0.21	0.24	0.24	0.23	0.23
Avg of Herbaceous tons per acre GM	0.20	0.20	0.20	0.25	0.23	0.25	0.23
Average of Shrubs tons per acre MC	0.40	0.37	0.34	0.74	0.78	0.70	0.73
Average of Shrubs tons per acre PO	0.22	0.22	0.22	0.19	0.19	0.21	0.20
Average of Shrubs tons per acre GM	0.25	0.24	0.25	0.30	0.30	0.31	0.30
Avg of ALL BA1 0-1” MC	1	1	0	0	0	0	0

NR Recovery MC = 11,065 Acres Modeled PO = 13,539 Acres Modeled GM. = 3,940 Acres Modeled on Tonto NF	Existing	No Action 2029	No Action 2039	Alt 2 2029	Alt 2 2039	Alt 3 2029	Alt 3 2039
Avg of ALL BA1 0-1” PO	1	1	0	0	0	0	0
Avg of ALL BA1 0-1” GM	1	1	1	0	0	0	0
Avg of ALL BA2 1-5” MC	12	12	13	1	1	2	2
Avg of ALL BA2 1-5” PO	10	11	13	2	1	3	3
Avg of ALL BA2 1-5” GM	14	15	16	1	1	2	2
Avg of ALL BA3 5-12” MC	39	40	39	13	10	15	12
Avg of ALL BA3 5-12” PO	41	40	38	16	12	22	19
Avg of ALL BA3 5-12” GM	54	53	51	14	11	17	14
Avg of ALL BA4 12-18” MC	61	59	58	32	29	33	30
Avg of ALL BA4 12-18” PO	54	54	54	34	32	38	35
Avg of ALL BA4 12-18” GM	61	62	63	31	27	33	29
Avg of ALL BA5 18-24” MC	43	52	57	44	45	42	43
Avg of ALL BA5 18-24” PO	37	44	47	39	41	41	42
Avg of ALL BA5 18-24” GM	31	36	38	33	31	31	31
Avg of ALL BA6 24” + MC	32	36	42	35	42	31	37
Avg of ALL BA6 24” + PO	21	23	25	23	27	23	27
Avg of ALL BA6 24” + GM	28	29	31	27	33	26	30

Foraging/Non-breeding Recovery Habitat

Design features (Appendix C) are included in both action alternatives, to use the following guidelines from the most current Mexican Spotted Owl Recovery Plan in Mexican spotted owl recovery foraging/non-breeding habitat:

1. Crown spacing between tree groups (interspace) would average 25 to 60 feet distance, providing for forest health, prey habitat development, and to move toward or facilitate stand conditions more conducive to low-severity fire.

2. Tree thinning in pine-oak would target 40 to 110 basal area; thinning in mixed conifer would target 40 to 135 basal area. The goal is to manage for a sustainable range of density and structural characteristics.

3. No trees greater than 24 inches in diameter would be cut and trees greater than 18 inches would be retained, unless overriding management situations require their removal.

Table 3-** shows the modeled effects from vegetation treatments by alternative to key MSO habitat variables in pine-oak, mixed conifer, and using the geophysical model (Tonto NF) in MSO Foraging/Non-breeding Recovery Habitat.

Table 23. FVS Modeled Effects on Key Habitat Variables in MSO Foraging/Non-breeding Recovery Habitat

Foraging/Non-breeding Recovery MC = 21,220 Acres Modeled PO = 85,458 Acres Modeled GM = 31,659 Acres Modeled on Tonto NF	Existing	No Action 2029	No Action 2039	Alt 2 2029	Alt 2 2039	Alt 3 2029	Alt 3 2039
Average of Tpa MC	1398	1242	1101	154	97	377	304
Average of Tpa PO	1192	1067	952	153	81	479	394
Average of Tpa GM	1443	1308	1196	107	73	289	244
Average of BA MC	157	170	182	76	75	89	91
Average of BA PO	140	150	158	68	66	96	98
Average of BA GM	170	177	182	63	59	84	82
Average of SDI MC	376	394	406	133	121	172	165
Average of SDI PO	329	343	351	123	108	198	192
Average of SDI GM	407	414	416	108	95	162	151
Average of QMD MC	5	6	6	12	14	11	13
Average of QMD PO	6	6	7	11	14	10	12
Average of QMD GM	5	6	6	12	14	11	13
Average of SNAG 12-18” MC	3	3	3	4	3	4	3
Average of SNAG 12-18” PO	2	2	3	4	3	3	3
Average of SNAG 12-18” GM	2	2	2	5	3	5	3
Average of SNAG 18-24” MC	1	1	1	2	2	2	2
Average of SNAG 18-24” PO	1	1	1	1	1	1	1
Average of SNAG 18-24” GM	1	0	0	2	2	1	1
Average of SNAG ≥ 24” MC	1	1	0	1	1	1	1
Average of SNAG ≥ 24” PO	0	0	0	0	0	0	0
Average of SNAG ≥ 24” GM	0	0	0	1	1	1	1

Foraging/Non-breeding Recovery MC = 21,220 Acres Modeled PO = 85,458 Acres Modeled GM = 31,659 Acres Modeled on Tonto NF	Existing	No Action 2029	No Action 2039	Alt 2 2029	Alt 2 2039	Alt 3 2029	Alt 3 2039
Percent CANCOV MC	71	74	75	51	51	56	57
Percent CANCOV PO	69	70	72	48	47	59	59
Percent CANCOV GM	74	75	76	46	45	54	53
Average of Surface Fuel TPA MC	24	28	32	17	15	19	18
Average of Surface Fuel TPA PO	16	20	22	12	12	15	15
Average of Surface Fuel TPA GM	19	22	24	13	12	15	14
Average of CWD 3”+ TPA MC	8	10	12	9	8	9	8
Average of CWD 3”+ TPA PO	5	6	8	6	6	6	6
Average of CWD 3”+ TPA GM	6	7	9	8	7	7	7
Average of Surface Herb TPA MC	0.21	0.20	0.20	0.27	0.27	0.26	0.26
Average of Surface Herb TPA PO	0.21	0.21	0.21	0.26	0.25	0.24	0.24
Average of Surface Herb TPA GM	0.19	0.19	0.19	0.26	0.26	0.25	0.25
Average of Surface Shrub TPA MC	0.29	0.28	0.26	0.68	0.71	0.62	0.65
Average of Surface Shrub TPA PO	0.22	0.23	0.23	0.20	0.17	0.22	0.21
Average of Surface Shrub TPA GM	0.27	0.26	0.26	0.35	0.34	0.33	0.31
Average of ALL_BA1 MC	1	1	1	0	0	0	0
Average of ALL_BA1 PO	1	1	1	0	0	0	0

Foraging/Non-breeding Recovery MC = 21,220 Acres Modeled PO = 85,458 Acres Modeled GM = 31,659 Acres Modeled on Tonto NF	Existing	No Action 2029	No Action 2039	Alt 2 2029	Alt 2 2039	Alt 3 2029	Alt 3 2039
Average of ALL_BA1 GM	1	1	1	0	0	0	0
Average of ALL_BA2 MC	15	18	19	2	1	4	4
Average of ALL_BA2 PO	11	13	14	1	1	5	5
Average of ALL_BA2 GM	16	17	18	1	0	4	4
Average of ALL_BA3 MC	47	46	45	10	7	16	13
Average of ALL_BA3 PO	48	47	46	11	7	24	21
Average of ALL_BA3 GM	64	64	62	8	5	19	16
Average of ALL_BA4 MC	48	51	54	20	18	24	23
Average of ALL_BA4 PO	44	49	50	21	19	30	30
Average of ALL_BA4 GM	49	52	54	19	16	25	23
Average of ALL_BA5 MC	28	34	39	26	26	26	27
Average of ALL_BA5 PO	22	26	30	21	22	22	24
Average of ALL_BA5 GM	22	24	27	20	21	21	22
Average of ALL_BA6 MC	17	20	23	19	23	19	23
Average of ALL_BA6 PO	13	15	16	15	17	15	17
Average of ALL_BA6 GM	17	19	20	16	16	16	17

In MSO Foraging/Non-breeding Recovery habitat, treatments would maintain or increase most habitat variables beneficial to the MSO, its critical habitat, and its prey species, while conserving these conditions over time (Table 3-**). These treatments would preserve Foraging/Non-Breeding Recovery habitat by thinning and burning while promoting large trees and reducing the fire hazard index and the risk of crown fire. A linear regression from basal area was used to estimate canopy cover. These estimates indicate that treatments will align with MSO Recovery Plan recommendations. The quadratic mean diameter in inches would increase with the action alternatives, showing that this trend toward larger trees would be achieved. Increases in snags of all size classes and increases in shrub and herbaceous biomass are desired outcomes from treatment. Reductions in surface fuel and creation of interspaces and uneven aged management would conserve MSO Foraging/Non-Breeding Recovery habitat over time. Fuel loads, the fire hazard index, and the risk of crown fire would be greatly reduced as a result of treatments (see Fire Ecology section for effects from the action alternatives).

Alternative 2 – Proposed Action

Under Alternative 2, mechanical treatments would occur in portions of all MSO habitats, except for core areas which would be only be burned (see Table 3-**). Total treatments in MSO habitat include 241,585 acres of mechanical thinning and low-severity prescribed fire (about 71 percent of the total MSO habitat in the project area). This represents the largest number of MSO habitat acres ever treated with prescribed fire. The minimum post-treatment basal area for nesting and roosting habitat would be 110 square feet per acre. Adjustments would be made during implementation to retain a basal area of at least 110 square feet per acre wherever possible. Low-severity prescribed fire would be applied to all MSO habitats. No trees greater than 24 inches in diameter would be cut in MSO habitat. Trees up to 18 inches in diameter could be thinned in PACs. Treatments in recovery nest/roost habitat would be designed to move forests toward nest/roost habitat conditions. Treatments in nest/roost habitat would not lower forest structure values below the minimum nest/roost levels described in the forest plans and in Table C.3 of the Revised Recovery Plan (USDI FWS 2012b). It is assumed that mechanical treatments and two low-severity fires would be implemented during the project's lifespan (2019-2049).

Mechanical thinning and low-severity prescribed fire would take place at different times in different locations. MSO habitat could be affected by mechanical treatments in one area while prescribed fire occurs in another area in the same period of time. It is anticipated that implementation of all proposed treatments would require 20 or more years to complete.

Table 24. Alternative 2 Thinning and Burning Treatments in MSO Habitat

Treatment Type	MSO Habitat Types			
	Protected	Nest/roost Recovery	Foraging/Non-Breeding Recovery	Total Acres
Prescribed Fire Only[1]	49,066			49,066
Thinning+ Prescribed Fire	24,873	28,235	138,801	191,909
Prescribed Burns in Core Areas	610			610
Total	74,549			241,585
No Proposed Treatments	7075			7,075
Total Analysis Acres	81,624	28,235	138,801	248,660

1. A single prescribed fire may include burning piles and a follow-up broadcast burn. Prescribed fire would be implemented as indicated by monitoring data to augment wildfire acres, with the expectation that desired conditions would require a fire return interval of about 10 years.

2. These areas would be treated as planned through other NEPA decisions for other project areas.

Table 25. Acres of Treatments in MSO Habitat Types, Alternative 2

MSO Habitat Type	Cover Type	Aspen	Grass land or Meadow	Madrean Pinyon Oak	M/C with Aspen	Mixed Conifer Frequent Fire	Other	PJ	Ponderosa Pine	Ponderosa Pine/Evergreen Oak	Riparian	Total
Protected	PAC	169	123	945	324	11265	622	4468	41741	6260	1699	67617
	PAC - Core Area	64	18	339	145	3961	16	758	6281	1452	434	13469
Recovery Replacement Nest/Roost			278	246	613	9327		56	13318	3317	1079	28235
	Geophysical Model Tonto NF			246				56	1796	1653	265	4017
	Mixed Conifer		86		613	9327			376		372	10774
	Pine-Oak		192						11146	1664	442	13444
Recovery Foraging/Non-Breeding			459	2176	1424	17391	486	1017	79328	34031	2490	138801
	Geophysical Model Tonto NF			2176			486	904	8461	18597	1160	31786
	Mixed Conifer		159		1424	17391			1095	777	573	21418
	Pine-Oak		299					113	69772	14657	757	85598
	Grand Total	**233**	**878**	**3707**	**2506**	**41943**	**1125**	**6299**	**140668**	**45061**	**5703**	**248123**

Protected Habitat

There are 196 PACs (110,890 acres) within the project area. Approximately 7,075 acres occur in other project areas that overlap with the Rim Country project area but would be treated as those projects were planned and consulted on with the FWS. Approximately 17, 500 acres that also occur in other overlapping project areas would have some other type of restoration (riparian, wet meadow, grassland, aspen). Under Alternative 2, 81,624 acres (73 percent) of protected MSO habitat are proposed for thinning and/or burning or other restoration activities. Therefore, most of the protected habitat of the PACs in the Rim Country project area not associated with other projects would have some type of vegetation treatment. Most vegetation treatments (greater than 60 percent) would be prescribed fire only. Little change would occur in forest structure and MSO prey habitat from low-severity fire treatments.

In PACs, Alternative 2 would allow cutting trees up to 18 inches in diameter. All stands identified for mechanical thinning would be marked by hand and marking would be coordinated with the FWS. No mechanical treatments would occur in core areas. Design features (Appendix C) were included to minimize effects on owls and to promote Primary Constituent Habitat Elements recommended by the MSO Recovery Plan and the forest plans. Mechanical treatments in PACs are summarized in the Effects Common to Both Action Alternatives section. The Mechanical Treatments Flexible Toolbox Approach contains the following language for treatments in PACs:

PACs exhibit a variety of topographic and forest conditions and occupied PACs can already be considered successful nesting habitat. Mechanical treatments in PACs should be designed to maintain or improve the characteristics that make each PAC effective at providing habitat while also making them resilient to disturbance. Consideration should be given to 1) increasing the number of large trees; 2) creating additional foraging habitat for MSO; 3) the fire hazard index in the PAC and whether it is in wildland-urban interface (WUI); 4) restoration/protection of other resource values nearby, such as perennial water; and 5) protecting other values at risk. Treating areas near PACs should be considered in order in improve resiliency in the PACs themselves. PACs should be treated with consideration of the larger landscape and not just separate entities. Specific treatments in PACs would be determined prior to implementation and in coordination with U.S. Fish and Wildlife Service (FWS) personnel.

Table 26. Summary of treatments in PACs, Alternative 2

Proposed Treatment	- Alternative 2 - Modified Proposed Action Acres
PAC - Aspen Restoration	28
PAC - Facilitative Operations Mechanical	301
PAC - Facilitative Operations Prescribed Fire Only	6,882
PAC - Grassland Prescribed Fire Only	41
PAC - Grassland Restoration	23
PAC – Mechanical	17,464
PAC - Prescribed Fire Only	50,832
PAC - Riparian Prescribed Fire Only	911
PAC - Riparian Restoration	1,775
PAC - Severe Disturbance Area Treatment	3,606
PAC - Wet Meadow & Riparian Prescribed Fire Only	32
PAC - Wet Meadow & Riparian Restoration	98
PAC - Wet Meadow Prescribed Fire Only	33
PAC - Wet Meadow Restoration	254
Total	**82,279**

Forest Structure

Under Alternative 2, the FVS modeling of treatments over the next 30 years indicates that most forest structure, as it pertains to Primary Constituent Elements important to the MSO in PACs, is preserved through time. Trees per acre would be reduced from the existing 1,291 in mixed conifer and 1,276 in pine-oak, to 227 in mixed conifer and 232 in pine-oak in 2039 (Table 3-**). Reducing trees per acre closer to NRV protects PACs and restores conditions for MSO by managing for less dense and encroached forested conditions. Openings created by bringing tree size classes to desired condition would provide habitat for a variety of prey species and would slow or reduce fire severity by breaking the continuity of dense tree canopies and ladder fuels.

Table 27. FVS Modeled Effects on Key Habitat Variables in Protected MSO Habitat from Alternative 2

PACs MC = 16,481 Acres Modeled PO = 56,180 Acres Modeled	Existing	Alt 2 2029	Alt 2 2039
Average of Tpa MC	1291	392	227
Average of Tpa PO	1276	369	232
Average of BA MC	173	131	127
Average of BA PO	144	110	106
Average of SDI MC	398	253	218
Average of SDI PO	339	215	191
Average of QMD MC	6	9	12
Average of QMD PO	6	9	11
Average of SNAG 12-18” MC	4	8	5
Average of SNAG12-18” PO	2	5	5
Average of SNAG18-24” MC	2	3	2
Average of SNAG18-24” PO	1	1	1
Average of SNAG ≥ 24” MC	1	1	1
Average of SNAG ≥ 24” PO	0	1	1
Average of CANCOV-BA Regression MC	74	67	66
Average of CANCOV-BA Regression PO	69	62	61
Average of Surface Fuel TPA MC	29	28	27
Average of Surface Fuel TPA PO	20	18	19
Average of CWD 3”+ TPA MC	10	12	13
Average of CWD 3”+ TPA PO	8	8	9
Average of Surface Herb TPA MC	0.21	0.24	0.26

PACs MC = 16,481 Acres Modeled PO = 56,180 Acres Modeled	Existing	Alt 2 2029	Alt 2 2039
Average of Surface Herb TPA PO	0.21	0.23	0.23
Average of Surface Shrub TPA MC	0.40	0.63	0.73
Average of Surface Shrub TPA PO	0.23	0.24	0.24
Average of ALL_BA1 MC	1	0	0
Average of ALL_BA1 PO	1	0	0
Average of ALL_BA2 MC	15	7	3
Average of ALL_BA2 PO	13	5	3
Average of ALL_BA3 MC	49	28	23
Average of ALL_BA3 PO	47	27	22
Average of ALL_BA4 MC	51	37	36
Average of ALL_BA4 PO	42	35	35
Average of ALL_BA5 MC	30	31	33
Average of ALL_BA5 PO	22	23	25
Average of ALL_BA6 MC	26	28	31
Average of ALL_BA6 PO	18	19	21

The average of all basal areas from saplings (Size Class 1) to old or large trees (Size Class 6) show that intermediate-sized trees (Size 3 with BA 5-12 inches and Size 4 with BA 12-18 inches are currently predominant on the landscape and vastly departed from NRV) would be lowered closer to desired condition as a result of treatments through 2049. The basal area average would be decreased from the existing 173 in mixed conifer and 144 in pine-oak, to 127 in mixed conifer and 106 in pine-oak in 2039. Increase basal area size classes for older trees and reducing medium-aged over-abundant size classes to NRV would benefit the MSO through reduction of over-encroached forest conditions. Further, this would increase vertical and horizontal habitat heterogeneity providing roosting options, thermal and hiding cover for the MSO and habitat for a variety of prey species.

The percent average canopy cover would be reduced from an existing 74 percent in mixed conifer and 69 percent in pine-oak, to 66 percent in mixed conifer and 61 percent in pine-oak in

2039. Retaining canopy cover allows for a thermal environment needed for nesting and roosting conditions for the MSO while allowing for prey base and for species that require interlocking crown habitat. Design features (Appendix C) would preserve the recommended habitat conditions in PACs wherever possible, while protecting this habitat from severe fire intensity or stand-replacing effects from crown fire (see the Fire Effects section for Alternative 2 below).

Promotion of large tree growth would be achieved from proposed treatments in Alternative 2 as stand density index would change from the existing 398 in mixed conifer and 339 in pine-oak, to 218 in mixed conifer and 191 in pine-oak in 2039.

A reduction in SDI competition would increase the quadratic mean diameter from the existing 6 inches in both mixed conifer and pine-oak, to 12 inches in mixed conifer and 11 inches in pine-oak in 2039. By emphasizing large trees, this should also provide for MSO life history needs (nesting and roosting) and provide for large snags and logs (Gainey et al. 2003).in 2049.

Snags

In PACs, standing snags, coarse woody debris, and downed logs over 12 inches would all increase as a result of treatments under Alternative 2 (Table 3-**). These Primary Constituent Element habitat variables important to the MSO and MSO prey species would be preserved over time under this action alternative.

Snags 12 to 18 inches in diameter would increase from four per acre in mixed conifer and two per acre in pine-oak to five per acre in both cover types in 2039. Snags 24 inches in diameter and greater would increase from one per acre in mixed conifer and 0 in pine-oak (existing) to one per acre in both cover types over 20 years. Retaining/increasing key habitat elements for the MSO such as snags of various sizes to provide for nesting and roosting and for prey habitat follows guidance from the MSO Revised Recovery Plan (2012). This is a long-term benefit to the MSO as a result of treatments in Alternative 2.

Coarse Woody Debris and Understory

In PACs, large downed logs 12 or more inches in size would increase from one to four tons per acre as a result of treatments over 30 years. Coarse woody debris would increase from the existing 5.68 tons per acre to 7.61 tons per acre in 2049.

Herbaceous biomass in tons per acre would increase slightly over 20 years. The existing 0.2 tons per acre in both mixed conifer and pine-oak cover types would increase to 0.26 tons per acre in mixed conifer and 0.23 tons per acre in pine-oak in 2039. Treatments would move the existing shrub biomass from 0.40 tons per acre in mixed conifer to 0.73 in 2039. Increasing these Primary Constituent Elements important to prey base for the MSO would be an added benefit from treatments in PACs in this alternative.

Fire Effects

Surface fuel loading in MSO Protected Habitat would be reduced under Alternative 2, moving from an existing 29 tons per acre in mixed conifer and 20 tons per acre in pine-oak, to 27 tons per acre in mixed conifer and 19 in pine-oak in 2039.

Fire modeling in PACs for Alternative 2 shows the least benefit from treatment compared to other habitat types, as the objective in PACs is to provide interlocking crowns with larger proportions of woody debris and snags which can serve as ladder fuels. This complicates quantifying effects from treatments showing fewer acres of protected habitat benefiting from treatment than in surrounding habitats (see Recovery Habitat analyses below). Further, by analyzing the highest hazard categories for Fire Hazard Index and potential for active crown fire, treatment in PACs shows greater differences/benefits for preserving existing protected habitat while treating surrounding habitats at a higher level.

Fire Hazard Index would decrease from Alternative 2 from 91,697 acres (76 percent of the PACs in the project area in need of treatment) in existing condition to 83,832 acres (69 percent). The highest and extreme need for treatment categories of Fire Hazard Index from Alternative 2 in PACs would be 33,410 acres (27 percent) of all PACs in the project area expected to experience high-severity wildfire. This is decreased from 49,888 acres (41 percent) of all PACs in the existing condition. Reductions of this magnitude should preserve existing MSO habitat while encouraging conditions to create more over time through recovery habitats.

Table 28. Fire Hazard Index in MSO Habitat Types, Alternative 2

MSO Habitat Type	Very Low Need For Treatment in Acres	%	Moderate Need for Treatment in Acres	%	Low Need for Treatment in Acres	%	High Need for Treatment in Acres	%	Extreme Need for Treatment in Acres	%
Protected PAC 120,970 Acres Modeled	37,145	31	19,295	16	31,127	26	21,666	18	11,744	9
Recovery Nest/Roost 10,288 Acres Modeled	6,538	64	888	09	2,274	22	331	03	258	02
Recovery Foraging/Non-Breeding 41,879 Acres Modeled	35,018	84	462	01	6,027	14	252	>01	120	>01

The potential for active and conditional crown fire would be decreased in Alternative 2 from 58,243 acres (48 percent) to 34,068 acres (28 percent) of this habitat type that would experience high-severity crown fire as a result of treatment (Table 3-**).

Table 29. Amount of Fire Types Expected in MSO Habitat Types, Alternative 2

MSO Habitat Type	Active Crown Fire Acres	%	Conditional Crown Fire Acres	%	Passive Crown Fire Acres	%	Surface Fire Acres	%	Non-Burnable Acres	%
Protected PAC 122,222 Acres Modeled	30,761	25	3,307	3	61,675	50	24,888	20	1,592	01
Recovery Nest/Roost 10,289 Acres Modeled	392	04	15	>01	5,822	56	4,039	39	20	>01
Recovery Foraging-Non-Breeding 41,879 Acres Modeled	339	>01	11	>01	28,863	69	12,459	30	206	>01

Nest/Roost Recovery

There are 39,461 acres of Nest/Roost Recovery Habitat in the Rim Country project area. Many of these acres (28,554 acres or 72 percent) could receive thinning and fire treatments under Alternative 2. The Mechanical Treatments Flexible Toolbox Approach (Appendix D) states the following for Nest/Roost Recovery Habitat:

Though these areas are distinct from PACs, their management objectives are similar. Any treatment proposed within MSO nest/roost recovery habitat should be designed specifically to maintain or accelerate the trajectory of these stands towards desired habitat conditions in the foreseeable future.

Design features for this project (Appendix C) would ensure that Primary Constituent Elements of habitat important to the MSO and its prey base are promoted through these treatments. Table 3-** summarizes the mechanical treatments in Nest/Roost Recovery Habitat in Alternative 2.

Table 30. Mechanical and Fire Treatments in MSO Nest/Roost Recovery Habitat, Alternative 2

Proposed Treatment	- Alternative 2 - Modified Proposed Action Acres
Mixed Conifer Recovery NR	**11,065**
Facilitative Operations Mechanical	577
Facilitative Operations Prescribed Fire Only	38
MSO Recovery - Replacement Nest/Roost	9,579
Prescribed Fire Only	165
Riparian Prescribed Fire Only	21
Riparian Restoration	510
Wet Meadow & Riparian Restoration	33
Wet Meadow Restoration	143
Pine-Oak Recovery NR	**13,539**
Grassland Restoration	71
MSO Recovery - Replacement Nest/Roost	12,328
Prescribed Fire Only	270
Riparian Prescribed Fire Only	69
Riparian Restoration	596

Wet Meadow & Riparian Prescribed Fire Only	148
Wet Meadow & Riparian Restoration	4
Wet Meadow Restoration	53
Geophysical Model Recovery NR	**3,940**
Facilitative Operations Mechanical	303
MSO Recovery - Replacement Nest/Roost	3,324
Riparian Restoration	313
Grand Total	28,554

Table 31. Habitat Variables Analyzed in Nest/Roost MSO Recover Habitat, Alternative 2

NR Recovery MC = 11,065 Acres Modeled PO = 13,539 Acres Modeled Geophys. = 3,940 Acres Modeled	Existing	Alt 2 2029	Alt 2 2039
Avg of Trees per Acre MC	1100	167	116
Avg of Trees per Acre PO	1280	217	137
Avg of Trees per Acre GM	1351	161	109
Avg of Basal Area MC	188	126	127
Avg of Basal Area PO	164	114	112
Avg of Basal Area GM	190	107	102
Avg of Stand Density Index MC	420	208	197
Avg of Stand Density Index PO	369	200	183
Avg of Stand Density Index GM	441	182	164
Avg of Quadratic Mean Diameter in Inches MC	6	14	16
Avg of Quadratic Mean Diameter in Inches PO	7	12	14
Avg of Quadratic Mean Diameter in Inches GM	6	12	14

NR Recovery MC = 11,065 Acres Modeled PO = 13,539 Acres Modeled Geophys. = 3,940 Acres Modeled	Existing	Alt 2 2029	Alt 2 2039
Average of SNAG 12-18” MC	4	5	3
Average of SNAG 12-18” PO	3	5	4
Average of SNAG 12-18” GM	3	6	4
Average of SNAG 18-24” MC	1	2	2
Average of SNAG 18-24” PO	1	2	2
Average of SNAG 18-24” GM	1	2	1
Average of SNAG ≥ 24” MC	1	1	1
Average of SNAG ≥ 24” PO	0	1	1
Average of SNAG ≥ 24” GM	0	1	1
Percent CANCOV MC	76	66	66
Percent CANCOV PO	73	64	62
Percent CANCOV GM	77	61	60
Avg of Surface Fuel tons per acre MC	30	24	23
Avg of Surface Fuel tons per acre PO	19	17	18
Avg of Surface Fuel tons per acre GM	23	19	18
Avg of Coarse Woody Debris 3”+ tons per acre MC	10	10	10
Avg of Coarse Woody Debris 3”+ tons per acre PO	6	8	8
Avg of Coarse Woody Debris 3”+ tons per acre GM	10	11	11
Avg of Herbaceous tons per acre MC	0.21	0.26	0.26

NR Recovery MC = 11,065 Acres Modeled PO = 13,539 Acres Modeled Geophys. = 3,940 Acres Modeled	Existing	Alt 2 2029	Alt 2 2039
Avg of Herbaceous tons per acre PO	0.21	0.24	0.24
Avg of Herbaceous tons per acre GM	0.20	0.25	0.23
Average of Shrubs tons per acre MC	0.40	0.74	0.78
Average of Shrubs tons per acre PO	0.22	0.19	0.19
Average of Shrubs tons per acre GM	0.25	0.30	0.30
Avg of ALL BA1 0-1” MC	1	0	0
Avg of ALL BA1 0-1” PO	1	0	0
Avg of ALL BA1 0-1” GM	1	0	0
Avg of ALL BA2 1-5” MC	12	1	1
Avg of ALL BA2 1-5” PO	10	2	1
Avg of ALL BA2 1-5” GM	14	1	1
Avg of ALL BA3 5-12” MC	39	13	10
Avg of ALL BA3 5-12” PO	41	16	12
Avg of ALL BA3 5-12” GM	54	14	11
Avg of ALL BA4 12-18” MC	61	32	29
Avg of ALL BA4 12-18” PO	54	34	32
Avg of ALL BA4 12-18” GM	61	31	27
Avg of ALL BA5 18-24” MC	43	44	45
Avg of ALL BA5 18-24” PO	37	39	41
Avg of ALL BA5 18-24” GM	31	33	31
Avg of ALL BA6 24” + MC	32	35	42
Avg of ALL BA6 24” + PO	21	23	27

NR Recovery MC = 11,065 Acres Modeled PO = 13,539 Acres Modeled Geophys. = 3,940 Acres Modeled	Existing	Alt 2 2029	Alt 2 2039
Avg of ALL BA6 24" + GM	28	27	33

Forest Structure

Under Alternative 2, the FVS modeling from treatments over the next 30 years indicate that most forest structure, as it pertains to Primary Constituent Elements important to the MSO in MSO Nest/Roost Recovery habitat, would be preserved through time. Trees per acre would be reduced from the existing 1,100 in mixed conifer, 1,280 in pine-oak, and 1,351 using the GM on the Tonto, to 116 in mixed conifer, 137 in pine-oak, and 109 using the GM on the Tonto. Reducing trees per acre closer to NRV would protect Nest/Roost Recovery habitat and restore conditions for the MSO by managing for less dense and encroached forested conditions. Openings created by bringing these size classes into desired condition would provide habitat for a variety of prey species and would slow or reduce fire severity by breaking the continuity of dense tree canopies and ladder fuels.

The average of all basal areas from saplings (Size Class 1) to old forest (Size Class 6) show that intermediate-sized trees (Size 3 with BA 5-12 inches and Size 4 with BA 12-18 inches are currently predominant on the landscape and vastly departed from NRV) would be lowered closer to desired condition as a result of treatments through 2039. Increasing basal area Size classes for older trees and reducing medium-aged over-abundant size classes to NRV benefits the MSO through the reduction of over-encroached forest conditions. Further, this would increase vertical and horizontal habitat heterogeneity providing roosting options, and thermal and hiding cover for the MSO and habitat for a variety of prey species.

The basal area average would decrease from the existing 188 in mixed conifer, 164 in pine-oak, and 190 GM on the Tonto, to 127 in mixed conifer, 112 in pine-oak, and 102 GM on the Tonto in 2029. The percent average canopy cover would be reduced from the existing 76 percent in mixed conifer, 73 percent in pine-oak, and 77 percent GM on the Tonto, to 66 percent in mixed conifer, 62 percent in pine-oak, and 60 percent GM on the Tonto in 2029. Design features for the project would preserve the recommended habitat conditions in Recovery Habitat wherever possible, while protecting this habitat from severe fire intensity or stand-replacing effects from crown fire.

Retaining canopy cover allows for a thermal environment needed for nesting and roosting conditions for the MSO while allowing for prey base and for species that require interlocking crown habitat. Promotion of large tree growth would be achieved in Alternative 2 from proposed treatments as stand density index would change from 420 in mixed conifer, 369 in pine-oak, and 441 GM on the Tonto, to 197, 183, and 164, respectively, in 2029. Reduction in stand density index competition would increase the quadratic mean diameter from the existing six inches in mixed conifer, seven in pine-oak, and six GM on the Tonto, to 16 inches in mixed conifer, and 14 inches in both pine-oak and the GM on the Tonto in 2029. By emphasizing for large trees, this should also provide for MSO life history needs (nesting and roosting) and provide large snags and logs (Gainey et al. 2003).

Snags

In Nest/Roost Recovery Habitat, snags would increase or be maintained as a result of treatments under Alternative 2 (Table 3-**). These Primary Constituent Element habitat variables important to the MSO and MSO prey species would be preserved over time under this action alternative. Retaining/increasing key habitat elements for the MSO, such as snags of various sizes to provide for nesting and roosting and for prey habitat, follows guidance from the MSO Revised Recovery Plan (2012). This is a long-term benefit to the MSO as a result of treatments under Alternative 2.

Coarse Woody Debris and Understory

Coarse woody debris greater than three inches would be maintained at 10 tons per acre in mixed conifer and increases in pine-oak from six trees per acre to eight trees per acre in 2029. Using the GM on the Tonto, coarse woody debris would increase from 10 trees per acre to 11 trees per acre in 2029. Herbaceous biomass would increase over the 20 years modeled in mixed conifer and the GM on the Tonto. The existing condition of 0.21 tons per acre in mixed conifer and 0.20 in GM on the Tonto would increase to 0.26 in mixed conifer and 0.23 in GM on the Tonto in 2039. More pronounced is the effect of treatments on the shrub biomass, which would change from 0.40 tons per acre in mixed conifer to 0.78 in 2029. In acres identified using the GM on the Tonto, shrub biomass would increase from 0.25 tons per acre to 0.30 tons per acre in 2029. Increasing these Primary Constituent Elements important to prey base for the MSO would be an added benefit to treatments in Nest/Roost Recovery habitat under this alternative.

Fire Effects

Surface fuel loading in MSO Nest/Roost Recovery habitat would be reduced under Alternative 2, moving from 30 tons per acre in mixed conifer, 19 in pine-oak, and 23 in GM on the Tonto, to 23 tons per acre in mixed conifer and 18 tons per acre in pine-oak and GM on the Tonto in 2029 (Table 3-**).

Fire Hazard Index would be decreased from 4,175 acres (41 percent of the Nest/Roost Recovery habitat in high or extreme need of treatment) to 588 acres (six percent). Reductions of this magnitude should preserve existing MSO habitat while encouraging conditions to create more over time through recovery habitats.

The potential for active and conditional crown fire would be decreased under Alternative 2 from 4,802 acres (47 percent) to 407 acres (four percent). Reducing active crown fires by this magnitude is a benefit to MSO and its critical habitat that would preserve Nest/Roost Recovery habitat over time.

Foraging/Non-breeding Recovery Habitat

There are 188,533 acres of MSO Foraging/Non-Breeding Recovery habitat in the Rim Country project area. Many of these acres (138,337 acres or 73percent) could be treated with thinning or prescribed fire with Alternative 2.

Table 32. Treatments in MSO Foraging/Non-breeding Recovery Habitat, Alternative 2

Proposed Treatment	- Alternative 2 - Modified Proposed Action Acres
Mixed Conifer Recovery	**21,220**

Proposed Treatment	- Alternative 2 - Modified Proposed Action Acres
Facilitative Operations Mechanical	1,463
Facilitative Operations Prescribed Fire Only	10
IT 10% - 25%	2,950
IT 25% - 40%	2,914
IT 40% - 55%	1,129
MSO Recovery - Replacement Nest/Roost	59
Prescribed Fire Only	680
Riparian Prescribed Fire Only	52
Riparian Restoration	560
SI 10% - 25%	527
SI 25% - 40%	528
SI 40% - 55%	274
UEA 10% - 25%	3,935
UEA 25% - 40%	3,192
UEA 40% - 55%	406
UEA 55% - 70%	2,179
Wet Meadow & Riparian Prescribed Fire Only	75
Wet Meadow & Riparian Restoration	29
Wet Meadow Restoration	259
Pine-Oak Recovery	**85,458**
Facilitative Operations Mechanical	115
Grassland Restoration	321
IT 10% - 25%	6,405
IT 25% - 40%	8,178
IT 40% - 55%	11,782
Prescribed Fire Only	373

Proposed Treatment	- Alternative 2 - Modified Proposed Action Acres
Riparian Prescribed Fire Only	8
Riparian Restoration	771
SI 10% - 25%	2,041
SI 25% - 40%	6,318
SI 40% - 55%	3,372
ST	722
UEA 10% - 25%	18,745
UEA 25% - 40%	17,445
UEA 40% - 55%	4,322
UEA 55% - 70%	4,203
Wet Meadow & Riparian Restoration	49
Wet Meadow Restoration	289
Geophysical Model Recovery	**31,659**
Facilitative Operations Mechanical	3,099
IT 10% - 25%	49
IT 25% - 40%	940
IT 40% - 55%	5,397
Riparian Restoration	1,216
SI 10% - 25%	494
SI 25% - 40%	1,016
SI 40% - 55%	2,441
ST	3,433
UEA 10% - 25%	5,775
UEA 25% - 40%	5,169
UEA 40% - 55%	1,028
UEA 55% - 70%	1,599

Proposed Treatment	- Alternative 2 - Modified Proposed Action Acres
Wet Meadow & Riparian Restoration	5
Grand Total	138,337

Table 33. FVS Modeling of Key Habitat Variables for MSO Foraging/Non-breeding Recovery Habitat, Alternative 2

Foraging/Non-breeding Recovery MC = 21,220 Acres Modeled PO = 85,458 Acres Modeled GM = 31,659 Acres Modeled on Tonto NF	Existing	Alt 2 2029	Alt 2 2039
Average of Tpa MC	1398	154	97
Average of Tpa PO	1192	153	81
Average of Tpa GM	1443	107	73
Average of BA MC	157	76	75
Average of BA PO	140	68	66
Average of BA GM	170	63	59
Average of SDI MC	376	133	121
Average of SDI PO	329	123	108
Average of SDI GM	407	108	95
Average of QMD MC	5	12	14
Average of QMD PO	6	11	14
Average of QMD GM	5	12	14
Average of SNAG 12-18” MC	3	4	3
Average of SNAG 12-18” PO	2	4	3
Average of SNAG 12-18” GM	2	5	3
Average of SNAG 18-24” MC	1	2	2
Average of SNAG 18-24” PO	1	1	1

Foraging/Non-breeding Recovery MC = 21,220 Acres Modeled PO = 85,458 Acres Modeled GM = 31,659 Acres Modeled on Tonto NF	Existing	Alt 2 2029	Alt 2 2039
Average of SNAG 18-24” GM	1	2	2
Average of SNAG $\geq$ 24” MC	1	1	1
Average of SNAG $\geq$ 24” PO	0	0	0
Average of SNAG $\geq$ 24” GM	0	1	1
Percent CANCOV MC	71	51	51
Percent CANCOV PO	69	48	47
Percent CANCOV GM	74	46	45
Average of Surface Fuel TPA MC	24	17	15
Average of Surface Fuel TPA PO	16	12	12
Average of Surface Fuel TPA GM	19	13	12
Average of CWD 3”+ TPA MC	8	9	8
Average of CWD 3”+ TPA PO	5	6	6
Average of CWD 3”+ TPA GM	6	8	7
Average of Surface Herb TPA MC	0.21	0.27	0.27
Average of Surface Herb TPA PO	0.21	0.26	0.25
Average of Surface Herb TPA GM	0.19	0.26	0.26
Average of Surface Shrub TPA MC	0.29	0.68	0.71
Average of Surface Shrub TPA PO	0.22	0.20	0.17
Average of Surface Shrub TPA GM	0.27	0.35	0.34
Average of ALL_BA1 MC	1	0	0
Average of ALL_BA1 PO	1	0	0
Average of ALL_BA1 GM	1	0	0
Average of ALL_BA2 MC	15	2	1
Average of ALL_BA2 PO	11	1	1

Foraging/Non-breeding Recovery MC = 21,220 Acres Modeled PO = 85,458 Acres Modeled GM = 31,659 Acres Modeled on Tonto NF	Existing	Alt 2 2029	Alt 2 2039
Average of ALL_BA2 GM	16	1	0
Average of ALL_BA3 MC	47	10	7
Average of ALL_BA3 PO	48	11	7
Average of ALL_BA3 GM	64	8	5
Average of ALL_BA4 MC	48	20	18
Average of ALL_BA4 PO	44	21	19
Average of ALL_BA4 GM	49	19	16
Average of ALL_BA5 MC	28	26	26
Average of ALL_BA5 PO	22	21	22
Average of ALL_BA5 GM	22	20	21
Average of ALL_BA6 MC	17	19	23
Average of ALL_BA6 PO	13	15	17
Average of ALL_BA6 GM	17	16	16

Forest Structure

Under Alternative 2, the FVS modeling of treatments over the next 30 years indicate that most forest structure as it pertains to Desired Conditions important to MSO would be preserved through time. In MSO Foraging/Non-Breeding Recovery habitat, trees per acre would be reduced from the existing 1,398 in mixed conifer, 1,192 in pine-oak, and 1,443 GM on the Tonto, to 97 in mixed conifer, 81 in pine-oak, and 73 GM on the Tonto in 2039.

Reducing trees per acre closer to NRV protects Foraging/Non-breeding Recovery habitat and restores conditions for the MSO by managing for a less dense and encroached forested condition. Openings created by bringing these size classes into desired condition would provide habitat for a variety of prey species and would slow or reduce fire severity by breaking the continuity of dense tree canopies and ladder fuels. Further, edge habitat for MSO prey species (e.g., *Neotoma*) would be increased as a result of these treatment to restore forest structure.

The average of all basal areas from saplings (Size Class 1) to old forest (Size Class 6) show that intermediate-sized trees (Size 3 with BA 5-12 inches and Size 4 with BA 12-18 inches are currently predominant on the landscape and vastly departed from the natural range of variation) would be lowered closer to desired condition as a result of treatments through 2049. Maintaining basal area size classes for older trees and reducing medium-aged over-abundant size classes to NRV benefits the MSO as above through reduction of over encroached forest conditions. Further, in Foraging/Non-breeding Recovery habitat, this would increase vertical and horizontal habitat heterogeneity providing habitat for a variety of prey species.

The basal area average would be decreased from the existing condition of 157 in mixed conifer, 140 in pine-oak, and 170 GM on the Tonto, to 75 in mixed conifer, 66 in pine-oak, and 59 GM on the Tonto in 2039. The percent average canopy cover would be reduced from 71 percent in mixed conifer, 69 percent in pine-oak, and 74 percent GM on the Tonto, to 51 percent in mixed conifer, 47 percent in pine-oak, and 45 percent GM on the Tonto in 2039. The percent average canopy cover would be reduced from 50 percent to 26 percent in 2029 and 20 percent in 2049. Design features would preserve the recommended habitat conditions in Recovery Habitat wherever possible, while protecting this habitat from severe fire intensity or stand-replacing effects from crown fire.

Promotion of large tree growth would be achieved with proposed treatments as the stand density index would change from 376 in mixed conifer, 329 in pine-oak, and 407 GM on the Tonto, to 121 in mixed conifer, 108 in pine-oak, and 95 GM on the Tonto in 2039. A reduction in SDI competition would increase the quadratic mean diameter from the existing five in mixed conifer, six in pine-oak, and five GM on the Tonto, to 14 in all cover types in 2039.

Snags

In Foraging/Non-Breeding Recovery Habitat, snags greater than 12 inches in diameter would all increase slightly as a result of treatments under Alternative 2 (Table 3-**). These Primary Constituent Element habitat variables important to the MSO and MSO prey species would be preserved over time under this action alternative.

Coarse Woody Debris and Understory

Coarse woody debris greater than three inches would increase from the existing 8 tons per acre in mixed conifer, five tons per acre in pine-oak, and six tons per acre GM on the Tonto, to 8 tons per acre in mixed conifer, six tons per acre in pine-oak, and seven tons per acre GM on the Tonto in 2039.

Herbaceous biomass in tons per acre would increase over 20 years. Shrub biomass would also increase in mixed conifer and GM on the Tonto in 2039. Shrub biomass would slightly decrease.

Fire Effects

Surface fuel loading in MSO Foraging/Non-breeding Recovery habitat would be reduced under Alternative 2, moving from 24 tons per acre in mixed conifer, 16 tons per acre in pine-oak, and 19 tons per acre GM on the Tonto, to 15 tons per acre in mixed conifer, and 12 tons per acre in pine-oak and GM on the Tonto in 2039 (Table 3-**).

Fire Hazard Index would be decreased from 10,717 acres (26 percent of the Foraging/Other Recovery habitat modeled in need of treatment) to 372 acres (one percent). Reductions of this magnitude should preserve existing MSO habitat while encouraging conditions to create more over time through recovery habitats.

The potential for crown fire would be decreased under Alternative 2 from 15,090 acres (36 percent) to 350 acres (one percent). Reducing active crown fires by this magnitude would be a benefit to the MSO and its critical habitat that would preserve Foraging/Other Recovery habitat over time.

For the effects from smoke, see the Effects Common to All Alternatives and Wildfire Modeling sections above.

Other Habitat Effects

Understory vegetation development is related to the amount of solar radiation reaching the ground. This creates a direct and inverse relationship between canopy closure and herbaceous cover. The uncharacteristic forest structure existing in the ponderosa pine forests of northern Arizona restricts herbaceous growth well below pre-settlement conditions. Ponderosa pine forests in Arizona are relatively homogeneous and the site-specific habitat variability that springs, streams, meadows, grasslands, savannas, and aspen represent are important to a wide array of wildlife, including MSO prey species. These distinct vegetation types support understory vegetation that is typically denser, more continuous, and more diverse because of the soil types supporting them and the increased solar radiation and moisture availability compared to ground conditions in the general forest. Understory vegetation provides the food and cover that supports an array of wildlife, including many small mammals, birds, bats, and a variety of arthropods that serve as food for vertebrate species and pollinators to help maintain herbaceous diversity. These microhabitats directly and indirectly support MSO prey species. Improvements to springs, riparian areas, stream channels, meadows, and aspen can benefit MSOs in ways greater than simple area estimates indicate.

Springs, Riparian and Stream Habitat, Grasslands, Savannas, Meadows, and Aspen

Springs, riparian areas, and stream channel restoration would be the same for both action alternatives and are described above in the Effects Common to Both Action Alternatives section. Grassland, savanna, and meadow treatments would include mechanical tree removal and prescribed burning within PACs under both Alternatives 2 and 3.

Alternative 3 – Focused Alternative

Protected Habitat

Approximately 61,695 acres are proposed for treatment in PACs under Alternative 3. Mechanical treatments could occur in 18,887 acres and are summarized below in Table 3-**.

Table 34. Treatments in MSO Protected Habitat, Alternative 3

Proposed Treatment	- Alternative 3 - Focused Alternative Acres
PAC - Aspen Restoration	28
PAC - Facilitative Operations Mechanical	301
PAC - Facilitative Operations Prescribed Fire Only	3,065
PAC - Grassland Prescribed Fire Only	41
PAC - Grassland Restoration	23
PAC – Mechanical	15,754
PAC - Prescribed Fire Only	37,964

Proposed Treatment	- Alternative 3 - Focused Alternative Acres
PAC - Riparian Prescribed Fire Only	911
PAC - Riparian Restoration	1,775
PAC - Severe Disturbance Area Treatment	1,416
PAC - Wet Meadow & Riparian Prescribed Fire Only	32
PAC - Wet Meadow & Riparian Restoration	98
PAC - Wet Meadow Prescribed Fire Only	33
PAC - Wet Meadow Restoration	254
Grand Total	**61,695**

Table 105. Habitat Variables Analyzed in Protected MSO Habitat, Alternative 3

PACs MC = 16,481 Acres Modeled PO = 56,180 Acres Modeled on Tonto NF	Existing	Alt 3 2029	Alt 3 2039
Average of Tpa MC	1291	531	379
Average of Tpa PO	1276	496	368
Average of BA MC	173	131	130
Average of BA PO	144	117	117
Average of SDI MC	398	262	235
Average of SDI PO	339	237	223
Average of QMD MC	6	9	12
Average of QMD PO	6	9	10
Average of SNAG 12-18” MC	4	7	5
Average of SNAG12-18” PO	2	5	4
Average of SNAG18-24” MC	2	2	2
Average of SNAG18-24” PO	1	1	1

PACs MC = 16,481 Acres Modeled PO = 56,180 Acres Modeled on Tonto NF	Existing	Alt 3 2029	Alt 3 2039
Average of SNAG ≥ 24” MC	1	1	1
Average of SNAG ≥ 24” PO	0	1	1
Average of CANCOV-BA Regression MC	74	67	67
Average of CANCOV-BA Regression PO	69	64	64
Average of Surface Fuel TPA MC	29	27	27
Average of Surface Fuel TPA PO	20	19	20
Average of CWD 3”+ TPA MC	10	12	12
Average of CWD 3”+ TPA PO	8	9	9
Average of Surface Herb TPA MC	0.21	0.24	0.24
Average of Surface Herb TPA PO	0.21	0.22	0.22
Average of Surface Shrub TPA MC	0.40	0.55	0.65
Average of Surface Shrub TPA PO	0.23	0.24	0.25
Average of ALL_BA1 MC	1	0	0
Average of ALL_BA1 PO	1	0	0
Average of ALL_BA2 MC	15	8	5
Average of ALL_BA2 PO	13	8	7
Average of ALL_BA3 MC	49	31	26
Average of ALL_BA3 PO	47	30	27
Average of ALL_BA4 MC	51	36	37
Average of ALL_BA4 PO	42	37	37
Average of ALL_BA5 MC	30	30	33
Average of ALL_BA5 PO	22	23	25
Average of ALL_BA6 MC	26	26	29
Average of ALL_BA6 PO	18	19	21

Forest Structure

Under Alternative 3, the FVS modeling of treatments over the next 30 years indicates that most forest structure, as it pertains to Primary Constituent Elements important to the MSO in PACs, is preserved through time. Trees per acre would be reduced from the existing 1,291 in mixed conifer and 1,276 in pine-oak, to 379 in mixed conifer and 368 in pine-oak in 2029 (Table 3-**). Reducing trees per acre closer to NRV protects PACs and restores conditions for MSO by managing for less dense and encroached forested conditions. Openings created by bringing tree size classes to desired condition would provide habitat for a variety of prey species and would slow or reduce fire severity by breaking the continuity of dense tree canopies and ladder fuels.

The average of all basal areas from saplings (Size Class 1) to old tree or large trees (Size Class 6) show that intermediate-sized trees (Size 3 with BA 5-12 inches and Size 4 with BA 12-18 inches are currently predominant on the landscape and vastly departed from NRV) would be lowered, but not to desired conditions, as a result of treatments through 2039. The basal area average would be decreased from the existing 173 in mixed conifer and 144 in pine-oak, to 130 in mixed conifer and 117 in pine-oak in 2039. These modeled results would align with the MSO Recovery Plan recommendations. Design features would preserve the recommended habitat conditions in PACs wherever possible, while protecting this habitat from severe fire intensity or stand-replacing effects from crown fire.

Promotion of large tree growth would be achieved in Alternative 3 as stand density index would change from the existing 398 in mixed conifer and 339 in pine-oak, to 235 in mixed conifer and 223 in pine-oak in 2039. A reduction in SDI competition would increase the quadratic mean diameter from the existing six inches in both mixed conifer and pine-oak, to 12 inches in mixed conifer and 10 inches in pine-oak in 2039.

Snags

In PACs, standing snags, coarse woody debris, and downed logs over 12 inches would all be maintained or increase as a result of treatments under Alternative 3 (Table 3-**). These Primary Constituent Element habitat variables important to the MSO and MSO prey species would be preserved over time under this action alternative. Snags 12 to 18 inches in diameter would increase from two per acre to four per acre in 2039. The number of snags per acre, snags 24 inches in diameter and greater would be maintained in PACs over the 20 years modeled. Retaining/increasing key habitat elements for the MSO such as snags of various sizes to provide for nesting and roosting and for prey habitat follows guidance from the MSO Revised Recovery Plan (2012). This is a long-term benefit to the MSO as a result of treatments in Alternative 3.

Coarse Woody Debris and Understory

In PACs, coarse woody debris three inches or greater would increase from 10 to 12 tons per acre in mixed conifer and from eight to nine tons per acre in pine-oak as a result of treatments over the 20 years modeled. Herbaceous biomass in tons per acre would increase slightly over 20 years. Proposed treatments would change the amount of shrub biomass from the existing 0.4 tons per acre in mixed conifer to 0.65 in 2039. Shrub biomass would slightly increase in pine-oak as a result of treatments over the 20 years modeled.

Fire Effects

Surface fuel loading in MSO Protected Habitat would be slightly reduced under Alternative 3, moving from an existing 29 tons per acre in mixed conifer to 27 tons per acre in 2039.

Fire Hazard Index would decrease from 49,889 acres (41 percent of the PACs in the project area in need of treatment) to 33,105 acres (30 percent). Reductions of this magnitude should preserve existing MSO habitat while encouraging conditions to create more over time through recovery habitats.

Table 36. Fire Hazard Index in MSO Habit Types, Alternative 3

MSO Habitat Type	Very Low Need For Treatment in Acres	%	Moderate Need for Treatment in Acres	%	Low Need for Treatment in Acres	%	High Need for Treatment in Acres	%	Extreme Need for Treatment in Acres	%
Protected PAC 120,970 Acres Modeled	30.077	27	18,086	16	29,679	27	21,283	19	11,822	11
Recovery Nest/Roost 10,288 Acres Modeled	5,948	58	959	09	2.602	25	489	05	259	03
Recovery Foraging/Non-Breeding 41,879 Acres Modeled	30,461	73	1,109	03	8,450	20	1,608	04	237	>01

Active crown fire in PACs in Alternative 3 total 33,044 acres (30 percent) compared to the existing 58,243 (48 percent) that would experience high-severity crown fire as a result of treatments.

Table 37. Potential for Crown Fire in MSO Habitat Types, Alternative 3

MSO Habitat Type	Active Crown Fire Acres	%	Conditional Crown Fire Acres	%	Passive Crown Fire Acres	%	Surface Fire Acres	%	Non-Burnable Acres	%
Protected PAC 122,222 Acres Modeled	29,603	27	3,440	3	55,985	50	20,820	19	1,098	01
Recovery Nest/Roost 10,289 Acres Modeled	624	06	61	>01	5,532	54	4,050	40	20	>01
Recovery Foraging-Non-Breeding	2,177	05	140	>01	26,812	64	12,530	30	206	>01

MSO Habitat Type	Active Crown Fire Acres	%	Conditional Crown Fire Acres	%	Passive Crown Fire Acres	%	Surface Fire Acres	%	Non-Burnable Acres	%
41,879 Acres Modeled										

Nest/Roost Recovery

Forest Structure

Under Alternative 3, the FVS modeling from treatments over the next 30 years indicate that most forest structure, as it pertains to Primary Constituent Elements important to the MSO in MSO Nest/Roost Recovery habitat, would be preserved through time. Trees per acre would be reduced from the existing 1,100 in mixed conifer, 1,280 in pine-oak, and 1,351 using the GM on the Tonto, to 155 in mixed conifer, 432 in pine-oak, and 176 using the GM on the Tonto in 2039. Reducing trees per acre closer to NRV would protect Nest/Roost Recovery habitat and restore conditions for the MSO by managing for less dense and encroached forested conditions. Openings created by bringing these size classes into desired condition would provide habitat for a variety of prey species and would slow or reduce fire severity by breaking the continuity of dense tree canopies and ladder fuels.

Table 38. Treatments in MSO Nest/Roost Recovery Habitat, Alternative 3

Proposed Treatment	- Alternative 3 - Focused Alternative Acres
Mixed Conifer Recovery NR	**10,458**
Facilitative Operations Mechanical	577
Facilitative Operations Prescribed Fire Only	38
MSO Recovery - Replacement Nest/Roost	8,972
Prescribed Fire Only	165
Riparian Prescribed Fire Only	21
Riparian Restoration	510
Wet Meadow & Riparian Restoration	33
Wet Meadow Restoration	143
Pine-Oak Recovery NR	**8,844**
Grassland Restoration	71
MSO Recovery - Replacement Nest/Roost	7,643

Prescribed Fire Only	260
Riparian Prescribed Fire Only	69
Riparian Restoration	596
Wet Meadow & Riparian Prescribed Fire Only	148
Wet Meadow & Riparian Restoration	4
Wet Meadow Restoration	53
Geophysical Model Recovery NR	**3,531**
Facilitative Operations Mechanical	302
MSO Recovery - Replacement Nest/Roost	2,916
Riparian Restoration	313
Grand Total	**22,833**

Table 39. Habitat Variables Analyzed in Nest/Roost Recovery Habitat, Alternative 3

NR Recovery MC = 11,065 Acres Modeled PO = 13,539 Acres Modeled GM. = 3,940 Acres Modeled on Tonto NF	Existing	Alt 3 2029	Alt 3 2039
Avg of Trees per Acre MC	1100	204	155
Avg of Trees per Acre PO	1280	521	432
Avg of Trees per Acre GM	1351	231	176
Avg of Basal Area MC	188	122	124
Avg of Basal Area PO	164	127	127
Avg of Basal Area GM	190	109	106
Avg of Stand Density Index MC	420	208	199
Avg of Stand Density Index PO	369	243	231
Avg of Stand Density Index GM	441	195	179
Avg of Quadratic Mean Diameter in Inches MC	6	13	15
Avg of Quadratic Mean Diameter in Inches PO	7	11	13

NR Recovery MC = 11,065 Acres Modeled PO = 13,539 Acres Modeled GM. = 3,940 Acres Modeled on Tonto NF	Existing	Alt 3 2029	Alt 3 2039
Avg of Quadratic Mean Diameter in Inches GM	6	12	16
Average of SNAG 12-18” MC	4	5	3
Average of SNAG 12-18” PO	3	5	4
Average of SNAG 12-18” GM	3	6	4
Average of SNAG 18-24” MC	1	2	2
Average of SNAG 18-24” PO	1	1	2
Average of SNAG 18-24” GM	1	1	1
Average of SNAG ≥ 24” MC	1	1	1
Average of SNAG ≥ 24” PO	0	1	1
Average of SNAG ≥ 24” GM	0	1	1
Percent CANCOV Regression from BA MC	76	65	65
Percent CANCOV Regression from BA PO	73	66	66
Percent CANCOV Regression from BA GM	77	62	61
Avg of Surface Fuel tons per acre MC	30	23	22
Avg of Surface Fuel tons per acre PO	19	19	19
Avg of Surface Fuel tons per acre GM	23	20	19
Avg of Coarse Woody Debris 3”+ tons per acre MC	10	10	10
Avg of Coarse Woody Debris 3”+ tons per acre PO	6	8	8
Avg of Coarse Woody Debris 3”+ tons per acre GM	10	11	11
Avg of Herbaceous tons per acre MC	0.21	0.25	0.26
Avg of Herbaceous tons per acre PO	0.21	0.23	0.23
Avg of Herbaceous tons per acre GM	0.20	0.25	0.23

NR Recovery MC = 11,065 Acres Modeled PO = 13,539 Acres Modeled GM. = 3,940 Acres Modeled on Tonto NF	Existing	Alt 3 2029	Alt 3 2039
Average of Shrubs tons per acre MC	0.40	0.70	0.73
Average of Shrubs tons per acre PO	0.22	0.21	0.20
Average of Shrubs tons per acre GM	0.25	0.31	0.30
Avg of ALL BA1 0-1” MC	1	0	0
Avg of ALL BA1 0-1” PO	1	0	0
Avg of ALL BA1 0-1” GM	1	0	0
Avg of ALL BA2 1-5” MC	12	2	2
Avg of ALL BA2 1-5” PO	10	3	3
Avg of ALL BA2 1-5” GM	14	2	2
Avg of ALL BA3 5-12” MC	39	15	12
Avg of ALL BA3 5-12” PO	41	22	19
Avg of ALL BA3 5-12” GM	54	17	14
Avg of ALL BA4 12-18” MC	61	33	30
Avg of ALL BA4 12-18” PO	54	38	35
Avg of ALL BA4 12-18” GM	61	33	29
Avg of ALL BA5 18-24” MC	43	42	43
Avg of ALL BA5 18-24” PO	37	41	42
Avg of ALL BA5 18-24” GM	31	31	31
Avg of ALL BA6 24” + MC	32	31	37
Avg of ALL BA6 24” + PO	21	23	27
Avg of ALL BA6 24” + GM	28	26	30

The average of all basal areas from saplings (Size Class 1) to old forest (Size Class 6) show that intermediate-sized trees (Size 3 with BA 5-12 inches and Size 4 with BA 12-18 inches are currently predominant on the landscape and vastly departed from NRV) would be lowered as a result of treatments through 2039. The basal area average would decrease from the existing 188 in mixed conifer, 164 in pine-oak, and 190 GM on the Tonto, to 124 in mixed conifer, 127 in pine-oak, and 106 GM on the Tonto in 2029. The percent average canopy cover would be reduced from the existing 76 percent in mixed conifer, 73 percent in pine-oak, and 77 percent GM on the Tonto, to 65 percent in mixed conifer, 66 percent in pine-oak, and 61 percent GM on the Tonto in 2039. Design features for the project would preserve the recommended habitat conditions in Recovery Habitat wherever possible, while protecting this habitat from severe fire intensity or stand-replacing effects from crown fire.

Promotion of large tree growth would be achieved in Alternative 3 as the stand density index changes from 420 in mixed conifer, 369 in pine-oak, and 441 GM on the Tonto, to 199, 231, and 179, respectively, in 2039. Reduction in stand density index competition would increase the quadratic mean diameter from the existing six inches in mixed conifer, seven in pine-oak, and six GM on the Tonto, to 15 inches in mixed conifer, and 13 inches in pine-oak, and 16 inches GM on the Tonto in 2039.

Snags

In Nest/Roost Recovery Habitat, snags would be maintained or increase as a result of treatments under Alternative 3 (Table 3-**). These Primary Constituent Element habitat variables important to the MSO and MSO prey species would be preserved over time under the focused alternative.

Coarse Woody Debris and Understory

In Nest/Roost Recovery habitat, coarse woody debris greater than three inches would increase as a result of treatments through 2039. Herbaceous biomass would increase over the 20 years under Alternative 3. The existing 0.21 tons per acre in mixed conifer and pine-oak and the 0.20 tons per acre in GM on the Tonto would slightly increase. Shrub biomass would change from 0.40 tons per acre to 0.73 tons per acres in mixed conifer by 2039.Increasing these Primary Constituent Elements important to prey base for the MSO would be an added benefit to treatments in Nest/Roost Recovery habitat under this alternative.

Fire Effects

Surface fuel loading in MSO Nest/Roost Recovery habitat would be reduced under Alternative 3, moving from 30 tons per acre in mixed conifer, 19 in pine-oak, and 23 in GM on the Tonto, to 22 tons per acre in mixed conifer, 19 in pine-oak, and 23 GM on the Tonto, to 22 in mixed conifer, 19 in pine-oak, and 19 GM on the Tonto in 2039 (Table 3-**).

Fire Hazard Index would be decreased from 4,175 acres (41 percent of the Nest/Roost Recovery habitat in high or extreme need of treatment) to 588 acres (six percent). Reductions of this magnitude should preserve existing MSO habitat while encouraging conditions to create more over time through recovery habitats.

The potential for crown fire would be decreased under Alternative 3 from 4,802 acres (47 percent) to 407 acres (four percent). Reducing active crown fires by this magnitude is a benefit to MSO and its critical habitat that would preserve Nest/Roost Recovery habitat over time.

Foraging/Non-breeding Recovery

Forest Structure

Under Alternative 3, the FVS modeling of treatments over the next 30 years indicate that most forest structure as it pertains to Primary Constituent Elements important to MSO would be preserved through time. In MSO Foraging/Non-Breeding Recovery habitat, trees per acre would be reduced from the existing 1,398 in mixed conifer, 1,192 in pine-oak, and 1,443 GM on the

Tonto, to 304 in mixed conifer, 394 in pine-oak, and 244 GM on the Tonto in 2039. Reducing trees per acre closer to NRV protects Foraging/Non-breeding Recovery habitat and restores conditions for the MSO by managing for a less dense and encroached forested condition. Openings created by bringing these size classes into desired condition would provide habitat for a variety of prey species and would slow or reduce fire severity by breaking the continuity of dense tree canopies and ladder fuels. Further, edge habitat for MSO prey species (e.g., *Neotoma*) would be increased as a result of these treatment to restore forest structure.

Table 40. Treatments in MSO Foraging/Non-breed Habitat, Alternative 3

Proposed Treatment	- Alternative 3 - Focused Alternative Acres
Mixed Conifer Recovery	**18,374**
Facilitative Operations Mechanical	1,332
Facilitative Operations Prescribed Fire Only	10
IT 10% - 25%	1,981
IT 25% - 40%	2,887
IT 40% - 55%	1,105
MSO Recovery - Replacement Nest/Roost	59
Prescribed Fire Only	432
Riparian Prescribed Fire Only	52
Riparian Restoration	560
SI 10% - 25%	437
SI 25% - 40%	480
SI 40% - 55%	233
UEA 10% - 25%	3,167
UEA 25% - 40%	3,081
UEA 40% - 55%	207
UEA 55% - 70%	1,990
Wet Meadow & Riparian Prescribed Fire Only	75
Wet Meadow & Riparian Restoration	29
Wet Meadow Restoration	259
Pine-Oak Recovery	**50,084**
Facilitative Operations Mechanical	95
Grassland Restoration	321
IT 10% - 25%	5,217
IT 25% - 40%	5,918

Proposed Treatment	- Alternative 3 - Focused Alternative Acres
IT 40% - 55%	8,146
Prescribed Fire Only	348
Riparian Prescribed Fire Only	8
Riparian Restoration	771
SI 10% - 25%	1,012
SI 25% - 40%	3,668
SI 40% - 55%	652
ST	70
UEA 10% - 25%	9,443
UEA 25% - 40%	9,288
UEA 40% - 55%	1,202
UEA 55% - 70%	3,587
Wet Meadow & Riparian Restoration	**49**
Wet Meadow Restoration	289
Geophysical Model Recovery	**24,238**
Facilitative Operations Mechanical	1,715
IT 10% - 25%	49
IT 25% - 40%	402
IT 40% - 55%	5,009
Riparian Restoration	1,216
SI 10% - 25%	236
SI 25% - 40%	554
SI 40% - 55%	2,287
ST	2,024
UEA 10% - 25%	4,367
UEA 25% - 40%	4,210

Proposed Treatment	- Alternative 3 - Focused Alternative Acres
UEA 40% - 55%	686
UEA 55% - 70%	1,479
Wet Meadow & Riparian Restoration	5
Grand Total	**92,696**

Table 41. Habitat Variables Analyzed in Foraging/Non-breeding Recovery Habitat, Alternative 3

Foraging/Non-breeding Recovery MC = 21,220 Acres Modeled PO = 85,458 Acres Modeled GM = 31,659 Acres Modeled on Tonto NF	Existing	Alt 3 2029	Alt 3 2039
Average of Tpa MC	1398	377	304
Average of Tpa PO	1192	479	394
Average of Tpa GM	1443	289	244
Average of BA MC	157	89	91
Average of BA PO	140	96	98
Average of BA GM	170	84	82
Average of SDI MC	376	172	165
Average of SDI PO	329	198	192
Average of SDI GM	407	162	151
Average of QMD MC	5	11	13
Average of QMD PO	6	10	12
Average of QMD GM	5	11	13
Average of SNAG 12-18” MC	3	4	3
Average of SNAG 12-18” PO	2	3	3
Average of SNAG 12-18” GM	2	5	3
Average of SNAG 18-24” MC	1	2	2

Foraging/Non-breeding Recovery MC = 21,220 Acres Modeled PO = 85,458 Acres Modeled GM = 31,659 Acres Modeled on Tonto NF	Existing	Alt 3 2029	Alt 3 2039
Average of SNAG 18-24” PO	1	1	1
Average of SNAG 18-24” GM	1	1	1
Average of SNAG ≥ 24” MC	1	1	1
Average of SNAG ≥ 24” PO	0	0	0
Average of SNAG ≥ 24” GM	0	1	1
Percent CANCOV Regression from BA MC	71	56	57
Percent CANCOV Regression from BA PO	69	59	59
Percent CANCOV Regression from BA GM	74	54	53
Average of Surface Fuel TPA MC	24	19	18
Average of Surface Fuel TPA PO	16	15	15
Average of Surface Fuel TPA GM	19	15	14
Average of CWD 3”+ TPA MC	8	9	8
Average of CWD 3”+ TPA PO	5	6	6
Average of CWD 3”+ TPA GM	6	7	7
Average of Surface Herb TPA MC	0.21	0.26	0.26
Average of Surface Herb TPA PO	0.21	0.24	0.24
Average of Surface Herb TPA GM	0.19	0.25	0.25
Average of Surface Shrub TPA MC	0.29	0.62	0.65
Average of Surface Shrub TPA PO	0.22	0.22	0.21
Average of Surface Shrub TPA GM	0.27	0.33	0.31
Average of ALL_BA1 MC	1	0	0
Average of ALL_BA1 PO	1	0	0
Average of ALL_BA1 GM	1	0	0
Average of ALL_BA2 MC	15	4	4

Foraging/Non-breeding Recovery MC = 21,220 Acres Modeled PO = 85,458 Acres Modeled GM = 31,659 Acres Modeled on Tonto NF	Existing	Alt 3 2029	Alt 3 2039
Average of ALL_BA2 PO	11	5	5
Average of ALL_BA2 GM	16	4	4
Average of ALL_BA3 MC	47	16	13
Average of ALL_BA3 PO	48	24	21
Average of ALL_BA3 GM	64	19	16
Average of ALL_BA4 MC	48	24	23
Average of ALL_BA4 PO	44	30	30
Average of ALL_BA4 GM	49	25	23
Average of ALL_BA5 MC	28	26	27
Average of ALL_BA5 PO	22	22	24
Average of ALL_BA5 GM	22	21	22
Average of ALL_BA6 MC	17	19	23
Average of ALL_BA6 PO	13	15	17
Average of ALL_BA6 GM	17	16	17

The average of all basal areas from saplings (Size Class 1) to old forest (Size Class 6) show that intermediate-sized trees (Size 3 with BA 5 to 12 inches and Size 4 with BA 12 to 18 inches are currently predominant on the landscape and vastly departed from the natural range of variation) would be lowered closer to desired condition as a result of treatments through 2039. Maintaining basal area size classes for older trees and reducing medium-aged over-abundant size classes to NRV benefits the MSO as above through reduction of over-encroached forest conditions. Further, in Foraging/Non-breeding Recovery habitat, this would increase vertical and horizontal habitat heterogeneity providing habitat for a variety of prey species.

The basal area average would be decreased from the existing condition of 157 in mixed conifer, 140 in pine-oak, and 170 GM on the Tonto, to 91 in mixed conifer, 98 in pine-oak, and 82 GM on the Tonto. The percent average canopy cover would be reduced from 71 percent in mixed conifer, 69 percent in pine-oak, and 74 percent GM on the Tonto, to 57 percent in mixed conifer, 59 percent in pine-oak, and 53 percent GM on the Tonto in 2039. Design features would preserve the recommended habitat conditions in Recovery Habitat wherever possible, while protecting this habitat from severe fire intensity or stand-replacing effects from crown fire.

Promotion of large tree growth would be achieved with proposed treatments as the stand density index would change from the existing 376 in mixed conifer, 329 in pine-oak, and 407 GM on the Tonto. A reduction in SDI competition would increase the quadratic mean diameter from the existing five in mixed conifer, six in pine-oak, and five GM on the Tonto, to 13 inches in mixed conifer, 12 inches in pine-oak, and 13 inches GM on the Tonto in 2039.

Snags

In Foraging/Non-Breeding Recovery Habitat, snags greater than 12 inches in diameter would be maintained or increase slightly as a result of treatments under Alternative 3 (Table 3-**). These Primary Constituent Element habitat variables important to the MSO and MSO prey species would be preserved over time under this action alternative.

Coarse Woody Debris and Understory

Coarse woody debris greater than three inches would be maintained or increase slightly through 2039. Herbaceous biomass in tons per acre would increase slightly over 30 years. Shrub biomass would also increase from 0.29 tons per acre in mixed conifer to 0.65 tons per acre in 2039.

Fire Effects

Surface fuel loading in MSO Foraging/Non-breeding Recovery habitat would be reduced under Alternative 3, moving from 24 tons per acre in mixed conifer, 16 tons per acre in pine-oak, and 19 tons per acre GM on the Tonto, to 18 tons per acre in mixed conifer, 15 tons per acre in pine-oak, and 19 tons per acre GM on the Tonto by 2039 (Table 3-**).

Fire Hazard Index would be decreased from 10,717 acres (26 percent of the Foraging/Other Recovery habitat modeled in need of treatment) to 372 acres (one percent). Reductions of this magnitude should preserve existing MSO habitat while encouraging conditions to create more over time through recovery habitats.

The potential for crown fire would be decreased under Alternative 3 from 15,090 acres (36 percent) to 350 acres (one percent). Reducing active crown fires by this magnitude would be a benefit to the MSO and its critical habitat that would preserve Foraging/Other Recovery habitat over time.

For the effects from smoke, see the Effects Common to All Alternatives and Wildfire Modeling sections above.

Other Habitat Effects

Understory vegetation development is related to the amount of solar radiation reaching the ground. This creates a direct and inverse relationship between canopy closure and herbaceous cover. The uncharacteristic forest structure existing in the ponderosa pine forests of northern Arizona restricts herbaceous growth well below pre-settlement conditions. Ponderosa pine forests in Arizona are relatively homogeneous and the site-specific habitat variability that springs, streams, meadows, grasslands, savannas, and aspen represent are important to a wide array of wildlife, including MSO prey species. These distinct vegetation types support understory vegetation that is typically denser, more continuous, and more diverse because of the soil types supporting them and the increased solar radiation and moisture availability compared to ground conditions in the general forest. Understory vegetation provides the food and cover that supports an array of wildlife, including many small mammals, birds, bats, and a variety of arthropods that serve as food for vertebrate species and pollinators to help maintain herbaceous diversity. These microhabitats directly and indirectly support MSO prey species. Improvements to springs, riparian areas, stream channels, meadows, and aspen can benefit MSOs in ways greater than simple area estimates indicate.

Springs, Riparian and Stream Habitat, Grasslands, Savannas, Meadows, and Aspen

Springs, riparian areas, and stream channel restoration would be the same for both action alternatives and are described above in the Effects Common to Both Action Alternatives section. Grassland, savanna, and meadow treatments would include mechanical tree removal and prescribed burning within PACs under both Alternatives 2 and 3

Cumulative Effects

Because of the size of the 4FRI Rim Country project area and the large portion of the western Upper Gila Mountain Recovery Unit and a portion of the Basin and Range Recovery Unit that it occupies, the project area itself was considered adequate for assessing habitat effects on PACs. Due to the potential for disturbance to owls, the cumulative effects analysis boundary was extended 0.5 mile beyond the project area periphery to account for the spatial component of this analysis. Cumulative effects include the effects of Alternative 1. With this additional 0.5-mile buffer, there are 209 PACs in the cumulative effects analysis area (Table 3-**). The temporal component in this analysis was defined as 10 years for short-term effects and 30 years for long-term effects.

Table 42. MSO PACs Within or in Close Proximity to the Rim Country Project Area

PAC Location	Number of MSO PACs
Within Areas of Proposed Mechanical and Fire Treatments1	156
Within the Rim Country Project Area2	196
Within 0.5 mile of the Project Area Boundary	209

1. The area where treatments are proposed in the Rim Country project area, a subset of the total project area.

2. Total area including all vegetation cover-types and all projects managed by the Forest Service within the 4FRI boundary

The effects from projects before 2000 are incorporated into existing conditions. Aspects of existing conditions that are a result of these early projects include a deficit in large trees and snags and even-aged conditions. Pre-2000 projects also had heavy selection pressure for preferred tree genetics to provide healthy trees with good form. This latter effect resulted from harvested areas being regenerated from planting stock or from the selected reserve trees left in seed tree harvest units (Higgins, personal communications 2006). Wildlife habitat in the form of nesting, feeding, and loafing sites was reduced by selecting for disease-free trees with symmetric shapes, eliminating fork-top trees, trees with unusual branching patterns, and replanting with selected genetic stock from nurseries.

Alternative 1 – No Action

Alternative 1 would not contribute to the improvement of either forest structure or prey habitat within MSO habitat. The contributions of past, ongoing, and reasonably foreseeable actions would affect habitat for MSO and their prey, but no cumulative effects would result from 4FRI Rim Country (i.e., no change would occur either spatially and temporally to alter these effects of other actions on the landscape).

Maintaining existing conditions would extend the current deficit of trees greater than 24 inches in diameter. Current numbers of trees per acre greater than or equal to 18 inches in diameter, already below forest plan and Recovery Plan direction, would likely be maintained due to increases in mortality rates resulting from competition. Slow to stagnating tree growth rates would prolong the time required for mid-aged trees to grow into mature trees. Replacement of mid-aged trees by younger trees would occur at low rates because of current deficits in small size classes, delaying, limiting, or preventing the long-term attainment of desired conditions for mature and old-growth forest. Ponderosa pine is not a shade-adapted species. Therefore, consistently dense canopy cover would delay or prevent development of multi-storied and uneven-aged forest structure in the long term. Growth could be further suppressed and mortality rates increased if climate patterns continue toward hotter and drier growing conditions. Within-stand mortality resulting from competition for rooting space, water, and nutrient availability, vulnerability to insects and disease, and fire could lead to patches of more open conditions. This could reduce potential nesting and roosting habitat even in locations where individual trees might benefit and eventually grow into larger size classes.

Pine-oak habitat would remain outside the natural range of variation in terms of tree densities and age-class distribution under Alternative 1. Loss of large diameter oak would continue, as would the suppression of young oak by competing pine trees. Total basal area in oak may decline over time and would likely remain below desired conditions. Dense forest structure could increase the risk of insect and disease outbreaks occurring and increase the scale at which they occur. Stochastic events outside the natural range of variation could continue to slow or prevent development of new MSO nesting and roosting habitat.

Limited road closures would allow continued access to most of the existing roads footprint and would maintain the same threat to large snag persistence. Ecosystem function would continue to decline with continued tree encroachment into spring, channel, meadow, and aspen habitats.

The ability to retain sustainable and resilient ecosystems would be further compromised by vulnerability to high-severity fires. The overt threat of high-severity fire could limit options for treating uncharacteristic fuel loads through the use of unplanned ignitions, compounding the risk of high-severity fire through time. By not treating outside of MSO habitat, the risk of high-severity fire remains high from ignitions starting outside of pine-oak habitats as well as fire igniting within MSO habitat.

Determination of Effect

Based on the above analysis, Alternative 1 of the 4FRI Rim Country Project **may affect, is likely to adversely affect the Mexican spotted-owl.**

Alternative 2 – Modified Proposed Action

Cumulatively, restoration treatments would contribute toward improving MSO forest health and vegetation diversity and composition under Alternative 2. This would aid in sustaining old forest structure over time and moving forest structure toward desired conditions.

Projects with treatments occurring specifically in MSO habitat include prescribed fire and mechanical thinning with prescribed fire in protected habitat and restricted habitat (See Cumulative Effects Past Projects). Most projects in protected habitat used 18-inch diameter limits and some used up to 24-inch diameter limits in other recovery habitat. Treatments in MSO habitat in reasonably foreseeable projects include thinning and burning restoration and fuels reduction treatments, such as those being developed for the C.C. Cragin Watershed Protection, Rim Lakes Forest Restoration, Larson Forest Restoration, and the Upper Beaver Creek Watershed Fuels Reduction projects. For these projects, Gambel oak is not targeted for removal, but prescribed fire would likely top-kill small diameter oak, potentially decreasing oak basal area in the short term. However, design features should ensure retention of large-diameter oak and small oak commonly sprout vigorously after fire. The total basal area of Gambel oak is not expected to change substantially in the long term.

Created canopy gaps should benefit MSO prey species, and the reduction in small trees should open the space between ground-level and canopy base height, improving MSO flight paths for foraging. However, diameter limits that retain mid-aged trees commonly prevent the development of complex forest structure and decrease inherent habitat heterogeneity.

Changes would be expected in MSO prey habitat. Reductions would be expected in coarse woody debris, logs, and snags, commonly decreasing structure in prey habitat in the short term. Burn prescriptions and ignition techniques should limit these losses. Burned snags would fall and provide logs, and trees killed by fire would become snags. However, the longevity of fire-killed snags is less than that of snags formed by other processes. Maintenance burning should provide pulses of snags and logs through time. Less coarse woody debris would be expected in the short term as a result of prescribed fire. Thinning and burning should increase tree growth rates, and self-pruning of lower tree branches should replenish coarse woody debris in the long term. Improving growing conditions would decrease density-related mortality of larger and older trees. Improving recruitment into larger tree size classes would improve MSO habitat and the ability to provide large snags that remain on the landscape longer than smaller diameter or fire-created snags. The combination of thinning and burning should improve species richness in the herbaceous understory, increase plant abundance, and improve fruit and seed production.

Current and reasonably foreseeable projects represent areas omitted from the Rim Country planning effort because some degree of planning was already in progress or they occur outside of ponderosa pine forest. Treatments in these areas would reduce the fire threat for MSO habitat within the respective project area, as well as reducing the threat of high-severity fire starting in these areas and burning habitat outside the project areas. Given the diameter limits employed and the generally low intensity of the treatments in MSO habitat, decreases in the risk of high-severity fire and improvements to understory vegetation and prey habitat are expected to be short term, before canopies expand and intercept light, rain, and snow, thereby reducing understory response in the long term.

Cumulative effects from reasonably foreseeable projects could include disturbance from noise and potentially from smoke. Implementation of the CC Cragin Watershed Restoration Project (on the Mogollon Rim Ranger District) and Flagstaff Watershed Protection Project (the San Francisco Peaks and Mormon Mountain), reopening or developing rock pits (Coconino and Apache-Sitgreaves), and other restoration work, such as in in the Beaver Creek Rim Lakes and Larsen projects (Mogollon Rim), could cumulatively degrade but retain MSO habitat, including PACs and recovery habitat, in the short and long terms. However, the risk of high-severity fire eliminating MSO habitat would be reduced in the short and long terms.

Because current and reasonably foreseeable projects represent areas omitted from the 4FRI Rim Country project area, overlap in the spatial component of cumulative effects would largely be avoided. Although smoke and noise can cross project boundaries, both largely disperse with distance. However, some areas where smoke settles could be at further risk of effects on owls. Other restoration projects such as the C.C. Cragin Watershed Protection Project could cumulatively increase effects on owls in PACs adjacent to shared boundaries.

Many current and reasonably foreseeable projects would overlap temporally. All or most PAC treatments would have timing restrictions, preventing treatments during the breeding season. Also, the most common PAC treatment would be prescribed fire, which would be managed to be similar to the owl's evolutionary environment.

Given the various stages of planning and implementation, most project effects would be dispersed both spatially and temporally. Projects in MSO habitat are typically designed to improve habitat, or to degrade elements of habitat structure while retaining habitat function, resulting in a decrease in risk of high-severity fire. Cumulative effects would likely increase disturbance to individual MSOs from noise or smoke in the short term. Effects would not be expected on fecundity because of timing restrictions. Given restoration project objectives, the scale of the cumulative effects area, the distribution of MSO habitat across the project area, and the length of time over which treatments would be implemented (20 or more years), cumulative effects would not be expected to negatively affect MSO population in the long term. Overall, treatments in MSO habitat should move forest conditions toward desired conditions and decrease the risk of habitat loss to large-scale high-severity fire.

Determination of Effect

Based on the above analysis, Alternative 2 of the 4FRI Rim Country Project **may affect, is likely to adversely affect the Mexican spotted owl.**

Alternative 3 – Focused Alternative

Alternative 3 would treat fewer acres in Rim Country. The direct and indirect effects would be similar to Alternative 2. Alternative 3 includes the same number of miles and acres of riparian and other habitat restoration, while reducing the total number of acres thinned and treated with prescribed burning. In areas assigned treatments using the decision matrix, the acres to be treated would be reduced by 205,728 acres in Alternative 3. In MSO and goshawk habitat, the areas not assigned treatments using the decision matrix would be 218,670 less in Alternative 3 than in Alternative 2. In PACs, 14,640 fewer acres would be thinned and burned. In Recovery Nest/Roost habitat, 5,820 fewer acres would be treated in Alternative 3. Savannah treatments in Alternative 3 would be reduced by 15,190 acres, providing less restoration to benefit the MSO prey base. While short-term effects from disturbance would be lessened slightly with Alternative 3, the long-term effects and risk of habitat degradation from stand-altering wildfire or insect infestations would be greater.

Determination of Effect

Based on the above analysis, Alternative 3 **may affect, is likely to adversely affect the Mexican spotted owl.**

Western Yellow-billed Cuckoo

Alternative 1 – No Action

Under Alternative 1, habitat conditions for wildlife would largely remain in their current condition. Thinning and prescribed fire would still occur as a result of current and reasonably foreseeable projects. However, the landscape would continue to move away from desired conditions (see Affected Environment above and in the Silviculture and Fire Specialist reports). Alternative 1 would have no direct effect on the Yellow-billed Cuckoo; however there would be substantial indirect effects. Dense forest conditions would still occur and the high fire hazard potential would persist. Large crown-wildfires could adversely affect potential habitat by destroying understory and overstory vegetation. As a result overland flow would increase, and soil erosion would increase with potentially high sediment loads. Water quality and riparian conditions would be adversely affected on a wide-scale basis (See Hydrology Report), resulting in indirect adverse effects.

Under Alternative 1, there would be no restoration of springs and riparian areas. These areas would continue to exhibit downward trends in functional condition or remain in static condition for the foreseeable future (See Hydrology Report), resulting in degradation of potential habitat for cuckoos.

Denser forest conditions produce lower values in understory biomass (pounds per acre). Under Alternative 1, understory biomass would continue to decline over the next 40 years. Limited cover around tanks and riparian areas as well as the limited herbaceous understory across the project area, would continue to reduce the likelihood that cuckoos would successfully locate and nest in these areas.

Determination of Effect

Alternative 1 **May affect, is Likely to Adversely Affect**the yellow-billed cuckoo and its proposed critical habitat.

Alternative 2 – Modified Proposed Action

Prescribed fire and mechanical thinning projects have occurred and are expected to continue in habitat used by western yellow-billed cuckoo on national forests where cuckoos occur. Therefore, proposed fire and non-fire treatments may directly and indirectly affect cuckoos by removing suitable habitat and displacing breeding or foraging birds, and/or by disturbing cuckoos where suitable habitat is not displaced, but within the vicinity of project activities.

These kinds of projects could have short-term adverse effects on western yellow-billed cuckoo habitat by reducing cover, affecting water quality, and reducing prey abundance. Implementation of proposed activities and associated fire and smoke can alter cuckoo behavior by creating visual, noise, and physiological disturbance. Yellow-billed cuckoos may exhibit avoidance, ranging from less than a day where visual and noise disturbance is temporary to more than one breeding season where breeding and foraging habitat have been removed. If cuckoos are present at the time of thinning or prescribed burning activities, individuals could abandon their roosting and nesting sites. If nests are abandoned, young or eggs would be lost. Any individuals present in or adjacent to treated areas could also experience effects from the loss of prey availability, fire, and visual, noise, and smoke disturbance. The effects could range from habitat use changes, activity pattern changes, increased stress responses, decreased foraging efficiency and success, reduced reproductive success, increased predation risk, and intraspecific diminished communication (NoiseQuest n.d. [2012]; Pater et al. 2009). These responses could vary depending on the nature of the disturbance, but would be expected to decrease as the distance from the activity increases.

Although design features are included in this alternative to mitigate effects from treatments, adverse effects on cuckoos and habitat are still likely to occur during migration and the early part of the breeding season. Prescribed burning just prior to arrival would reduce the available foraging habitat and prey species to cuckoos. Cuckoo home ranges are large, usually at least 50 acres in size. As such, effects on cuckoos and habitat from thinning and prescribed fire might occur within cuckoo riparian breeding habitat and adjacent foraging habitat up to 0.5 mile away.

Prescribed fire, and to a lesser extent mechanical thinning, would also benefit cuckoos by maintaining long-term ecosystem function on these fire-adapted landscapes. Thinning and fire would promote seral stage diversity and reduce fuel build-up that might otherwise result in a stand-replacing, high-severity fire. The regenerating and resprouting trees, shrubs, and herbaceous vegetation resulting from fire would increase the insect production needed by cuckoos to raise young.

Prescribed burning would occasionally use riparian drainages as control lines where no natural physical barriers, roads, trails, or openings can be used. Design features described above would ensure that effects on riparian habitat would be spread across the landscape and temporally separated. In this way, there would never be a case over the lifespan of the project that a single riparian drainage would be treated along its entire length.

Determination of Effect

Implementation of Alternative 2 **May affect, is Likely to Adversely Affect** the western yellow-billed cuckoo and its proposed critical habitat.

Alternative 3 – Focused Alternative

Direct and indirect effects for Alternative 3 would be the same as with Alternative 2. Alternative 3 includes the same number of miles and acres of riparian restoration, while reducing the total number of forested acres thinned and treated with prescribed burning. Alternative 3 would treat fewer acres in Rim Country. Project design features have been developed (included in Alternative 2 analysis for the Western yellow-billed cuckoo above) to reduce the potential of effects on nesting and foraging cuckoo habitat.

Determination of Effect

Implementation of Alternative 3 **May affect, is Likely to Adversely Affect** the Western yellow-billed cuckoo and its proposed critical habitat.

Cumulative Effects

The area analyzed for cumulative effects for Yellow-billed Cuckoo is within the project area’s riparian corridors and a 0.5-mile buffer. Cumulative effects include effects of Alternative 1. This alternative would continue to result in indirect effects on the Yellow-billed Cuckoo. Degradation of habitat facilitated by this alternative would cumulatively combine with other forest activities, high-impact recreational use, livestock grazing, habitat loss and degradation on private lands. Synergistic effects of climate change would continue to fragment key riparian habitat.

Climate change, in combination with drought cycles, is likely to exacerbate existing threats to the western yellow-billed cuckoo’s habitat in the southwestern United States, now and into the foreseeable future. Increased and prolonged drought associated with changing climatic patterns would result in continued warming and drying of riparian habitats, would likely alter vegetation structure and composition, and would reduce the amount and quality of nesting and foraging habitat for yellow-billed cuckoos in the action area. However, implementation of restoration projects such as Rim Country should help to mitigate some of the long-term effects from climate change on western yellow-billed cuckoo habitat.

Mexican Grey Wolf

Alternative 1 – No Action

Under Alternative 1, habitat conditions for wildlife would largely remain in their current condition. Thinning and prescribed fire would still occur as a result of current and reasonably foreseeable projects. However, the landscape would continue to move away from desired conditions (see Affected Environment above and in the Silviculture and Fire Ecology and Air Quality Reports). Alternative 1 would have no direct effect on Mexican wolves. Dense forest conditions would still occur and the high fire hazard potential would persist. Large crown fires could adversely affect potential habitat by destroying understory and overstory vegetation.

Under Alternative 1, there would be no restoration of springs and riparian areas. These areas would continue to exhibit downward trends in functional condition or remain in static condition for the foreseeable future (see Water and Riparian Resource Report), resulting in degradation of conditions for potential prey species.

Determination of Effect

Alternative 1 would have **No Effect** to the Mexican wolf.

Alternative 2 – Modified Proposed Action

The 4FRI Rim Country Project lies within the Blue Range Wolf Recovery Area where Mexican wolf denning has not occurred. The Mexican wolf has not been reported denning in or near the Rim Country project area, though dispersing adults have moved through the area and could potentially den in the project area in the future.

If conflicts occur, the Forest Service would work with the Mexican Wolf Field Team to arrive at a solution. Actions taken on the other Ranger Districts where wolves occur included placing temporary restrictions around a wolf den site.

Dispersing reintroduced Mexican wolves might be disturbed during implementation of thinning and prescribed fire. Due to the mobility of the species, reintroduced wolves are likely able to avoid areas receiving treatment. Direct effects from thinning operations would not be expected to affect denning wolves because of the added design feature to limit disturbance.

Thinning and management-ignited fire alters prey species habitat to various degrees. Especially in areas that sustain low to moderate-intensity burns, there would be an eventual, relatively short-term increase in forage and browse used by some prey species.

Cumulative Effects

The cumulative effects analysis area for the wolf is the project area and a 10-mile buffer outside of the project boundary to include dispersing animals.

Cumulative effects would include the effects of Alternative 1. Degradation of habitat facilitated by this alternative would combine with other forest management activities, high-impact recreational use, livestock grazing, and habitat loss and degradation on private lands. Synergistic effects from climate change would continue to fragment habitat.

Dispersing reintroduced Mexican wolves might be disturbed during implementation of thinning and prescribed fire. Due to the mobility of the species, reintroduced wolves are likely able to avoid areas receiving treatment. Direct effects from thinning operations would not be expected to affect denning wolves because of the added design feature to limit disturbance.

Thinning and management-ignited fire alters prey species habitat to various degrees. Especially in areas that sustain low to moderate-intensity burns, there would be an eventual, relatively short-term increase in forage and browse used by some prey species.

The proposed activities to reintroduce fire, and improve ecosystem/vegetation health, watersheds, and soils could potentially improve wolf prey habitat conditions related to forage and cover, although there could be associated short-term disturbance effects. While design features could limit effects, not all negative effects would be reduced or eliminated.

Rangeland management and road work could disturb Mexican wolves through activities such as road use and herding of livestock, although authorized livestock grazing and trailing, and legally allowed vehicle use on established roads are specifically exempted from the definition of disturbance under the ESA Section 10(j) rule for the Mexican wolf. These associated activities could also expose Mexican wolves to harm by increasing motor vehicle traffic and the presence of vulnerable livestock.

Project activities for lands and minerals, recreation and wilderness, and wildlife, fish, and rare plants have the potential to disturb wolves and their prey, primarily through short-term activities such as mineral exploration, special use facility maintenance, group recreational events, or wildlife surveys or monitoring. While standards and guidelines could limit disturbance effects (e.g., reduce the need to relocate dens), not all negative effects would be reduced or eliminated.

Determination of Effect

Potential effects on the Mexican wolf reintroduction project from the Rim Country Project have been analyzed and found to be insignificant and discountable. Wolves have long endured in fire-adapted ecosystems and the implementation of this alternative would not adversely affect the reintroduction effort. Communication with the Interagency Field Team would allow project managers to avoid treatment in close proximity to dens, or during the wolf denning season.

By definition, a non-essential experimental population is not crucial to the continued existence of the species. Therefore, no management activities associated with the Rim Country Project would affect this 10(j) population so designated that could lead to a jeopardy determination for the entire species. The management activities associated with the Rim Country Project in the 10(j) area with Mexican wolves are **not likely to jeopardize the continued existence of the Mexican wolf.**

Alternative 3 – Focused Alternative

The direct and indirect effects from Alternative 3 would be similar to those from Alternative 2. Alternative 3 includes the same number of miles and acres of riparian restoration, while reducing the total number of acres thinned and treated with prescribed burning. Alternative 3 treat fewer acres in the Rim Country project area. A design feature was included (see Alternative 2 analysis above) to reduce the potential of effects on denning wolves.

Determination of Effect

Implementation of Alternative 3 is not likely to jeopardize the continued existence of the Mexican wolf.

Forest Service Sensitive Species

Northern Goshawk

Alternative 1 – No Action

Vegetation Changes

Under the no action alternative, most of the overall landscape would move toward desired conditions more slowly than the other alternatives, while some areas may not move toward desired conditions at all (Table 3-**). Post-fledging family areas (PFAs and lands outside PFAs (LOPFAs) would have less age-class diversity than either of the action alternatives.

Table 113. Habitat variables in PFAs by alternative decade

PFAs	Existing Condition	No Action 2029	No Action 2049	Alt2 2029	Alt 2 2049	Alt 3 2029	Alt3 2049
Avg of Trees per Acre	1062.52	958.87	778.86	450.22	162.39	620.50	379.60
Avg of Basal Area	130.53	137.53	145.49	70.36	57.96	94.55	92.65
Avg of Stand Density Index	303.15	311.01	313.76	154.85	106.20	209.68	185.61
Avg of Quadratic Mean Diameter in Inches	6.01	6.51	7.37	6.55	10.82	6.62	9.74
Avg of SNAG 12-18	1.75	3.08	4.70	6.53	4.09	4.75	3.95
Avg of SNAG 18-24	0.65	0.96	1.54	2.04	1.80	1.51	1.60
Avg of SNAG ≥24	0.35	0.38	0.56	1.06	1.07	0.78	0.83
Avg of Canopy Cover %	43.82	45.76	47.56	23.79	18.35	32.17	30.32
Avg of Surface Fuel tons per acre	14.83	16.88	22.06	9.87	9.77	11.95	13.40
Avg of Coarse Woody Debris	4.38	5.06	8.21	4.17	5.15	4.37	5.73
Avg of Downed Logs ≥12”	0.78	1.09	2.47	1.69	2.94	1.44	2.57
Avg of Herbaceous tons per acre	0.21	0.20	0.20	0.25	0.26	0.23	0.23
Average of Shrubs tons per acre	0.31	0.31	0.31	0.37	0.31	0.35	0.31

PFAs	Existing Condition	No Action 2029	No Action 2049	Alt2 2029	Alt 2 2049	Alt 3 2029	Alt3 2049
Avg of ALL BA1 0-1”	0.76	0.61	0.43	0.44	0.09	0.47	0.18
Avg of ALL BA2 1-5”	12.05	13.55	15.17	3.49	2.62	7.24	7.52
Avg of ALL BA3 5-12”	43.09	42.56	41.89	16.35	8.82	26.37	22.63
Avg of ALL BA4 12-18”	39.35	41.76	42.65	21.82	16.10	29.02	26.83
Avg of ALL BA5 18-24”	19.82	22.39	26.31	15.24	15.77	17.51	19.46
Avg of ALL BA6 24” +	15.45	16.67	19.02	13.02	14.55	13.94	16.03

Specifically, it would have the lowest proportion in grass-forb-shrubs, seedlings, and saplings; the highest proportion in mid-aged forest; and the lowest proportion in the older age classes.

Post-fledging Family Areas (PFAs)

In PFAs the FVS modeling of the effects of treatments on northern goshawk by alternative shows that the average trees per acre would remain high under Alternative 1, from the existing 1,062 to 958 in 2029 and 778 in 2049. The average of all basal area and canopy cover would continue to increase slightly, while the stand density index would remain high, from the existing 303 to 313 after 30 years. High competition for resources would keep the quadratic mean diameter low, from the current six inches to seven inches after 30 years. Mid-aged forest (BA3, 5-12 inches, and BA4, 12-18 inches) would continue to dominate the landscape and represent a huge shift in the NRV for the forested ecosystem.

Snags of all size classes important to prey species would continue to increase very slightly. Coarse woody debris and downed logs important to prey species would increase over 30 years. Herbaceous and shrub layers would show no improvement over time under Alternative 1.

Fuel loads in average of tons per acre would increase from 15 tons per acre in the existing condition to 22 tons per acre after 40 years under Alternative 1. The fire hazard index was modeled in PFAs under existing conditions (Table 3-**). Of the 39,478 acres modeled, Alternative 1 would result in 31,877acres (81 percent) of the PFAs that could potentially experience high-severity wildfire.

Table 44. Fire Hazard Index in PFAs, Alternative 1

Fire Hazard Index	Acres	Percent
1	7,665	19%
2	7,033	18%
3	8,787	22%
4	13,546	35%
5	2,510	6%

The risk of crown fire was modeled in PFAs based on the existing condition (table 56). Alternative 1 would result in 34,730 acres (88 percent) of PFAs in the Rim Country project area experiencing crown fire.

Table 45. Risk of crown fire in PFAs, Alternative 1

Crown Fire	Acres	Percent
Active	15,620	39%
Conditional	454	01%
Passive	18,654	47%

Crown Fire	Acres	Percent
Surface	4.811	12%

Lands outside of PFAs (LOPFAs)

The three forest plans have guidance to manage toward uneven-age stand conditions. In LOPFAs, Alternative 1 would have the slowest progress of all alternatives toward having age classes in uneven-aged (desired) condition.

In LOPFAs, FVS modeling of effects on Northern Goshawk by alternative shows that the average trees per acre would remain high under Alternative 1, from the current 1,062 to 964 in 2029 and 783 in 2049. The average of all basal area and canopy cover would continue to increase slightly, while the stand density index would remain high, from 303 to 313 after 30 years. High competition for resources would keep the quadratic mean diameter low, from the existing six inches to seven inches after 30 years. Mid-aged forest (BA3, 5-12 inches, and BA4, 12-18 inches) would continue to dominate the landscape and represent a huge shift in the Natural Range of Variation of the forested ecosystem.

Snags of all size classes important to prey species would continue to increase very slightly. Coarse woody debris and downed logs important to prey species would increase over 30 years. Herbaceous and shrub layers would show no improvement over time under Alternative 1. Wildfire modeling in the ponderosa pine habitat type by alternative show that of the 553,137 acres of ponderosa pine habitat type, 407,189 acres (81 percent) have the potential to experience high-severity wildfire under Alternative 1. Crown fire potential in ponderosa pine habitat from Alternative 1 could occur in 480,996 acres (87 percent) of this habitat type.

Determination of Effect

Alternative 1 may affect individual goshawks, but is not likely to cause a trend toward federal listing or loss of viability.

Table 46. Habitat Variables in LOPFAs, Alternative 1

LOPFA	Existing Condition	No Action 2029	No Action 2049	Alt2 2029	Alt 2 2049	Alt 3 2029	Alt3 2049
Avg of Trees per Acre	1069.14	964.77	783.26	451.07	162.65	626.16	383.92
Avg of Basal Area	130.36	137.32	145.24	70.21	57.71	94.74	92.84
Avg of Stand Density Index	303.01	310.80	313.51	154.57	105.76	210.28	186.22
Avg of Quadratic Mean Diameter in Inches	6.01	6.50	7.37	6.55	10.80	6.61	9.72
Avg of SNAG 12-18	1.75	3.10	4.69	6.57	4.08	4.76	3.95
Avg of SNAG 18-24	0.64	0.96	1.54	2.06	1.79	1.51	1.59
Avg of SNAG ≥ 24	0.35	0.38	0.56	1.07	1.08	0.79	0.83
Avg of Canopy Cover %	43.76	45.71	47.53	23.76	18.30	32.24	30.41
Avg of Surface Fuel tons per acre	14.81	16.86	22.06	9.87	9.78	11.97	13.46
Avg of Coarse Woody Debris	4.35	5.03	8.19	4.17	5.16	4.37	5.75
Avg of Downed Logs ≥12”	0.77	1.08	2.47	1.69	2.96	1.44	2.58
Avg of Herbaceous tons per acre	0.21	0.20	0.20	0.25	0.26	0.23	0.23
Average of Shrubs tons per acre	0.32	0.31	0.32	0.38	0.31	0.35	0.31

LOPFA	Existing Condition	No Action 2029	No Action 2049	Alt2 2029	Alt 2 2049	Alt 3 2029	Alt3 2049
Avg of ALL BA1 0-1”	0.77	0.62	0.44	0.44	0.09	0.48	0.18
Avg of ALL BA2 1-5”	11.98	13.52	15.24	3.48	2.63	7.27	7.60
Avg of ALL BA3 5-12”	42.96	42.42	41.71	16.30	8.78	26.44	22.71
Avg of ALL BA4 12-18”	39.36	41.71	42.58	21.78	16.04	29.10	26.90
Avg of ALL BA5 18-24”	19.79	22.36	26.26	15.23	15.74	17.53	19.47
Avg of ALL BA6 24” +	15.48	16.68	18.99	12.98	14.43	13.93	15.96

Effects Common to Both Action Alternatives

Gambel oak, juniper and pinyon species greater than five inches in diameter at the root collar (diameter root collar) may be considered as residual trees in the target group spacing and stocking.

Manage for large oaks (10 inch diameter at the root collar or larger) by removing ponderosa pine up to 18 inches in diameter that do not meet the "old tree" definition and do not have interlocking crown with oaks and occur within 30 feet of base of oak 10 inches in diameter at the root collar or larger.

Mechanical Treatments

Habitat features that appear to be important to a variety of goshawk prey species would be retained or improved with Alternatives 2 and 3 (see analysis under each alternative in this report and the Silviculture Report,). These habitat features include snags, downed logs, large trees, openings and associated herbaceous and shrubby vegetation, interspersion, and canopy cover (Reynolds et al. 1992, USDI FWS 1998, Squires and Kennedy 2006).

Noise disturbance from logging trucks was monitored for nesting goshawks in a study on the Apache-Sitgreaves NF. The study was coordinated between the Apache-Sitgreaves NF, Rocky Mountain Research Station, U.S. Army, and a private sound consultant. Results from this field-based, controlled experiment found no evidence of negative effects from truck noise. Observed goshawk response to logging truck noise was limited to, at most, looking in the direction of the hauling road (Grubb et al. 2012).

A study on the Kaibab National Forest in Northern Arizona found no movement or flush responses from nesting northern goshawk from as near as 78 meters away from passing logging trucks (Grubb et al. 2013).

Disturbance from hauling would vary based on which nest site is selected during the time that hauling occurs. Therefore, road disturbance, even with thousands of truck trips, may cause little or no disturbance.

Road work and use of haul roads could increase the potential for goshawk collision with vehicles. Little information is available on how frequently collisions might occur and what conditions might increase or lessen the vulnerability of goshawks.

A speed limit of 25 miles per hour would be implemented for vehicles passing through PFAs to reduce the hazard of collisions. Given the adult goshawk's natural agility in flight and the size and noise of the large trucks and chip vans, adult goshawks would be expected to avoid colliding with log trucks passing through the PFA. Newly fledged goshawks still developing their flight skills may have a slightly higher potential for colliding with a large truck, but the reduced speed of the trucks and natural agility of goshawks should minimize this potential. Birds migrating or dispersing through unfamiliar terrain may be at higher risk than resident birds.

Vehicle activity would alternate throughout the Rim Country landscape as different contracts are issued and would concentrate in particular areas while the work is being conducted. Activity would be expected to increase well above existing traffic levels for about two years until operations shift to other areas.

In summary, hauling of wood products or road gravel would be unlikely to cause noise disturbance to nesting goshawks or result in collisions, but there is the potential to disrupt reproduction and rearing of young by, at most, one or two pair of goshawks and might result in the injury or death of one or more young. This risk would be lowered with a lower speed limit.

Prescribed Fire

The forest plans allow for wildfire to occur within PFAs during and outside the breeding season, although human disturbance should be limited during the breeding season so that goshawk reproductive success is not affected by human activities. Low-intensity ground fires are allowed at any time, but high-intensity crown fires are not acceptable in PFAs or nest areas.

The effects from burning would be influenced by the life history of the goshawk at the time of the fire, as well as several fire-related factors including pre-fire fuel loading and structure, the season when the fire occurs, fire intensity, and fuel consumption.. Burning effects would also be related to how similar burning conditions are to the natural fire regime. Knapp et al (2009) provide a good overview of the ecological effects of prescribed fire season.

Goshawks and their prey could be directly affected by the heat, flames, and smoke of a fire or indirectly by habitat modification. Animals that live in fire-adapted ponderosa pine forests have presumably developed behavioral adaptations to escape fires or find refugia and allow populations to persist (Knapp et al 2009).

Incubating adults or young goshawks unable to fly could inhale smoke from prescribed fires. Smoke could result in an extended absence of the adults during brooding or when the chicks are very young. This could result in increased vulnerability to predators or to unfavorable weather, or reduced feeding. Smoke is likely to be worse during first-entry burning, under conditions where fuels have built up to unnatural levels due to years of fire suppression. Smoke would be expected to be more within the range of natural variation after a first-entry burn and to have less intensity or duration. There would be a low likelihood of loss of nest trees or goshawks due to the heat, flames, or smoke of a prescribed fire with the design features for this project.

Wildfire Modeling

Fire hazard index was modeled for one treatment and two prescribed burns in 39,488 acres of PFAs within the project area. Fire hazard index by alternative is in the table below. The highest and greatest hazard categories of fire hazard index were calculated with percentages of the total habitat type in the project area for further analysis by alternative. 553,120 acres of ponderosa pine habitat type was also modeled for wildfire effects.

Table 47. Fire hazard index in PFA habitat by alternative

Fire Hazard Index	Existing	Alternative 1	Alternative 2	Alternative 3
PFA	27,414 (69%)	31,877 (81%)	10,261 (26%)	18,075 (46%)
PFAs with the Highest and Greatest Hazard Categories	13,511 (34%)	16,056 (41%)	1,968 (05%)	5,106 (13%)
Ponderosa Pine Habitat Type FHI	327,867 (59%)	407,189 (74%)	129,762 (23%)	247,350 (45%)

The potential for crown fire was also modeled in PFAs and ponderosa pine habitat type in the project area by alternative with acres and percentages included in the table below. For further analysis active crown fire was assessed as well in both habitat types.

Table 48. Crown Fire Assessment in PFAs by Alternative

Fire Hazard Index	Existing	Alternative 1	Alternative 2	Alternative 3
PFA All Crown Fire	32,695 (83%)	34,730 (88%)	30,732 (78%)	31,771 (80%)
PFA Active Crown Fire	13,033 (33%)	15,626 (40%)	1,583 (04%)	4,584 (12%)
PP Habitat Type All Crown Fire	430,771 (78%)	480,996 (87%)	447,738 (81%)	471,447 (85%)
PP Active Crown Fire Potential	112,496 (20%)	160,879 (29%)	12,486 (2%)	45,680 (08%)

Alternative 2 – Modified Proposed Action

PFAs

Vegetation Changes

FVS Modeling of Alternative 2 treatments on 37,860 acres of PFAs in the project area would take trees per acre from 1,062 to 450 in 2029 and 162 in 2049. The stand density index would be greatly reduced, from the existing 303 to 106 after 30 years. The quadratic mean diameter would increase from six inches to 10.7 inches after 30 years. Mid-aged forest (BA3, 5-12 inches, and BA4, 12-18 inches) would be treated to attain the desired condition, reducing these size classes to better represent uneven-aged management. Snags of all size classes important to prey species would continue to increase. Coarse woody debris and downed logs important to prey species would increase over 30 years. Also important to goshawk prey species, herbaceous and shrub layers would increase over time under Alternative 2.

Lands Outside of PFAs (LOPFA)

In LOPFAs the FVS modeling on 902,064 acres of ponderosa pine habitat shows that the average trees per acre would be lowered from 1,069 to 783 in 2029 and 451 in 2049. The average of all basal area and canopy cover would decrease, but the stand density index would be most reduced under Alternative 2, from 303 to 106 after 30 years. Lower competition for resources would increase the quadratic mean diameter, from six inches to nearly 11 inches after 30 years. Mid-aged forest (BA3, 5-12 inches, and BA4, 12-18 inches) would be greatly reduced under Alternative 2, bringing the age class distribution to desired condition after 30 years.

Snags of all size classes important to prey species would continue to increase from existing conditions. Coarse woody debris and downed logs important to prey species would increase over 30 years modeled. Herbaceous and shrub layers, also important for prey species, would be increased or maintained under Alternative 2.

Fire Effects

In both PFAs and in ponderosa pine habitat fuel loads in average of tons per acre would increase from 15 tons per acre in the existing condition to less than 10 tons per acre after 30 years under Alternative 2.

Fire hazard index was modeled in PFAs for Alternative 2 (Table 3-** above). Of the 39,488 acres modeled Alternative 2 would result in a reduction over the existing condition from 27,414

(69 percent) of all PFA acres in the project area to 10,261 acres (26 percent) that could experience high-severity wildfire.

Risk of crown fire was modeled in PFAs for Alternative 2 (Table 3-** above). Alternative 2 would result in 30,732 acres (78 percent) of PFAs in the Rim Country project area with the potential to experience crown fire. Active crown fire is reduced from 15,626 acres (40 percent) in alternative 1 to 1,583 (4 percent) acres that would experience active crowning under Alternative 2.

Determination of Effect

Considering direct, indirect, and cumulative effects, implementation of Alternative 2 may affect individual goshawks, but is not likely to cause a trend toward federal listing or loss of viability.

Alternative 3 – Focused Alternative

PFA

Vegetation Changes

Alternative 3 would change trees per acre from the existing 1,062 to 620 in 2029 and 379 in 2049. The stand density index would be highly reduced, from 303 to 185 after 30 years. The quadratic mean diameter would increase, from six inches to nearly 10 inches after 30 years. Mid-aged forest (BA3, 5-12 inches, and BA4, 12-18 inches) would be lowered, though not to the desired conditions. Snags of all size classes important to prey species would continue to increase. Coarse woody debris and downed logs important to prey species would increase over 30 years. Herbaceous and shrub layers would be maintained over time under Alternative 3.

Lands Outside of PFAs (LOPFA)

In LOPFAs, FVS modeling shows that the average trees per acre would be lowered under Alternative 3, from the existing 1,069 to 384 in 2049. The average of all basal area and canopy cover would decrease, but the stand density index would be reduced from 303 to 186 after 30 years. Lower competition for resources would increase the quadratic mean diameter, from six inches to nearly 10 inches after 30 years. Mid-aged forest (BA3, 5-12 inches, and BA4, 12-18 inches) would be greatly reduced under Alternative 3, bringing these age classes closer to desired conditions after 30 years.

Snags of all size classes important to prey species would continue to increase. Coarse woody debris and downed logs important to prey species would increase over 30 years. Herbaceous and shrub layers, also important for prey species, would be increased or maintained under Alternative 3.

Fire Effects

In both PFAs and in ponderosa pine habitat fuel loads in average of tons per acre increase from 15 tons per acre in the existing condition to less than 13 tons per acre after 40 years under Alternative 3.

Fire hazard index was modeled in PFAs for Alternative 3 (Table 3-** above). Of the 39,488 acres modeled Alternative 3 would result in a reduction over the existing condition from 27,414 (69 percent) of all PFA acres in the project area to 18,075 acres (46 percent) that could experience high-severity wildfire.

Risk of Crown Fire was modeled in PFAs for alternative 3 (Table 3-** above). Alternative 3 would result in 31,771 acres (80 percent) of PFAs in the Rim Country project area with the potential to experience crown fire. Active crown fire is reduced from 15,626 acres (40 percent) in Alternative 1 to 4,584 acres (12 percent) that would experience active crowning under Alternative 3.

Determination of Effect

Considering direct, indirect, and cumulative effects, implementation of Alternative 3 may affect individual goshawks, but is not likely to cause a trend toward federal listing or loss of viability.

Cumulative Effects

The cumulative effects analysis boundary is defined as the project area and a one-half mile buffer around the outside of the project boundary, and includes effects for a period of 25 years beginning with implementation of the Rim Country Project. The No Action Alternative would maintain the current fire risk to northern goshawk habitat and adjacent forest lands. The cumulative effects of the No Action Alternative would be to increase the number of acres of National Forest System lands that are vulnerable to severe fire effects, as dense forest conditions would continue to place goshawk habitat and adjacent habitat at risk of stand-replacing fire. The fire hazard would increase over time as vegetation would continue to grow, fuels continue to accumulate, and the effects from climate change persist, thus continuing to have negative effects on northern goshawk.

For Alternatives 2 and 3, the majority of acreage identified as part of the cumulative effects analysis occurs in LOPFA habitat. The majority of past, current, and foreseeable future treatment acres are prescribed fire only. However, most of the alternative treatments are mechanical thinning with prescribed fire. Alternative 2 cumulatively would have the most treatment acres whereas Alternative 3 would have the fewest.

Restoration treatments would contribute toward improving forest health, vegetation diversity, and vegetation composition in goshawk habitat under Alternatives 2 and 3. This would aid in sustaining old forest structure over time and moving forest structure toward desired conditions.

Project treatments would primarily decreased the number of trees less than 14 inches in diameter. The degree of treatment intensity is highly variable, with some projects not cutting trees greater than 12 inches in diameter and others looking to lower the threat of high-severity fire in goshawk habitat. The overall ratio of trees greater than 12 inches in diameter is likely to increase as a result of removing smaller trees and increasing the growth and survivability of larger trees. Total basal area of pine would decrease in the short term, but because the focus is on small trees, basal area might not substantially change. Overall basal area would be expected to increase in the long term.

Gambel oak is not targeted for removal, but prescribed fire would likely top-kill small diameter oak, potentially decreasing oak basal area in the short term. However, design features should ensure retention of large diameter oak and small oak commonly sprout vigorously after fire. The total basal area of Gambel oak is not expected to change substantially in the long term. Created canopy gaps, interspaces, and tree groups should benefit prey species and thinning should hasten tree growth, improving goshawk habitat.

Changes are expected in goshawk prey habitat. Decreases would occur in coarse woody debris, logs, and snags, commonly decreasing structure in prey habitat in the short term. Burn prescriptions and ignition techniques should limit these losses. Burned snags fall and provide logs, and trees killed by fire would become snags. However, the longevity of fire-killed snags is less than that of snags formed from other processes. However, maintenance burning should provide pulses of snags and logs through time. Less coarse woody debris is expected to be present in the short term as a result of prescribed fire. Thinning and burning should increase tree growth rates and self-pruning of lower tree branches should replenish coarse woody debris in the long term. Improving growing conditions should decrease density-related mortality of larger and older trees. Improving recruitment into the larger size classes would improve goshawk habitat and the ability to provide large snags that remain on the landscape longer than smaller diameter or fire-created snags. The combination of thinning and burning should improve species richness in the herbaceous understory, increase plant abundance, and improve fruit and seed production.

Current and reasonably foreseeable projects represent areas omitted from the 4FRI planning effort because some degree of planning was already in progress or they occur outside of ponderosa pine forest. Treating within these areas would reduce fire threat for goshawk habitat within the respective project area as well as reducing the threat of high-severity fire starting in these areas and burning habitat outside the areas. In addition, improvements to understory vegetation and prey habitat are expected to occur in goshawk habitat and be more persistent in the long term compared to more conservative treatments in MSO habitat that are employed because MSOs have different habitat requirements than goshawks.

Cumulative effects from reasonably foreseeable projects could include disturbance from noise and potentially from smoke but could collectively work to improve goshawk habitat, including PFAs, because the risk of high-severity fire eliminating goshawk habitat would be reduced in the short term and long term. Because current and reasonably foreseeable projects represent areas omitted from the 4FRI project area effort, overlap in the spatial component of cumulative effects would largely be avoided. Although smoke and noise can cross project boundaries, both largely disperse with distance. However, some areas where smoke settles could have longer duration short term effects. Other projects, such as the CC Cragin and Beaver Creek Watershed Protection and Fuels Reduction Projects could cumulatively increase effects on goshawks in PFAs adjacent to shared boundaries.

Many current and reasonably foreseeable projects would overlap temporally. It is conceivable that actions would be occurring in PFAs in multiple locations within the 4FRI boundary. However, all or most PFA mechanical treatments or activities would have timing restrictions, postponing treatments until after the breeding season. Wild fire could occur at any time. Adult goshawks would be expected to adapt to fire because it inhabits ponderosa pine, which is a fire-adapted vegetation type in the southwest.

Given the various stages of planning or implementation, most project effects would be dispersed both spatially and temporally. Projects in goshawk habitat are typically designed to improve habitat, or to degrade elements of habitat structure while retaining habitat function, resulting in a decrease in risk of high-severity fire. Cumulative effects would likely increase disturbance to individual goshawks from noise or smoke in the short term. Effects are not expected to affect fecundity because of timing restrictions. Given typical project objectives, the spatial scale of the cumulative effects area, the distribution of goshawk habitat across the project area, and the length of time over which treatments would be implemented (10 or more years), cumulative effects are not expected to negatively affect the goshawk population in the long term. Overall, treatments in goshawk habitat should move forest conditions toward desired conditions and decrease the risk of habitat loss to large-scale high-severity fire.

Northern Leopard Frog

Alternative 1 – No Action

Under Alternative 1, habitat conditions for wildlife would largely remain in their current condition. Thinning and prescribed fire would still occur as a result of current and reasonably foreseeable projects. However, the landscape would continue to move away from desired conditions. Alternative 1 would have no direct effects on northern leopard frogs; however, there would be substantial indirect effects. Dense forest conditions would still occur and the high fire hazard potential would persist. Large crown wildfires could adversely affect potential habitat by destroying understory and overstory vegetation. As a result, overland flow would increase and soil erosion would increase, with the potential for high sediment loads. Water quality and riparian conditions would be adversely affected on a wide-scale basis, resulting in indirect adverse effects.

Under Alternative 1, there would be no restoration of springs and riparian areas. These areas would continue to exhibit downward trends in functional condition or remain in static condition for the foreseeable future, resulting in degradation of potential habitat for frogs.

Denser forest conditions produce lower values in understory biomass (pounds per acre). Under Alternative 1, understory biomass would continue to decline over the next 40 years. Limited cover around tanks and riparian areas, as well as the limited herbaceous understory across the project area, would continue to reduce the likelihood that frogs would successfully disperse and feed while traveling between waters. The limited cover would also leave frogs vulnerable to predation.

Determination of Effect

Alternative 1 would have no effect on Northern leopard frogs.

Alternative 2 – Modified Proposed Action

Dispersing leopard frogs could be directly affected if they collide with mechanical equipment or if they could not find refugia during prescribed fire activities. All springs and riparian reaches would be surveyed prior to restoration activities. Design features would reduce the likelihood of direct effects on frogs from mechanical thinning, temporary road construction, spring and riparian restoration, road decommissioning, and prescribed fire.

Under the modified Proposed Action, dense forest conditions and surface fuel loading would be reduced. The likelihood of large crown wildfires adversely affecting potential habitat by destroying understory and overstory vegetation would be reduced from 327,867 acres (59 percent) of all ponderosa pine in the project area, to 129,762 acres (23 percent) from Alternative 2. Fire hazard index in grasslands would also be greatly reduced from treatments (from 5,000 acres in the existing condition to 138 acres in Alternative 2). As a result, overland flow would be stable, and soil erosion would not have the high sediment-loading potential. Water quality would be not adversely affected on a wide-scale basis, resulting in indirect beneficial effects.

Under Alternatives 2 and 3, springs, meadows, and aquatic habitat restoration would be implemented, benefiting NLFs. There would be short-term disturbance to vegetation during implementation of stream and spring restoration projects; however, restored vegetation would be expected to recover within one to three years. An important consideration for restoration of springs is to restore discharge from the spring source except where prescribed by existing water rights adjudicated. Alternatives 2 and 3 would allow discharge from springs to resume flow through their historic spheres of discharge. Spring and seep restoration would improve riparian vegetation increasing availability of food and reproductive sites for this species over the long term, resulting in direct beneficial effects on habitat. Restoration of aquatic habitats would improve cover and water flow that provides escape from predators and prevents water loss for migrating leopard frogs.

Reconstructing 40 miles of temporary roads along their original alignments would generally have limited effects on the physical habitat features along the roads. About 30 miles of road reconstruction would address safety concerns for hauling. The remaining miles (about 10) would relocate roads out of drainage bottoms. Relocated roads would include rehabilitation of the abandoned road segment. Disturbance associated with road traffic is not expected to change because this represents improvements to segments of existing road, not new road construction. If each mile affects approximately three acres of habitat, then about 120 acres of breeding and dispersal habitat would be affected by road reconstruction.

Constructing temporary roads would disturb vegetation and reduce habitat quality for leopard frogs. Use of these roads by machinery and equipment could crush animals moving across the road. These effects may affect individuals but are expected to be short-term, occurring only during project implementation. Temporary roads would be decommissioned to eliminate use and vegetation would be restored over the long term.

Decommissioning roads would improve the quality of the habitat in those areas where the roads are decommissioned. While the physical structure and features of the habitat may not measurably change along the former road alignment, eliminating disturbance along the roadway would be expected to improve the quality of habitat and reduce the potential for frogs to be crushed by vehicles using these roads.

Implementation of the modified proposed action could increase the risk of spread of Chytrid fungus across the project area. Machinery and equipment used during implementation could transfer Chytrid fungus between waterbodies, increasing the occurrence of the pathogen in leopard frog habitats across the project area. Potential effects from Chytrid fungus that is spread by machinery and equipment would be minimized by requiring decontamination procedures to be followed when activities take place within wetted areas or moist perimeter of a tank or ephemeral stream (see design features). Therefore, minimal potential for spread would exist.

Under the modified proposed action, surface disturbance within proximity of suitable habitats would increase. Direct effects could result from crushing and trampling of migrating or basking individuals. The use of heavy machinery and increased levels of human activity and traffic are likely to increase sedimentation in the earthen livestock tanks in the vicinity, especially in those located downslope from treated areas. Effects from sedimentation on leopard frog habitats are extensive and varied. They include alterations in water quality and vegetation structure, that ultimately have detrimental effects on leopard frogs by decreasing rate of development, increasing vulnerability to predators, and reducing food availability.

Prescribed burning may result in mortality of leopard frogs. Early fall prescribed fire has the highest likelihood of affecting leopard frogs, as this is a time of year when they are migrating between suitable habitats. Leopard frogs may migrate en masse, and large numbers may therefore be susceptible to fire at one time. Prescribed burns would be coordinated with a wildlife biologist to insure protections for migrating frogs. In coordination with AZGFD, occupied and potential breeding sites have been identified and mapped and would be included in individual contract maps with a special water designation. Project design features have been developed to reduce the potential effects on these important breeding sites and frogs using and moving between these sites (see Appendix 5 in the Wildlife Specialist Report). Implementation of best management practices would curtail soil erosion and minimize the potential for inflow into potential northern leopard frog habitat.

Determination of Effect

Implementation of Alternative 2 may affect individual northern leopard frogs, but is not likely to cause a trend toward federal listing or loss of viability.

Alternative 3 – Focused Alternative

Alternative 3 treats fewer forest acres in Rim Country, but the direct and indirect effects would be similar to Alternative 2. Alternative 3 includes the same miles and acres of riparian and other habitat restoration, while reducing the total number of acres thinned and treated with prescribed burning. While short-term effects from disturbance would be slightly less in Alternative 3, the long-term effects on the risk of habitat degradation from stand-altering wildfire or insect infestations would be greater.

Determination of Effect

Implementation of Alternative 3 may affect individual northern leopard frogs, but is not likely to cause a trend toward federal listing or loss of viability.

Cumulative Effects

The cumulative effects analysis area for northern leopard frogs is the project area and a 0.25-mile buffer outside of the project boundary to include current and potential breeding sites. Cumulative effects include the effects of Alternative 1. This alternative would continue to result in indirect effects on northern leopard frogs. Degradation of habitat facilitated by this alternative would combine with other forest activities, high-impact recreational use, livestock grazing, and habitat loss and degradation on private lands. Synergistic effects from climate change would continue to fragment key aquatic and dispersal habitat.

Alternatives 2 and 3 would result in short-term direct and indirect effects on Northern leopard frogs (see above). The restoration of aquatic habitats included in this alternative would slow the combined effects from other forest activities, high-impact recreational use, livestock grazing, habitat loss and degradation on private lands. Implementing restoration of key aquatic and dispersal habitat would link, rather than fragment, these habitats, allowing for the needs of breeding and dispersing leopard frogs.

Bald Eagle

Alternative 1 – No Action

Under Alternative 1, current and reasonably foreseeable projects would still be implemented in the Rim Country project area. Wildfire modeling in the ponderosa pine habitat type by alternative show that of the 553,137 acres of ponderosa pine habitat type, 407,189 acres (81 percent) have the potential to experience high-severity wildfire under Alternative 1. Crown fire potential in ponderosa pine habitat from Alternative 1 could occur in 480,996 acres (87 percent) of this habitat type. Dense forest conditions would still occur across the project area, and the high fire hazard potential would continue to place potential bald eagle nesting, roosting, and foraging habitat at risk with respect to stand-replacing fire.

Tree densities would continue to be high, slowing or stagnating growth into larger diameter classes, thereby limiting the development of roosting and perching habitat. Meadows, grasslands, and savannas would continue to be encroached by trees, limiting potential foraging areas.

Determination of Effect

Alternative 1 **would not result in take** as defined in the Eagle Act for bald eagles.

Effects Common to Both Action Alternatives

Direct effects would be from activities that cause disturbances (smoke, auditory or visual) to bald eagles nesting or foraging within or adjacent to the project area. Under the action alternatives (the modified proposed action and the focused alternative), there would be no direct adverse effects on nesting eagles as project design features would eliminate disturbance near known nesting sites. No vegetation treatments would occur within 0.5 mile (2,500 feet), unless mitigated by topography, of an occupied bald eagle nest between March 1 and August 31. Drift smoke from prescribed fire would be expected. Concentrations of smoke that might settle in an area for more than one or two nights when a female is on the nest could have adverse effects on individuals. Prevailing southwest winds and the topography of the area typically act to lift smoke, carrying it away from ignition sites. Nests on cinder cones and other raised topographic features and in Sycamore and Oak Creek Canyons, or in canyons immediately adjacent to Sycamore and Oak Creek Canyons or the Mogollon Rim, are not expected to have smoke settle in them long enough to cause measurable effects on eagles because of the air movement in these landscape-scale features. Conversely, nests in small canyons or valleys might incur effects from dense smoke settling near nesting locations.

When smoke settles into low-lying areas it typically does not last more than one or two nights. Limited smoke at nest locations would be expected to expose adult eagles to negligible effects as this would repeat an aspect of their evolutionary environment (Horton and Mannan 1988, Prather et al. 2008). However, on occasion dense smoke may settle into specific nest locations. Dense smoke settling into nest areas early in the season (January through June) could disturb brooding females. If the female is flushed long enough to affect incubation, this could result in loss of viability of the eggs. Dense smoke settling for multiple consecutive nights could affect the developing lungs of nestlings. Unlike mammals, damaged avian lungs do not repair themselves through time (Rombout et al. 1991). Triggering a female to discontinue incubating eggs or affecting the lung development of nestlings would constitute long-term adverse effects. Outside of these examples, smoke settling in nest locations would typically be short-term and not likely to cause adverse effects.

Alternatives 2 and 3 would exclude mechanical thinning treatments within a 300-foot buffer around confirmed nest and roost sites. Additionally, timing restrictions during the winter roosting season would provide protection from disturbance to roosting eagles. Potential roost treatments would be designed to maintain and develop roost characteristics such as large trees and snags, while reducing surface fuel loading and crown fire potential within the roost, increasing roosting habitat for eagles in the project area.

There would be no effect on nesting or roosting eagles; however, short-term disturbance to foraging bald eagles would occur during mechanical treatments, prescribed burning, hauling of wood products, and other project activities that may cause visual or auditory disturbance. Prescribed burning and mechanical treatment would occur annually; however, these are short-term effects and would be minimized due to activities being temporally and spatially separated. Prescribed burning effects would dissipate over time as first-entry burns would consume accumulated surface fuels, raising crown bulk height and reducing crown bulk density. In maintenance or second-entry burns in ponderosa pine cover types, fuel loads would be significantly lower and produce low-severity effects with fewer emissions. Disturbances would be localized, of short duration, and might affect individual birds but would not affect the overall distribution or reproduction of the species.

Indirect effects on the bald eagle include effects on eagle habitat, eagle prey species, or prey species habitat. No adverse effects on prey species or prey species habitat are anticipated. Indirect effects on habitat would occur from treatments that modify the number of trees in a group of suitable roost trees, as eagles prefer to roost in large trees in close proximity to each other. However, thinning would improve old tree longevity, resulting in beneficial effects. In RUs with documented bald eagle use, snags would slightly increase after treatment (2020) and continue to increase in the long term. Ignition techniques and site preparation would reduce potential mortality in these components from burning activities.

The modified proposed action (Alternative 2) would develop older larger tree size classes which could be used as future winter roost sites for bald eagles.

Determination of Effect

Because of the design features included for both action alternatives to mitigate disturbance to eagles, Alternatives 2 and 3 would not result in take as defined in the Eagle Act for bald eagles. Cumulative Effects

The cumulative effects analysis area for bald eagles is the ponderosa pine habitat within the project area and a 0.5-mile buffer outside the project boundary. Cumulative effects include the effects from Alternative 1. Cumulative effects from Alternative 1 would be the greatest to wintering bald eagles. Continued dense forest conditions would limit the growth and sustainability of large trees, slowing development of potential winter roost areas. Other activities, including utility line and road construction and maintenance, high-impact recreation, and climate change, would combine to result in degradation of nesting and roosting habitat.

Short-term effects added to similar effects from nearby projects were considered. Implementation of other project activities could occur simultaneously; however, it is not anticipated that effects from those activities would combine with the effects from the Rim Country Project to produce negative effects. Both action alternatives would improve and develop quality potential nesting and roosting habitat by developing groups of large trees and snags that are more fire resistant. This positive effect would combine with similar effects from activities such as the Travel Management Rule efforts, which may decrease the frequency of disturbance on the majority of potential roost sites, and slightly counteract the effects from utility line and road construction and maintenance as well as short-term disturbances from vegetation management and prescribed fire.

Golden Eagle

Alternative 1 – No Action

There would be no direct effects on golden eagles as no habitat-altering activities or disturbance associated with project implementation would occur. Alternative 1 would not treat meadows, savannahs, or grasslands within the project area and trees would continue to encroach, reducing potential habitat for small mammals and consequently golden eagles. Tree densities would continue to be high, slowing growth into larger diameter classes and thereby limiting the development of larger diameter (18 inches or larger) trees important for nesting, roosting, and perching. Habitat conditions would remain in their current condition, notwithstanding natural processes. Dense forest conditions would still occur and the high fire hazard potential would continue to place potential golden eagle breeding, nesting, and foraging habitat at risk with respect to stand-replacing fire.

Effects Common to Both Action Alternatives

Both action alternatives would have the same effects on eagles, with Alternative 2 thinning and treating more acres, but with the same potential effects from restoration activities. Direct effects would be from activities that cause disturbances (smoke, auditory, or visual) to golden eagles nesting or foraging within or adjacent to the project. Under the modified proposed action or focused alternative, there would be no direct adverse effects on nesting eagles as project design features would eliminate disturbance near known nesting sites. No vegetation treatments would occur within 0.5 mile (2,500 feet) of an occupied golden eagle nest (unless mitigated by topography) between March 1 and August 31. Drift smoke from prescribed fire would be expected in most places; concentrations of smoke that might settle in an area for more than one or two nights when a female is on the nest could have adverse effects on individuals. Prevailing southwest winds and the topography of the area typically act to lift smoke, carrying it away from ignition sites. Nests on cinder cones and other raised topographic features on the Mogollon Rim are not expected to have smoke settle in them long enough to cause measurable effects on eagles because of the air movement in these landscape-scaled features. Conversely, nests in areas occurring in small canyons or valleys may have dense smoke settle in nesting locations.

When smoke settles into low-lying areas, it typically does not last more than one or two nights. Limited smoke at nest locations would be expected to expose adult eagles to negligible effects as this would repeat an aspect of their evolutionary environment (Horton and Mannan 1988, Prather et al. 2008). However, on occasion dense smoke may settle into specific nest locations. Dense smoke settling into nest areas early in the season (March through June) could disturb brooding females. If the female is flushed long enough to affect incubation, this could result in loss of viability of the eggs. Dense smoke settling for multiple consecutive nights could affect the developing lungs of nestlings. Unlike mammals, damaged avian lungs do not repair themselves through time (Rombout et al. 1991). Causing the female to discontinue incubating eggs or affecting lung development of nestlings would result in long-term adverse effects. Outside of these examples, smoke settling in nest locations would typically be short-term and not likely to cause adverse effects.

Under the modified proposed action, mechanical treatments, prescribed burning, road construction and decommissioning, hauling of wood products, and other restoration activities may cause visual or auditory disturbance to foraging golden eagles. This disturbance would be localized, of short duration and low intensity, and would not be expected to substantially interfere with normal feeding behavior. Up to 40,000 acres of prescribed burning and 45,000 acres of mechanical treatment would occur annually; however, these would be short-term effects and would be minimized due to activities being spatially and temporally separated. Additionally, prescribed burning effects would dissipate over time, as first entry burns usually consume accumulated surface fuels, raising crown bulk height and reducing crown bulk density. In maintenance or second entry burns in ponderosa pine, fuel loads would be significantly lower and produce low-severity effects with fewer emissions.

Indirect effects on the golden eagle include effects on eagle habitat, eagle prey species, or prey species habitat. There are no anticipated adverse effects on prey species or their habitats. Opening the canopy would provide improved visibility of and access to prey by golden eagles. Grassland and savanna treatments would maintain and improve foraging habitat on 36,340 acres of grassland and 17,590 acres of savanna habitat, improving prey species habitat by increasing availability of food for small mammals and resulting in an indirect beneficial effect.

Determination of Effect

Because of the design features included for both action alternatives to mitigate disturbance to eagles, the proposed treatments and activities **would not result in take** as defined in the Eagle Act for golden eagles.

Cumulative Effects

The cumulative effects analysis area for the golden eagle is the project area and within 0.5 mile of the project boundary. Continued pine tree encroachment into grasslands and private development in grasslands would result in cumulative effects with such activities as grazing and high-impact recreational use to limit meadow and grassland habitats. Prescribed burning in adjacent projects may result in short-term effects on habitat, but these are not expected to result in long-term cumulative effects and are expected to be localized in nature. This alternative would result in the most stress on meadow and grassland habitats and thus would have the greatest negative contribution to potential golden eagle habitat.

Under Alternatives 2 and 3, there would be no effect on nesting eagles; however, there is the potential for short-term disturbance to potential foraging habitat with long-term benefits. Short-term disturbance to foraging eagles would occur during thinning, hauling, temporary and permanent road construction, and prescribed burning activities that may cause eagles to forage in nearby areas for the duration of the activity. Other activities planned that may have similar effects include temporary disturbances caused by prescribed fire and thinning in adjacent projects, or effects on roosting habitat from utility infrastructure development and maintenance. These short-term effects added to similar effects from other activities were considered. Implementation of other fuel reduction and restoration activities could occur simultaneously; however, it is not anticipated that effects from those activities would combine with effects from the Rim Country Project to cause negative effects.

American Peregrine Falcon

Alternative 1 – No Action

In grasslands, savannas, and meadows, tree encroachment and surface litter accumulation would continue, continuing to negatively affect some prey habitats for peregrine falcons. Stability of key ecosystem components such as species composition, forest structure, soil characteristics, and hydrologic function would be at moderate to high risk of loss in the event of a disturbance such as a high-severity wildfire. This alternative would result in the most stress on meadow and grassland habitats and thus would have the greatest negative contribution to potential grassland habitat.

Determination of Effect

Under the No Action Alternative, there would be **no direct or indirect effects on peregrines**. There would be no change to the prey species base, and no change in falcon hunting patterns within associated forest structure.

Effects Common to Both Action Alternatives

Constructing and reconstructing roads along their original alignments, including temporary and relocated roads, would not have noticeable effects on the physical habitat features along the roads. Increased disturbance associated with the increased activity on the improved road conditions may decrease the habitat quality along the improved roads. Aquatic and other habitat restoration in Alternatives 2 and 3 would improve habitat. There would be short-term disturbance to vegetation during implementation of restoration projects. However, restored vegetation would be expected within one year following restoration activities.

Decommissioning of roads in Alternatives 2 and 3 would improve the quality of the habitat in those areas where roads are decommissioned. The physical structure and features of habitat for falcons and their prey would be improved along the former road alignment, and disturbance along the roadway would largely be eliminated, thereby improving the quality of habitat in the long term.

Constructing temporary roads would disturb vegetation and reduce available habitat for peregrine prey. This may affect individuals but is expected to be short term, occurring only during project implementation. Temporary roads would be obliterated to eliminate use and vegetation would be restored over the long term.

Alternative 2 – Modified Proposed Action

Under the modified proposed action, no direct effects from mechanical treatments, temporary road construction, prescribed burning, or spring, riparian habitat, and ephemeral stream restoration is expected. There are four peregrine eyries (nest locations) within the project area. All four are associated with one pair of peregrines. These eyries are located on cliff ledges in a rugged canyon. No thinning treatments are proposed in these areas though they often overlook woodlands, riparian areas, or other habitats supporting avian prey species in abundance, which describes most of the Mogollon Rim and Steeper canyons:a burn-only treatment is planned. Smoke from burning operations would be expected to drain away from the nest location, reducing the potential for birds to be exposed to heavy concentrations of smoke. This area is also designated as a Mexican spotted owl protected activity center; protection measures developed for the owl would also protect peregrines breeding in this area as their breeding season overlaps with the owl.

Mechanical treatments prescribed burning, hauling of wood products, and other project activities may cause visual or auditory disturbance to foraging peregrine falcons. Approximately 40,000 acres of prescribed burning and 45,000 acres of mechanical treatment would occur annually; however, these are short-term effects and would be minimized due to activities being temporally and spatially separated. This disturbance would be localized, of short duration and low intensity, and may affect individual birds, but would not affect the overall distribution or reproduction of the species.

While peregrines do not nest or forage in ponderosa pine forest, active management in portions of the pine forest could potentially affect prey base habitat such as meadows, grasslands, and savannas, which are commonly encroached by pine trees as a result of fire exclusion. Restoring these habitats toward historic conditions and increasing water yield across the forest to improve marsh, pond, or lake habitat could increase prey base for peregrine falcons, resulting in an indirect beneficial effect.

Determination of Effect

Alternative 2 may affect individual peregrine falcons, but is not likely to cause a trend toward federal listing or loss of viability.

Alternative 3 – Focused Alternative

Alternative 3 treats fewer forest acres in Rim Country. The direct and indirect effects would be similar to Alternative 2. Alternative 3 includes the same miles and acres of riparian and other habitat restoration, while reducing the total number of acres thinned and treated with prescribed burning. While short term effects from disturbance would be lessened slightly in Alternative 3, long term effects of risk of habitat degradation from stand-altering wildfire or insect infestations are greater.

Determination of Effect

Alternative 3 may affect individual peregrine falcons, but is not likely to cause a trend toward federal listing or loss of viability.

Cumulative Effects

The cumulative effects analysis area for peregrine falcons is grassland, savanna, and riparian habitat within the project area and within 0.5 mile outside the project boundary. The cumulative effects analysis includes the effects from Alternative 1. This alternative would result in cumulative effects on peregrine falcons by a continued reduction in the quality of foraging habitat due to a decrease in meadow, grassland, and savanna habitats. Additionally, the trend away from desired conditions in terms of tree numbers and densities would reduce water yield, potentially affecting marsh, pond, and lake habitats that are dependent upon seasonal precipitation. Increasing effects from climate change could add synergistic effects to decreasing water availability.

Under all alternatives, there would be an additive indirect effect from activities that modify vegetation. Those projects where thinning and burning are implemented could affect the prey base on a short-term basis by affecting individuals of prey species, by disturbing or harming prey species' habitat with fire. However, projects would be implemented at different times and in different locations, minimizing disturbances to the prey base.

Other past, present, and ongoing projects have implemented thinning and prescribed burning (39,000 acres) in grasslands, which would improve habitats for peregrine prey species in the long term.

Western Burrowing Owl

There are no documented nesting burrowing owls on the project area; however, potential nesting habitat does exist.

Alternative 1 – No Action

Tree encroachment and canopy development of existing trees would largely continue under Alternative 1. Denser forest conditions would produce lower values in understory biomass (pounds per acre). Understory biomass would continue to decline over the next 40 years under Alternative 1. This in turn would lead to less available habitat for prairie dogs and, consequently, burrowing owls. Vegetation would continue to grow and fuel would continue to accumulate, continuing to have negative effects on prairie dog habitat and potential habitat for western burrowing owls. Acres of grassland in Fire Regime Condition Class 1 would decrease in the absence of any type of treatment, as woody species continue to encroach and species composition shifts in favor of less fire-adapted species. Grasslands in the project area are at high risk of losing key ecosystem components such as species composition, forest structure, soil characteristics, and hydrologic function in the event of high-severity fire. High fire severity potential would persist, and a large crown wildfire event would have the potential to affect many individuals.

This alternative would result in the most stress on meadow and grassland habitats and thus would have the greatest negative effects on potential western burrowing owl habitat.

Alternative 2 – Modified Proposed Action

Alternative 2 would restore about 54,000 acres of historic grassland and savannahs. Indirect effects on burrowing owls would include effects on owl habitat, owl prey species, or prey species habitat. Active management in some areas of ponderosa pine forest could potentially affect their habitat (e.g., meadows and grasslands are commonly encroached by pine trees as a result of fire exclusion). Restoring these habitats toward historic conditions could increase potential nesting and foraging habitat for western burrowing owls.

Meadow restoration treatments would improve and increase available habitat for prairie dogs, which would subsequently provide nesting habitat for burrowing owls. The modified proposed action would increase available habitat for prairie dogs with 54,000 acres of grassland, meadow, and savanna restoration treatments. Grassland treatments would not lead to a change in the percent of area with the potential for crown fire. Prescribed burning would result in the removal of cover and food; however, it is anticipated that meadows and open areas would rebound afterwards, with more vigorous herbaceous vegetation and healthier understory habitats for insects and small mammals, increasing food sources and resulting in an indirect beneficial effect for burrowing owls.

Determination of Effect

Alternative 2 would have **no effect** on burrowing owls but would improve potential future habitat for the species. **It is not likely to cause a trend toward federal listing or loss of viability.**

Alternative 3 – Focused Alternative

Direct, indirect, and cumulative effects from Alternative 3 would be the same as those from Alternative 2.

Determination of Effect

Alternative 3 would have no effect to burrowing owls. It is not likely to cause a trend toward federal listing or loss of viability.

Cumulative Effects

The cumulative effects analysis area for burrowing owls encompasses the project area and the associated prairie dog complexes. Cumulative effects include the effects from Alternative 1. Alternative 1 would maintain the current risk to burrowing owl habitat and adjacent forest lands. Alternative 1 would have a cumulative effect of reducing the number of grassland acres within the project area, as dense forest conditions would continue to place burrowing owl habitat and adjacent habitat at risk of tree encroachment. The fire hazard would increase over time as vegetation would continue to grow and fuel would continue to accumulate, continuing to have negative effects on burrowing owl habitat.

Cumulative activities such as implementing the Travel Management Rule are likely to decrease motorized use in grasslands, thus decreasing effects on prairie dog populations. This, combined with forest thinning and prescribed burning activities, could open up more habitat and increase grassland habitat connectivity. Short-term and localized effects from mechanical thinning and prescribed burning would result in disturbance, and the potential for collapse of burrows and displacement of prairie dogs. This effect may be cumulative with short-term effects from localized dispersed camping, wildfire, and wildfire suppression activities to temporarily displace prairie dog populations (and potentially burrowing owls) in limited areas.

Thinning 36,340 acres of grassland would add to treatment acres from this project to reduce tree densities in grasslands and connect open corridors across the project area, providing additional potential future habitat for burrowing owls.

Navajo Mogollon Vole

Alternative 1 – No Action

In Alternative 1, grasslands, meadows, and savannahs would not be rehabilitated. At the landscape scale, there would be no benefits to vole habitat. Favorable habitat would decrease over time as conifers encroach into meadows and canopy closure increases. Acres of grassland would decrease in the absence of any type of treatment, as woody species continue to encroach and species composition shifts in favor of less fire-adapted species. Acres of ponderosa pine with the likelihood of high-severity wildfire would continue to increase. Ponderosa pine in the project area would be at a high risk of losing key ecosystem components, should there be a disturbance event such as fire or extended drought (Fire Ecology and Air Quality Report). Ponderosa pine in the project area is at high risk of losing key ecosystem components such as species composition, forest structure, soil characteristics, and hydrologic function in the event of high-severity fire.

Wildfire modeling in the ponderosa pine habitat type by alternative show that of the 553,137 acres of ponderosa pine habitat type in the project area, 407,189 acres (81 percent) have the potential to experience high-severity wildfire under Alternative 1. Crown fire potential in ponderosa pine habitat from Alternative 1 could occur in 480,996 acres (87 percent) of this habitat type, affecting the surrounding grasslands, meadows, and savannahs.

Vegetation would continue to grow and fuel would continue to accumulate, continuing to have negative effects on vole habitat.

Determination of Effect

Alternative 1 will have no effect on the Navajo Mogollon voles, and is not likely to cause a trend toward federal listing or loss of viability.

Alternative 2 – Modified Proposed Action

Under the modified proposed action, thinning and prescribed burning activities might disturb individual voles, resulting in direct adverse effects. Prescribed burning would result in the removal of cover and food; however it is anticipated that meadows and open areas would rebound afterwards, with more vigorous herbaceous vegetation and healthier understory habitats. Such activities would occur across the project area at different times; thereby reducing effects on this species. In addition, the effect would be short-term and would have no effect on the population viability of voles. However, fire exclusion has resulted in uncharacteristically dense forests and meadow and grassland encroachment. Forest treatments can indirectly affect potential vole habitat by restoring meadows and reducing uncharacteristic tree densities and patterns in ponderosa pine forest. Restoring meadows and creating openings in the forest would increase potential understory development, including bunch grasses and other plants with C3 photosynthetic pathways, providing preferred food sources for voles.

In addition to grassland, savannah, and meadow restoration treatments, Alternative 2 calls for a diverse range of mechanical treatments where canopy openness would vary from 10 to 90 percent, depending on localized site conditions. Opening the canopy would provide both habitat connectivity and habitat stepping stones, facilitating landscape movements of dispersing voles. Reducing stand density could potentially reverse the declining trend in C3 plants and increase habitat quality for Mogollon voles. Prescribed fire and mechanical treatments would improve the stability of key ecosystem elements such as species composition, forest structure, soils, and hydrologic function. Moving these habitats toward historic conditions could increase potential habitat quality and quantity and reduce the risk of uncharacteristic, high-severity wildfire. The reduction of ponderosa pine basal area, increased growth in the understory vegetation on the forest floor, and increases in snags would result in indirect beneficial effects on the vole.

Under Alternative 2, as many as 250 miles of closed roads could be decommissioned. Roads often encourage removal of snags as hazard trees and provide easy access for fuelwood cutting, potentially reducing snags along roadways. Ganey (personal communications 2012) found an inverse relationship between snags and roads, so the proposed decommissioning of roads means more snags would be available in the future within vole habitat.

Fence design would allow access to small mammals. In addition, about 10 miles of road segments would be moved out of drainage bottoms, further enhancing vole habitat.

Determination of Effects

Alternative 2 may affect the Navajo Mogollon vole, but is not likely to cause a trend toward federal listing or loss of viability.

Alternative 3 – Focused Alternative

The effects from this alternative would be similar to those from Alternative 2. The same grassland restoration acres are proposed. Fewer acres are proposed for thinning and burning and 15,000 fewer acres of savannah treatments are proposed.

Determination of Effects

Alternative 3 may affect the Navajo Mogollon vole, but is not likely to cause a trend toward federal listing or loss of viability.

Cumulative Effects

The cumulative effects analysis area for Navajo Mogollon voles is the project area. Cumulative effects include the effects from Alternative 1. Indirect effects on Navajo Mogollon vole habitat would continue under this alternative. Cumulative effects from indirect effects on voles would occur from increased tree densities. This would result in limited herbaceous understory, affecting the ability of voles to successfully forage around and migrate between habitats. At the landscape scale, overstory development would continue to shift understory composition toward less digestible species (appendix 6). Encroachment into openings and species composition changes would also favor less fire-adapted species. Degradation and fragmentation of habitat facilitated by this alternative would combine with other forest activities, including high-impact recreational use, livestock grazing, use of non-jurisdictional roads, and habitat loss and degradation on private lands. Climate change would continue to fragment key nesting and foraging habitat. Grazing may result in short-term effects on habitat, which are expected to be localized in nature but are not expected to result in long-term cumulative effects. This alternative would result in the most stress on meadow, grassland, and ponderosa pine habitats and thus would have the greatest negative effect on potential Mogollon vole habitat.

Short-term effects added to similar effects from nearby projects were considered. Implementation of other project activities could occur simultaneously; however, it is not anticipated to cause cumulative negative effects. Both action alternatives would move these habitats toward historic conditions and could increase potential habitat quality and quantity, reducing the risk of uncharacteristic, high-severity wildfire. This positive effect, combined with similar effects from activities such as the Travel Management Rule efforts, may decrease the frequency of disturbance on the majority of potential breeding sites, slightly counteracting the effects from utility line and road construction and maintenance, and short-term disturbances from vegetation management and prescribed fire.

Short-term and localized effects from mechanical thinning, temporary road construction, and prescribed burning would result in the reduction of understory vegetation and soil compaction. This effect may combine with short-term cumulative effects from localized dispersed camping, wildfire and wildfire suppression activities, ungulate grazing, and drought from climate change to alter availability of both food and cover for voles and temporarily displace voles in a limited area. Livestock are managed in systems designed to allow forage a chance to recover from livestock grazing, reducing the potential for cumulative effects from their grazing. However, wild ungulates would continue to reduce vegetative understory and affect plant composition. Cumulative activities such as the Travel Management Rule are likely to decrease motorized use in grasslands and meadows, thus decreasing effects on vole habitat. This, combined with forest restoration activities, could open up more habitats or provide more contiguous swaths of grassland habitat key to supporting thriving vole populations.

Western Red Bat

Alternative 1 – No Action

With no treatments for the Rim Country Project, habitat quality would deteriorate for this species as overtopping ponderosa pine would lead to a decline in Gambel oak roosting habitat. The high fire hazard potential would persist, and a large, uncharacteristically severe wildfire event would have the potential to affect individuals. Acres of grassland in Fire Regime Condition Class 1 would decrease in the absence of treatments beyond the 13,440 acres of grassland thinning and burning resulting from current and reasonably foreseeable projects (see cumulative effects to all species section). At the landscape scale, woody species would continue to encroach into openings and species composition would shift in favor of less fire-adapted species. Ponderosa pine cover types in the project area would be at a high risk of losing key ecosystem components, should there be a large-scale disturbance event. In the event of high-severity fire, these key ecosystem components include species composition, forest structure, soil characteristics, and hydrologic function. High fire severity potential would persist, and a large crown wildfire event would have the potential to affect many individuals.

Wildfire modeling in the ponderosa pine habitat type by alternative show that of the 553,137 acres of ponderosa pine habitat type in the project area, 407,189 acres (81 percent) have the potential to experience high-severity wildfire under Alternative 1. Crown fire potential in ponderosa pine habitat from Alternative 1 could occur in 480,996 acres (87 percent) of this habitat type, affecting the surrounding grasslands, meadows, and savannahs.

Although habitat would be provided for this species, most of the forested area within the project area is in a moderately closed or closed canopy condition. Favorable habitat would decrease over time as conifers encroach into meadows and canopy closure increases, resulting in indirect adverse effects. Under Alternative 1, limited acres of grasslands and forest opening would be restored, thus reducing foraging habitat for red bats. Gambel oak would continue to be overtopped by pine. Loss of mid- to large-diameter classes of oak from competition and from crown fire could reduce day roosts for red bats.

Water quality and riparian conditions would be adversely affected on a wide-scale basis, resulting in indirect adverse effects. Under Alternative 1, there would no restoration of springs and no restoration of ephemeral channels. These areas would continue to exhibit downward trends in functional condition or remain in static condition for the foreseeable future, resulting in degradation of potential habitat for western red bats.

Determination of Effect

Alternative 1 may affect western red bats, but is not likely to cause a trend toward federal listing or loss of viability.

Alternative 2 – Modified Proposed Action

Prescribed burning in riparian areas will be coordinated with wildlife biologists to determine presence of federally listed or sensitive species (plants or animals) as well as mitigations needed for rare or sensitive species in/near the work areas. Thinning and prescribed burning activities could potentially disturb red bats if they are roosting in trees and caves, or hibernating among leaf litter within the ponderosa pine treated area. Prescribed burning occurring when bats are rearing young (April–July) or in deep hibernation (mid-winter) could have negative effects on local populations. However, most prescribed burning would occur in the spring and fall, and burn plans within 0.5 mile of known roosts or hibernacula would be designed to limit smoke at critical times (April–July and mid-winter).

Prescribed burning might result in the loss of snags and Gambel oak which could affect roosting bats. However, mitigation including managing for retention of all snags 18 inches in diameter and ignition techniques would reduce the losses of these forest components. Recruitment snags would be provided by retaining trees 18 inches in diameter and greater with dead tops and lightning damage. Selective thinning designed to release oak from competition would help create and retain mid- to large-sized oak. The modified proposed action is expected to result in a slight short-term decrease in snags followed by an increase over the long term. This short-term loss of snags is not expected to affect the overall distribution of western red bats on the forest.

Alternative 2 calls for a diverse range of mechanical treatments that would vary from 10 to 90 percent open depending on site conditions. Prescribed burning after mechanical treatments would result in the removal of cover and food. However, it is anticipated that meadows and open areas would rebound afterwards, with more vigorous herbaceous vegetation and healthier understory habitats. The reduction of dense forest canopy and increased growth in the herbaceous vegetation on the forest floor would result in indirect beneficial effects on bats. Forest conditions after treatment would improve bat habitat within the project area by increasing diversity and the density of understory vegetation, which provides habitat for prey populations, as many invertebrates are tied to specific understory plant species. Indirect benefits could potentially result from restoring meadows encroached by pine trees, and reducing uncharacteristic tree densities and patterns in the ponderosa pine forest that resulted from fire exclusion. These efforts would aid in restoring openings and edge habitat within the forest and improving understory vegetation that would benefit western red bats and their prey. Moving these habitats toward historic conditions would also increase the resilience of these habitats and decrease the risk of uncharacteristic, high-severity wildfire.

Under the modified proposed action, spring, seep, and ephemeral channel restoration would improve riparian vegetation, increasing availability of food for bats over the long term, resulting in indirect beneficial effects.

Determination of Effect

Alternative 2 may affect the western red bat, but is not likely to cause a trend toward federal listing or loss of viability.

Alternative 3 – Focused Alternative

The direct, indirect, and cumulative effects on the Western red bat from Alternative 3 would be the same as from Alternative 2.

Determination of Effect

Alternative 3 may affect the western red bat, but is not likely to cause a trend toward federal listing or loss of viability.

Cumulative Effects

The cumulative effects analysis area for western red bats is the project area; cumulative effects include the effects from Alternative 1. This alternative would continue to result in indirect effects on western red bats, which may combine with ongoing activities that have similar effects. Cumulative effects from indirect effects on western red bats would include increased ponderosa pine densities, resulting in fewer mid- to large-sized oak (i.e., a decrease in roosting habitat).

Herbaceous understory would limit the availability of insects and consequently reduce prey for bats. There would also be reduced tree growth resulting in limited large trees, affecting the ability of bats to successfully forage and locate roost sites. Degradation of habitat facilitated by this alternative would cumulatively combine with other forest activities including high-impact recreational use, livestock grazing, use of non-jurisdictional roads, habitat loss and degradation on private lands, and climate change, which would continue to fragment key roosting and foraging habitat. Prescribed burning treatments in adjacent projects and grazing may result in short-term effects on habitat, but these are not expected to result in long-term cumulative effects and are expected to be localized in nature. This alternative would result in the most stress on meadow, grassland and ponderosa pine habitats, and thus would have the greatest negative contribution to potential western red bat habitat.

Short-term disturbance to bats would occur during thinning, hauling, and prescribed burning activities and may cause disturbance in nearby areas for the duration of the activity. These short-term effects added to similar effects from other past, present, and reasonably foreseeable projects were considered. Implementation of other fuel reduction activities could occur simultaneously; however, it is not anticipated that effects from these projects would combine with effects from the Rim Country Project activities to cause a negative effect. Ungulate grazing within the project area would reduce understory vegetation, which would reduce plant availability to adult insects, a primary food source. Generally, grazing systems are managed on a rotation to allow forage a chance to recover from livestock grazing, reducing the potential for cumulative effects. However, wild ungulates would continue to reduce vegetative understory and affect plant composition in meadows and around waters.

Pale Townsend's Big-eared Bat

Alternative 1 – No Action

With no treatments for the Rim Country Project, habitat quality would deteriorate for this species as overtopping ponderosa pine would lead to a decline in roosting habitat. As tree densities increase, there would be less edge habitat, thereby reducing foraging opportunities. Seeps and springs would not be restored, which would continue to reduce the availability of riparian-associated host plants for noctuid moths on which the bat preys. High fire severity potential would persist, and a large, uncharacteristically severe wildfire event would have the potential to affect many individuals. Wildfire modeling in the ponderosa pine habitat type by alternative show that of the 553,137 acres of ponderosa pine habitat type in the project area, 407,189 acres (81 percent) have the potential to experience high-severity wildfire under Alternative 1. Crown fire potential in ponderosa pine habitat from Alternative 1 could occur in 480,996 acres (87 percent) of this habitat type, affecting the surrounding grasslands, meadows, and savannahs.

Fire intensity would continue to increase over time as vegetation would continue to grow and fuel would continue to accumulate, continuing to have negative effects on bat habitat. Acres of grassland would decrease in the absence of any type of treatment, as woody species continue to encroach and species composition shifts in favor of less fire-adapted species. Ponderosa pine cover types in the project area would be at a high risk of losing key ecosystem components, should there be a disturbance event, such as fire or extended drought (Fire Ecology and Air Quality Report). Key ecosystem components such as species composition, forest structure, soil characteristics and hydrologic function would be at a high risk of loss in the event of high-severity fire. High fire severity potential would persist, and a large crown wildfire event would have the potential to affect many individuals. Thirty-nine percent of the ponderosa pine and 12 percent of grassland habitat would support a crown fire. Marginal foraging habitat would still exist for this species; however, the high fire hazard potential would persist, and a large crown wildfire event could have the potential to affect individuals, resulting in indirect adverse effects.

Determination of Effect

Alternative 1 may affect pale Townsend's big-eared bats, but is not likely to cause a trend toward federal listing or loss of viability.

Alternative 2 – Modified Proposed Action

Forest management treatments potentially benefiting bats and their prey include group selection (small groups of trees removed for regeneration of new age classes resulting in a mosaic of roosting habitat, and small to medium gaps for foraging) and single tree selection (individual trees of all size classes removed fairly uniformly). These treatments maintain diverse forest structure and roost trees, create gaps that enhance edge habitat, and provide diverse vegetation structure increasing herbaceous vegetation important for bats' insect prey (Taylor 2006).

There are caves within 300 feet of the project boundary. Coconino Forest Plan guidelines recommend a 300-foot buffer around cave entrances, sinkhole rims and drainages leading to these features. This is a design feature for all known caves within the project area for Alternatives 2 and 3. Design features were added to the project to reduce effects on bat roosts. This would eliminate the potential for damage to the cave from mechanized equipment or increased sedimentation and would eliminate disturbance to Townsend's bats if they are roosting in caves. This would eliminate the potential for damage to the cave from mechanized equipment or increased sedimentation, and would eliminate disturbance to Townsend's bats if they are roosting in caves.

Thinning and prescribed burning activities could potentially disturb Townsend's bats if they are roosting in trees within the ponderosa pine treated area. Prescribed burning occurring when bats are rearing young (April–July) or in deep hibernation (mid-winter) can have negative effects on local populations. However, most prescribed burning would occur in the spring and fall, and burning within 0.5 mile of known roosts or hibernacula or unsurveyed caves and mine shafts would be designed to limit smoke at critical times (April–May and mid-winter). Prescribed burning could also result in the loss of individual snags/hollow logs, which could affect roosting bats; however, mitigation including managing for retention of all snags 18 inches diameter and greater prior to prescribed burning would reduce the effects. The modified proposed action would be expected to result in a slight short-term increase in snags followed by a continued increase over the long term.

Prescribed burning would result in the removal of cover and food. However, it is anticipated that meadows and open areas would rebound afterwards, with more vigorous herbaceous vegetation and healthier understory habitats. Indirect effects would result from vegetation modification activities such as thinning and prescribed burning. These activities would disturb or remove understory vegetation, subsequently reducing availability of insects. These effects would be short-term and would be minimized due to activities being temporally and spatially separated. In contrast, reducing canopy closure, removing trees in and at the edges of meadows, restoring meadows, and prescribed burning would encourage the development of understory vegetation, and increase the amount of edge which would increase availability of food for the bat over the long term. Increasing diversity and density of understory vegetation provides habitat for prey populations. Many invertebrates are tied to specific understory plant species (Capinera 2010). Indirect benefits could potentially result from both restoring meadows encroached by pine trees and reducing uncharacteristic tree densities and patterns in the ponderosa pine forest that resulted from fire exclusion. These efforts would aid in restoring openings and edge habitat within the forest and improving understory vegetation that would benefit pale Townsend's big-eared bats and their prey. Moving these habitats toward historic conditions would also increase the resilience of these habitats and decrease the risk of uncharacteristic, high-severity wildfire.

Under Alternative 2 there are up to 250 miles of closed roads that could be decommissioned. Roads often encourage removal of snags as hazard trees and provide easy access for fuelwood cutting potentially reducing snags along roadways. Ganey (personal communications, 2012) found an inverse relationship between snags and roads, so the proposed decommissioning of roads means more snags would be available in the future within Townsend's big-eared bat habitat, providing more roosting structures.

Under the proposed action, spring, seep, and channel restoration would improve riparian vegetation, increasing availability of food for noctuids and therefore Townsend's big-eared bats over the long term, resulting in indirect beneficial effects.

Determination of Effect

Alternative 2 may affect pale Townsend's big-eared bats, but is not likely to cause a trend toward federal listing or loss of viability.

Alternative 3 – Focused Alternative

The effects of Alternative 3 would be the same as Alternative 2. One documented cave roost is located within an AZGFD research site; however, these treatments are designed to provide tree groups up to 15 acres and can be designed to buffer cave locations as needed. Buffers are designed to eliminate potential sedimentation into the cave or damage from heavy machinery working over shallow passages. Alternative 3 has the same number of acres of grassland restoration treatments, while reducing savannah treatments by 15,000 acres.

Determination of Effect

Alternative 3 may affect pale Townsend's big-eared bats, but is not likely to cause a trend toward federal listing or loss of viability.

Cumulative Effects

The cumulative effects analysis area for pale Townsend's big-eared bats is the project area. Cumulative effects include the effects from Alternative 1. This alternative would continue to result in indirect effects on Townsend's big-eared bats, which may combine with ongoing activities that have similar effects. Cumulative effects from indirect effects on Townsend's big-eared bats would be limited to increased tree densities resulting in limited herbaceous understory; this would limit the availability of insects and, consequently, reduce prey for bats. Tree growth would be reduced, resulting in limited large trees, and consequently recruitment snags, affecting the ability of bats to successfully forage and locate roost sites. Degradation of habitat facilitated by this alternative would combine with the effects from other forest activities, including high-impact recreational use, livestock grazing, use of non-jurisdictional roads, habitat loss and degradation on private lands, and climate change, which would continue to fragment key roosting and foraging habitat. Prescribed burning treatments and grazing may result in short-term effects on habitat, but these are not expected to result in long-term cumulative effects and are expected to be localized in nature. This alternative would result in the most stress on meadow, grassland, and ponderosa pine habitats and thus would have the greatest negative contribution to potential Townsend's big-eared bat habitat.

Short-term disturbance to bats would occur during thinning, hauling, and prescribed burning activities and may cause disturbance in nearby areas for the duration of the activity. These short-term effects added to similar effects from other past, present, and reasonably foreseeable projects were considered. Implementation of other fuel reduction project activities could occur simultaneously; however, they are not anticipated to combine with Rim Country activities to cause a negative effect. Ungulate grazing within the project area reduces understory vegetation, which reduces plant availability to adult insects, a primary food source. Generally, grazing systems are managed on a rotation to allow forage a chance to recover from livestock grazing, reducing the potential for cumulative effects. However wild ungulates would continue to reduce vegetative understory and affect plant composition in meadows and around waters. Implementation of the Travel Management Rule has reduced the number of roads near Townsend's big-eared bat roost locations.

Allen's Lappet-browed Bat

Alternative 1 – No Action

Under Alternative 1, only current and reasonably foreseeable projects would continue. Habitat would still exist for this species; however, the high fire hazard potential would persist, and a large, uncharacteristically severe wildfire event could have the potential to affect individuals and long-term suitability of habitat. Most of the forested area within the project area is in a moderately closed or closed canopy condition. Under Alternative 1, grasslands and forest openings would not be restored, thus recruitment of large snags would not meet forest objectives in the long term. Large-diameter trees would not maintain the numbers and distribution that would support large-diameter snags distributed across forested areas. There would be reduced foraging habitat for Allen's lappet-browed bats as conifers encroach into meadows and canopy closure increases, resulting in indirect adverse effects. High basal area and trees per acre counts would decrease or stagnate growth of large trees. Active competition-induced mortality would increase, decreasing future recruitment of large snags and decreasing future maternity roost sites.

Determination of Effect

Alternative 1 may affect Allen's lappet-browed bats, but is not likely to cause a trend toward federal listing or loss of viability.

Alternative 2 – Modified Proposed Action

Forest management treatments potentially benefiting bats and their prey include group selection (small groups of trees removed for regeneration of new age classes, which results in a mosaic of roosting habitat, and small to medium gaps for foraging) and single tree selection (individual trees of all size classes removed fairly uniformly). This would ensure a consistent source of large-diameter snags by maintaining recruitment of trees into larger size classes. These treatments would maintain diverse forest structure, including snags and gaps that enhance edge habitat, create diverse vegetation structure, and increase herbaceous vegetation important for bats' insect prey (Taylor 2006).

Thinning and prescribed burning activities could potentially disturb Allen's lappet-browed bats if they are roosting in trees within the ponderosa pine and pinyon juniper treated areas. Prescribed burning occurring when bats are rearing young (April–July) or in deep hibernation (mid-winter) can have negative effects on local populations. However, most prescribed burning would occur in the spring and fall and burning within 0.5 mile of known roosts/hibernacula or unsurveyed caves and mine shafts would be designed to limit smoke at critical times (April–May and mid-winter).

Prescribed burning could also result in the loss of individual snags which could affect roosting bats; however, mitigation including managing for retention of all snags 18 inches in diameter and greater would reduce this effect. Recruitment snags would be provided by retaining and growing more trees 18 inches in diameter and greater. Selection of trees with dead tops and lightning damage would contribute to potential habitat. The modified proposed action is expected to result in a slight short-term increase in snags followed by a continuing increase over the long term, with incidental loss of snags greater than 18 inches in diameter.

Prescribed burning would result in the removal of cover and food. However, it is anticipated that meadows and open areas would rebound afterwards, with more vigorous herbaceous vegetation and healthier understory habitats. The reduction of dense forest canopy and increased growth in the herbaceous vegetation on the forest floor would result in indirect beneficial effects on bats. Forest conditions after treatment would improve bat habitat within the project area. Increasing diversity and density of understory vegetation provides habitat for prey populations. Many invertebrates are tied to specific understory plant species (Capinera 2010). Indirect benefits could potentially result from restoring meadows encroached by pine trees, as well as reducing uncharacteristic tree densities and patterns in the ponderosa pine forest resulting from fire exclusion. These efforts would aid in restoring openings and edge habitat within the forest and improving understory vegetation that would benefit Allen’s lappet-browed bats and their prey. Moving these habitats toward historic conditions would also increase resilience of these habitats and decrease the risk of uncharacteristic, high-severity wildfire.

Under Alternative 2 there are up to 250 miles of closed roads that could be decommissioned. Roads often encourage removal of snags as hazard trees and provide easy access for fuelwood cutting potentially reducing snags along roadways. Ganey (personal communications, 2012) found an inverse relationship between snags and roads, so the proposed decommissioning of roads means more snags would be available in the future within Allen’s lappet-browed bat habitat providing more roosting structures.

Under the modified proposed action, spring, seep, and channel restoration would improve riparian vegetation, increasing availability of food for bats over the long term, resulting in indirect beneficial effects.

Determination of Effect

Alternative 2 may affect Allen’s lappet-browed bats, but is not likely to cause a trend toward federal listing or loss of viability.

Alternative 3 – Focused Alternative

Alternative 3 treats fewer forest acres in Rim Country, but the direct and indirect effects would be similar to Alternative 2. Alternative 3 includes the same miles and acres of riparian and other habitat restoration, while reducing the total number of acres thinned and treated with prescribed burning. The same grassland restoration acres are proposed as in Alternative 2, but 15,000 fewer acres in forest openings such as meadows and savannahs are proposed. While short-term effects from disturbance would be slightly less to Allen’s lappet-browed bats in Alternative 3, the long-term effects on the risk of habitat degradation from stand-altering wildfire or insect infestations would be greater.

Determination of Effect

Alternative 3 may affect Allen’s lappet-browed bats, but is not likely to cause a trend toward federal listing or loss of viability.

Cumulative Effects

The cumulative effects analysis area for Allen's lappet-browed bats is the project area; cumulative effects include the effects from Alternative 1. This alternative would continue to result in indirect effects on Allen's lappet-browed bats, which may combine with ongoing activities that have similar effects. Indirect effects on Allen's lappet-browed bats would be limited to increased tree densities and decreased tree growth rates. This would result in limited herbaceous understory, thereby limiting the availability of arthropod prey for bats. In addition, reduced tree growth would reduce large tree availability and, consequently, future recruitment of large snags. Combined, this would reduce foraging habitat and potential roost sites. Degradation of habitat under this alternative would be cumulative with other forest activities, including high-impact recreational use, livestock grazing, use of non-jurisdictional roads, habitat loss and degradation on private lands, and climate change. These would continue to fragment key roosting and foraging habitat. Prescribed burning treatments and grazing may result in short-term effects on habitat, but these are not expected to result in long-term cumulative effects and are expected to be localized in nature. This alternative would result in the most stress on meadow, grassland, and ponderosa pine habitats and thus would have the greatest negative contribution to potential Allen's lappet-browed bat habitat.

There might be potential short-term disturbance to potential foraging and roosting habitat with long-term benefits from the action alternatives. Short-term disturbance to bats would occur during thinning, hauling, and prescribed burning activities and may cause disturbance in nearby areas for the duration of the activity. Roosting and foraging habitat may be reduced in some areas in the short term. The alternatives would be expected to result in a slight short-term increase in snags (greater than 12 inches diameter) followed by a continued increase over the long term of large snags (greater than 18 inches diameter). These short-term effects added to similar effects from other past, present, and reasonably foreseeable projects were considered.

The Forest Plans calls for an average of two large snags per acre in ponderosa pine forests, with large snags defined as 18 inches or larger in diameter and 30 feet tall or higher. However, research completed well after the forest plan was signed suggests this specification may be unrealistic. Ganey (1999) found only 30 percent of ponderosa pine plots in unlogged sites met or exceeded Forest Service snag guidelines. Waskiewicz et al. (2007) found pine snag densities well below Forest Service guidelines in relatively undisturbed forests in northern Arizona. Fire promotes and beetles increase recruitment of large snags, but neither form of snag creation produces snags that remain a long time on the landscape compared to other snags (Chambers and Mast 2005, Chambers and Mast 2014). In 2011, Ganey and Vojta reported a 74 percent increase in ponderosa pine mortality from 2002 to 2007 compared to mortality between 1997 and 2002. This was likely the result of a drought-mediated pulse in tree mortality (Ganey and Vojta 2011), meaning fewer large trees survived the drought period. These stochastic events are likely to continue (see the Climate Change section) and combined may elevate snag numbers over time, benefiting Allen's lappet-browed bats. However, these pulses in snag creation reduce the availability of large trees and reduce future large snag recruitment.

Implementation of other fuel reduction and restoration activities could occur simultaneously; however, it is not anticipated that these effects would be additive to cause negative effects. Other fuel reduction and restoration projects might result in decreased large snags (greater than 18 inches in diameter) into the future. However, decreasing the potential for large-scale wildfires, and designing projects to increase tree growth for more large trees and, consequently, more recruitment snags, would improve the ability of tree roosting bats to locate roost sites across the landscape.

Prescribed burning produces low-severity burns that would reduce surface fuels and cause periodic loss of snags. Other activities such as high-severity wildfire, construction and maintenance of utility corridors, management of snags along forest roads, and private land development would also reduce the number of snags available for roosting in the long term. Large snags would be preserved whenever possible and design features to maintain and, where possible, develop snags on the landscape are incorporated into all projects. Although individual trees may be lost, large snags would be maintained and developed across the landscape to provide roosting habitat for Allen’s lappet-browed bats.

Ungulate grazing within the project area reduces understory vegetation, which reduces plant availability to adult insects, a primary food source. Generally grazing systems are managed on a rotation to allow forage a chance to recover from livestock grazing, reducing the potential for cumulative effects. However, wild ungulates would continue to reduce vegetative understory and affect plant composition in meadows and around water.

Spotted Bat

Alternative 1 – No Action

Under Alternative 1, only current and reasonably foreseeable projects would continue, as discussed in the cumulative effects to all species section. However, the high fire hazard potential would persist, and a large, uncharacteristically severe wildfire event would have the potential to affect individuals. Ponderosa pine forest in the project area would be at a high risk of losing key ecosystem components, should there be a disturbance event such as fire or extended drought (Fire Ecology and Air Quality Report). Key ecosystem components in ponderosa pine forest include species composition, forest structure, soil characteristics, and hydrologic function. High fire severity potential would persist, and a large crown wildfire event would have the potential to affect many individuals. Although habitat would be provided for this species, most of the forested area within the project area is in a moderately closed or closed canopy condition. Under Alternative 1, grasslands and forest openings would not be restored, thus there would be no benefits to bats. Favorable habitat would decrease over time as conifers encroach into meadows and canopy closure increases, resulting in indirect adverse effects. Wildfire modeling in the ponderosa pine habitat type by alternative show that of the 553,137 acres of ponderosa pine habitat type, 407,189 acres (81 percent) have the potential to experience high-severity wildfire under Alternative 1. Crown fire potential in ponderosa pine habitat from Alternative 1 could occur in 480,996 acres (87 percent) of this habitat type.

Determination of Effect

Alternative 1 may affect spotted bats, but is not likely to cause a trend toward federal listing or loss of viability.

Alternative 2 – Modified Proposed Action

Forest management treatments potentially benefiting bats and their prey include group selection (small groups of trees removed for regeneration of new age classes resulting in a mosaic of roosting habitat, and small to medium gaps for foraging) and single tree selection (individual trees of all size classes removed fairly uniformly). These treatments maintain diverse forest structure and roost trees, create gaps that enhance edge habitat, and provide diverse vegetation structure increasing herbaceous vegetation important for bats’ insect prey (Taylor 2006).

Under the modified proposed action, thinning and prescribed burning activities could potentially disturb spotted bats if they are roosting in rock crevices in the ponderosa pine treated area. Prescribed burning occurring when bats are rearing young (April–July) or in deep hibernation (mid-winter) could have negative effects on local populations. However, most prescribed burning would occur in the spring and fall and burning within 0.5 mile of caves, mines, or cliff habitats would be designed to limit smoke at critical times (April–May and mid-winter).

Prescribed burning would result in the removal of cover and food; however, it is anticipated that meadows and open areas would rebound afterwards, with more vigorous herbaceous vegetation and healthier understory habitats. Indirect effects would result from vegetation modification activities such as thinning and prescribed burning. These activities would disturb or remove understory vegetation, subsequently reducing availability to insects. These effects would be short-term and would be minimized due to activities being temporally and spatially separated. In contrast, reducing canopy closure, removing trees in meadows, restoring meadows, and prescribed burning would encourage the development of understory vegetation, increasing availability of food for the bat over the long term.

Increasing the diversity and density of understory vegetation provides habitat for prey populations. Many lepidopterans are tied to specific understory plant species (Waltz and Covington 2004). Indirect benefits could potentially result from restoring meadows encroached by pine trees and reducing uncharacteristic tree densities and patterns in the ponderosa pine forest, a result of fire exclusion. These efforts would aid in restoring openings and edge habitat within the forest and improving understory vegetation that would benefit spotted bats and their prey. Moving these habitats toward historic conditions would also increase the resilience of these habitats and decrease the risk of uncharacteristic, high-severity wildfire. Under the modified proposed action, spring, seep, and channel restoration would improve riparian vegetation, increasing availability of food for bats over the long term, resulting in indirect beneficial effects.

Determination of Effect

Alternative 2 may affect spotted bats, but is not likely to cause a trend toward federal listing or loss of viability.

Alternative 3 – Focused Alternative

Alternative 3 treats fewer forest acres in Rim Country, but the direct and indirect effects would be similar to Alternative 2. Alternative 3 includes the same miles and acres of riparian and other habitat restoration, while reducing the total number of acres thinned and treated with prescribed burning. The same grassland restoration acres are proposed as in Alternative 2, but 15,000 fewer acres in forest openings such as meadows and savannahs are proposed. While short-term effects from disturbance would be slightly less to spotted bats in Alternative 3, the long-term effects on the risk of habitat degradation from stand-altering wildfire or insect infestations would be greater.

Determination of Effect

Alternative 3 may affect spotted bats, but is not likely to cause a trend toward federal listing or loss of viability.

Cumulative Effects

The cumulative effects analysis area for spotted bat is the project area; cumulative effects include the effects from Alternative 1. The cumulative effects of Alternative 1 would be similar to the indirect effects discussed above. Alternative 1 would not create disturbance to roosting habitat nor would it improve foraging habitat within the project area. Therefore, there would be no cumulative effects from this alternative.

There could be potential short-term disturbance to potential foraging and roosting habitat with long-term benefits from the action alternatives. Short-term disturbance to bats would occur during thinning, hauling, and prescribed burning activities and may cause disturbance in nearby areas for the duration of the activity. These short-term effects, added to similar effects from other past, present, and reasonably foreseeable mechanical vegetation management and fuels reduction projects were considered. Implementation of these projects could occur simultaneously; however, it is not anticipated to accumulate to cause negative effects. Ungulate grazing in the project area reduces understory vegetation, which reduces plant availability to adult insects, a primary food source. Generally grazing systems are managed on a rotation to allow forage a chance to recover from livestock grazing, reducing the potential for cumulative effects. However, wild ungulates would continue to reduce vegetative understory and affect plant composition in meadows and around water.

Forest Service Management Indicator Species

Tonto NF Management Indicator Species

Rocky Mountain Elk

The Tonto NF estimated 283,200 acres of habitat occur on that forest for Elk (Tonto NF, 2005). No treatment or limited treatments as per previous years of acres accomplished in this forest type would leave nearly 220,000 acres of this (77 %) untreated. Alternative 1 would not result in an immediate change to the quantity or quality of habitat used by elk on the Tonto NF.

Alternatives 2 and 3 would not result in a type conversion of mixed conifer or Ponderosa pine/mixed conifer habitat on the Tonto NF and therefore will have no effect to the population trend for elk. These alternatives will promote thinning trees and prescribed burning in ponderosa pine that would open the canopy and decrease fine fuels on the forest floor. The Tonto NF estimated 283,200 acres of habitat occur on that forest for Elk (Tonto NF, 2005). The action alternatives could treat up to approximately 226,416 of this habitat on the Tonto NF, maintaining or improving the habitat quality of 80% of the available habitat on the Tonto NF. The result would be increased growth of herbaceous and shrub-level vegetation on these treated acres, which would provide increased forage in the long term. Reducing tree densities and ladder fuels would reduce available thermal and hiding cover for elk. However, thermal protection for elk would continue to be available in areas maintained at higher BA and canopy density.

Merriam's Turkey

The Tonto NF estimated 283,200 acres of ponderosa pine and mixed conifer habitat occur on that forest for turkey (Tonto NF, 2005). No treatment or limited treatments as per previous years of acres accomplished in this forest type would leave nearly 220,000 acres of this (77 %) untreated. Alternative 1 would not result in an immediate change to the quantity or quality of habitat used by turkey on the Tonto national forest in the project area.

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Alternatives 2 and 3 would not result in a type conversion of mixed conifer or Ponderosa pine habitat on the Tonto NF and therefore will have no effect to the population trend for turkey. The Tonto NF estimated 283,200 acres of habitat occur on that forest for turkey (Tonto NF, 2005). The action alternatives could treat up to approximately 226,416 of this habitat on the Tonto NF, maintaining or improving the habitat quality of 80% of the available habitat on the Tonto NF. The proposed treatments in Alternatives 2 and 3 would protect nesting and roosting habitat. The proposed thinning and burning activities would create tree groups that are favored by turkeys and would also increase the understory production. Increasing the understory would also increase plant and invertebrate abundance. Vegetation design features would protect most mast-producing Gambel oaks within the project area. Targeted removal of over-topping ponderosa pines would increase resiliency and persistence of large oaks. Design features also specifically address retaining medium to high canopy cover in stringers of large ponderosa pine trees in the pinyon-juniper transition zones. This is a habitat favored by roosting turkeys. Low-severity prescribed fire along ridges and slopes is expected to retain yellow pine and roosting cover above drainages in the pinyon- juniper transition zone. While turkeys are not grassland species, groups of large and old trees would be retained where they occur on mollic-integrade soils. The results of these treatments would be savanna conditions. This would add resilience to groups of large, old trees, potentially increasing turkey roost habitat. In addition, the open habitat conditions resulting from the grassland and savanna treatments would increase foraging habitat for adults and poults.

Abert's Squirrel

The Tonto NF estimated 283,200 acres of habitat occur on that forest for Abert's squirrels (Tonto NF, 2005). No treatment or limited treatments as per previous years of acres accomplished in this forest type would leave nearly 220,000 acres of this (77%) untreated. Alternative 1 would continue to provide large patches of trees with higher basal area, canopy density, and interlocking crowns, thereby providing wintering habitat for squirrels on national forests. However, Alternative 1 would threaten the long-term viability of squirrels. Under Alternative 1, the current unnatural stand densities would threaten the sustainability of squirrel habitat over time by reducing tree vigor and health, limiting pine cone production, and creating a risk for uncharacteristic, high-severity fire. Vigor and health of trees in the older age class categories are important for sustaining squirrel nesting habitat over time. Pine cone production is important for squirrel foraging and nutritional demands. Large-scale losses of squirrel habitat from uncharacteristically large, stand-replacing fire would affect squirrel populations across the project area.

Alternatives 2 and 3 would not result in a type conversion of mixed conifer or Ponderosa pine habitat on the Tonto NF and therefore will have no effect to the population trend for Abert's squirrells. The Tonto NF estimated 283,200 acres of habitat occur on that forest for Abert's squirrells (Tonto NF, 2005). The action alternatives could treat up to approximately 226,416 of this habitat on the Tonto NF, maintaining or improving the habitat quality of 80% of the available habitat on the Tonto NF.

Alternatives 2 and 3 call for a diverse range of mechanical treatments to maintain forest habitat. Forest habitats would vary from 10 to 70 percent open, outside of grassland and savanna habitat, with variable basal area, trees per acre, and stand density index depending on site-specific conditions.

Arizona Gray Squirrel

The Tonto NF estimated 10,232 acres of high elevation riparian habitat occur on that forest for Arizona gray squirrels (Tonto NF, 2005). No treatment or limited treatments as per previous years of acres accomplished in this forest type would leave this habitat largely untreated. Alternative 1, No action would have no effect to the population trend of this species as habitat quantity and quality will not be reduced forestwide.

Alternatives 2 and 3 would not result in a type conversion of high elevation riparian habitat on the Tonto NF and therefore will have no effect to the population trend for Arizona gray squirrells. The Tonto NF estimated 10,232 acres of habitat occur on that forest for Arizona gray squirrells (Tonto NF, 2005). The action alternatives could treat much this habitat on the Tonto NF, maintaining or improving the habitat quality of the available habitat on the Tonto NF.

Common Black Hawk

The Tonto NF estimated 10,232 acres of high elevation riparian habitat occur on that forest for the common Blackhawk (Tonto NF, 2005). No treatment or limited treatments as per previous years of acres accomplished in this forest type would leave this habitat largely untreated. Alternative 1, No action would have no effect to the population trend of this species as habitat quantity and quality will not be reduced forestwide.

Alternatives 2 and 3 would not result in a type conversion of high elevation riparian habitat on the Tonto NF and therefore will have no effect to the population trend for common blackhawks. The Tonto NF estimated 10,232 acres of habitat occur on that forest for common blackhawks (Tonto NF, 2005). The action alternatives could treat much this habitat on the Tonto NF, maintaining or improving the habitat quality of the available habitat on the Tonto NF.

Ash-throated Flycatcher

The Tonto NF estimated 265,480 acres of Pinyon Juniper habitat occur on that forest for Ash-throated flycatchers (Tonto NF, 2005). No treatment or limited treatments as per previous years of acres accomplished in this forest type would leave nearly 240,000 acres of this (90%) untreated.

Alternatives 2 and 3 would not result in a type conversion of mixed conifer or Ponderosa pine habitat on the Tonto NF and therefore will have no effect to the population trend for Ash-throated flycatchers. The Tonto NF estimated 265,480 acres of habitat occur on that forest for Ash-throated flycatchers (Tonto NF, 2005). The action alternatives could treat up to approximately 38, 251 acres of this habitat on the Tonto NF, maintaining or improving the habitat quality of 14% of the available habitat on the Tonto NF.

Gray Vireo

The Tonto NF estimated 265,480 acres of Pinyon Juniper habitat occur on that forest for gray vireos (Tonto NF, 2005). No treatment or limited treatments as per previous years of acres accomplished in this forest type would leave nearly 240,000 acres of this (90%) untreated.

Alternatives 2 and 3 would not result in a type conversion of mixed conifer or Ponderosa pine habitat on the Tonto NF and therefore will have no effect to the population trend for gray vireos. The Tonto NF estimated 265,480 acres of habitat occur on that forest for gray vireos (Tonto NF, 2005). The action alternatives could treat up to approximately 38, 251 acres of this habitat on the Tonto NF, maintaining or improving the habitat quality of 14% of the available habitat on the Tonto NF.

Juniper Titmouse

The Tonto NF estimated 265,480 acres of Pinyon Juniper habitat occur on that forest for the juniper titmouse (Tonto NF, 2005). No treatment or limited treatments as per previous years of acres accomplished in this forest type would leave nearly 240,000 acres of this (90%) untreated.

Alternatives 2 and 3 would not result in a type conversion of mixed conifer or Ponderosa pine habitat on the Tonto NF and therefore will have no effect to the population trend for the juniper titmouse. The Tonto NF estimated 265,480 acres of habitat occur on that forest for the juniper titmouse (Tonto NF, 2005). The action alternatives could treat up to approximately 38, 251 acres of this habitat on the Tonto NF, maintaining or improving the habitat quality of 14% of the available habitat on the Tonto NF.

Hairy Woodpecker

The Tonto NF estimated 283,200 acres of habitat occur on that forest for Hairy woodpeckers (Tonto NF, 2005). No treatment or limited treatments as per previous years of acres accomplished in this forest type would leave nearly 220,000 acres of this (77%) untreated.

Alternatives 2 and 3 would not result in a type conversion of mixed conifer or Ponderosa pine habitat on the Tonto NF and therefore will have no effect to the population trend for hairy woodpeckers. The Tonto NF estimated 283,200 acres of habitat occur on that forest for hairy woodpeckers (Tonto NF, 2005). The action alternatives could treat up to approximately 226,416 of this habitat on the Tonto NF, maintaining or improving the habitat quality of 80% of the available habitat on the Tonto NF.

Northern Goshawk

The Tonto NF estimated 283,200 acres of habitat occur on that forest for goshawk (Tonto NF, 2005). No treatment or limited treatments as per previous years of acres accomplished in this forest type would leave nearly 220,000 acres of this (77%) untreated.

Alternatives 2 and 3 would not result in a type conversion of mixed conifer or Ponderosa pine habitat on the Tonto NF and therefore will have no effect to the population trend for goshawk. The Tonto NF estimated 283,200 acres of habitat occur on that forest for goshawk (Tonto NF, 2005). The action alternatives could treat up to approximately 226,416 of this habitat on the Tonto NF, maintaining or improving the habitat quality of 80% of the available habitat on the Tonto NF.

Alternatives 2 and 3 would produce the largest increase in the quantity of late seral ponderosa pine habitat as well as the most improvement in the quality of habitat for northern goshawks and their prey species as all elements move toward desired future conditions. Overall, Alternatives 2 and 3 increase habitat quantity and improve habitat quality for northern goshawk and its prey species.

Northern Flicker

The Tonto NF estimated 265,480 acres of Pinyon Juniper habitat occur on that forest for the northern flicker (Tonto NF, 2005). No treatment or limited treatments as per previous years of acres accomplished in this forest type would leave nearly 240,000 acres of this (90%) untreated.

Alternatives 2 and 3 would not result in a type conversion of mixed conifer or Ponderosa pine habitat on the Tonto NF and therefore will have no effect to the population trend for the northern flicker. The Tonto NF estimated 265,480 acres of habitat occur on that forest for the northern flicker (Tonto NF, 2005). The action alternatives could treat up to approximately 38, 251 acres of this habitat on the Tonto NF, maintaining or improving the habitat quality of 14% of the available habitat on the Tonto NF.

Pygmy Nuthatch

The Tonto NF estimated 283,200 acres of habitat occur on that forest for the pygmy nuthatch (Tonto NF, 2005). No treatment or limited treatments as per previous years of acres accomplished in this forest type would leave nearly 220,000 acres of this (77%) untreated.

Alternative 1 would not result in an immediate change to the quantity or quality of habitat used by the pygmy nuthatch.

Alternatives 2 and 3 would not result in a type conversion of mixed conifer or Ponderosa pine habitat on the Tonto NF and therefore will have no effect to the population trend for the pygmy nuthatch. The Tonto NF estimated 283,200 acres of habitat occur on that forest for the pygmy nuthatch (Tonto NF, 2005). The action alternatives could treat up to approximately 226,416 of this habitat on the Tonto NF, maintaining or improving the habitat quality of 80% of the available habitat on the Tonto NF.

Townsend's Solitaire

The Tonto NF estimated 265,480 acres of Pinyon Juniper habitat occur on that forest for the Townsend's solitaire (Tonto NF, 2005). No treatment or limited treatments as per previous years of acres accomplished in this forest type would leave nearly 240,000 acres of this (90%) untreated.

Alternatives 2 and 3 would not result in a type conversion of mixed conifer or Ponderosa pine habitat on the Tonto NF and therefore will have no effect to the population trend for the Townsend's solitaire. The Tonto NF estimated 265,480 acres of habitat occur on that forest for the Townsend's solitaire (Tonto NF, 2005). The action alternatives could treat up to approximately 38, 251 acres of this habitat on the Tonto NF, maintaining or improving the habitat quality of 14% of the available habitat on the Tonto NF.

Violet-green Swallow

The Tonto NF estimated 283,200 acres of mixed conifer or Ponderosa pine habitat occurs on that forest for violet-green swallows (Tonto NF, 2005). No treatment or limited treatments as per previous years of acres accomplished in this forest type would leave nearly 220,000 acres of this (77%) untreated.

Alternative 1 would not result in an immediate change to the quantity or quality of habitat used by Violet-green swallows.

Alternatives 2 and 3 would not result in a type conversion of mixed conifer or Ponderosa pine habitat on the Tonto NF and therefore will have no effect to the population trend for violet-green swallows. The Tonto NF estimated 283,200 acres of habitat occur on that forest for violet-green swallows (Tonto NF, 2005). The action alternatives could treat up to approximately 226,416 of this habitat on the Tonto NF, maintaining or improving the habitat quality of 80% of the available habitat on the Tonto NF.

Western Bluebird

The Tonto NF estimated 283,200 acres of habitat occur on that forest for western blubirds (Tonto NF, 2005). No treatment or limited treatments as per previous years of acres accomplished in this forest type would leave nearly 220,000 acres of this (77%) untreated.

Alternative 1 would not result in an immediate change to the quantity or quality of habitat used by western blubirds.

Alternatives 2 and 3 would not result in a type conversion of mixed conifer or Ponderosa pine habitat on the Tonto NF and therefore will have no effect to the population trend for western blubirds The Tonto NF estimated 283,200 acres of habitat occur on that forest for western blubirds (Tonto NF, 2005). The action alternatives could treat up to approximately 226,416 of this habitat on the Tonto NF, maintaining or improving the habitat quality of 80% of the available habitat on the Tonto NF.

Western Wood Peewee

The Tonto NF estimated 10,232 acres of high elevation riparian habitat occur on that forest for the western wood peewee (Tonto NF, 2005). No treatment or limited treatments as per previous years of acres accomplished in this forest type would leave this habitat largely untreated. Alternative 1, No action would have no effect to the population trend of this species as habitat quantity and quality will not be reduced forestwide.

Alternatives 2 and 3 would not result in a type conversion of high elevation riparian habitat on the Tonto NF and therefore will have no effect to the population trend for the western wood peewee. The Tonto NF estimated 10,232 acres of habitat occur on that forest for the western wood peewee (Tonto NF, 2005). The action alternatives could treat much this habitat on the Tonto NF, maintaining or improving the habitat quality of the available habitat on the Tonto NF.

Cumulative Effects

Some MIS are much more mobile than others. Therefore it is important to recognize habitat outside the project area as the affected environment for some animals. The cumulative effects analysis area varies by species (Table 3-**). The analysis includes the combined effects from all activities within the area as evaluated for each alternative. For example, the Abert's squirrel typically does not travel far; they stay in ponderosa pine forest year-round instead of migrating to lower elevations for the winter. Therefore, its cumulative effects analysis area is the ponderosa pine habitat type within the project area. On the other hand, elk use much larger areas to mate, calve, graze, and overwinter, so the cumulative effects analysis area for elk includes habitat outside the project area.

The effects from projects that have already been implemented were used to help describe current conditions in the project area and will not be discussed in this section. Cumulative effects can be an integral part of the effects analysis for wildlife and are discussed for each species. The cumulative effects discussed have occurred since 2001 and are considered changes in existing condition. The timeframe considered is approximately 10 years in the future, at which time the majority of the actions proposed will have been completed and the vegetation response to these actions will have occurred.

Table 49. Cumulative effects analysis area by species

Cumulative Effects Analysis Area	Species	Reason for Selection
Within project area	Pygmy nuthatch, turkey, Abert's squirrel, hairy woodpecker, red-naped sapsucker, juniper titmouse, Grace's warbler, western bluebird	Abert's squirrel use is focused on the area around their nest trees. Birds may move to other areas, but their nesting habitat is the most limiting factor for these species.
Project area plus 0.25-mile buffer around project area	Goshawk	The 0.25-mile buffer takes into account potential disturbances from activities within the project area.
Game management unit	Elk,	These species have wider mobility; GMUs are designed to encompass herd movements.

Alternative 1

The cumulative effects from the treatments occurring in current and within the reasonably foreseeable future are listed in the cumulative effects for all alternatives. These projects would improve the habitats of MIS species in the long term. Movement corridors and savanna treatments incorporated into ponderosa pine on the National Forests would benefit pronghorn and elk by creating forage and movement corridors. Other projects' restoration treatments would have limited effects on MIS species in the short term, but should improve habitat in the long term.

Fuelwood gathering would affect MIS species by removing snags and logs needed for nesting or prey species. The proposed activities could benefit elk, pronghorn, goshawk, squirrel, and song bird species locally by creating openings to support browse and improve landscape permeability.

Recreation would cause localized decreases in MIS habitat quality due to the loss of understory vegetation (trampling, removal) associated with camping; disturbance from motorized use and hikers. This would cause disturbance and displacement of MIS spatially and temporally, although many species have likely acclimated to areas with regular use. Species selected for riparian habitat such as the Common Black hawk and Arizona Gray Squirrel would continue to experience disturbance from recreation.

Right-of-way maintenance would benefit species that use open habitat like pronghorn, elk, and turkey by keeping liner strips of grassland open across the forest. These areas could also support prey species for goshawks. Right-of-way maintenance can also remove snags, logs, shrubs, and large trees, negatively affecting species tied to these habitat features such as the pygmy nuthatch, hairy woodpecker, western bluebird, northern flicker, and mule deer.

Development on private lands, particularly in the grassland and savanna habitats, would reduce habitat quantity and quality and affect movement corridors for pronghorn and elk.

Alternatives 2 and 3

The planned thinning and burning of ponderosa pine and mixed conifer habitat would help reduce small tree densities and help move habitat toward historical stand structures. These treatments would have the same benefits discussed in Alternative 1, but when added to the additional treatments in the alternatives, would provide for improvement across the landscape. These treatments would affect the MSO, Northern goshawk, Pygmy nuthatch, Rocky Mountain elk, Merriam's turkey, Abert's squirrel, Violet-green swallow, Hairy woodpecker, Western bluebird, and Western wood peewee by improving their habitats in the long term. These species' forestwide habitat trends would be improved by thinning projects that retain and enhance the large tree component within the ponderosa pine forest and that help create and retain large snags.

The 36,340 acres of grassland restoration, 17,600 acres of ponderosa pine savanna treatments, and 6,760 acres of meadow treatments would benefit pronghorn and elk by creating forage and corridors for movement between areas.

Treatment is possible on up to 115,000 acres of pinyon-juniper habitat. Design features will preserve older trees in this habitat type so effects from treatments to these MIS populations (Ash-throated flycatcher, Gray vireo, Juniper titmouse, Northern flicker and Townsend's solitaire) are expected to be minimal.

Fuelwood gathering and travel management requirements together help determine where the public can legally collect fuelwood. Since off road travel is only allowed in fuelwood areas, this would limit how far the public can travel to collect fuelwood. This would likely leave more dead and down woody material in areas farther from roads. There would likely be less dead woody material available within fuelwood areas closer to roads. This could prevent achieving forest plan requirements for snags, logs, and dead and down woody material near some roads. This would also limit how much fuelwood is removed away from roads and increase fuelwood removal along roads. Proposed treatments should help limit the amount of area not meeting forest requirements. This would affect the Northern goshawk, Pygmy nuthatch, Hairy woodpecker, Violet-green swallow, Northern flicker, and Juniper titmouse by removing snags that are needed for nesting or prey species.

The effects on MIS from ongoing and foreseeable activities, along with the proposed activities in Alternatives 2 and 3, are as follows: For all of the MIS species, the cumulative effects from these projects **would not adversely change the predicted forestwide habitat and population trends**.

Migratory Birds and Important Bird Areas

In the Mogollon Rim Snowmelt Draw Important Bird Area, the Rim Country Project would affect approximately 45,673 acres of ponderosa pine, aspen, pinyon-juniper, grasslands and savannas, ephemeral streams, and spring habitats. Mexican spotted owl protected, recovery, and critical habitats occur in the Important Bird Area. All design features associated with these habitat types would be followed as discussed in previous sections of this report.

Effects of the Proposed Activities on Migratory Birds

Alternatives 2 and 3 would have short term negative with long term positive effects to migratory birds. The proposed treatments would have no population effects to migratory birds.

Currently, many migratory birds depend on habitats or habitat elements related to canopy openings, snags, and early seral conditions. Existing closed canopy forests limit or eliminate many of the necessary habitat components needed by these species, such as understory development sufficient to support abundant seeds, arthropods, and cover. The desired condition of closed canopy tree groups interspersed with open rooting space that supports herbaceous vegetation would provide key habitat components for these species of status as well as species adapted to closed-canopy forests. The ability to grow and maintain large trees would provide consistent development of future snags.

Table 50. Long-term effects on migratory bird habitats from Alternatives 2 and 3

Species	Habitat Links	Long-Term Effect to Habitat
Northern Goshawk	Late-seral PIPO[1]/Prey Habitat	Improved
Flammulated Owl	PIPO/openings/insects/snags	Improved
Cordilleran Flycatcher	PIPO/insects/ oak/dense forest	Mixed
Grace’s Warbler	PIPO/openings/insects/	Improved
Olive Warbler	PIPO/openings/insects/	Improved
Lewis’s Woodpecker	PIPO/openings/insects/snags	Improved
Purple Martin	PIPO/openings/insects/snags	Improved
Cassin’s Finch	PIPO/openings/seeds	Improved
Common Nighthawk	PIPO/openings/insects/	Improved
Mexican Whip-poor-will	PIPO/openings/insects/	Improved
Olive-sided Flycatcher	MC/openings/insects/snags	Improved
Evening Grosbeak	MC/openings/seeds	Improved
Red-faced Warbler	MC/oak/willow/insects/	Improved
Band-tailed Pigeons	MC/oak/willow/seeds/	Improved
Red-naped sapsucker	Aspen	Improved
Black-chinned Sparrow	Interior Chaparral	Mixed
Gray Vireo	Pinyon-juniper	Improved
Pinyon Jay	Pinyon-juniper	Improved
Juniper titmouse	Pinyon-juniper	Mixed
Black-throated Gray Warbler	Pinyon-juniper	Improved
Gray Flycatcher	Pinyon-juniper	Improved
Swainson’s Hawk	Open/Grassland	Improved
Ferruginous Hawk	Open/Grassland	Improved

Species	Habitat Links	Long-Term Effect to Habitat
Burrowing Owl (western)	Open/Grassland	Improved
Grasshopper Sparrow	Open/Grassland	Improved
Bendire’s Thrasher	Open/Grassland	Improved
Chestnut-collared Longspur	Semidesert Grassland	Improved
Lark Bunting	Semidesert Grassland, Desert Communities	Improved
Common Black-Hawk	Cottonwood/willow/riparian forest.	Improved
Bell's Vireo	Cottonwood Willow Riparian Forest	Improved
Elf Owl	Cottonwood Willow Riparian Forest	Improved
Lucy’s Warbler	Cottonwood Willow Riparian Forest	Improved
Yellow Warbler	Cottonwood Willow Riparian Forest; Mixed Deciduous Riparian Forest	Improved
Lincoln's Sparrow	Montane Willow Riparian Forest (breeding)	Improved
MacGillivray's Warbler	Montane Willow Riparian Forest, Aspen and Maple, Mixed Conifer	Improved
Brewer’s Blackbird	Wetlands, Montane/Subalpine Grasslands, Montane Willow Riparian Forest	Improved
Wood Duck	Cottonwood Willow Riparian Forest	Improved
Phainopepla	Desert Communities	None
Savannah Sparrow	Open habitats project-wide	Improved

Ponderosa Pine and Mixed Conifer Forest Habitats

To evaluate effects to priority species Arizona Partners in Flight, USDA Forest Service, and the U.S. Fish and Wildlife Service (FWS) designated ten different species of birds to represent ponderosa pine habitat. These are the Northern goshawk, Flammulated owl, Olive-sided flycatcher, Cordilleran flycatcher, Grace’s warbler, Olive warbler, Lewis’s woodpecker, Purple martin, Cassin’s finch, Common nighthawk, and Mexican whip-poor-will. Four priority breeding birds that use mixed conifer as primary habitats are the Olive-sided flycatcher, Evening grosbeak, Red-faced warbler, and Band-tailed pigeon.

Alternatives 2 and 3 propose restoration treatments for 471,811 to 424,431 acres of thinning and burning depending on alternative in ponderosa pine habitat. Approximately 50,500 acres of mixed conifer could be treated under the action alternatives. The action alternatives are designed to maintain or enhance late-seral ponderosa pine and mixed conifer trees and protect all MSO PACs, goshawk nesting areas, and PFAs.

Unintentional take would be minimized through the application of breeding season timing restrictions in PACs and goshawk nest stands, deferral areas, and other design features described above. Long-term benefits to migratory birds would be the creation of openings and habitat heterogeneity where forests are currently dominated by homogenous conditions. Openings would support increased biomass development, including increased seed production, arthropods, and small mammals. Design features would protect existing snags and increase large tree growth. The risk of habitat loss from large-scale, high-severity fire would decrease after treatment.

Aspen Habitat

Alternatives 2 and 3 propose to mechanically thin and burn approximately 1,230 acres of aspen habitat to and protect treated aspen to prevent ungulate grazing of the new sprouts. Snag and burning requirements that are described in the ponderosa pine section would also apply to aspen treatments. Arizona Partners in Flight designated one species to represent aspen habitat, the Red-naped sapsucker. Currently there is very little aspen regeneration and the overstory is dying or compromised by a variety of factors, including competition with conifers. The alternatives would stimulate aspen growth and protect ramets from browsing, creating multi-storied conditions over time. The risk of habitat loss from large-scale, high-severity fire would decrease after treatment. Unintentional take would be minimized through the application of breeding season timing restrictions in PACs and PFAs, deferral areas, and other design features described above.

Pinyon-Juniper Habitat

Both action alternatives include various levels of restoration implementation within pinyon-juniper. The alternatives could mechanically thin and burn 114,753 acres of pinyon-juniper. Arizona Partners in Flight, the FS, and the FWS designated five different species of bird to represent pinyon-juniper habitat. These are the Black-throated gray warbler, Common Nighthawk, Juniper Titmouse, Pinyon Jay, and Gray Vireo. Long-term benefits would include increasing understory development, managing for snag retention, and increasing habitat heterogeneity. Areas with currently dense conditions would be more open, leading to mixed long-term results for some species of birds, such as the Juniper Titmouse. Unintentional take is would be minimized through the application of breeding season timing restrictions in PFAs, deferral areas, and other design features described above.

High Elevation and Semi-desert Grassland Habitat

The action alternatives would restore up to 36,320 acres of grassland, 6,720 acres of meadows, and 18,570 acres of savannahs (Alternative 2) or 2,470 acres of Savannah (Alternative 3). Priority birds that use high elevation grasslands are the Brewer’s blackbird, Common nighthawk, and Ferruginous hawk. Priority species that use semi-desert grassland habitat for breeding are Bendire’s thrasher and Phainopepla. Additionally, the Chestnut-collared longspur, Ferruginous hawk, Grasshopper sparrow, and Lark bunting use these habitats for overwintering. Burning would restore disturbances that work to maintain grasslands, meadows, and savannas. Low-severity prescribed fire is expected to increase growth and diversity of herbaceous vegetation, which would provide increased forage in the long term. Expected benefits could occur as soon as one to two years following prescribed fire. However, most post-settlement trees would likely remain after grassland burn prescriptions.

Habitat loss and fragmentation for grassland species has been an on-going issue both nationally and locally. Encroachment of this habitat has been a direct result of fire suppression in the Rim Country project area. Implementing the action alternatives would not only improve habitat effectiveness but also increase overall acres of habitat. Unintentional take would be minimized through the application of design features described above.

Riparian Forests

Alternatives 2 and 3 both propose 14,560 acres of riparian restoration. Improvement of stream function is proposed for 777 miles across the project area through the action alternatives.

Priority breeding birds that use riparian forest habitats are the Common black-hawk, Bell's vireo, Brewer's blackbird, Elf owl, Lincoln's sparrow, Lucy's warbler, MacGillivray's warbler, Red-faced warbler, Wood duck, and Yellow warbler. Management of wildlife habitat is a key emphasis. Design features for restoration implementation in riparian habitat would minimize disturbance to migratory birds.

Species-specific Effects

The anticipated effects from proposed activities on priority species of migratory birds are presented in the table below.

Important Bird Areas

Most of the major vegetation cover types within the Mogollon Rim Snowmelt Draw IBA would be affected by Alternatives 2 and 3. The habitat of this IBA includes Ponderosa pine, white fir, Douglas fir, southwestern white pine, quaking aspen, and Gambel oak. Young plants of these canopy trees, plus canyon maple and New Mexico locust dominate the understory woody species. While most of the acres treated are within ponderosa pine and dry mixed conifer habitats, treatments would also occur in savannah, meadows, aspen, and pinyon juniper habitats. In addition, 53 miles of road decommissioning, restoration of six springs, and 7.5 miles of ephemeral stream channel restoration activities are proposed within the IBA in Alternatives 2 and 3. Design features (Appendix 5) are included in the project to reduce effects on bird species.

Overall, treatment objectives are to help restore forests to their natural range of variation.

Project activities including road decommissioning and spring and stream channel restoration, would help restore the area to more natural conditions. This should improve habitat conditions for all bird species that use the project area. There could be some limited effects on the species due to activities that might occur during the breeding season. It is expected that the habitats for which the Important Bird Area was established would benefit from the proposed treatments.

Cumulative Effects on Migratory Birds

Because of their seasonal movement, the primary management concern for migratory birds is nesting habitat and, for bald eagles, winter roost sites and known nest sites. The cumulative effects analysis area for migratory birds is the project area. The effects from projects that have already been implemented were used to help describe current conditions of the project area and will not be discussed in this section. Ongoing and reasonably foreseeable activities are listed in the cumulative effects for all alternatives section. .Cumulative effects discussed here include those that have occurred since 2001 and the effects of the Rim Country alternatives. The timeframe considered is approximately 20 years in the future, at which time the majority of the activities proposed will have been completed and the vegetation response to these actions will have occurred.

There are many ongoing or planned projects that will thin ponderosa pine habitat. These thinning treatments vary greatly and include noncommercial thinning, group selection, sanitation thinning, and shelterwood cuts. Slash treatments associated with this thinning include lopping and scattering, hand and dozer piling and burning, and prescribed burning. There is an estimated 122,468 acres of thinning from other projects already planned or reasonably foreseeable within the project area.

Many of the thinning treatment areas include prescribed burning. There are also burn-only areas within the ponderosa pine habitat. There are also many areas that have planned maintenance burns occurring in 5- to 20-year cycles. There will be an estimated 195,405 acres of prescribed burns in the project area. There will also be 4,416 acres of ponderosa pine savanna restoration occurring on the Apache-Sitgreaves NF.

Both the Apache-Sitgreaves and Coconino NFs are actively trying to restore aspen clones. The majority of the aspen on the Coconino NF is found within wilderness areas, whereas aspen is usually found in small patches scattered within the ponderosa pine forest on the Apache-Sitgreaves NF. There are 683 acres of planned aspen restoration and subsequent barrier construction planned on the Apache-Sitgreaves NF, and 4,637 acres of planned aspen restoration with associated barriers on the Coconino NF. In total, 5,320 acres of aspen restoration are planned or ongoing within the Rim Country project area.The Coconino NF has begun implementing travel management within the project area. These efforts would change effects from fuelwood cutting, hunting, and recreational camping across both national forests. On the Coconino NF, the public is allowed to travel cross country to collect cut fuelwood with the proper permit. On the Apache-Sitgreaves NF, the public is only allowed to drive off-road to collect fuelwood within designated areas. While there are species-specific rules for cutting dead trees, it is not uncommon for larger snags to be cut. This generally occurs closer to roads and decreasing miles of open road should decrease the loss of the resource.

The Apache-Sitgreaves NF allows for retrieval of elk during hunting season in all game management units, while the Coconino NF allows elk retrieval in all game management units except 5a and 5b. The Coconino NF designated 300-foot corridors on select roads for people to park vehicles away from roads. Parking along roads without camping corridors on the Coconino NF is allowed up to 30 feet away. The Apache-Sitgreaves NF allows parking up to 30 feet away from all open roads and does not have any designated areas for parking farther in from roads for camping.

Pinyon-juniper thinning and burning is occurring on all three Rim Country forests. The Apache-Sitgreaves and Coconino NFs have planned 7,040 acres within the project area. Grassland restoration treatments include removal of encroaching conifers and prescribed burning to rejuvenate grasses and forbs. Within the project areas there are 9,840 acres of planned grassland treatments.

All three national forests have ongoing maintenance of rights-of-way for power and gas lines. This involves thinning and burning within the ROWs to keep them clear of trees and shrubs. ROWs comprise approximately 32,340 acres in the project area, with the majority on the Coconino NF.

Grazing is occurring throughout the project area on all three national forests. Grazing is an ongoing activity and the timing of season of use varies by allotment. On average, 30 to 40 percent of the forage is allowed for utilization by livestock and wildlife. There is no proposal to increase any livestock numbers within these allotments. Therefore there would be no additional effects.

There are approximately 150,000 acres of lands in other ownership inside the project boundary. These areas include housing tracts, vacation homes, and ranchland.

Alternative 1

Resulting forest structure from planned thinning and burning of 195,405 acres of ponderosa pine habitat outside of the Rim Country boundary would result in habitat within the NRV. In the long term, wildlife species are less likely to be adversely affected by treatments that result in habitat conditions consistent with those of their evolutionary past and so are expected to respond positively to the ongoing and proposed thinning projects (Kalies et al. 2010). These treatments would improve habitat for most birds species associated with the ponderosa pine cover type in the long term (e.g., bark gleaners, woodpeckers, and flycatchers), but may negatively affect foliage gleaners in the short term (Patton and Gordon 1995, George et al. 2005).

Aspen restoration is proposed for areas that are a high priority for restoration. These treatments would yield limited improvements for the red-naped sapsucker in the short term, but should improve about 5,200 acres of habitat in the long term.

Fuelwood gathering and travel management requirements together help determine where the public collects fuelwood. The public would be limited in where they can travel off road to gather fuelwood on both the Coconino and Apache-Sitgreaves NFs. This would likely leave higher densities of dead and down woody material in areas farther from roads. Less dead woody material would be expected to remain in fuelwood areas and areas closer to roads. Designated fuelwood areas on the Apache-Sitgreaves NF might not always meet forest plan requirements once wood gathering activities are terminated. Areas adjacent to roads might be deficit on the Coconino NF. This could have a negative effect on species that use snags or down material in the ponderosa pine, aspen, and pinyon-juniper. In grasslands, the travel management requirements would benefit grassland species by preventing cross-country travel into their habitat.

Pinyon-juniper thinning and burning has the potential to both remove habitat and improve habitat for the birds that use this habitat type. The proposed activities could result in loss of young of year depending on timing of activities. The effects on pinyon-juniper associated species are expected to be limited because only a small amount of this habitat is proposed for treatment within the cumulative effects analysis area.

Right-of-way maintenance would help keep strips of land open and create the equivalent of relatively narrow, liner grasslands. While this might affect individual birds, there would not likely be an effect on any species because of the limited space and spatial configuration of this habitat. It would benefit some grassland species.

Development on private land and other federal lands continue to remove habitat within and adjacent to the project area. The cover type with the most development occurring is within grasslands and savanna habitat. This would remove habitat and potentially cause some mortality of grassland species, particularly young-of-the-year, depending on the timing of the development.

The Coconino NF has implemented an innovative management strategy to protect wetlands from grazing and prolonged drought within the Anderson Mesa Important Bird Area by regulating the timing and duration of livestock grazing in permitted areas. Wetlands are being protected from livestock by constructing fences that still allow passage of wildlife. Habitat restoration, including the restoration of grasslands, is ongoing. Ranchers and conservation organizations are actively engaged through the Diablo Trust in achieving conservation objectives for the site.

The cumulative effects on the migratory birds could result in some incidental mortality caused by implementation activities. How much mortality would be proportional to how many acres are treated during the spring nesting season of April, May, June, and July. Seasonal restrictions would limit project implementation activities between March 1 and September 30 in goshawk PFAs and MSO PACs, which would reduce the potential for loss for birds in ponderosa pine habitat. Prescribed fire could also occur in the fall, outside of the spring nesting season. Since only a small percentage of habitats would be treated at any one time, the loss of eggs or nestlings would not result in a measurable negative effect on the migratory birds populations listed above.

Alternatives 2 and 3

Resulting forest structure from planned thinning and burning of 195,405 acres of ponderosa pine habitat outside of the Rim Country boundary would be habitat within the natural range of variation. In the long term, wildlife species are less likely to be adversely affected by treatments that result in habitat conditions consistent with those of their evolutionary past and so are expected to respond positively to the ongoing and proposed thinning projects (Kalies et al. 2010). These treatments would improve habitat for most birds species associated with the ponderosa pine cover type in the long term (e.g., bark gleaners, woodpeckers, and flycatchers), but may negatively affect foliage gleaners in the short term (Patton and Gordon 1995, George et al. 2005). Cumulatively there would be approximately 700,000 acres of ponderosa pine habitat treated within the cumulative effects analysis area.

The proposed aspen restoration would be in areas that are a high priority for restoration. Cumulatively, this would treat the aspen outside of wilderness that are at most risk of being lost in the near future. These treatments would yield limited improvements for the red-naped sapsucker in the short term, but should improve their habitat components in the long term.

Fuelwood gathering and travel management effects would be similar to those for Alternative 1. However, cumulatively there would be approximately 800 miles of roads decommissioned that would reduce the opportunities for woodcutting along these roads (at least on the Coconino NF where woodcutters are allowed to collect fuelwood on closed roads).

Pinyon-juniper thinning and burning has the potential to both remove habitat and improve habitat for the birds that use this habitat type. The proposed activities could result in loss of young of year depending on timing of activities. The effects on pinyon-juniper-associated species would be expected to be limited because only a small amount of this habitat would be treated within the cumulative effects analysis area, both cumulatively and within the proposed project.

Right-of-way maintenance and development on private land would have the same effects as described above from Alternative 1.

The Coconino NF has implemented an innovative management strategy to protect wetlands from grazing and prolonged drought within the Anderson Mesa Important Bird Area, by regulating the timing and duration of livestock grazing in permitted areas as described in Alternative 1. The proposed project would treat between 42,486 to 43,863 acres of habitat within the Important Bird Area. This would cumulatively improve habitat condition within a broader area of the Important Bird Area.

The cumulative effects on migratory birds could result in some incidental mortality caused by project implementation activities. How much mortality would be proportional to how many acres are treated during the spring nesting season of April, May, June, and July. Seasonal restrictions would limit project implementation activities between March 1 and September 30 in goshawk nest areas and post-fledging family areas and within Mexican spotted owl protected activity centers, which would reduce the potential for loss of species in ponderosa pine habitat. Prescribed fire could also occur in the fall, outside of the spring nesting season. Since only a small percentage of habitats would be treated at any one time, the loss of eggs or nestlings would not result in a measurable negative effect on the migratory birds populations listed above.

Locally Important Species

Two locally important species that occur in the project area were identified by FS and USFW biologists. The Arizona toad and the Arizona Black Rattlesnake.

The project could affect individual animals. Snakes or toads could be hit by vehicles associated with project implementation. Activities related to implementation could disturb individuals or interfere with hunting or foraging. However, overall there would not be a measurable negative effect on these two species populations. Long-term habitat improvements would include improved habitat and a decrease in potential disturbance from road decommissioning.

Rare Plants

Affected Environment and Environmental Consequences

This section details the affected environment and environmental consequences for the threatened, endangered and Southwestern Region Regional Forester's sensitive plants (hereafter Southwestern Region sensitive plants), within the project area. It establishes the baseline against which the decision maker and the public can compare the effects of the action alternatives.

This section also describes the direct, indirect, and cumulative effects of implementing each alternative on threatened, endangered and Southwestern Region sensitive plants. It presents the scientific and analytical basis for the comparison of the alternatives presented in Alternatives section. The information presented here is part of the Botany and Noxious Weeds specialist report (Crisp 2018), which is incorporated by reference.

Assumptions and Methodology

Assumptions

The environmental effects disclosed for rare plants are based on the following assumptions:

- All relevant laws, regulations, manual guidance and Forest Service policy relating to management of the resources discussed within are followed during analysis and implementation.
- Management will follow the guidance of the Forest Plans.
- Silviculture and prescribed burning treatments will be implemented as written and addressed in the Silviculture and Fire Ecology and Air Quality specialist reports and not substantially modified without review of the effects of such activities.
- Management activities related to roads and transportation as well as spring and channel restoration will be implemented as addressed in their respective reports and not substantially modified without review of the effects of such activities.

- Prescribed fires will be of lower severity and intensity in any given area compared to large-scale wildfires in the same area so the amount of disturbance from prescribed burning is less than compared to wildfires.
- Fire effects to individual species vary depending on several factors including life cycle, time of burning and several biotic and abiotic factors (Pyke et al 2010). As a result, the responses of the plant species discussed in this report may vary in any given area or time. The effects of fire on these species will be mitigated through the burning prescription.
- Areas to be treated will be surveyed for Southwestern Region sensitive plants before and after treatments are implemented. These factors should be considered when identifying survey needs
    a) Target special features and microhabitat needed by the species of interest. This is generally only a small portion of the area, and is estimated to be 5 percent or less of any given area.
    b) Survey and mitigation will be based on the likelihood of any of the species addressed in this document occurring within the project area. Not all areas contain suitable habitat for a given species.
    c) The amount of disturbance predicted to occur during treatment. For example, surveys may not be needed in areas scheduled for prescribed burning if the treatments are scheduled to be of low intensity.
    d) Areas to be treated will be surveyed for noxious or invasive weeds before and after treatments are implemented. These factors should be considered when identifying survey needs
    e) Likelihood of any of the species addressed in this document occurring within the project area
    f) Amount of disturbance. For example, surveys may not be needed in areas scheduled for prescribed burning if the treatments are scheduled to be of low intensity.
- Application of the design features, BMPs, and mitigation and conservation measures discussed in the Rare Plants section of chapter 3 and in appendix C are included in analysis and project implementation.
- The acreage of potential disturbance in this project is much larger than generally analyzed in similar projects, necessitating more noxious or invasive weed treatments to control invasive species. This will lead to increases in personnel and budget to accomplish this need.

Questions to Answer through Analysis

How would proposed treatments affect Southwestern Region sensitive plant species? The indicators used to evaluate environmental consequences are: (1) a qualitative evaluation of whether populations are maintained or increased per FSM 2760. 5(19), (2) a qualitative evaluation of whether potential habitat is maintained or enhanced, (3) an evaluation of whether impacts to sensitive plants and their habitats are effectively minimized, and, (4) an evaluation on habitat and species resiliency to natural disturbances including fire and climate change.

A unit of measure for Southwestern Region sensitive plant species is to maintain or increase the populations within the project area. Additionally, potential habitat for these species should be maintained or enhanced.

How would project activities affect interactions between noxious or invasive weeds and Southwestern Region sensitive plants?

Indicators/Topics of Analysis

The indicators used to evaluate environmental consequences are:

1. A qualitative evaluation of whether populations are maintained or increased per FSM 2670.5(19)
2. A qualitative evaluation of whether potential habitat is maintained or enhanced
3. An evaluation of whether effects on sensitive plants and their habitats are effectively minimized
4. An evaluation on habitat and species resiliency to natural disturbances including fire and climate change.

Federally Listed Threatened or Endangered Plants

The Rim Country project area **does not include** any locations or potential habitat for Threatened or Endangered plant species.

Southwestern Region Regional Forester's Sensitive Plants

Table 95 displays the Southwestern Region sensitive plants occurring within the project area.

Table 51. Southwestern Region Regional Forester's Sensitive Plants

Common name	Scientific Name	Forest	ERU/Habitat	Data source	Notes
Greene Milkweed	*Asclepias uncialis ssp. uncialis*	Apache Sitgreaves	Madrean/Pine-Oak woodland Great Basin Grassland	Apache Sitgreaves LMRP Wildlife Report (2016)	No documented occurrences and distribution is poorly known.
Villous groundcover milkvetch	*Astragalus humistratus var. crispulus*	Apache Sitgreaves	Narrow-leaf cottonwood/shrub. These occurrences are in the Rodeo-Chediski Fire (2002) and are in severely disturbed sites.	HDMS Data SEINet	The species has limited distribution on the Forest and is considered a disturbance species. There were not enough data to determine a finding of effect at the forest planning scale. It is still addressed in site specific NEPA (USDA Forest Service 2014)
Arizona Bugbane	*Actaea* (*Cimicifuga*) *arizonica*	Coconino, Tonto	Ponderosa pine, Mixed Conifer with Aspen	HDMS, SEINet and Forest Service files.	Arizona bugbane occurs mostly in deep canyons.
Dane Thistle	*Cirsium parryi ssp. mogollonicum*	Coconino	Springs	Goodwin (2005)	Field notes prepared by Goodwin (2005) provide the most accurate location and condition description for this species.

Common name	Scientific Name	Forest	ERU/Habitat	Data source	Notes
Hairy Clematis (Arizona leatherflower)	*Clematis hirsutissima var. hirsutissima*	Coconino		Fs files – at Hoe tank check seinet for more info.	Generally on limestone soils,
Mogollon Fleabane	*Erigeron anchana*	Tonto	Ponderosa pine/willow, ponderosa pine/evergreen oak, mixed conifer frequent fire.	SEINet, HDMS	Rock crevices or ledges on boulders and vertical rock faces, usually in canyons, usually on granite (HDMS 2003)
Rock Fleabane	*Erigeron saxatilis*	Coconino	Ponderosa pine, Mixed Conifer Frequent Fire, narrow-leaf cottonwood/shrub, willow/alder, Mixed Conifer with Aspen	SEINet, HDMS, NRM/TESP	Cliffs or vertical rock faces, usually on Coconino sandstone
Arizona Sneezeweed	*Helenium arizonicum*	Coconino, Apache Sitgreaves	Ponderosa pine Forest (wet meadows) Apache Sitgreaves Add ERUs for Coconino	SEINet, FS files and local knowledge, NRM/TESP	
Eastwood (Senator Mine) Alumroot	*Heuchera eastwoodiae*	All	Ponderosa Pine Evergreen Oak,(TNF) Mixed Conifer Frequent Fire (TNF) Mixed Conifer with Aspen (TNF, A-S) Cottonwood Shrub (TNF), Ponderosa Pine/Willow (TNF, A-S) and Ponderosa Pine (A-S)	SEINet and HDMS	Specimens for this species on the Coconino NF have been reclassified to another species (Folk and Alexander 2015)

Common name	Scientific Name	Forest	ERU/Habitat	Data source	Notes
Flagstaff beardtongue	*Penstemon nudiflorus*	Coconino	Ponderosa pine/Gambel oak	HDMS NRM/TESP	
Blumer's Dock	*Rumex orthoneurus*	All	Fremont cottonwood/shrub, herbaceous, Mixed conifer frequent fire, mixed conifer with aspen, narrow leaf cottonwood/shrub, ponderosa pine/evergreen oak, ponderosa pine/willow and ponderosa pine forest.	SEINet and HDMS	
Bebb's Willow	*Salix bebbiana*	Coconino, Apache Sitgreaves	Montane willow riparian forest for hart prairie	SEINet	

Greene Milkweed (Asclepias uncialis)

Greene milkweed is a Region 3 sensitive species for the Apache-Sitgreaves NFs. The distribution of this small milkweed is poorly understood Greene milkweed is known from scattered locations in Arizona, Colorado, New Mexico, Nevada, western Oklahoma and Utah (Sundell 1994). Typical habitat for this species is level to gently sloping terrain on a variety of soil types except for pure sand. It is typically found in juniper woodland and savannas but within the grassland components of those systems (NatureServe 2017). Green milkweed occurs in small scattered clusters and tends to bloom earlier in the spring than many plants so may be overlooked during typical plant surveys (Decker 2006).

Green milkweed was included in the Great Basin Grasslands and Madrean/Pine Oak Woodland ERUs during forest plan revision (USDA Forest Service 2016). There is one historical location from the White Mountains near Springerville in 1915 (Decker 2006). There are no documented for Greene milkweed in the analysis area.

Villous groundcover milkvetch (Astragalus humistratus var. crispulus)

Villous groundcover milkvetch is a Region 3 sensitive species for Apache Sitgreaves. It is a perennial species with prostrate, forking stems. Its distribution is limited to southeastern Apache County in Arizona and in neighboring Catron County in New Mexico where it grows on sandy soils of volcanic origin in dry pine forests (Spellenberg 2007). The occurrences on the forest are in narrow-leaf cottonwood/shrub ERUs.

Occurrences were recorded by Glenn Rink and G. Clifton on July 23, 2014 for Bear Spring and July 24, 2014 for Black Canyon Lake (Arizona Game and Fish Department 2017). Both sites within the Rodeo-Chediski Fire (2002). This landscape scale event was a major driving force in defining the existing conditions on these sites which is now outside the natural range of variation (NRV).

Arizona Bugbane (Cimicifuga arizonica)

Arizona bugbane is endemic to northern Arizona, occurring on Coconino, Kaibab and Tonto National Forests where it occurs in mesic habitats, typically along the bottoms and lower slopes of steep, narrow canyons. The overstory often includes a combination of coniferous and deciduous tree species. Important overstory species include Douglas fir (*Psuedotsuga menziesii*), white fir (*Abies concolor*), big tooth maple (*Acer saccharum* ssp. *grandidentatum*), Arizona alder (*Alnus oblongifolia*) and red osier dogwood (*Cornus stolonifera*).

Arizona bugbane is a Region 3 sensitive species for Kaibab, Coconino and Tonto National Forests. Almost all of the known occurrences are in wilderness areas including those known from West Clear Creek drainage (Arizona Game and Fish Department 2012).

In this analysis occurrences of Arizona bugbane are limited to the Coconino National Forest. The area of known occurrence is in the Tom's Creek Mexican Spotted Owl PAC and the treatment is listed as a potential PAC treatment. Because occupied PACs can already be considered successful nesting habitat, mechanical activity within PACs should be designed to protect the habitat characteristics that make each PAC effective at providing habitat. Consideration should be given to treating areas near PACs in order in improve resiliency within the PACs themselves. PACs should be treated with consideration of the larger landscape and not just separate entities. As a result, treatments within PACs will be determined separately and in coordination with appropriate FWS personnel (see the Implementation Plan in appendix D of this DEIS).

Dane (Mogollon) thistle (Cirsium parryi subsp. mogollicum)

Dane thistle is a Region 3 sensitive species for Coconino National Forest. It is endemic to a few canyons on the Mogollon Rim Ranger District.

Dane thistle was first "discovered" in 1987 and its description was published in 1990 (Schaack and Goodwin 1990). Dane thistle is distinguished from the more common Parry thistle by its white corollas and nearly entire leaves (Arizona Game and Fish Department) 2005).

This rare thistle is known from only four locations on the Mogollon Rim Ranger District, Coconino National Forest where it is associated with springs or canyons including Dane, Dane Spring, and Yeager Canyons (Goodwin 2005). The data provided by Goodwin show the locations for the plants in Dane Canyon and Dane Spring Canyon but no accurate description for the occurrence in Yeager Canyon was found. These areas are proposed for aquatic habitat restoration. Non-native invasive species such as bull thistle (*Cirsium vulgare*) can compete with rare species such as Dane thistle for resources such as water and light. Mitigation to prevent infestations in these areas is especially important.

One known occurrence is in a drainage below Dane Spring and is in MSO recovery habitat. Mechanical and prescribed fire are proposed for this area. The other two occurrences are within the Coyote Springs MSO PAC and will receive PAC treatment. Treatment at the first location may be guided by the MTFTA but treatment in MSO PACS will be negotiated separately with USFWS.

All of the occurrences are near stream channels which will receive aquatic habitat restoration. Treatments for aquatic habitat restoration will be guided by the AWFTA (see appendix D). Design features (appendix C) will also be applied.

Hairy Clematis (Arizona leatherflower) (Clematis hirsutissima var. hirsutissima) (syn. var. Arizonica)

Hairy clematis is a Region 3 sensitive species for Coconino National Forest.

A balance of shade and sun is important habitat components of hairy clematis. Intermediate amounts (approximately 50%) of light and shade provided the most beneficial conditions. Higher levels of light increased photosynthesis in adult plants, but resulted in lower reproductive success, and increased risk of desiccation. Low levels of light resulted in decreased photosynthesis, fewer stems per plant and lower seed production (Maschinski and others 1997). Juvenile plants benefit from the presence leaf litter. The litter provides a source of humidity around seedlings. However, heavy accumulation of litter can be detrimental to seedling survival and vegetative reproduction in adults.

There is one location of hairy clematis near the proposed Iron Mine Draw Stream Channel Restoration in the area near Hoe Tank.

Mogollon fleabane (Erigeron anchana)

Mogollon fleabane is a Region 3 sensitive species for Tonto National Forest. Mogollon fleabane is one of four species identified by Nesom in 1990 in a revision of *Erigeron pringlei*. Prior to then, all were considered one species. All of the four species occur in various areas of northern Arizona where they are endemic. Mogollon fleabane is the only one of the four that occurs in the "sub-Mogollon" portion (below the Mogollon Rim) of the state with most occurrences in the Sierra Ancha Mountain range. Occurrences tend to be on rock cliffs (Arizona Game and Fish

Department 2003) where it occurs in cliff crevices, ledges, soil pockets among boulders (Nesom, 2006).

There is one confirmed location of Mogollon fleabane in the project area. It is near Bear Flat Campground on the Tonto NF. The area where the plants are located is proposed for mechanical and prescribed fire treatment (goshawk foraging; meadow restoration), and is near a stream channel proposed for aquatic restoration.

There is an occurrence of Mogollon fleabane in the Mogollon Rim Area (4D) Management Area (MA) of the Tonto NF LMRP. The management emphasis is for a variety of renewable resource outputs with primary emphasis on intensive, sustained yield timber management, timber resource protection, creation of wildlife habitat diversity, increased populations of emphasis harvest species, and recreation opportunity. Fire management objectives for this area include: providing a mosaic of age classes within the total type which would provide for a mix of successional stages, and to allow fire to resume its natural ecological role within ecosystems. A standard and guideline for the area states that habitat requirements for TES species would take precedence over other species.

Rock (cliff) fleabane (Erigeron saxatilis)

Rock fleabane is a Region 3 sensitive species for Coconino National Forest. All known occurrences are limited to the Coconino NF.

Rock fleabane is a small daisy-like plant that tends to grow in erosion pockets on vertical cliff faces, most commonly Coconino sandstone. Generally, risks from management activities are confined to activities that would affect the cliff habitat on which it depends. Rock fleabane is an endemic species that occurs only in northern and central Arizona where it inhabits sheer canyon walls, moist north-facing slopes, steep solid rock and bedrock outcrops from 5,000 to 8,350 ft. (Arizona Game and Fish Department 2003). It is closely related to Mogollon fleabane and is one of the four species identified by Nesom in his 1990 revision of *Erigeron pringlei*.

Arizona sneezeweed (Helenium arizonicum)

Arizona sneezeweed is a Region 3 sensitive species for Coconino and Apache-Sitgreaves National Forests Arizona sneezeweed is a perennial herb that grows up to four feet tall with several stems. Flower heads consist of yellow to orange 3-lobed ray flowers and purplish-brown globular disk flowers and bloom July through September. Hundreds of individuals may exist in a single population. This endemic species ranges from the Mormon Lake area southeastward to the White Mountains area where it grows in drainages, near springs, ponds and other wet areas (Arizona Game and Fish Department 2005).

Eastwood (Senator Mine) Alumroot (Heuchera eastwoodiae)

Eastwood Alumroot is a Region 3 sensitive species for all three forests. Eastwood alumroot is endemic to central Arizona where it grows on moist shaded slopes in ponderosa pine forests and canyons. The typical substrate is crevices in basalt soil or basalt soil (Arizona Game and Fish Department 2005). Many of the previous occurrences of this species have been reclassified and are no longer included is this taxon (Folk and Alexander 2015). This has reduced the number of known occurrences of Eastwood alumroot on the forests and possibly within the project area.

There are three occurrences of Eastwood alumroot within the analysis area documented in SEINet. Hendricks collected the species in 1930 from “Strawberry Hill”. The location falls within ponderosa pine/evergreen oak habitat. SEINet documents three collections of Eastwood alumroot on private land in 1966 in the Christopher Creek drainage. Lehto collected the species on April 30, 1966 at Christopher Creek Campground and on October 1, 1966 on a mountainside near Christopher Creek. David Keil collected it near the mountainside location on April 30, 1966. In addition to these areas, there are documented occurrences of Eastwood alumroot in the Hunter Creek and Christopher Creek drainages on the Tonto NF (Arizona Game and Fish Department 2017). All of these areas are proposed for riparian restoration as part of this project.

Flagstaff beardtongue (Penstemon nudiflorus)

Flagstaff beardtongue is a Region 3 sensitive species for Coconino NF. Flagstaff beardtongue grows in dry pine forests, pine/oak, pine/oak/ juniper and pinyon juniper forests. It occurs on dry slopes, in openings and along edges of openings and in forested areas. Documented locations for Flagstaff beardtongue include Anderson Mesa, near Lake Mary, Luke Mountain, Mormon Lake, Stoneman Lake, along the Schnebly Hill Road, along Oak Creek. In recent years, numerous locations have been found in proposed fuels reduction projects such as Upper Beaver Creek Watershed Fuels Reduction Project (2010) and in the Rocky Park Fuels Reduction Project (2001).

Flagstaff beardtongue is endemic to northern and central Arizona where grows in dry pine forests (Arizona Game and Fish Department 2003). It tends to occur at elevations from 5100 to 7000 ft. in stony basaltic soil (Crosswhite, 1967).

Blumer's Dock (Rumex orthoneurus)

Blumer’s dock is a Region 3 sensitive species for all three forests. Blumer’s dock is a large, long-lived herbaceous perennial plant endemic to New Mexico and Arizona. Its range is from east-central to southeastern Arizona (depending on taxonomic interpretation). Habitat for Blumer’s dock includes mid- to high-elevation wetlands with moist, organic soil adjacent to perennial springs or streams in canyons or meadows (Arizona Game and Fish Department 2002. The species was proposed for federal listing in 1998 but the petition was rescinded in 1999.

There are numerous occurrences of Blumer’s dock on the Apache-Sitgreaves NF. The Wildlife specialist report for forest plan revision on Apache-Sitgreaves NF identified the habitat for Blumer’s dock as All Riparian PVNTs. Healthy riparian condition and clean water are identified as the habitat elements (fine filter components) addressed in analyses for plan revision (USDA Forest Service 2015).

Historically, there were both naturally occurring and introduced populations of Blumer’s dock on Tonto NF (USDA Forest Service 1985). The introductions occurred in the 1980’s. The introduced plants were cultivated from seeds collected from naturally occurring populations on the forest. The four naturally occurring populations include Reynolds Creek, Workman Creek, Rose Creek and Cold Springs Canyon. There are seventeen additional introduced populations including Canyon Creek, Haigler Creek, Pueblo Canyon, Bray Creek, Chase Creek, See Canyon, Nappa Spring, Dude Creek, East Verde River, Horton Springs, Pine Creek, Tonto Creek, Tonto Spring, Washington Park, Webber Creek, Ellison Creek, Christopher Creek, See Canyon and Horton Spring (USDA Forest Service 1993).

The Tonto NF prepared a Conservation Strategy for Blumer’s dock in 1993. Directions in the Conservation Strategy included a series of mitigations including maintaining or improving suitable riparian condition and actions to reduce the effects of roads. These are:

1. Locate new roads away from populations
2. Minimize road maintenance and reconstruction of existing roads adjacent to populations
3. Seek opportunities to obliterate and/or close roads adjacent to or impacting the population.

The documented locations within the project area on the Coconino NF are in the East Clear Creek and Barbershop Canyon areas.

Bebb's Willow (Salix bebbiana)

Bebb's willow is a Region 3 sensitive species for Coconino and Apache Sitgreaves National Forests. Bebb's willow (Salix bebbiana) is a large native shrub or a small bushy tree fifteen to twenty-five feet tall that ranges from Alaska south to British Columbia to east Newfoundland and in northeast United States and upper mid-western United States. Bebb's willow plants can regenerate from root and basal stem sprouting. Stem and root fragments root naturally if buried in moist soil. Plants are dioecious; male and female flowers are borne on separate plants. Large quantities of seed may be produced but remain viable for only a few days. Bebb's willow is drought and shade intolerant. Changes in water regime such as channel changes reduce successful germination from seed (Tesky 1992).

Environmental Consequences

Alternative 1 – No Action

This discussion addresses the no action alternative for the Southwestern Region sensitive plants. The discussion of these species is grouped together because the effects of no action are the same. All of these species differ in location and habitat needs from each other. These topics are discussed below in each species section.

Federally Listed Threatened or Endangered Plants

The Rim Country project area does not include any locations or potential habitat for Threatened or Endangered plant species and therefore there would be no effects on them from a decision to choose the no action alternative.

Southwestern Region Regional Forester's Sensitive Plants

Direct and Indirect Effects common to these species

Alternative 1 is the no action alternative. Under this alternative, none of the management actions including tree removal, burning, spring restoration, channel restoration, aspen restoration or actions related to road reconstruction, or decommissioning would occur. There would be no direct effects from management actions to these Region 3 sensitive species.

If the no action alternative were selected, none of the management actions would occur. There would be no tree cutting and no prescribed burning. As a result, tree density and canopy would not be reduced and stands would remain overstocked. Conditions associated with dense ponderosa pine stands result in physiologically stressful environments for understory plants. Stressors include increased shading, deep litter horizons, low soil moisture, low nutrient availability and contribute to a decline in species richness within the plant community. (Laughlin and others 2011). These factors affect all understory species including Region 3 sensitive plants. There would continue to be a reduction or loss of understory vegetation and therefore, a loss of understory services.

With no treatment, fire hazard would continue to increase therefore increasing the risk of severe wildfire in many parts of the project area (see Vegetation and Fire Reports for more information). Factors that contribute to fire hazard ratings that would be reduced through management actions such as canopy cover, trees per acre and dead and down fuel loading would not be reduced. The risk of wildfire transitioning to crown fires would increase in many areas of the project area resulting in the increased risk of severe wildfire and degradation of potential habitat. Severe wildfires often result in short and long-term effects, which include removal of tree canopy, loss of the understory plant community and alteration of soil structure and nutrients (Pyke and others 2010). Fire affects plant communities in several ways including, removal of vegetation and litter, alteration of soil characteristics and redistribution or modification of nutrients (Raison 1979). Severe wildfires often result in deaths of all plants including Region 3 sensitive plants, loss of seed banks (Korb and others 2004) and volatilization, alteration or removal of nutrients (Kaye and Hart 1998; Ballard 2000; Choromanska and DeLuca, 2002). These changes could adversely affect the habitat and populations of Region 3 sensitive plants by damaging soil, killing existing plants and by reducing or destroying the seed bank. Fire size may also increase, leading to largescale crown fires, which in turn may cause a permanent loss in understory diversity (Covington 2000). Primary fire effects such as deaths of individual plants or groups may recover in a matter of a few years. However, secondary effects such as permanent changes in biotic and abiotic factors can result in permanent changes in the post fire plant community (see Pyke and others 2010).

With no action, dead and down fuels would continue to increase, which in turn could negatively affect the vigor of Region 3 sensitive plants by increasing the amount of shade and litter (see Vegetation Report). Noxious or invasive weeds such as Dalmatian toadflax (Crawford and others 2001; Collins and others 2007, Dodge and others, 2008) and cheatgrass (McGlone and others 2009; Pyke and others 2010) more easily invade areas of severe wildfires than unburned areas. Therefore, if a severe wildfire occurred in the habitat of Region 3 sensitive plants, noxious or invasive weeds would also increase and contribute to the degradation of the habitat and loss of individuals and groups of Region 3 sensitive plants.

In the no action alternative, there would be no road reconstruction or decommissioning so there would be no direct or indirect risks such as deaths of individual plants and no risk of introduction of noxious or invasive weeds from management activities associated with road activities.

No spring or channel restoration would occur. There would be no improvements to upland watershed conditions in areas near Arizona bugbane habitat. Opportunities to improve habitat for such species as Arizona sneezeweed, Bebb's willow and Blumer's dock would not occur and areas that might have historically provided habitat for these species and would remain degraded and unsuitable for these and other plant species that require mesic conditions for their survival.

With no action, there would be no restoration of structure and function in the treatment areas, resulting in continued departure from the desired conditions for all resources in this project, including Region 3 sensitive plant species.

Greene Milkweed (Asclepias uncialis)

There is no effect to Greene milkweed from management actions since none is known to occur in the analysis area.

Villous groundcover milkvetch (Astragalus humistratus var. crispulus)

There are no direct effects to villous groundcover milkvetch from management actions since none will occur.

The no action alternative would not move these areas toward the Desired Conditions for Forest-wide Ecosystem Health or Desired Conditions for Riparian, Fine Scale Desired Conditions or Guidelines for Wildlife and Rare Plants or Desired Conditions and Guidelines for Landscape Scale disturbance. It will not meet the Purpose and Need of this project. Management actions that would improve the habitat for terrestrial and aquatic species would not occur and there would be no actions to improve the condition and function of these stream channels.

Arizona Bugbane (Cimicifuga arizonica)

There are no direct effects to Arizona bugbane from management actions since none will occur.

The no action alternative would not address the purpose and need of the project and would not move the area toward the desired conditions as defined in the Coconino LRMP (2018). The purpose of the Rim Country Project is to reestablish and restore forest structure and pattern, forest health, and vegetation composition and diversity in ponderosa pine ecosystems to conditions within the natural range of variation. Alternative 1 would not increase forest resiliency and sustainability or reduce the risk of undesirable fire effects. There would be no improvement in terrestrial habitat. There would be no treatments to restore the structure and function of the area the Arizona bugbane by reducing the risk of loss to disturbances such as uncharacteristic wildfire. The Desired Conditions and Guidelines that apply to the Arizona bugbane in this area include Desired Conditions All Ecosystems Soil, Terrestrial Ecosystems, or Wildlife, Fish and Plants. As a result, there would be no improvement of forest health, change in vegetation composition and diversity, resiliency would not be improved and Arizona bugbane plants in the project area would remain at a higher risk of loss from loss from undesirable fire effects if a wildfire were to occur within or near the Arizona bugbane population.

Dane (Mogollon) thistle (Cirsium parryi subsp. mogollicum)

There are no direct effects to Dane thistle from management actions since none will occur.

The no action alternative would not address the purpose and need of the project and would not move the area toward the desired conditions as defined in the Coconino LRMP (2018). The purpose of the Rim Country Project is to reestablish and restore forest structure and pattern, forest health, and vegetation composition and diversity in ponderosa pine ecosystems to conditions within the natural range of variation. Alternative 1 would not increase forest resiliency and sustainability or reduce the risk of undesirable fire effects. There would be no improvement in terrestrial habitat. There would be no treatments to restore the structure and function of the area containing Dane thistle by reducing the risk of loss to disturbances such as uncharacteristic wildfire. The Desired Conditions and Guidelines that apply to Dane thistle include Desired Conditions All Ecosystems Soil, Terrestrial Ecosystems, or Watershed and Water, Springs or Wildlife, Fish and Plants. As a result, there would be no improvement of forest health, change in vegetation composition and diversity, resiliency would not be improved and Dane thistle plants in the project area would remain at a higher risk of loss from loss from undesirable fire effects if a wildfire were to occur within or near Dane thistle.

Hairy Clematis (Arizona leatherflower) (Clematis hirsutissima var. hirsutissima) (syn. var. Arizonica)

There are no direct effects to hairy clematis from management actions since none will occur.

The no action alternative would not address the purpose and need of the project and would not move the area toward the desired conditions as defined in the Coconino LRMP (2018). The purpose of the Rim Country Project is to reestablish and restore forest structure and pattern, forest health, and vegetation composition and diversity in ponderosa pine ecosystems to conditions within the natural range of variation. Alternative 1 would not increase forest resiliency and sustainability or reduce the risk of undesirable fire effects. There would be no improvement in terrestrial habitat. There would be no treatments to restore the structure and function of the area containing hairy clematis by reducing the risk of loss to disturbances such as uncharacteristic wildfire. The Desired Conditions and Guidelines that apply to hairy clematis include Desired Conditions All Ecosystems Soil, Terrestrial Ecosystems, or Wildlife, Fish and Plants. As a result, there would be no improvement of forest health, change in vegetation composition and diversity, resiliency would not be improved and hairy clematis plants in the project area would remain at a higher risk of loss from loss from undesirable fire effects if a wildfire were to occur within or near hairy clematis.

Mogollon fleabane (Erigeron anchana)

There are no direct effects to Mogollon fleabane from management actions since none will occur.

The no action alternative would not address the purpose and need of the project or the direction of the current Tonto NF LMRP (1985) for the area. The purpose of the Rim Country Project is to reestablish and restore forest structure and pattern, forest health, and vegetation composition and diversity in ponderosa pine ecosystems to conditions within the natural range of variation. Alternative 1 would not increase forest resiliency and sustainability or reduce the risk of undesirable fire effects. There would be no improvement in terrestrial habitat. There would be no treatments to restore the structure and function of the area surrounding Mogollon fleabane by reducing the risk of loss to disturbances such as uncharacteristic wildfire.

Alternative 1 would not achieve the management emphasis for MA 4D. Specifically, there would be no management actions that would help protect timber resources by reducing the risk of uncharacteristic disturbances. The emphasis on using vegetation management to improve wildlife habitat and watershed condition would not occur. If Alternative 1 is selected there would be no reduction of the risk for uncharacteristic fire in the area surrounding this occurrence Mogollon fleabane. There would be no prescribed fire so there would be no opportunities to provide a mosaic of age classes or succession stages in the overstory component and no progress toward allowing fire to resume its natural ecological role. This could result in the adverse risks from wildfires to natural resources including the areas surrounding Mogollon fleabane should they occur, resulting in the need to suppress fire as directed in the Tonto NF LRMP.

There would be no mechanical or prescribed fire, or facilitative operations in the area.

If Alternative 1 is selected, there would be no activities associated with roads and transportation in this project so there would be no effects to Mogollon fleabane.

There would be no stream or channel restoration in the area near Mogollon fleabane so there would be no effects to the documented occurrence shown in figure 8.

There are no rock pits or in-woods processing areas near this occurrence of Mogollon fleabane so no effects will occur.

Rock (cliff) fleabane (Erigeron saxatilis)

The no action alternative would not address the purpose and need of the project and would not move the area toward the desired conditions as defined in the Coconino LRMP (2018). The purpose of the Rim Country Project is to reestablish and restore forest structure and pattern, forest health, and vegetation composition and diversity in ponderosa pine ecosystems to conditions within the natural range of variation. Alternative 1 would not increase forest resiliency and sustainability or reduce the risk of undesirable fire effects. There would be no improvement in terrestrial habitat. There would be no treatments to restore the structure and function of the area containing rock fleabane by reducing the risk of loss to disturbances such as uncharacteristic wildfire. The Desired Conditions and Guidelines that apply to rock fleabane include All Ecosystems Soil, Terrestrial Ecosystems, Geologic Features, Watershed and Water, and Wildlife, Fish and Plants. As a result, there would be no improvement of forest health, change in vegetation composition and diversity, resiliency would not be improved.

If Alternative 1 is selected, there would be no activities associated with roads and transportation in this project so there would be no effects to rock fleabane.

There are no rock pits or in-woods processing areas near the occurrences of rock fleabane so no effects will occur.

Arizona sneezeweed (Helenium arizonicum)

There are no direct effects to Arizona sneezeweed from management actions since none will occur.

The no action alternative would not address the purpose and need of the project and would not move the area toward the desired conditions, standards and guidelines, or management emphasis as defined in the Apache-Sitgreaves (2016), Coconino (2018) or Tonto (1985) LMRPs. . The purpose of the Rim Country Project is to reestablish and restore forest structure and pattern, forest health, and vegetation composition and diversity in ponderosa pine ecosystems to conditions within the natural range of variation. Alternative 1 would not increase forest resiliency and sustainability or reduce the risk of undesirable fire effects. There would be no improvement in terrestrial habitat. There would be no treatments to restore the structure and function of the area the Arizona sneezeweed by reducing the risk of loss to disturbances such as uncharacteristic wildfire.

Alternative 1 would not be consistent with the LMRPs for the forests. As a result, there would be no improvement of forest health, change in vegetation composition and diversity, resiliency would not be improved and Arizona sneezeweed plants in the project area would remain at a higher risk of loss from loss from undesirable fire effects if a wildfire were to occur within or near an occurrence of Arizona sneezeweed.

For the Apache-Sitgreaves NF, the forest wide desired conditions for overall forest health and the desired conditions and guidelines for soil, desired conditions for All PNVTs Landscape Scale and Mid-scale Desired Conditions would not be met. Guidelines for wildlife and rare plants, specifically the guideline that protect unique habitat features to retain their distinctive ecological functions and maintain viability of associated species and the guideline that considers and provides for the needs of localized species during project activities to ensure their limited or specialized habitats so they are not lost or degraded would not be followed

For the Coconino NF, the desired conditions and guidelines that apply to Arizona sneezeweed include desired conditions all ecosystems soil, terrestrial ecosystems, or watershed and water, springs or wildlife, fish and plants.

Alternative 1 would not comply with the Forest wide standards and guidelines for the Tonto NF that provide for consideration of the habitat requirements of sensitive species.

There are four documented occurrences of Arizona sneezeweed on the Tonto NF, two in MA 4D and two in MA 4F.

The management emphasis in MA 4D (Mogollon Rim) is for timber production, wildlife habitat improvement and recreation. The fire management objectives in the area include providing a mosaic of age classes with a mix of successional stages while allowing fire to resume its natural ecological role within ecosystems. This emphasis is complementary to the purpose and need of the project would not be met in Alternative 1.

The management emphasis in MA 4F is on watershed protection, livestock grazing, non-wilderness dispersed recreation, fuelwood production and wildlife habitat improvement. Fire management objectives for this area include: providing a mosaic of age classes within the total type which will provide for a mix of successional stages, and to allow fire to resume its natural ecological role within ecosystems. These objectives are complementary to the purpose and need of this project but would not be met in Alternative 1.

Eastwood (Senator Mine) Alumroot (Heuchera eastwoodiae)

There are no direct effects to Eastwood alumroot from management actions since none will occur.

The no action alternative would not address the purpose and need of the project and would not move the area toward the desired conditions, standards and guidelines, or management emphasis as defined in the Apache-Sitgreaves (2016), Coconino (2018) or Tonto (1985) LMRPs. Alternative 1 would not increase forest resiliency and sustainability or reduce the risk of undesirable fire effects. There would be no improvement in terrestrial habitat. There would be no treatments to restore the structure and function of the area the Eastwood alumroot by reducing the risk of loss to disturbances such as uncharacteristic wildfire.

Flagstaff beardtongue (Penstemon nudiflorus)

There are no direct effects to Flagstaff beardtongue from management actions since none will occur.

The no action alternative would not address the purpose and need of the project and would not move the area toward the desired conditions as defined in the Coconino LRMP (2018). The purpose of the Rim Country Project is to reestablish and restore forest structure and pattern, forest health, and vegetation composition and diversity in ponderosa pine ecosystems to conditions within the natural range of variation. Alternative 1 would not increase forest resiliency and sustainability or reduce the risk of undesirable fire effects. There would be no improvement in terrestrial habitat. There would be no treatments to restore the structure and function of the area containing Flagstaff beardtongue by reducing the risk of loss to disturbances such as uncharacteristic wildfire. The Desired Conditions and Guidelines that apply to Flagstaff beardtongue include Desired Conditions All Ecosystems Soil, Terrestrial Ecosystems, or Wildlife, Fish and Plants. As a result, there would be no improvement of forest health, change in vegetation composition and diversity, resiliency would not be improved and Flagstaff beardtongue plants in the project area would remain at a higher risk of loss from loss from undesirable fire effects if a wildfire were to occur within or near Flagstaff beardtongue.

Blumer's Dock (Rumex orthoneurus)

There are no direct effects to Blumer's dock from management actions since none will occur.

The no action alternative would not address the purpose and need of the project and would not move the area toward the desired conditions, standards and guidelines, or management emphasis as defined in the Apache-Sitgreaves (2016), Coconino (2018) or Tonto (1985) LMRPs. The portion of the purpose and need that addresses the need to improve terrestrial and aquatic habitats and the need to improve the condition of streams and springs. Alternative 1 would not improve terrestrial or aquatic habitats or improve the condition of streams and springs.

There would be no improvement of forest health, change in vegetation composition and diversity, resiliency would not be improved and the habitats that support Blumer's dock would not be restored or improved. There would be no improvement in aquatic habitats and there would be no opportunities to improve the conditions of stream channels and springs.

For the Apache-Sitgreaves NF, the forest wide desired conditions for overall forest health and the desired conditions and guidelines for soil, desired conditions for All PNVTs landscape scale and mid-scale desired conditions would not be met. The landscape scale and midscale desired conditions for All Riparian Areas would not be addressed. Guidelines for wildlife and rare plants, particularly the guideline that protect unique habitat features to retain their distinctive ecological functions and maintain viability of associated species and the guideline that considers and provides for the needs of localized species during project activities to ensure their limited or specialized habitats so they are not lost or degraded would not be followed.

For the Coconino NF, the desired conditions and guidelines for All Ecosystems, soil, all riparian, riparian forests, wetlands, springs or wildlife, fish and plants would not be addressed and there would be no progress toward achieving the desired conditions.

Alternative 1 would not comply with the forest wide standards and guidelines for the Tonto NF addressing the habitat requirements of sensitive species. Blumer's dock occurs in MAs 4D and 5D where plan direction related to riparian systems is limited to the establishment of buffer strips for protection of aquatic and riparian resources. This guidance would be applied only in areas identified by the ID team during planning and implementation.

Bebb's Willow (Salix bebbiana)

There are no direct effects to Bebb's willow from management actions since none will occur.

The no action alternative would not address the purpose and need of the project and would not move the area toward the desired conditions, standards and guidelines, or management emphasis as defined in the Apache-Sitgreaves (2016) or Coconino (2018) LMRPs. Alternative 1 would not increase forest resiliency and sustainability or reduce the risk of undesirable fire effects. There would be no improvement in terrestrial habitat. There would be no treatments to restore the structure and function of the area to reduce the risk of loss to disturbances such as uncharacteristic wildfire.

The no action alternative would not address the purpose and need of the project and would not move the area toward the desired conditions, standards and guidelines, or management emphasis as defined in the Apache-Sitgreaves (2016) or Coconino (2018) LMRPs. . The purpose of the Rim Country Project is to reestablish and restore forest structure and pattern, forest health, and vegetation composition and diversity in ponderosa pine ecosystems to conditions within the natural range of variation.

Alternative 1 would not be consistent with the LMRPs for the forests. As a result, there would be no improvement of forest health, change in vegetation composition and diversity, resiliency would not be improved and Bebb's willow in the project area would remain at a higher risk of loss from undesirable fire effects if a wildfire were to occur within or near an occurrence of Bebb's willow.

The portion of the purpose and need that addresses the need to improve terrestrial and aquatic habitats and the need to improve the condition of streams and springs. Alternative 1 would not improve terrestrial or aquatic habitats or improve the condition of streams and springs.

The habitats that support Bebb's willow would not be restored or improved. There would be no improvement in aquatic habitats and there would be no opportunities to improve the conditions of stream channels and springs.

Short-term effects of prescribed fire include deaths of individual plants. The potential long-term effects include the loss of shade, increased risk of noxious or invasive weeds and an increased risk of erosion. This will be mitigated by burning at intensities in all entries low enough to limit mortality to trees (see design features BT003 and FE004).

Opportunities to plant Bebb's willow in existing locations or other suitable locations not currently occupied would not occur and the opportunities to construct protective barriers around Bebb's willow would not occur.

For the Apache-Sitgreaves NF, the forest wide desired conditions for overall forest health and the desired conditions and guidelines for soil, desired conditions for All PNVTs landscape scale and mid-scale desired conditions would not be met. The landscape scale and midscale desired conditions for All Riparian Areas would not be addressed. Guidelines for wildlife and rare plants, particularly the guideline that protect unique habitat features to retain their distinctive ecological functions and maintain viability of associated species and the guideline that considers and provides for the needs of localized species during project activities to ensure their limited or specialized habitats so they are not lost or degraded would not be followed.

For the Coconino NF, the desired conditions and guidelines for all ecosystems, soil, all riparian, riparian forests, wetlands, springs or wildlife, fish and plants would not be addressed and there would be no progress toward achieving the desired conditions.

Federally Listed Threatened or Endangered Plants

The Rim Country project area does not include any locations or potential habitat for Threatened or Endangered plant species and therefore there would be no effects on them from implementation of the action alternatives.

Southwestern Region Regional Forester’s Sensitive Plants

Greene Milkweed (Asclepias uncialis)

There is no effect to Greene milkweed from management actions since none are known to occur in the analysis area.

The preliminary determination is that management actions proposed in the Rim Country EIS will not impact individuals of Greene milkweed and are not likely to result in a trend toward federal listing or loss of viability.

Villous groundcover milkvetch (Astragalus humistratus var. crispulus)

Known occurrences of villous ground cover milkvetch are in areas proposed for stream channel restoration. These actions would help move the treated areas toward the desired conditions as described in the Apache-Sitgreaves LRMP including mitigating the landscape scale disturbance that occurred as a result of the Rodeo-Chediski Fire in 2002.

Management actions related to stream restoration could result in the damage or loss of individual plants or groups of plants at the two known locations. This can be mitigated by following the guidelines for wildlife and rare plants in the forest plans, stating that modifications, mitigations, or other measures should be incorporated to reduce negative impacts to plants, animals, and their habitats and to help provide for species needs, consistent with project or activity objectives. Design features AQ020 and BT007 will help to mitigate impacts to villous groundcover vetch.

The management activities needed to restore the stream channels will be guided by the Aquatic Toolbox which will also mitigate the loss of plants. It is anticipated that the tools for improving the form and function of stream channels and floodplains (see AWFTA in appendix D) and the tools for improving spring outflows will be used at these sites.

The plant locations were documented in 2014 so are present despite the disturbance from the fire. No scientific data or publications were found that document the effects of fire on the plant. Villous groundcover milkvetch has been observed growing in roadbeds so is assumed to tolerate disturbance (Spellenberg 2007) so will likely tolerate the burning treatments proposed for these areas.

The preliminary determination is that management actions proposed in the Rim Country EIS may impact individuals of villous groundcover milkvetch (*Astragalus humistratus* var. *crispulus)* but is not likely to result in a trend toward federal listing or loss of viability.

Arizona Bugbane (Cimicifuga arizonica)

See individual effects discussions related to alternatives 2 and 3, respectively, below.

Dane (Mogollon) thistle (Cirsium parryi subsp. mogollicum)

Two occurrences of Dane thistle are within the Coyote Springs Mexican Spotted Owl (MSO) PAC and will be treated using the PAC Mechanical, a treatment designed to reduce the risk of uncharacteristic wildfire in MSO PACs. Refer to the Silviculture Report for a complete description of the treatment.

Mexican Spotted Owl habitat will be treated according to the direction provided in the revised MSO Recovery Plan (USDI FWS 2012). The treatment of this area will be negotiated with the US Fish and Wildlife Service and not by using the treatment matrix in the mechanical toolbox. Trees removed from areas in this treatment are generally smaller in diameter than those removed in other treatments. Canopy cover after treatment is generally higher as compared to those prescribed using the mechanical toolbox for areas outside MSO habitat. The third occurrence in figure 6 is within MSO recovery habitat. Vegetation treatment for this area will be developed using the Mechanical Toolbox and will follow guidance in the MSO Recovery Plan (2012). The most significant effect to Dane thistle from this treatment is direct losses of individuals from management actions but these can be mitigated by using design features and mitigations (BT001, BT005 BT007).

Short-term effects of prescribed fire include deaths of individual plants. The potential long-term effects include the loss of shade, increased risk of noxious or invasive weeds and an increased risk of erosion. This will be mitigated by burning at intensities in all entries low enough to limit mortality to trees (BT003)

The management actions would help move the treated areas toward the desired conditions as described in the Coconino NF LRMP. The effects of disturbance from vegetation treatments and prescribed fire include loss of individual plants. Disturbance may also increase the risk of invasion of noxious or invasive weeds. Invasion of non-native thistles such as bull thistle (*Cirsium vulgare*) are of particular concern due to the potential of hybridization. Therefore, mitigating the threat of noxious or invasive weeds in this area is needed (BT007, NW001, NW004 and NW009).

Aquatic restoration may include site disturbing activities that would affect the occurrences of Dane thistle, especially the northernmost mapped occurrence in figure 6 which is less than 1/10th mile from the proposed restoration site. Ground disturbing activities such as moving soil would increase the risk of disturbance to individual plants and their habitat. These effects can be mitigated through design features and mitigations specifically BT007 to mitigate loss of mitigate loss of sensitive plants by avoiding them as much as possible. Design feature AQ020 also applies, stating that all federally listed or sensitive species will be identified during pre-planning on a site specific basis and mitigations for those species will be determined.

There are no rock pits or in-woods processing areas near this occurrence of Dane thistle so no effects will occur.

The locations of Dane thistle are not near any roads so there are no effects from management actions along roads.

The preliminary determination is that management actions proposed in the Rim Country EIS may impact individuals of Dane thistle (*Cirsium parryi* subsp. *mogollicum*) but are not likely to result in a trend toward federal listing or loss of viability.

Hairy Clematis (Arizona leatherflower) (Clematis hirsutissima var. hirsutissima) (syn. var. Arizonica)

See individual effects discussions related to alternatives 2 and 3, respectively, below.

Mogollon fleabane (Erigeron anchana)

Treatments in the area of known occurrences of Mogollon fleabane include mechanical and prescribed fire treatment (goshawk foraging; meadow restoration). The area is also near a stream channel proposed for aquatic restoration.

The vegetation and prescribed fire treatments would support the management emphasis for MA 4D. The vegetation treatments would protect timber resources by reducing the risk of uncharacteristic disturbances and would improve watershed condition. The mechanical treatment emphases habitat for northern goshawk so would fulfill the emphasis for wildlife habitat. Prescribed fire would reduce the risk of uncharacteristic fire in the area surrounding this occurrence Mogollon fleabane and move toward allowing fire to resume its natural ecological role. The most significant risk to Mogollon fleabane is loss of individual plants or the group of plants at this location.

Aquatic restoration may include site disturbing activities that would affect this occurrence of Mogollon thistle. Ground disturbing activities such as moving soil would increase the risk of disturbance to individual plants and their habitat. These effects can be mitigated through design features and mitigations specifically BT007 to mitigate loss of mitigate loss of sensitive plants by avoiding them as much as possible. Design feature AQ020 also applies, stating that all federally listed or sensitive species will be identified during pre-planning on a site specific basis and mitigations for those species will be determined.

This occurrence of Mogollon fleabane appears to be near the roadway so may be affected if construction, maintenance or reconstruction of the road occurs, especially if the rocky areas favored by the species is affected. This can be mitigated by locating and avoiding the plants before activities occur.

There are no rock pits or in-woods processing areas near this occurrence of Mogollon fleabane so no effects will occur.

The preliminary determination is that management actions proposed in the Rim Country EIS may impact individuals of Mogollon fleabane (*Erigeron anchana*) but are not likely to result in a trend toward federal listing or loss of viability.

Rock (cliff) fleabane (Erigeron saxatilis)

Two areas containing rock fleabane are slated for mechanical treatment (goshawk foraging). The treatments will be developed using the mechanical treatment toolbox. The treatment will encompass considerations for the habitat of northern goshawk. The effects of mechanical treatment include loss of individual plants or groups of plants. These effects can be mitigated by using the design features in appendix C, specifically BT001, BT005, BT007.

Prescribed fire will occur throughout the project area but rock fleabane tends to occur in rocky areas that are sheltered from most fire activities so effects to the species from burning are anticipated to be minimal. Management activities such as fireline construction are not likely to occur in these areas. Short-term effects of prescribed fire include deaths of individual plants.

The potential long-term effects include, increased risk of noxious or invasive weeds and an increased risk of erosion.

There are two occurrences of rock fleabane in aquatic restoration areas. Management actions to accomplish this work will be guided by the Aquatic Toolbox. The risk to rock fleabane from these actions include loss or damage of plants or loss of habitat. These can be mitigated through using the design features AQ020, BT001, BT005, BT007 and SW001. Ground disturbing activities such as moving soil would increase the risk of disturbance to individual plants and their habitat. These effects can be mitigated through design features and mitigations specifically BT007 to mitigate loss of mitigate loss of sensitive plants by avoiding them as much as possible. Design feature AQ020 also applies, stating that all federally listed or sensitive species will be identified during pre-planning on a site specific basis and mitigations for those species will be determined.

An indirect effect of management actions within the potential habitat of rock fleabane includes an increased risk of invasion from noxious or invasive weeds incorporation of the design features, best management practices, mitigation and conservation measures in appendix C would mitigate the effects of increased disturbance from management activities, and help to control the spread and introduction of weeds within the habitat of rock fleabane. See design features BT007, NW001, NW002, NW003, NW004 and NW009.

Two occurrences of rock fleabane appears to be near roadways so may be affected if construction, maintenance or reconstruction of the road occurs, especially if the rocky areas favored by the species is affected. This can be mitigated by locating and avoiding the plants before activities occur (BT001)

Factors contributing to the degradation of aquatic habitats that led to the decision to include the areas in this analysis may have also affected the habitat of Mogollon fleabane. Aquatic habitat restoration, depending on the actions taken could preserve or improve the habitat of rock fleabane in this area, depending on the actions taken by restoring the general area and reducing effects such as erosion in the long term.

There are no rock pits or in-woods processing areas near this occurrence of rock fleabane so no effects will occur.

The preliminary determination is that management actions proposed in the Rim Country EIS may impact individuals of rock fleabane (*Erigeron saxatilis*) but are not likely to result in a trend toward federal listing or loss of viability.

Arizona sneezeweed (Helenium arizonicum)

The action alternatives would better meet the purpose and need of the project and would better fulfill the direction of the forest LMRPs as compared to Alternative 1.

Arizona sneezeweed occurs on all three forests included in this analysis and within several treatments (see existing condition). Vegetation treatments except those in MSO habitat will be developed using the flexible toolbox. Treatments within MSO habitat will be developed in cooperation with U.S. Fish and Wildlife Service. These effects can be mitigated by using the design features in Appendix C of the DEIS specifically BT001, BT005, BT007.

Short-term effects of prescribed fire include deaths of individual plants. The potential long-term effects include the loss or damage of plants, increased risk of noxious or invasive weeds and an increased risk of erosion. These effects can be mitigated through the use of design features and mitigations (see design features BT003).

An indirect effect of management actions within the potential habitat of Arizona sneezeweed includes an increased risk of invasion from noxious or invasive weeds Incorporation of the design features, best management practices, mitigation and conservation measures in appendix C would mitigate the effects of increased disturbance from management activities, and help to control the spread and introduction of weeds within the habitat of roc fleabane. See design features BT007, NW001, NW002, NW003, NW004 and NW009.

Arizona sneezeweed is known to occur in the following aquatic restoration units; Woods Canyon Creek, Chevelon Lake and Canyon Creek but may be in additional sites as well. Aquatic restoration may include site disturbing activities that would affect this occurrence of Arizona sneezeweed. Ground disturbing activities such as moving soil would increase the risk of disturbance to individual plants and their habitat. These effects can be mitigated through design features and mitigations specifically BT007 to mitigate loss of mitigate loss of sensitive plants by avoiding them as much as possible. Design feature AQ020 also applies, stating that all federally listed or sensitive species will be identified during pre-planning on a site specific basis and mitigations for those species will be determined.

Arizona sneezeweed near roadways may be affected if construction, maintenance or reconstruction of the road occurs, especially if the rocky areas favored by the species is affected. This can be mitigated by locating and avoiding the plants before activities occur (BT001, TR016, and TR011).

Factors contributing to the degradation of aquatic habitats that led to the decision to include the areas in this analysis may have also affected the habitat of Arizona sneezeweed. Aquatic habitat restoration, depending on the actions taken could preserve or improve the habitat of Arizona sneezeweed in this area, depending on the actions taken by restoring the general area and reducing effects such as erosion in the long term.

There are no rock pits or in-woods processing areas near this occurrence of Arizona sneezeweed so no effects will occur.

Arizona sneezeweed may occur near roadways so may be affected if construction, maintenance or reconstruction of the road occurs and can be mitigated by locating and avoiding the plants before activities occur (BT001, TR011, TR016).

The preliminary determination is that management actions proposed in the Rim Country EIS may impact individuals of Arizona sneezeweed (*Helenium arizonicum*) but are not likely to result in a trend toward federal listing or loss of viability.

Eastwood (Senator Mine) Alumroot (Heuchera eastwoodiae)

The occurrence of Eastwood alumroot documented in figure 10 is in an area that will be treated using the IT 10%-IT 25% prescription in both action alternatives. The treatment will be developed using the mechanical treatment toolbox. The effects of mechanical treatment include loss of individual plants or groups of plants. These effects can be mitigated by using the design features in appendix C of the DEIS, specifically BT001, BT005, BT007.

Prescribed fire will occur in the project area. Short-term effects of prescribed fire include deaths of individual plants. The potential long-term effects include, increased risk of noxious or invasive weeds and an increased risk of erosion.

Hunter and Christopher Creeks are slated for riparian restoration. Management actions to accomplish this work will be guided by the Aquatic Toolbox. The risk to Eastwood alumroot from these actions include loss or damage of plants or loss of habitat. These can be mitigated through using the design features AQ020, BT001, BT005 and BT007. Ground disturbing activities such as moving soil would increase the risk of disturbance to individual plants and their habitat. These effects can be mitigated through design features and mitigations specifically BT007 to mitigate loss of sensitive plants by avoiding them as much as possible. Design feature AQ020 also applies, stating that all federally listed or sensitive species will be identified during pre-planning on a site specific basis and mitigations for those species will be determined.

An indirect effect of management actions within the potential habitat of Eastwood alumroot includes an increased risk of invasion from noxious or invasive weeds Incorporation of the design Features, best management practices, mitigation and conservation measures in appendix C would mitigate the effects of increased disturbance from management activities, and help to control the spread and introduction of weeds within the habitat of Eastwood alumroot. See design features BT007, NW001, NW002, NW003, NW004 and NW009.

There are no rock pits or in-woods processing areas near this occurrence of Eastwood alumroot so no effects will occur.

Eastwood alumroot may occur near roadways so may be affected if construction, maintenance or reconstruction of the road occurs and can be mitigated by locating and avoiding the plants before activities occur (BT001, TR011, TR016).

The preliminary determination is that management actions proposed in the Rim Country EIS may impact individuals of Eastwood alumroot (Heuchera eastwoodiae) but are not likely to result in a trend toward federal listing or loss of viability.

Flagstaff beardtongue (Penstemon nudiflorus)

See individual effects discussions related to alternatives 2 and 3, respectively, below.

Blumer's Dock (Rumex orthoneurus)

Most of the occurrences of Blumer's dock occur in areas scheduled for riparian restoration, with some in areas where wet meadow restoration is planned. Management actions in riparian and wet meadow areas will be guided by the Aquatics and Watershed Flexible Toolbox Approach (AWFTA). These treatments will be prioritized based on the criteria in toolbox. Mechanical and fire treatments may occur in the uplands adjacent to these areas and will be guided by the Mechanical Treatments Flexible Toolbox Approach (MTFTA).

The risk to Blumer's dock from management actions to restore aquatic habitats and stream channels include loss or damage of plants or loss of habitat. These can be mitigated through using the design features AQ020, BT001, BT005, BT007, FE007 and SW001. Ground disturbing activities such as moving soil would increase the risk of disturbance to individual plants and their habitat. These effects can be mitigated through design features and mitigations specifically BT007 to mitigate loss sensitive plants by avoiding them as much as possible. Design feature AQ020 also applies, stating that all federally listed or sensitive species will be identified during pre-planning on a site specific basis and mitigations for those species will be determined.

An indirect effect of management actions within the potential habitat of Blumer's dock includes an increased risk of invasion from noxious or invasive weeds Incorporation of the Design Features, best management practices, mitigation and conservation measures in Appendix C would mitigate the effects of increased disturbance from management activities, and help to control the spread and introduction of weeds within the habitat of Blumer's dock. See design features BT007, NW001, NW002, NW003, NW004 and NW009.

Prescribed fire will occur in the project area. Short-term effects of prescribed fire include deaths of individual plants but these can be mitigated by using design features BT003, FE005.

There are no rock pits or in-woods processing areas near the occurrences of Blumer's dock so no effects will occur.

Blumer's dock may occur near roadways so may be affected if construction, maintenance or reconstruction of the road occurs and can be mitigated by locating and avoiding the plants before activities occur (BT001, TR011, TR016).The action alternatives would better address the purpose and need for aquatic and riparian habitats for the Apache Sitgreaves and Coconino NFs and would address the desired conditions and guidelines in the LMRPs. On the Tonto NF, the design features, mitigations and Aquatic Toolbox would provide better protection for riparian areas and stream courses as compared to the protections in Tonto NF LMRP (1985). Management actions would be guided by a comprehensive set of mitigations. The Aquatic Toolbox contains decision matrices and tools to address a series of conditions that affect the ecosystem health in aquatic systems. Examples include addressing the effects of erosion, noxious weeds, and soil disturbance or compaction that degrade all habitats including those occupied by Blumer's dock.

The preliminary determination is that management actions proposed in the Rim Country EIS may impact individuals of Blumer's dock (*Rumex orthoneurus*) but are not likely to result in a trend toward federal listing or loss of viability.

Bebb's Willow (Salix bebbiana)

Some of the areas containing Bebb's willow will receive vegetation treatments. The treatments will be developed using the mechanical treatment toolbox. The effects of mechanical treatment include loss of individual plants or groups of plants. These effects can be mitigated by using the design features in appendix C of the DEIS, specifically BT001, BT005, BT007.

Management actions in aquatic and riparian areas will be guided by the AWFTA. These treatments will be prioritized based on the criteria in toolbox. Mechanical and fire treatments may occur in the uplands adjacent to these areas and will be guided by the MFTFTA.

The risk to Bebb's willow from management actions to restore aquatic habitats and stream channels include loss or damage of plants or loss of habitat. These can be mitigated through using the design features AQ020, BT001, BT005, BT007, FE007 and SW001. Ground disturbing activities such as moving soil would increase the risk of disturbance to individual plants and their habitat. These effects can be mitigated through design features and mitigations specifically BT007 to mitigate loss sensitive plants by avoiding them as much as possible. Design feature AQ020 also applies, stating that all federally listed or sensitive species will be identified during pre-planning on a site specific basis and mitigations for those species will be determined.

Prescribed fire will occur in the project area. Short-term effects of prescribed fire include deaths of individual plants but these can be mitigated by using design feature BT003 and FE005.

An indirect effect of management actions within the potential habitat of Bebb's willow includes an increased risk of invasion from noxious or invasive weeds Incorporation of the design Features, best management practices, mitigation and conservation measures in appendix C would mitigate the effects of increased disturbance from management activities, and help to control the spread and introduction of weeds within the habitat of Bebb's willow. See design features BT007, NW001, NW002, NW003, NW004, and NW009.

There are no rock pits or in-woods processing areas near the occurrences of Bebb’s willow so no effects will occur.

Bebb’s willow may occur near roadways so may be affected if construction, maintenance or reconstruction of the road occurs and can be mitigated by locating and avoiding the plants before activities occur (BT001, TR011, TR016).The action alternatives would better address the purpose and need for aquatic and riparian habitats for the Apache Sitgreaves and Coconino NFs and would address the desired conditions and guidelines in the LMRPs. The Aquatic Toolbox contains decision matrices and tools to address a series of conditions that affect the ecosystem health in aquatic systems. Examples include addressing the effects of erosion, noxious weeds, and soil disturbance or compaction that degrade all habitats including those occupied by Bebb’s willow.

The preliminary determination is that management actions proposed in the Rim Country EIS may impact individuals of Bebb’s willow (Salix bebbiana) but are not likely to result in a trend toward federal listing or loss of viability.

Forest Planning or “Other” Species

Forest Planning Species (Apache Sitgreaves NF) and “Other” Species (Coconino NF) are those species which were used to evaluate Plan components during the revision on the respective LMRPs. Assuming that all management actions comply with the plan components of the forest plans, then viability for these species will be appropriately addressed and no further consideration is needed.

There is no finding of effect for these species.

Alternative 2 – Modified Proposed Action

Southwestern Region Regional Forester’s Sensitive Plants

Greene Milkweed (Asclepias uncialis)

See the discussion of effects common to both action alternatives, above.

Villous groundcover milkvetch (Astragalus humistratus var. crispulus)

See the discussion of effects common to both action alternatives, above.

Arizona Bugbane (Cimicifuga arizonica)

The proposed management actions would help move the treated areas toward the desired conditions as described in the LRMP. The most significant effect to Arizona bugbane from management actions is direct losses of individuals from management actions but these would be mitigated by incorporating the components in appendix C of the DEIS – design features, best management practices, mitigation and conservation measures (BT001, BT005, and BT007).

This occurrence of Arizona bugbane is within the Tom’s Creek Mexican Spotted Owl (MSO) PAC and will be treated using the PAC Mechanical, a treatment designed to reduce the risk of uncharacteristic wildfire in MSO PACs. Refer to the Silviculture Report for a complete description of the treatment.

Mexican Spotted Owl habitat will be treated according to the direction provided in the revised MSO Recovery Plan (USDI FWS 2012). The treatment of this area will be negotiated with the US Fish and Wildlife Service and not by using the treatment matrix in the mechanical toolbox. Trees removed from areas in this treatment are generally smaller in diameter than those removed in other treatments. Canopy cover after treatment is generally higher as compared to those prescribed using the mechanical toolbox for areas outside MSO habitat. Shade for Arizona bugbane plants in this area may be affected but it will not be extensive. This could result in the loss of a few individuals but will not affect the entire population at this site.

Short-term effects of prescribed fire include deaths of individual plants. The potential long-term effects include the loss of shade, increased risk of noxious or invasive weeds and an increased risk of erosion. This will be mitigated by burning at intensities in all entries low enough to limit mortality to trees (see design feature BT003). The current knowledge of fire effects on Arizona bugbane are based largely on observations on a local wildfire, the Fry Fire in 2003. No published data for fire effects to Arizona bugbane were found. A related species red baneberry (*Actaea rubra*) has been studied in the Northwestern U. S (Crane 1990). In that species, the tops of plants are removed by fire and then plants regenerate from thick underground caudices, but seedlings did not appear for several years post-fire. Another related species (*Cimicifuga elata*) grows in various habitats t habitats in the northwestern U.S. where it demonstrates fire tolerance. The lack of fire has been implicated as a factor in limiting population size and distribution in the northwestern U.S (Klinkenberg and Klinkenberg 2003).

Activities associated with roads and transportation in this project would be limited those needed to accomplish the management actions that will occur in the area. No hauling is proposed in the immediate area of Arizona bugbane populations. Indirect effects from road use would be limited to dust from road maintenance but these will be minimal and inconsequential.

An indirect effect of management actions within the potential habitat of Arizona bugbane includes an increased risk of invasion from noxious or invasive weeds. Incorporation of the design features would mitigate the effects of increased disturbance from management activities, and help to control the spread and introduction of weeds within the habitat of Arizona bugbane. See design features BT007, NW001, NW004 and NW009.

No locations of Arizona bugbane occur within sites for spring or channel restoration were found, so there are no effects to the species.

There are no rock pits or in-woods processing areas near this occurrence of Arizona bugbane so no effects will occur.

Dane (Mogollon) thistle (Cirsium parryi subsp. mogollicum)

See the discussion of effects common to both action alternatives, above.

Hairy Clematis (Arizona leatherflower) (Clematis hirsutissima var. hirsutissima) (syn. var. Arizonica)

The area containing hairy clematis is slated for mechanical treatment (goshawk foraging). The treatment will be developed using the mechanical treatment toolbox. The treatment will encompass considerations for the habitat of northern goshawk. The effects of mechanical treatment include loss of individual plants or groups of plants. These effects can be mitigated by using the design features specifically BT001, BT005, BT007.

Short-term effects of prescribed fire include deaths of individual plants. The potential long-term effects include the loss of shade, increased risk of noxious or invasive weeds and an increased risk of erosion. This will be mitigated by burning at intensities in all entries low enough to limit mortality to trees (see design features BT003 and FE004).

Activities associated with roads and transportation in this project would be limited those needed to accomplish the management actions that will occur in the area. The effects of road construction, maintenance, reconstruction and decommissioning can be mitigated by using the design features in Appendix C, specifically BT009 and BT010. The effects of dust on plants from transportation can be mitigated by design feature TR016.

An indirect effect of management actions within the potential habitat of hairy clematis includes an increased risk of invasion from noxious or invasive weeds. Incorporation of the design features, best management practices, mitigation and conservation measures in appendix C would mitigate the effects of increased disturbance from management activities, and help to control the spread and introduction of weeds within the habitat of hairy clematis. See design features BT007, NW001, NW002, NW003, NW004 and NW009.

This occurrence of hairy clematis is near the proposed Iron Mine Draw. Stream channel restoration actions needed to restore the channel will be guided by the AWFTA. The risk to hairy clematis from these actions include loss or damage of plants or loss of habitat. These can be mitigated through using the design features AQ020, BT001, BT005, BT007 and SW001.

There are no rock pits or in-woods processing areas near this occurrence of hairy clematis so no effects will occur.

Mogollon fleabane (Erigeron anchana)

See the discussion of effects common to both action alternatives, above.

Rock (cliff) fleabane (Erigeron saxatilis)

Four occurrences are in Mexican Spotted Owl habitat and will be treated according to the direction provided in the revised MSO Recovery Plan (USDI FWS 2012). The treatment of these areas will be negotiated with the US Fish and Wildlife Service and not by using the treatment matrix in the MTFTA. Trees removed from areas using this treatment are generally smaller in diameter than those removed in other treatments. Canopy cover after treatment is generally higher as compared to those prescribed using the mechanical toolbox for areas outside MSO habitat. The most significant effect to rock from this treatment is direct losses of individuals from management actions but these can be mitigated by using design features and mitigations (BT001, BT005 BT007).

Arizona sneezeweed (Helenium arizonicum)

See the discussion of effects common to both action alternatives, above.

Eastwood (Senator Mine) Alumroot (Heuchera eastwoodiae)

See the discussion of effects common to both action alternatives, above.

Flagstaff beardtongue (Penstemon nudiflorus)

Most of the areas containing Flagstaff beardtongue receiving vegetation treatments areas are proposed for mechanical treatment (goshawk foraging). The treatments will be developed using the mechanical treatment toolbox. The treatment will encompass considerations for the habitat of northern goshawk. The effects of mechanical treatment include loss of individual plants or groups of plants. These effects can be mitigated by using the design features in appendix C, specifically BT001, BT005, BT007.

Prescribed fire will occur across the project area. Short-term effects of prescribed fire include deaths of individual plants. The potential long-term effects include the loss of shade, increased risk of noxious or invasive weeds and an increased risk of erosion. This will be mitigated by burning at intensities in all entries low enough to limit mortality to trees (see design features BT003).

An indirect effect of management actions within the potential habitat of Flagstaff beardtongue includes an increased risk of invasion from noxious or invasive weeds. Incorporation of the design features, best management practices, mitigation and conservation measures in appendix C would mitigate the effects of increased disturbance from management activities, and help to control the spread and introduction of weeds within the habitat of Flagstaff beardtongue. See design features BT007, NW001, NW002, NW003, NW004 and NW009.

Activities associated with roads and transportation in this project would be limited to those needed to accomplish the management actions that will occur in the area. The effects of road construction, maintenance, reconstruction and decommissioning can be mitigated by using the design features in Appendix C, specifically BT009 and BT010. The effects of dust on plants from transportation can be mitigated by design feature TR016.

There are no rock pits or in-woods processing areas near the occurrences of Flagstaff beardtongue so no effects will occur.

Blumer's Dock (Rumex orthoneurus)

See the discussion of effects common to both action alternatives, above.

Bebb's Willow (Salix bebbiana)

See the discussion of effects common to both action alternatives, above.

Alternative 3 – Focused Alternative

Southwestern Region Regional Forester's Sensitive Plants

Greene Milkweed (Asclepias uncialis)

See the discussion of effects common to both action alternatives, above.

Villous groundcover milkvetch (Astragalus humistratus var. crispulus)

See the discussion of effects common to both action alternatives, above.

Arizona Bugbane (Cimicifuga arizonica)

Under alternative 3, no mechanical treatments would take place in the area where Arizona bugbane is known to occur, so the effects of mechanical treatment described in alternative 2 above do not apply. The effects on Arizona bugbane of all other management actions are similar to those described above in the discussion of effects of alternative 2.

Dane (Mogollon) thistle (Cirsium parryi subsp. mogollicum)

See the discussion of effects common to both action alternatives, above.

Hairy Clematis (Arizona leatherflower) (Clematis hirsutissima var. hirsutissima) (syn. var. Arizonica)

In alternative 3, no mechanical or fire treatments are proposed in areas where hairy clematis is known to occur so the effects of those actions are similar to alternative 1, the no action alternative. The effects of transportation and channel restoration are the same as those discussed for alternative 2, above, including the threats of noxious or invasive weeds.

Mogollon fleabane (Erigeron anchana)

See the discussion of effects common to both action alternatives, above.

Rock (cliff) fleabane (Erigeron saxatilis)

One occurrence of rock fleabane (in the Barbershop MSO PAC) will not receive mechanical and prescribed fire treatments in this alternative and would not move as quickly toward desired condition as compared to the potential MSO PAC treatment in Alternative 2. Two occurrences that would be treated as MSO habitat in alternative 2 will receive different mechanical treatments in this alternative. One area will receive an individual tree removal and the other will be treated using an uneven age thinning treatment. Both will receive some form of prescribed burning. The effects of these treatments may result in different overstory composition and structure but the effects to rock fleabane and its habitat are expected to be similar.

Arizona sneezeweed (Helenium arizonicum)

Fewer areas containing Arizona sneezeweed will be treated as compared to alternative 2. As a result, alternative 3 would not fulfill the purpose and need of the project as well as alternative 2 and there would be less progress toward the desired conditions of the forest LMRPs, including those that apply to Region 3 sensitive plants such as Arizona sneezeweed.

Eastwood (Senator Mine) Alumroot (Heuchera eastwoodiae)

See the discussion of effects common to both action alternatives, above.

Flagstaff beardtongue (Penstemon nudiflorus)

Under alternative 3 few acres containing Flagstaff beardtongue would receive vegetation treatments (see the Botany and Noxious Weeds specialist report). Alternative 3 would not address the purpose and need to the extent that alternative 2 would. There would be less progress toward the desired conditions that affect Flagstaff beardtongue. Forest resilience and would be attained on fewer acres and the risk of undesirable fire effects would be reduced in fewer areas. Flagstaff beardtongue plants and habitat in these areas would remain at higher risk of loss or damage from undesirable fire effects.

Blumer's Dock (Rumex orthoneurus)

See the discussion of effects common to both action alternatives, above.

Bebb's Willow (Salix bebbiana)

Fewer areas containing Bebb's willow would receive vegetation or prescribed fire treatments as compared to alternative 2. As a result, it would not fulfill the purpose and need of the project to the extent that alternative 2 would and there would be less progress toward the desired conditions and guidelines in the forest LMRPs, including those that apply to Region 3 sensitive plants such as Bebb's willow.

Cumulative Effects

The cumulative effects project area is the Rim Country project area. The timespan considered is from the year 2000 to the present.

Past management actions within the project area have defined the existing conditions and set the stage for the current departure from reference condition and need for change. Past activities such as fire exclusion and heavy grazing have resulted in a shift in environmental conditions. Conditions in many western forests, including the ponderosa pine forests in northern Arizona have changed from an ecosystem regulated by frequent, low intensity ground fire to a system with fire exclusion and stand-replacing fire regimes. These changes have resulted in decreased understory vegetation and alteration of the hydrological systems (see Silviculture and Riparian and Watershed specialist reports). Other changes include shifts to more frequent occurrences of fire intolerant species, increases in litter, (Abella and others 2007), declines in species density and shrub cover (Bakker and Moore 2007), changes in species composition and functional groups including shifts toward more shade tolerant understory species under denser tree canopies (Laughlin and others 2011).

Alternative 1 – No Action

Federally Listed Threatened or Endangered Plants

The Rim Country project area does not include any locations or potential habitat for Threatened or Endangered plant species and therefore there would be no additional cumulative effects on them from a decision to choose the no action alternative for the Rim Country Project.

Southwestern Region Regional Forester's Sensitive Plants

If the "no action" alternative is selected management actions such as fuels reduction projects, prescribed fire, spring and channel restoration will be limited to those analyzed and implemented by the individual projects analyzed in other NEPA on each forest (see the Cumulative Effects section near the beginning of chapter 3). The effects of the no action would be continued survey, analysis and mitigation for Region 3 sensitive plant species on the Apache-Sitgreaves, Coconino and Tonto NFs based on project-level analyses. Opportunities for cooperation with external partners for such items as survey and monitoring would not occur.

Forest Planning or "Other" Species

Forest Planning Species (Apache-Sitgreaves NF) and "Other" Species (Coconino NF) are those species which were used to evaluate Plan components during the revision on the respective LMRPs. Standards and guidelines in the Apache-Sitgreaves (2016) and Coconino (2018) NF LRMPs would not be applied. There would be no additional progress toward the desired conditions and guidelines defined in the LRMPs.

Cumulative Effects Common to Both Action Alternatives

Federally Listed Threatened or Endangered Plants

The Rim Country project area does not include any locations or potential habitat for Threatened or Endangered plant species and therefore there would be no additional cumulative effects on them from implementation of the action alternatives for the Rim Country Project.

Southwestern Region Regional Forester's Sensitive Plants

Greene Milkweed (Asclepias uncialis)

There are no effects to Greene milkweed from management actions so there are no cumulative effects.

Villous groundcover milkvetch (Astragalus humistratus var. crispulus)

The timeframe for analysis of cumulative effects on villous groundcover milkvetch is from 2002 when the Rodeo-Chediski Fire burned through the area to 20 years in the future. The Rodeo Chediski Fire was a major disturbance that defined the existing conditions in the areas containing villous groundcover milkvetch. The LRMP addresses future landscape scale events stating actions to be taken by the forest. The guidance is mentioned here because it provides important insight into the long-lasting effects of landscape scale disturbance stating "These can lead to ecological succession away from desired conditions, which can be complicated by other factors like climate change and invasive species. When uncharacteristic outcomes occur, the landscape can take hundreds of years or more to recover to some level of stability. Where outcomes are uncharacteristic and there are needs to accelerate recovery, additional direction is provided to protect existing resources and facilitate recovery of soil and vegetation components and improve ecosystem health." (USDA Forest Service 2016). The degraded channels in the area may be attributed at least in part to the effects of the Rodeo-Chediski Fire in the areas around the occurrences of villous groundcover milkvetch as well as in the watersheds above and attributed to the need for action to restore these channels.

The effects of recreation on the plants at Black Canyon Lake are not known but may attribute to the impacts to the villous groundcover milkvetch in the area.

Both of the documented occurrences of villous groundcover milkvetch are within the Heber Wild Horse Territory, a special area designated in the LRMP. Desired conditions for this area include grazing that is in balance with the available forage. It is not known if horses or other grazers in the area utilize villous groundcover milkvetch as forage.

Arizona Bugbane (Cimicifuga arizonica)

The following past actions have affected the abundance of Arizona bugbane and have established baseline current condition for Arizona bugbane. Some impacts observed include grazing, recreation, wildfire and natural disturbances such as flooding, drought, tornados and mortality in overstory trees. Grazing impacts were addressed in the Conservation Assessment and Strategy for the Coconino and Kaibab National Forests and include fencing and monitoring in certain populations. This has led to a reduction in these conflicts.

The Tram Fire burned in 2002 along the south side of West Clear Creek in an area above the Tram Trail where there is a known large group of Arizona bugbane. There were no direct effects to the plants. The Fry Fire in 2003 burned into Fry Canyon and into some populations of Arizona bugbane but did not appear to severely impact the Arizona bugbane populations in the canyon. The source of the fire was a lightning strike on August 9, 2003 near the south edge of Fry Canyon. The fire burned approximately 180 acres of ponderosa pine and mixed conifer forest in upland areas and canyons slopes. Activities during the suppression effort included but were not limited to fire line construction and felling of trees in the canyon. Additionally, some backfires were set in the upland areas to reduce fire spread and intensity. On subsequent visits after the fire, Arizona bugbane was observed growing along the fire line.

Arizona bugbane occurs on the Tonto National Forest but there are no data that support its occurrence in the treatment areas for Rim Country. Arizona bugbane was previously managed using a Conservation Assessment (1993) and Agreement (1998). Most occurrences of Arizona bugbane are within the Sierra Anchas Experimental Forest. Others are in the Sierra Anchas Wilderness. The most recent survey of the area was by Glenn Rink, who recorded occurrences in three areas including Workman Creek, Pueblo Canyon and Cold Springs Canyon. He surveyed other canyons in the general area and reported finding no additional occurrences. The Juniper Fire (2016) burned in the experimental forest and in the wilderness. The Coon Fire (2000) burned within the experimental forest. The effects to Arizona bugbane and its habitat from these fires is unknown.

In addition to the management actions in this analysis, the most likely foreseeable actions in area include recreation such as hiking, rock climbing and canyoneering. Grazing by cattle and wildlife will continue. Vegetation treatments and prescribed fire analyzed in this analysis will occur. Wildfires may also occur in the area. Singly none of these actions will extirpate the Arizona bugbane at the site.

Dane (Mogollon) thistle (Cirsium parryi subsp. mogollicum)

The area of this cumulative effects analysis includes the known range of Dane thistle, which includes the area described in the Affected Environment section above. The timeframe begins when Dane thistle was first described (Schaack and Goodwin 1990) to twenty years in the future. The known range of Dane thistle is a small portion of the overall project area. At least one occurrence of Dane thistle was protected with a small wire structure in the past but this area has not been revisited in several years so the fates of the plants and structure are unknown.

There have been a variety of management activities in the uplands surrounding the known Dane thistle occurrences but few activities have occurred in the steep canyon areas. Grazing by cattle has occurred in the past but the allotment containing Dane thistle is not currently being used. Grazing by wildlife still occurs. A limited amount of recreational activities such as hiking may occur in the areas but there are no established trails in the canyon areas.

There is a large dispersed camping area in the uplands above one occurrence. A fence restricts vehicle travel and camping near the canyon edge. Hikers from the camping area may occasionally venture into the area. At the same site, there is an historical cabin and spring diversion upslope. There are plans to rehabilitate the spring, allowing it to be free-flowing but management actions from this action are not anticipated to have any effect on Dane thistle.

In addition to the management actions in this analysis, grazing by wildlife and recreation will continue in this area.

Hairy Clematis (Arizona leatherflower) (Clematis hirsutissima var. hirsutissima) (syn. var. Arizonica)

The area of this analysis is the project boundary. The time frame is from 2005 to 20 years in the future which is considered the length of the decision to be made by this analysis.

One occurrence was detected in 2005 during a survey for the Bald Mesa Fuels Reduction Project. Since then there has been at least one entry of prescribed fire in this area. The effects were mitigated by locating and constructing hand line around the plants. Other activities include grazing and dispersed recreation in the uplands.

In addition to the management actions in this analysis, the most likely foreseeable actions within the habitat of hairy clematis include recreation such as hiking and dispersed camping. Wildfires may burn in the area. Grazing by cattle and wildlife will continue. Singly none of these actions will extirpate the hairy clematis at the site.

Mogollon fleabane (Erigeron anchana)

The timeframe of this discussion of cumulative effects on Mogollon fleabane is from 1990 to 20 years in the future. The area of this analysis is the project boundary. Many of the documented collections of Mogollon fleabane are in wilderness or remote areas and would not be affected by management actions such as those proposed in this analysis.

The known occurrence in the project area is near the Bear Flat Campground, so past and future impacts from recreational activities have occurred and will continue to occur near the site. Recreational activities such as rock climbing could affect plants by crushing individuals and altering habitat.

Factors contributing to the degradation of Tonto Creek that led to the decision to include it in this analysis may have also affected the habitat of Mogollon fleabane. Aquatic habitat restoration, depending on the actions taken, could preserve or improve the habitat of Mogollon fleabane in this area.

The past actions such as construction and maintenance of roads in the area could have contributed to the effects on habitat in this area, especially if rock formations were altered during construction and maintenance.

In addition to the management actions in this analysis, the foreseeable actions in area include recreation and occupancy of nearby land. Grazing by cattle and wildlife may occur in the area. Wildfire may also occur in the area. These may affect the habitat or plants occurring at this location but are not likely to affect the entire species.

Rock (cliff) fleabane (Erigeron saxatilis)

The timeframe considered is from 1990 to 20 years in the future. The area of this analysis is the project boundary.

Factors contributing to the degradation of areas scheduled for aquatic restoration that led to the decision to include it in this analysis may have also affected the habitat of rock fleabane. Aquatic habitat restoration, depending on the actions taken could preserve or improve the habitat of rock fleabane in this area.

The past actions such as construction and maintenance of roads in the area could have contributed to the effects on habitat in this area, especially if rock formations were altered during construction and maintenance.

In addition to the management actions in this analysis, grazing by cattle and wildlife may occur in the area. Wildfire may also occur in the area. These may affect the habitat or plants occurring at this location but are not likely to affect the entire species.

Arizona sneezeweed (Helenium arizonicum)

The timeframe considered is from 1999 when Arizona sneezeweed was added to the sensitive species list to 20 years in the future. The area of this analysis is the project boundary.

On the Coconino NF, Arizona sneezeweed has been addressed in Upper Beaver Creek Watershed Fuel Reduction (2010), Clint's Well Forest Restoration (2013) and the Cragin Watershed Protection Project (2018), in which effects were mitigated through design features and mitigations similar to those proposed in this project.

Arizona sneezeweed tends to grow in drainages and open areas. These areas are also favored by dispersed recreationists who may crush plants and alter habitat during activities. Activities such as grazing and fuelwood gathering have occurred and will continue in these areas.

Eastwood (Senator Mine) Alumroot (Heuchera eastwoodiae)

The area of consideration for this discussion is the project area boundary. The timeframe includes 20 years past and future. Although this species occurs on all three forests within the project area, no data were found to document the effects of management on the species. Several of the areas where Eastwood alumroot occurs are in remote areas and/or in wilderness areas such as the Sierra Ancha, Red Rock Secret Mountain, and Mazatzal Mountains. Some of these areas have been affected by previous wildfires such as the Slide Fire in the Red Rock Secret Mountain Wilderness (2014). Past activities that have resulted in the need to restore Hunter and Christopher Creeks may have also affected Eastwood alumroot habitat. Past impacts to basalt soils and crevices, especially in canyons and drainage areas may have affected individuals, groups or habitat for Eastwood alumroot. Dispersed recreation, especially activities such as canyoneering and rock climbing occur in potential habitat for Eastwood alumroot.

Flagstaff beardtongue (Penstemon nudiflorus)

The area of consideration for this discussion includes the Coconino NF within the analysis area boundary. The timeframe includes 20 years past and future.

Surveys have been conducted for Flagstaff beardtongue on several of past projects that addressed vegetation and prescribed fire treatments. These include Upper Beaver Creek Watershed Fuel Reduction (2011), Clint’s Well Forest Restoration, Lake Mary Road ROW Clearing (ADOT) (2016) and the 1st 4FRI EIS. Effects to Flagstaff beardtongue were mitigated with similar measures as those proposed in this DEIS.

Management activities such as grazing have occurred and will continue to occur in the area of consideration. Other activities such as utility corridors have impacted individual plants or groups but has not substantially affected the species as a whole. Activities such as dispersed recreation and fuel wood cutting occur in the area of consideration. Flagstaff beardtongue is showy and is cultivated and offered for sale by local and regional wildflower vendors but the effects of these activities on wild populations is not known.

Blumer's Dock (Rumex orthoneurus)

The area of consideration for this discussion includes the portion of the project area containing Blumer’s dock plants and habitat, especially the drainages in the area. The timeframe is from 1993 to 20 years in the future. The 1993 timeframe was chosen to allow inclusion of introductions of Blumer’s dock on the Apache Sitgreaves and Tonto NFs as documented in the Conservation Strategy. These introductions were implemented to supplement the numbers of plants and populations of this rare species. The fates of some of these introductions are unknown but are not thought to have persisted. This would affect the distribution of Blumer’s dock in the project area and could affect the mitigations and management actions for restoring these areas.

There are a series of exclosures on the Apache Sitgreaves NF. Some of these contain or were designed to protect Blumer’s dock. The status of these are unknown. Some likely need repair.

Several large fires have occurred in the project area. The largest of these is the Rodeo-Chediski (2002). It and other large fires have affected the terrestrial and aquatic habitats in the area containing Blumer’s dock by destroying or altering vegetation communities, creating landscape scale disturbance, contributing to the risk of invasion of noxious or invasive weeds and contribution to erosion. The extent of effects on Blumer’s dock is not known.

Grazing by livestock and wildlife has occurred and will continue to occur in the area. Blumer’s dock is palatable to animals and small populations may be completely eaten in a single year. Activities such as dispersed recreation and firewood gathering have occurred and will continue to occur in the area.

Bebb’s Willow (Salix bebbiana)

The area of consideration for this discussion includes the portion of the project area containing Bebb’s willow and its habitat, especially the drainages in the area. The timeframe is 20 years past and in the future.

There are a series of exclosures on the Apache Sitgreaves NF and Coconino NFs. Some of contain, or were designed to protect, Bebb’s willows. The status of these is unknown. Some likely need repair.

Several large fires have occurred in the project area. The tops of Bebb’s willow may be removed by fire but the species is able to regenerate through basal sprouting. However, regeneration is often targeted and eaten by domestic and wild grazers, leading to depletion of underground reserves ultimately leading to the death of individual plants.

Grazing by livestock and wildlife has occurred and will continue to occur in the area. Bebb's willow is palatable to animals and small populations may be completely eaten in a single year. Activities such as dispersed recreation and firewood gathering have occurred and will continue to occur in the area.

Aquatics

The analysis of aquatic biota and habitat, as well as the endangered, threatened, and sensitive aquatic species and their occupied, critical, and recovery habitats, that occur within the Rim Country project area is part of the Aquatics Report (Coleman 2018), which is incorporated by reference.

Affected Environment

Watershed Condition

The proposed project occurs within portions of 142 different 6th HUC subwatersheds. Of these watersheds, thirty-eight have less than 5 percent of their total area within the project boundary. Overall, the project area is dominated by functional-at-risk subwatersheds (about 451,500 acres, or 46 percent of the project area); with several impaired subwatersheds (about 316,800 acres, or about 32 percent of the project area) and a few properly functioning subwatersheds (about 220,400 acres, or about 22 percent of the project area). Thirty-six of the project area subwatersheds are part of species analysis areas throughout this document.

Watershed Condition Framework (WCF) rankings were used to described the existing conditions for aquatic species analysis areas at this scale. Five indicators most relevant to water quality and aquatic species are discussed in more detail: aquatic habitat, aquatic biota, riparian/wetland vegetation, water quality, and roads and trails (Figure 1). A more comprehensive analysis of all Watershed Condition Framework scores for the Rim Country Project Area can be found in the Soils and Watershed Report (MacDonald 2018).

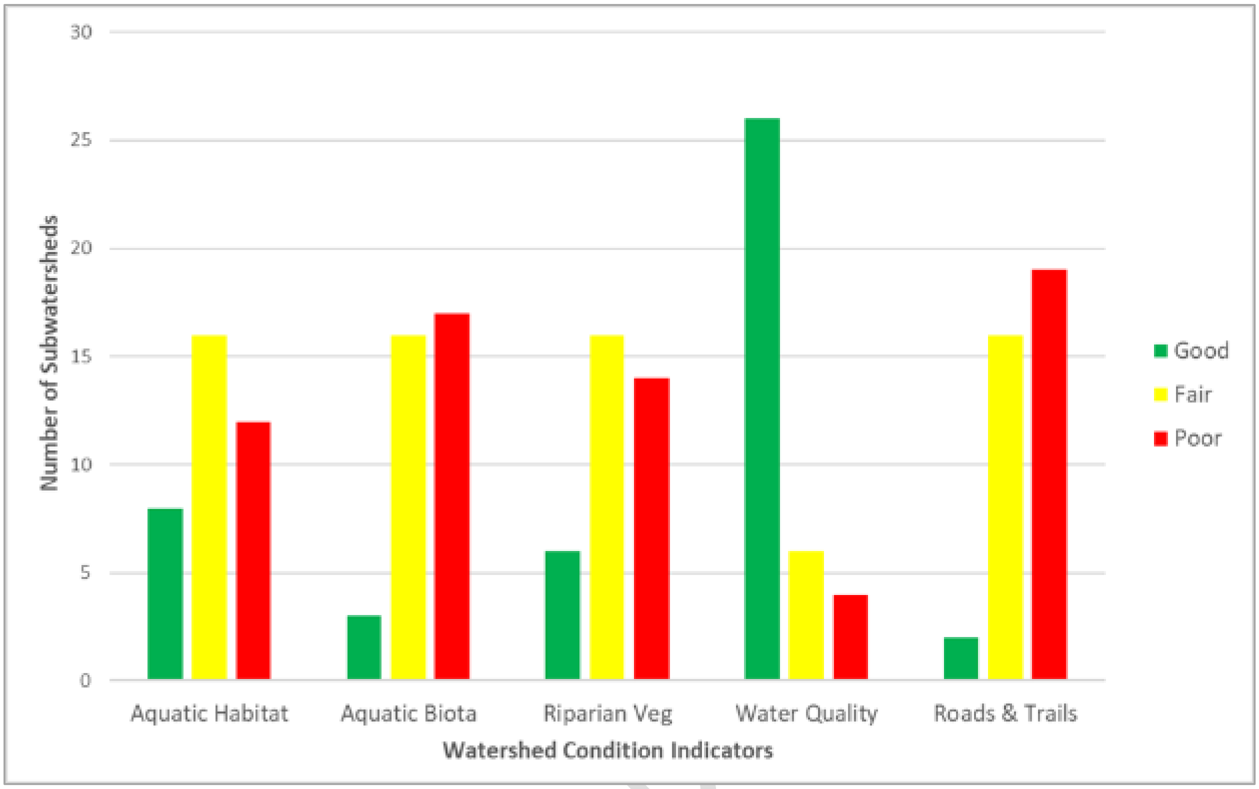
For aquatic habitat, 8 subwatersheds were rated in good condition, 16 in fair condition and 12 watersheds rated in poor condition based on habitat quality, fragmentation, and stream channel condition (Figure 1). Watersheds in 'poor condition' for aquatic habitat largely reflect past land uses (i.e. grazing, logging), including fragmentation by roads, lack of large wood in channels, and altered channel morphology. Many of these conditions continue to persist long after the original effect.

For aquatic biota, 3 subwatersheds were rated in good condition, 16 in fair condition, and 17 watersheds were rated in poor condition based on community structure (natives vs. nonnatives/invasives) and continuity of populations.

For the riparian vegetation indicator, 6 subwatersheds were rated in good condition, 16 rated in fair condition, and 14 rated in poor condition based on relative condition and departure from potential. As with aquatic habitat, riparian conditions also reflect past land uses that are no longer active or allowed as well as current impacts (i.e. recreation, OHV).

For water quality, 26 subwatersheds were rated in good condition, 6 fair condition, and 4 rated in poor condition. This attribute rating is based on 303(d) status (percent of miles listed) and other known water quality impairments.

Figure 8. Number of subwatersheds by watershed condition



Watershed function and health, as they relate to roads and trails, were based on factors that include open road density, maintenance investment, and proximity to water. Two were rated in good condition, 16 rated in fair condition, and 19 watersheds rated poor condition. Road management is an ongoing agency emphasis, with national direction for transportation analysis to identify a ‘sustainable’ (economic, social, and ecological) road system, and develop a plan to reduce road effects. Ongoing challenges include desire for public access for various purposes, needs for access for resource management and protection, and diminished funding for maintenance and storage or decommissioning of unneeded roads.

The desired condition is to have watershed function maintained or improved towards functioning properly (Good Rating). Watersheds would exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. Tree density would be reduced and moving toward the historical range. Unneeded roads would be decommissioned or restored to their natural condition improving the road and trail indicator. Soil and riparian condition and function would be improved and moving towards satisfactory and properly functioning.

Riparian Condition

Riparian Condition by aquatic species was determined averaging the Watershed Classification and Assessment Tracking Tool (WCATT) scores for the riparian vegetation indicator for all subwatersheds within a species action area. This provides an overview of the riparian condition as it relates to each species and their associated habitat. Averages from 1-1.4 are considered Good, 1.5-2.4 is Fair, and 2.5-3.0 is Poor (table 3XX).

Four species have riparian condition rated in good condition which equates to functioning properly. Proper functioning condition indicates adequate vegetation, landform, and/or large woody debris are present to:

1. Dissipate stream energy associated with high waterflow, thereby reducing erosion and improving water quality.
2. Capture sediment and aid floodplain development.
3. Improve flood-water retention and ground-water recharge.
4. Develop root masses that stabilize streambanks against erosion.
5. Maintain channel characteristics.

These watersheds have native vegetation in proper functioning condition throughout the stream corridor or along wetlands and water bodies. Native plant communities are vigorous, healthy and diverse in age, structure, cover and composition on >80% of the riparian/wetland areas in the watershed. Sufficient reproduction of native species is occurring to ensure sustainability. Mesic herbaceous plant communities occupy most of their site potential and vegetation is in a dynamic equilibrium appropriate to the system.

Six species have riparian condition rated in fair condition, which is considered Functioning at Risk. These riparian areas are in limited functioning condition; however, existing hydrologic, vegetative, or geomorphic attributes make them susceptible to impairment. Disturbance partially compromises proper functioning condition of native vegetation attributes along stream corridors, wetlands, or water bodies. Native vegetation demonstrates a moderate loss of vigor, reproduction and growth, or changes in composition; particularly in areas most susceptible to human impact. Areas displaying light to moderate impact to structure, composition and cover may occupy 25 to 80% of the overall riparian area with only a few areas displaying significant impacts. Up to 25% of species cover or composition occurs from early seral species, but the communities across the watershed are still dominated by mid to late seral stages. Xeric herbaceous communities exist where water relationships have been altered but are relatively small, localized, and do not dominate across the watershed.

Four species have riparian condition rated in poor condition, which are considered Impaired. These riparian areas clearly are not providing adequate vegetation, landform, or woody material to dissipate stream energy associated with moderately high flows, and thus are not reducing erosion, improving water quality, etc. large percentage of native vegetation attributes along stream corridors, wetlands, and water bodies are not in proper functioning condition. Native vegetation is vigorous, healthy and diverse in age, structure, cover and composition on <75% of the riparian/wetland areas in the watershed. Native vegetation demonstrates a noticeable loss of vigor, reproduction and growth, and changes in composition as compared with site potential communities. In these areas, cover and composition are strongly reflective of early seral species dominance although there will be late and mid seral species present in pockets. Mesic dependent herbaceous vegetation is limited in extent with many lower terraces dominated by xeric species most commonly associated with uplands. Reproduction of mid and late seral species is very limited. For much of the area, the water table is disconnected from the riparian area and the vegetation reflects this loss of available soil water.

Table 52. Average Riparian Condition from WCATT for species analysis areas.

Species	Riparian Condition
Gila trout	2.3
Gila chub	2
Gila topminnow	1
Little Colorado spinedace	2.3
Loach minnow	1
Razorback sucker	1
Spikedace	1
Narrow-headed gartersnake	2.5
Northern Mexican gartersnake	2.7
Desert sucker	2.6
Sonoran sucker	2.7
Little Colorado sucker	2.3
Headwater chub	2.4
Roundtail chub	2

Ecological Response Units (Vegetation Types)

Ecological Response Units (ERUs) are map unit constructs, technical groupings, from the National Vegetation Classification. Each unit combines finer scale vegetation classes that share similar ecosystem processes and successional dynamics as well as potential vegetation under historic disturbance regimes. These units are supposed to facilitate landscape analysis and strategic planning.

The Rim Country project area contains six overarching ERU types: riparian, human/other, grassland, shrubland, woodland, and forest. These types encompass a total of 25 ERUs varying in overall acreage within the project area (Table 98). Riparian and human/other ERUs occur on approximately 22,300 acres (less than 2 percent of project area) and represent vegetation types most closely associated with aquatic species and habitats analyzed in this report. However, it should also be noted that many high elevation streams are within Forested ERUs where vegetation such as ponderosa pine or mixed conifer are providing riparian functions such as stream shading and bank stabilization.

Table 53. Acreages of Ecological Restoration types and individual Ecological Restoration Units (ERUs) within the entire Rim Country Project Area.

ERU Type	ERU	Acres
Riparian		**21,326**

	Arizona Alder - Willow	228
	Arizona Walnut	68
	Fremont Cottonwood - Conifer	169
	Fremont Cottonwood / Shrub	539
	Herbaceous Riparian	4,270
	Historic Riparian - Residential/Urban	298
	Narrowleaf Cottonwood / Shrub	7,584
	Ponderosa Pine / Willow	5,607
	Sycamore - Fremont Cottonwood	946
	Willow - Thinleaf Alder	1,617
Human/Other		**974**
	Water	974
Grasslands		**38,758**
	Colorado Plateau / Great Basin Grassland	14,086
	Montane / Subalpine Grassland	24,672
Shrubland		**2,542**
	Gambel Oak Shrubland	0
	Interior Chaparral	2,542
Woodland		**97,787**
	Juniper Grass	2,409
	Madrean Encinal Woodland	16,457
	Madrean Pinyon-Oak Woodland	3,868
	PJ Evergreen Shrub	27,150
	PJ Grass	10,087
	PJ Woodland	37,815
Forest		**1,076,784**
	Mixed Conifer - Frequent Fire	106,633
	Mixed Conifer w/ Aspen	62,700

	Ponderosa Pine Forest	749,600
	Ponderosa Pine / Evergreen Oak	157,849
Total		**1,238,171**

Riparian areas are directly coupled to streams, the portions of watersheds required for maintaining hydrologic, geomorphic, and ecological processes that directly affect streams, stream processes, and aquatic habitats. Riparian areas are shaped by disturbances characteristic of upland ecosystems, such as fire and windthrow, as well as disturbance processes unique to stream systems, such as lateral channel erosions, peakflows, depositions by floods and debris flows. The near-stream riparian areas and floodplains may contain an increased diversity of plant species and extensive hydrologic nutrient cycling interactions between groundwater and riparian vegetation. This vegetation, ranging from conifers to deciduous hardwoods, provides organic debris to stream channels and associated aquatic invertebrate communities. Further, riparian vegetation moderates light levels and stream temperature, helps armor stream banks with extensive root systems, and contributes large wood into the stream channel.

Stream-riparian ecosystems naturally experience periodic catastrophic disturbances, which then moved through a series of recovery states over a period of decades to centuries, resulting in a landscape that varies in suitability for aquatic species. A pulse disturbance is one that allows an ecosystem to recovery to pre-disturbance conditions, and a press disturbance is one that prohibits an ecosystem from rebounding to pre-disturbance conditions. The dominant pulse disturbances aquatic species are adapted to include natural fire regimes, fire related landslides, and floods, all working in concert in a manner that produce habitat patches, varying in quality and quantity. In short, fires would burn through an area, landslides and mass wasting would distribute the sediment and debris throughout stream networks. The pulse disturbance regime, or varying forms thereof, was altered with the onset of fire suppression and extensive timber harvest. The resulting effects are different from the natural pulse regime in that sediment is transported in the system without wood, the interval between disturbances had been drastically reduced in most cases, and harvest and road construction is widely distributed, resulting in chronic sedimentation across a larger landscape.

Streams and Aquatic Species

The Rim Country proposed project area encompasses the headwaters of three major river basins in Arizona; the Salt, Verde, and Little Colorado Rivers. There are approximately 4,055 miles of stream channels within the proposed project area, including ephemeral, intermittent, and perennial channels (table 3XX). Ephemeral steams only carry water during runoff and do not support riparian vegetation. Intermittent and perennial streams support riparian vegetation and various species that use those habitats. USGS defines ephemeral streams at channels above the water table at all times and only flow in direct response to precipitation (runoff). Therefore, they do not support riparian vegetation. Intermittent streams flow receive water from rainfall runoff, springs, or other surface sources such as snowmelt. Perennial streams normally have water in the channel at all times. Therefore, intermittent and perennial streams are capable of supporting riparian vegetation and providing aquatic habitat. Of these streams, approximately 360 miles are occupied or suitable habitat for aquatic species such as fish, gartersnakes, mollusks, and invertebrates.

Table 54. Miles of Each Stream Type within the Rim Country project area.

Forest	Ephemeral	Intermittent	Perennial	Total
Apache-Sitgreaves NF	719.6	876.3	51.6	1647.5
Coconino NF	23.9	1,077.0	118.9	1,219.8
Tonto NF	1.3	969.5	217.3	1188.1
Total	744.8	2,922.8	387.8	4,055.4

Most streams and aquatic and riparian habitats have experienced considerable degradation and alteration from a variety of human and management related activities (Rinne 1994, Rinne and Minckley 1991); their ability to recover and improve has been affected, especially as ongoing and new effects occur. Habitat quality and complexity have resulted from loss of pool habitat, loss of large wood within streams, riparian area effects, channel alterations, and down cutting. Increased sedimentation rates can adversely affect habitat and species through negative effects to water quantity and quality. Fish population surveys and sampling efforts have also shown declines for some species, while some non-native species have shown increases.

Decline of aquatic species and their habitats can be traced to a variety of factors that are common in the western United States. These include major and minor dams, water diversions, channelization, and groundwater mining for irrigation and municipal use (Rinne 1994); sediment (Newcombe and MacDonald 1991), land management activities including grazing ((Belsky et al. 1999; Ohmart 1996 Zwartes et al. 2005), road construction Trombulka and Frissell 2000), and timber-harvest; increased fuel loading leading to uncharacteristic wildfire (Rieman et al, 2003; Young et al., 2002), loss of riparian vegetation through land conversion; and sport fishing (Post et al. 2002). The pattern of degradation in aquatic habitats and communities closely parallels human settlement and land use. Concurrent with the extensive modification of aquatic habitats was the introduction of nonnative species that leading to competition, hybridization, and predation with native fishes (Rahel 2000; Rinne 1994; Rinne and Minckley 1991). Native fish populations have been reduced from large interconnected populations to isolated populations within severely altered and degraded habitats. All the native species have lost much of their population redundancy within and outside the forests. This is reflected in the historic and recent population declines and fragmentation of fish species in the Southwest.

The native aquatic species and habitats analyzed here have persisted environmental disturbances altering them from historic conditions. (e.g., fire and suppression of fire, climate variation, degraded watersheds and aquatic habitat, altered hydrologic conditions, loss of riparian and aquatic habitat, recreation demands, non-native species introductions, roads). While most of these impacts have occurred slowly over many decades, the individual and collective impacts still remain today. Current conditions for aquatic species and habitats at the 5th level HUC watershed can be attributed to many factors. Diversions and water withdrawals reduce surface waters and alter flowing streams into intermittent streams, reservoirs, or dewatered channels reducing available habitat. Stream channelization for flood control or from altered hydrologic regimes reduces riparian and aquatic habitat quantity and quality. Competition and predation by non-native species has also reduced native populations. Other general factors that have directly or indirectly altered habitats include roads, recreation, livestock grazing, timber harvest and fire suppression.

Federally-listed and Forest Service Sensitive Species lists for all three Forests were screened to determine species that occur or have suitable habitat with the project and action area. Eleven federally listed species and nineteen sensitive aquatic species occur within the three Forests. Of those, nine federally listed and 16 sensitive individual species will be analyzed in detail (Table 3-**). Two of the species (gartersnakes) are both federally listed and sensitive species.

Table 55. Federally-listed and Forest Service Sensitive Aquatic Species Expected in the Project Area

Species	Status	Occurrence	Notes
Gila trout (Oncorhyncus gilae)	Federally Threatened	Documented Occurrence	Occurs within the Project and Action areas
Little Colorado Spinedace (Lepidomeda vittata)	Federally Threatened, with designated Critical Habitat	Documented Occurrence	Occurs within the Project and Action areas
Gila chub (Gila intermedia)	Federally Endangered with designated Critical habitat	Documented Occurrence	Does not occur within the Project Area, but does occur in watersheds within the project boundary.
Gila topminnow (Poeciliopsis occidentalis occidentalis)	Federally Endangered	Documented Occurrence	Does not occur within the Project Area, but does occur in watersheds within the project boundary.
Razorback sucker (Xyrauchen texanus)	Federally Endangered with designated Critical habitat	Documented Occurrence	Does not occur within the Project Area, but does occur in watersheds within the project boundary.
Loach minnow (Tiaroga cobitis)	Federally Endangered with designated Critical habitat	Documented Occurrence	Does not occur within the Project Area, but does occur in watersheds within the project boundary.
Spikedace (Meda fulgida)	Federally Endangered with designated Critical habitat	Documented Occurrence	Does not occur within the Project Area, but does occur in watersheds within the project boundary.

Species	Status	Occurrence	Notes
Narrow-headed gatersnake (Thamnophis rufipunctatus)	Federally Threatened, with proposed Critical Habitat & Forest Service Sensitive	Documented Occurrence	Occurs within the Project Area
Northern Mexican gartersnake (Thamnophis eques)	Federally Threatened, with proposed Critical Habitat & Forest Service Sensitive	Documented Occurrence	Occurs within the Project Area
Desert sucker (Catostomus clarki)	Forest Service Sensitive	Documented Occurrence	Occurs within the Project Area
Sonoran sucker (Catostomus insignis)	Forest Service Sensitive	Documented Occurrence	Occurs within the Project Area
Little Colorado sucker (Catostomus sp. 3)	Forest Service Sensitive	Documented Occurrence	Occurs within the Project Area
Headwater chub (Gila nigra)	Forest Service Sensitive	Documented Occurrence	Occurs within the Project Area
Roundtail chub (Gila robusta)	Forest Service Sensitive	Documented Occurrence	Occurs within the Project Area
Netwing Midge (Agathon arizonicus)	Forest Service Sensitive	Documented Occurrence	Occurs within the Project Area.
A Mayfly (Fallceon eatoni)	Forest Service Sensitive	Suspected to Occur	Little is known about the species, but suitable habitat exists in the Project Area.
A Stonefly (Capnia caryi)	Forest Service Sensitive	Suspected to Occur	Little is known about the species, but suitable habitat exists in the Project Area.
Parker's cylloepus riffle beetle (Cylloepus parkeri)	Forest Service Sensitive	Suspected to Occur	Little is known about the species, but suitable habitat exists in the Project Area.

Species	Status	Occurrence	Notes
A Mayfly (Fallceon eatoni)	Forest Service Sensitive	Suspected to Occur	Little is known about the species, but suitable habitat exists in the Project Area.
A Mayfly (Moribaetis mimbresaurus)	Forest Service Sensitive	Suspected to Occur	Little is known about the species, but suitable habitat exists in the Project Area.
A Caddisfly (Lepidostoma apache)	Forest Service Sensitive	Suspected to Occur	Little is known about the species, but suitable habitat exists in the Project Area.
A Caddisfly (Lepidostoma knulli)	Forest Service Sensitive	Suspected to Occur	Little is known about the species, but suitable habitat exists in the Project Area.
A Caddisfly (Limnephillus granti)	Forest Service Sensitive	Suspected to Occur	Little is known about the species, but suitable habitat of springs in ponderosa pine exist.
A Caddisfly (Wormaldia planae)	Forest Service Sensitive	Documented Occurrence	Occurs within the Action area
Ferris' Copper (Lycaena ferrisi)	Forest Service Sensitive	Suspected to Occur	Little is known about the species, but suitable habitat of herbaceous wetlands exist.
Nokomis Fritillary (aka Great Basin Silverspot) (Speyeria nokomis nokomis)	Forest Service Sensitive	Documented Occurrence	Little is known about the species, but suitable habitat of herbaceous wetlands and streams exist.
Fossil springsnail (Pyrgulopsis simplex)	Forest Service Sensitive	Documented Occurrence	Occurs within the Action area
California floater (Anodonta californiensis)	Forest Service Sensitive	Documented Occurrence	Occurs within the Project and Action areas

Species	Status	Occurrence	Notes
Species Not Analyzed in Detail			
Apache trout (Oncorhyncus gilae apache)	Federally Threatened	No Documented Occurrence	Does not occur within the Project or Action Area
Colorado pikeminnow (Ptychochelus lucius)	Experimental-Nonessential Population	No Documented Occurrence	Does not occur within the Project or Action Area
A Caddisfly (Wormaldia planae)	Forest Service Sensitive	Not Suspected to Occur	Does not Occur in the Project Area, and elevation range is lower than that of the project.
Balmorhea Saddle-Case Caddisfly (Protoptila balmorhea)	Forest Service Sensitive	Not Suspected to Occur	Does not Occur in the Project or Action Area, associated ERU semidesert grassland does not occur.

Threatened and Endangered Species Analyzed in Detail

Gila trout (Oncorhynchus gilae gilae)

Status: Threatened (USDI 2006).

In Arizona, four streams currently have Gila trout. On the Coconino NF, a recreational Gila trout population exists in West Fork Oak Creek and a recovery population was stocked in Dude Creek and Chase Creek on the Tonto National Forest. Gila trout occurred on the Coronado NF in Ash, and Frye Creeks; it is believed that both populations were lost in 2017 after the Frye Fire. Potential recovery streams include Chase, Ellison, Haigler, Webber, Marijilda, Raspberry, KP, Coleman, and Grant Creeks. Potential recreational fisheries include Christopher Creek, East Verde River, and Workman Creek.

Threats to the species include the destruction, modification, and curtailment of its habitat or range; livestock grazing; fire; timber harvest operations and the associated erosion, siltation, and increases in water temperatures; and the introduction of nonnative trout species that hybridize and compete with the Gila trout. Further information on this species can be found at: https://www.fws.gov/southwest/es/arizona/Gila_Trout.htm

Habitat in the Analysis Area. Gila trout occur in approximately 32 miles of streams within the project area (table 3-**). The six streams are either currently occupied by the species or provide suitable habitat for recovery efforts.

Table 56. Miles of streams and associated 6th Code subwatersheds with Gila trout within the Rim Country proposed project area.

Stream Name	6th HUC Subwatershed	Stream Miles in Project Area
Chase Creek		**4.4**
	East Verde River Headwaters	4.4
Christopher Creek		**8.2**
	Bull Tank Canyon-Tonto Creek	0.0
	Christopher Creek	8.1
Dude Creek		**2.2**
	East Verde River Headwaters	2.2
Ellison Creek		**4.4**
	Ellison Creek – East Verde River	4.4
Haigler Creek		**8.9**
	Haigler Creek	8.9
Workman Creek		**4.0**
	Workman Creek	4.0
Grand Total		**32.1**

Six watersheds (6th HUCs) contain Gila trout streams within the project area. Riparian condition within these watersheds ranges from Properly Functioning (n=1) to Impaired (n=3) (Table 3XX). The average riparian condition for Gila trout watersheds is 2.3, which equates to Functioning at Risk.

Table 57. Riparian condition scores from Watershed Condition Framework for 6th Code HUCs with Gila trout within the Rim Country proposed project area.

Occupied 6th HUCs	WCATT Riparian Condition Score	Associated Rating
Bull Tank Canyon-Tonto Creek	3	Poor
Christopher Creek	3	Poor
East Verde River Headwaters	3	Poor
Ellison Creek-East Verde River	2	Fair
Haigler Creek	2	Fair
Workman Creek	1	Good
Average	**2.3**	**Fair**

Little Colorado Spinedace (Lepidomeda vittata) and designated Critical Habitat

Status: Threatened with designated critical habitat (USFWS, 1987).

Based on the 5-Year Review spinedace are consistently located in West Leonard and Leonard Canyons, Lower Chevelon Creek on private land, Little Colorado River on two AZGFD properties, Rudd Creek, and Nutrioso Creek.

The most recent survey and habitat data for each watershed are indicated below from the 5-Year Status Review (USFWS 2008).

Chevelon Creek Watershed: Currently, spinedace occupies a section of Chevelon Creek, several miles upstream of Chevelon Creek's confluence with the LCR on the privately own Rock Art Ranch. Chevelon Creek through the Rock Art Ranch supports robust populations of spinedace, where large schools of fish (40-50 individuals) can be seen swimming in pools downstream of The Steps, something not seen in any other currently occupied area.

On July 23, 2007, AZGFD stocked 95 spinedace into five pools on West Chevelon Creek on the ASNFs. This tributary to middle Chevelon Creek contains only native fish at this time and is expected to provide habitat for spinedace. In July 2008, surveys located spinedace within the perennial pools where they were originally stocked and downstream of the area in ephemeral reaches. It is unclear how many fish are still present or if they spawned in 2008. Further surveys and stockings of this area are needed in order to ensure that spinedace persist in West Chevelon Creek if it is to contribute to recovery.

East Clear Creek Watershed: Spinedace currently occupy small, perennial pool habitats in West Leonard Canyon, Leonard Canyon (including Dines Tank), Bear Canyon, Dane Canyon, and Yeager Canyon. The populations and available habitat are all relatively small throughout the watershed, but West Leonard and Leonard Canyons continue to be one of the most dependable locations to find spinedace in the entire watershed. Bear, Dane, and Yeager Canyon populations are sustained by moving spinedace from West Leonard Canyon and Dines Tank to these areas.

Habitat in the Analysis Area. Little Colorado spinedace occur or have suitable habitat in approximately 187 miles of streams within the project area (table 3-**). The seven streams are either currently occupied by the species or provide suitable habitat for recovery efforts. Two sections of East Clear Creek are identified as designated critical habitat within the project area: 13 miles of stream above Blue Ridge Reservoir and 18 miles of stream from the confluence of Leonard Canyon upstream to Blue Ridge Reservoir.

Table 58. Miles of streams and associated 6th Code subwatersheds (HUC) with Little Colorado spinedace within the Rim Country proposed project area.

Stream Name	6th HUC Subwatershed	Total
Alder Creek		**5.1**
	Alder Canyon	5.1
Barbershop Canyon		**14.7**
	Barbershop Canyon	14.7
	East Clear Creek-Clear Creek	0.0

Stream Name	6th HUC Subwatershed	Total
Bear Canyon		**7.0**
	Bear Canyon	7.0
Beaver Canyon		**5.0**
	Gentry Canyon	5.0
Buck Springs Canyon		**7.1**
	Leonard Canyon	7.1
Chevelon Creek		**19.9**
	Durfee Draw-Chevelon Canyon	7.7
	Long Tom Canyon-Chevelon Canyon	8.7
	Upper Chevelon Canyon-Chevelon Canyon Lake	3.6
	Woods Canyon and Willow Springs Canyon	0.0
Dane Canyon		**4.4**
	Barbershop Canyon	4.4
East Clear Creek		**34.1**
	East Clear Creek-Blue Ridge Reservoir	14.1
	East Clear Creek-Clear Creek	20.0
	Leonard Canyon	0.0
	Miller Canyon	0.0
Gentry Canyon		**3.9**
	Gentry Canyon	3.9
Houston Draw		**6.1**
	Bear Canyon	6.1
Kehl Canyon		**4.5**
	East Clear Creek-Blue Ridge Reservoir	4.5
Leonard Canyon		**23.7**
	Leonard Canyon	23.7

Stream Name	6th HUC Subwatershed	Total
Turkey Creek		**7.3**
	Gentry Canyon	7.3
West Chevelon Creek		**4.2**
	Upper West Chevelon Canyon	4.2
West Leonard Canyon		**3.2**
	Leonard Canyon	3.2
Willow Creek		**22.5**
	East Clear Creek-Clear Creek	0.0
	Gentry Canyon	0.0
	Lower Willow Creek	13.3
	Upper Willow Creek	9.2
Yeager Canyon		**14.0**
	East Clear Creek-Clear Creek	14.0
Grand Total		**186.9**

Fifteen watersheds (6th HUCs) contain Little Colorado spinedace streams within the project area. Riparian condition within these watersheds ranges from Properly Functioning (n=3) to Impaired (n=7) (table 3-11). The average riparian condition for Little Colorado spinedace watersheds is 2.3, which equates to Functioning at Risk.

Table 59. Riparian condition scores from Watershed Condition Framework for 6th Code HUCs with Little Colorado spinedace within the Rim Country proposed project area.

Occupied 6th HUCs	WCATT Riparian Condition Score	Associated Rating
Alder Canyon	2	Fair
Barbershop Canyon	3	Poor
Bear Canyon	3	Poor
Durfee Draw-Chevelon Canyon	1	Good
East Clear Creek-Blue Ridge Reservoir	3	Poor
East Clear Creek-Clear Creek	2	Fair
Gentry Canyon-Upper Clear Creek	3	Poor
Leonard Canyon	3	Poor
Long Tom Canyon-Chevelon Canyon	1	Good
Lower Willow Creek	2	Fair
Miller Canyon	3	Poor

Upper Chevelon Canyon-Chevelon Canyon Lake	1	Good
Upper West Chevelon Canyon	2	Fair
Upper Willow Creek	3	Poor
Woods Canyon and Willow Springs Canyon	2	Fair
Average	**2.3**	**Fair**

Gila chub (Gila intermedia) and designated Critical Habitat

Status: Endangered with designated critical habitat (USFWS 2005).

Life history, ecology, historical distributions and abundances, habitat requirements, and other information relevant to this species are limited. Most of the available information for this species has been summarized and reviewed within the Proposed and Final Rules for the "Listing Gila Chub as Endangered with Critical Habitat" completed in 2002 and in 2005, respectively. This species is found in pools in smaller streams and cienegas ranging in elevation from approximately 600 to 1675 meters. They are highly secretive, and adults prefer deeper water in pools and eddies below riffles or runs; often remaining in cover from terrestrial vegetation, boulders, and fallen logs. Young use the shallow margins of pools with aquatic vegetation or debris for cover, while older juveniles may be found in higher velocity runs and riffles. Primary food items are aquatic and terrestrial insects and filamentous algae. Breeding primarily occurs in late spring to summer, males follow the larger females over beds of aquatic plants, and there is no parental care of the young. Temperature may be the primary cue for initiation of spawning.

Gila chub are becoming rare, especially where land use practices such as overgrazing lead to incision of floodplains and lowering of water tables, which, in turn, drain marshlands and other stream-associated habitats. Threats to the chub include introduction of nonnative aquatic competitors and predators, such as fish, bullfrogs, and crayfish, continued water use for development purposes, and habitat degradation due to improper land management on the watershed. Erosion from roads or off bare ground on the watersheds can fill in the deep pools needed by the species, thus degrading the habitat. Where it is still present, populations are often small, fragmented, and at risk from known and potential threats and from random events such as drought, flood events, and wildfire. Further information on the species can be found at: https://www.fws.gov/southwest/es/arizona/GilaChub.htm

Habitat in the Analysis Area. Gila chub and their designated habitat do not occur within the project boundary. They do occur directly downstream of the project area in Red Tank Draw and Spring Creek on the Tonto NF. Approximately 11,600 acres of the Red Tank Draw watershed (32 percent) and 10,000 acres of the Upper Spring Creek watershed (47 percent) occur within the project area. No designated critical habitat occurs within the project area.

Two watersheds (6th HUCs) contain Gila chub streams within the project area. Riparian condition for both watersheds is rated as Functioning at Risk (table 3-12). The average riparian condition for Gila chub watersheds is 2.0, which equates to Functioning at Risk.

Table 60. Riparian condition scores from Watershed Condition Framework for 6th Code HUCs with Gila chub within the Rim Country proposed project area.

Occupied 6th HUCs	WCATT Riparian Condition Score	Associated Rating
Red Tank Draw	2	Fair
Upper Spring Creek	2	Fair
Average	**2.0**	**Fair**

Gila topminnow (Poeciliopsis occidentalis occidentalis)

Status: Endangered (USFWS 1967).

The Gila topminnow is a small, guppy-like, live-bearing fish. It occurs in small streams, springs, and cienegas below 4,500 ft. elevation, primarily in shallow areas with aquatic vegetation and debris for cover. It can tolerate relatively high water temperatures and low dissolved oxygen. Breeding occurs primarily during January through August, but in thermally constant springs young may be produced through the year. Gila topminnow are opportunistic omnivorous feeders. Primary food includes detritus, vegetation, amphipods, ostracods, and insect larvae.

Historically, it was one of the most common fish throughout the Gila River drainage in Arizona, Mexico, and New Mexico. Currently, most of the remaining naturally occurring populations in are in the Santa Cruz River system. The species occurs in small streams, springs and cienegas in Gila, Pinal, Graham, Yavapai, Santa Cruz, Pima, Maricopa, and La Paz counties, Arizona. It has been released at almost 200 locations in efforts to reestablish populations.

Effects on the species include introduction and spread of nonindigenous predatory and competitive fishes, water impoundments and diversions, water pollution, groundwater pumping, stream channelization, and habitat modification. Further information on this species can be found at: https://www.fws.gov/southwest/es/arizona/Gila_Top.htm

Habitat in the Analysis Area. Gila topminnow does not occur within the project area, but does occur within the action area. The species occurs in Fossil Creek directly downstream of the project area in the Upper Fossil Creek subwatershed. Approximately, 12,300 acres of that watershed (48 percent) occur within the project area.

Only one watershed (6th HUC) contains a Gila topminnow stream within the project area. Riparian condition for the watershed is rated as Functioning Properly (table 3-13).

Table 61. Riparian condition score from Watershed Condition Framework for 6th Code HUCs with Gila topminnow within the Rim Country proposed project area.

Occupied 6th HUCs	WCATT Riparian Condition Score	Associated Rating
Upper Fossil Creek	1	Good
Average	**1.0**	**Good**

Razorback sucker (Xyrauchen texanus) and designated Critical Habitat

Status: Endangered (USDI 1991) with designated critical habitat (USDI 1994)

The razorback sucker, also known as the humpback sucker, is a member of the Catostomidae family. The species can grow more than 600mm (2 feet) in length, weigh more than 3kg (6 pounds), and live over 40 years. The species is a bottom-feeder, whose diet includes planktonic crustaceans, diatoms, filamentous algae, and detritus. Spawning occurs in the lower Colorado River basin from January through April. Spawning occurs over mixed substrates that range from silt to cobble and at water temperatures ranging from 10.5 to 21º C (51 to 70º F). Razorback sucker inhabit riverine systems which provide a wide variety of habitats including backwaters, sloughs, oxbow lakes, and seasonally inundated flood plains, which are used to satisfy various life history requirements. Adult razorback suckers prefer shallow and swift waters of mid-channel sandbars (less than 12 feet in depth) during the summer months and slow runs, slack waters, and eddies in the winter. The Razorback Sucker Recovery Plan describes the life history and habitat use for this species in detail.

Detailed information relative to the distribution and abundance of the razorback sucker can be found in the Recovery Plan (USDI 1999). Razorback sucker occur in the Verde and Salt Rivers with designated critical habitat in both systems. Razorback sucker have been stocked in the Verde River on a regular basis since the 1980s. Stockings in the Salt River sub-basin have not occurred since the early 1990s. Surveys do detect the species in the Verde River. However, a viable population is not thought to be extant.

Decline of the razorback sucker has been associated with major changes in its riverine ecosystem including water diversion, water depletion, and construction and operation of dams. The species decline is also attributed to predation by green sunfish, warmouth, channel catfish, flathead catfish, threadfin shad, smallmouth bass, and largemouth bass. Further information on this species can be found at: https://www.fws.gov/southwest/es/arizona/Razorback.htm

Habitat in the Analysis Area. Razorback sucker does not occur within the project area, but does occur within the action area. The species occurs in Fossil Creek directly downstream of the project area in the Upper Fossil Creek subwatershed. Approximately, 12,300 acres of that watershed (48 percent) occur within the project area. No designated critical habitat occurs within the project area.

Only one watershed (6th HUC) contains a Razorback sucker stream within the project area. Riparian condition for the watershed is rated as Functioning Properly (Table 108).

Table 62. Riparian condition score from Watershed Condition Framework for 6th Code HUCs with Razorback sucker within the Rim Country proposed project area.

Occupied 6th HUC	WCATT Riparian Condition Score	Associated Rating
Upper Fossil Creek	1	Good
Average	**1.0**	**Good**

Loach minnow (Tiaroga cobitis) and designated Critical Habitat

Status: Endangered with designated critical habitat (USDI 2012).

Loach minnows are found in turbulent, rocky riffles of rivers and tributaries from approximately 2,300 to 8,000 feet in elevation. Loach minnow are bottom-dwelling inhabitants of shallow, swift waters flowing over gravel and cobble substrates in mainstream rivers and tributaries. They use the spaces between, and the protective shelter of larger substrates for resting and spawning. The species is rare or absent from habitats where fine sediments fill the spaces between larger substrate. The first spawn of loach minnow generally occurs in their second year, primarily from March through May; and they may also spawn in the fall. Spawning occurs in the same riffles occupied by adults during the non-spawning season. The adhesive eggs of the loach minnow are attached under the downstream side of a rock that forms the roof of a small cavity in the substrate. Longevity is typically 15 months to two years, although loach minnow can live as long as three years. Loach minnow feed exclusively on aquatic insects; and they are opportunistic bottom-feeding insectivores, feeding primarily on riffle-dwelling larval mayflies and midges. They actively seek their food on bottom substrates, rather than pursuing food items in the drift.

During the last century, both the distribution and abundance of the loach minnow has been greatly reduced throughout the species range. Competition and predation by nonnative fish and habitat destruction have reduced the historic range of the loach minnow by about 85 percent.

Both historic and present landscapes surrounding loach minnow habitats have been affected to varying degrees by domestic livestock grazing, mining, agriculture, timber harvest, recreation, development, or impoundments. These activities degrade loach minnow habitats by altering flow regimes, increasing watershed and channel erosion and thus sedimentation, and adding contaminants to streams and rivers. As a result, these activities may affect loach minnow through direct mortality, interference with reproduction, and reduction of invertebrate food supplies. Further information on this species can be found at: https://www.fws.gov/southwest/es/arizona/Loach.htm

Habitat in the Analysis Area. Loach minnow does not occur within the project area, but does occur within the action area. The species was stocked into Fossil Creek directly downstream of the project area in the Upper Fossil Creek subwatershed, it does not appear to have established. Approximately, 12,300 acres of that watershed (48%) occur within the project area. No designated critical habitat occurs within the project area.

Only one watershed (6th HUC) contains a Loach minnow stream within the project area. Riparian condition for the watershed is rated as Functioning Properly (table 3-15).

Table 63. Riparian condition score from Watershed Condition Framework for 6th Code HUCs with Loach minnow within the Rim Country proposed project area.

Occupied 6th HUCs	**WCATT Riparian Condition Score**	Associated Rating
Upper Fossil Creek	1	Good
Average	**1.0**	**Good**

Spikedace (Meda fulgida)

Status: Endangered with designated critical habitat (USDI 2012).

Adult spikedace are 2.5 to 3.0 inches long; the eyes are large, the snout fairly pointed, and the mouth is slightly sub-terminal with no barbells present. The species is slender and somewhat anteriorly compressed. Spikedace can live up to 24 months, although few survive more than 13 months; and reproduction occurs primarily in one-year-old fish. Spawning extends from the middle of March into June and occurs in shallow riffles with gravel and sand bottoms and moderate flow. By the middle of May, most spawning has occurred, although in years of high water flows, spawning may continue into late May or early June. Spikedace feed primarily on aquatic and terrestrial insects.

Spikedace occupy mid-water habitats usually less than 3 feet deep, with slow to moderate water velocities over sand, gravel, or cobble substrates. Adults often occur in shear zones along gravel-sand bars where rapid water borders slower flow, quiet eddies on the downstream edges of riffles, and broad shallow areas above gravel-sand bars. The preferred habitat of the spikedace varies seasonally and with maturation. In winter, the species congregates along stream margins with cobble substrates. The erratic flow patterns of southwestern streams that include periodic and recurrent flooding are essential to the feeding and reproduction of the spikedace by scouring the fine sediment and keeping gravels clean. Spikedace larvae and juveniles tend to occupy shallow, peripheral portions of streams that have slow currents and sand or fine gravel substrates, but will also occupy backwater habitats.

The spikedace is native to the Gila River drainage, including the San Francisco drainage, except in the extreme headwaters. Relict spikedace populations exist only in the upper Verde River and

Aravaipa Creek in Arizona and portions of the Gila River in New Mexico. Although, spikedace have not been collected in the Verde River in recent years. In New Mexico the species is generally absent from the Gila River from the confluence of the West and East Forks downstream to the mouth of Turkey Creek, and occurs irregularly downstream from the mouth of the Middle Box of the Gila River to the Arizona-New Mexico state line. There are reestablished populations in the Blue River AZ, San Francisco River NM, and Fossil Creek AZ.

The majority of historic habitat for the spikedace has been drastically altered or destroyed by human uses of the rivers, streams, and watersheds. Causes of such alterations and degradation include damming, water diversion, channel down-cutting, excessive groundwater pumping, lowering water tables, channelization, riparian vegetation destruction, erosion, mining, grazing, and other watershed disturbances. An increasing threat to spikedace includes the introduction and spread of non-native species that compete or predate upon spikedace. Further information on this species can be found at: https://www.fws.gov/southwest/es/arizona/Spikedace.htm

Habitat in the Analysis Area. Spikedace does not occur within the project area, but does occur within the action area. The species occurs in Fossil Creek downstream of the project area in the Upper Fossil Creek subwatershed. Approximately, 12,300 acres of that watershed (48 percent) occur within the project area. No designated critical habitat occurs within the project area.

Only one watershed (6th HUC) contains a Spikedace stream within the project area. Riparian condition for the watershed is rated as Functioning Properly (table 3-16).

Table 64. Riparian condition score from Watershed Condition Framework for 6th Code HUCs with Spikedace within the Rim Country proposed project area.

Occupied 6th HUCs	WCATT Riparian Condition Score	Associated Rating
Upper Fossil Creek	1	Good
Average	**1.0**	**Good**

Narrow-headed gartersnake (Thamnophis rufipunctatus) and Proposed Critical Habitat

Status: Designated as Threatened on July 8, 2014 (USDI 2014c). Critical Habitat was proposed on July 10, 2013 (USDI 2013).

Historical range of the narrow-headed gartersnake (NHG) included perennial drainages across the Mogollon Rim from northern and eastern Arizona, southeast into southwestern New Mexico.

The species is strongly associated with clear, rocky streams using predominately pool and riffle habitat that includes cobbles and boulders. Narrow-headed gartersnakes specialize on fish as their primary prey, feeding almost exclusively on native or soft-rayed fish. They are ambush predators that often anchor to stream cobbles and wait for fish to pass. They bask on nearby rocks, boulders and vegetation and seek cover in crevices and beneath rocks. Brumation occurs during fall and winter in rocky outcroppings above the high water mark, usually within 0.5 mi of the stream. Threats to this species include harmful nonnative species, destruction and modification of habitat and effects from wildfire on their prey base. Additional information for the narrow-headed gartersnake can be found at: https://www.fws.gov/southwest/es/arizona/N-HGartersnake.htm

Habitat in the Analysis Area. Proposed critical habitat occurs within the project area in Canyon, Carrizo, and Tonto creeks (table 3-17). USFWS considers all proposed critical habitat as occupied.

Table 65. Narrow-headed gartersnake proposed Critical Habitat acres by stream and 6th Code subwatershed (HUCs) within the Rim Country proposed project area.

Streams within Unit	6th Code HUC subwatershed	Acres within Project area
Canyon Creek		**1153.4**
	Canyon Creek Headwaters	1153.4
Carrizo Creek		**174.3**
	Bear Canyon – Black Canyon	0.66
	Buckskin Canyon – Carrizo Creek	173.6
Tonto Creek		**1488.9**
	Bull Tank Canyon – Tonto Creek	1479.2
	Christopher Creek	9.70
	Horton Creek – Tonto Creek	1068.2

Six watersheds (6th HUCs) contain Narrow-headed gartersnake streams within the project area. Riparian condition within these watersheds ranges from Functioning at Risk (n=3) to Impaired (n=3) (table 3-18). The average riparian condition for Narrow-headed gartersnake watersheds is 2.5, which equates to Functioning at Risk.

Table 66. Riparian condition scores from Watershed Condition Framework for 6th Code HUCs with Narrow-headed gartersnake within the Rim Country proposed project area.

Occupied 6th HUCs	WCATT Riparian Condition Score	Associated Rating
Bear Canyon-Black Canyon	3	Poor
Buckskin Canyon-Carrizo Creek	2	Fair
Bull Tank Canyon-Tonto Creek	3	Poor
Canyon Creek Headwaters	2	Fair
Christopher Creek	3	Poor
Horton Creek-Tonto Creek	2	Fair
Average	**2.5**	**Poor**

Northern Mexican gartersnake (Thamnophis eques megalops) and Proposed Critical Habitat

Status: Designated as Threatened on July 8, 2014 (USDI 2014c). Critical Habitat was proposed on July 10, 2013 (USDI 2013).

The natural history of the northern Mexican gartersnake is detailed in the Final Rule to list the species as threatened (USDI 2014c) and is incorporated by reference in this report. The northern Mexican gartersnake (NMG) is generally found in riparian areas when not engaged in dispersal, gestation, or brumation behaviors. It is also often found in streams, rivers, cienegas, stock tanks, ephemeral pools, and spring sources within large-river riparian woodlands, forests, streamside gallery forests, and grasslands.

Historically, the northern Mexican gartersnake occurred within major watersheds in Arizona, as well as in the Gila and San Francisco watersheds in New Mexico. The current range of the snake in New Mexico still includes the Gila River. The snake's range in Arizona has been reduced to the following specific locations: the Bill Williams River, Agua Fria River, the upper Salt River subbasin, Tonto Creek, the Verde River subbasin, the upper Santa Cruz River subbasin, Redrock Canyon, the Buenos Aires National Wildlife Refuge, the Cienega Creek subbasin, the San Pedro River subbasin, the Babocomari River subbasin, and the San Bernardino National Wildlife Refuge. Approximately 83 percent of the population throughout its range is estimated to be at low-enough densities that the populations are not likely viable.

Threats to the species include predation by nonnative aquatic species (e.g., warm water sportfish, bullfrogs, and crayfish); reduction or removal of its prey base; natural or anthropogenic dewatering of aquatic habitat; indirect effects from fisheries management activities; road construction, use, and maintenance; adverse interactions with humans; livestock grazing in the presence of harmful nonnative species; and, to a lesser extent, ash flows from wildfires that remove the prey base or habitat for prey species. Further information on this species can be found at: https://www.fws.gov/southwest/es/arizona/MexGartersnake.htm

Proposed critical habitat for the northern Mexican gartersnake was published in 2013 (U.S. Fish and Wildlife Service 2013e); this information is incorporated by reference in this BA. In total, 421,423 acres is proposed as critical habitat in the various river basins and areas throughout New Mexico and Arizona. Fourteen individual critical habitat units are proposed: upper Gila River, Mule Creek, Bill Williams River, Agua Fria River, upper Salt River, Tonto Creek, Verde River, upper Santa Cruz River, Redrock Canyon, Buenos Aires National Wildlife Refuge, Cienega Creek, San Pedro River, Babocomari River, and San Bernardino National Wildlife Refuge.

Habitat in the Analysis Area. Approximately 1,465 acres of proposed critical habitat occurs within the project area in Tonto Creek (table 3-19). USFWS considers all proposed critical habitat as occupied.

Table 67. Northern Mexican gartersnake proposed Critical Habitat acres by stream and 6th Code subwatershed (HUCs) within the Rim Country proposed project area.

Streams within Unit	6th Code HUC subwatershed	Acres within Project area
Tonto Creek		**1465.3**
	Bull Tank Canyon-Tonto Creek	401.1
	Christopher Creek	9.7
	Horton Creek-Tonto Creek	1054.5

Three watersheds (6th HUCs) contain Northern Mexican gartersnake streams within the project area. Riparian condition within these watersheds ranges from Functioning at Risk (n=1) to Impaired (n=2) (table 3-20). The average riparian condition for Northern Mexican gartersnake watersheds is 2.7, which equates to Impaired.

Table 68. Riparian condition scores from Watershed Condition Framework for 6th Code HUCs with Northern Mexican gartersnake within the Rim Country proposed project area.

Occupied 6th HUCs	WCATT Riparian Condition Score	Associated Rating
Bull Tank Canyon-Tonto Creek	3	Poor
Christopher Creek	3	Poor
Horton Creek-Tonto Creek	2	Fair
Average	**2.7**	**Poor**

Sensitive Species Analyzed in Detail

Narrow-headed gartersnake (Thamnophis rufipunctatus)

For information regarding this species' biology, habitat, historical range, species status reviews, and presence in the action area refer to Affected Environment: Threatened and Endangered Species Analyzed in Detail above.

Northern Mexican gartersnake (Thamnophis eques megalops)

For information regarding this species' biology, habitat, historical range, species status reviews, and presence in the action area refer to Affected Environment: Threatened and Endangered Species Analyzed in Detail above.

Desert sucker (Pantosteus clarki)

The desert sucker (*C. clarki*), also known as the Gila mountain-sucker, is a moderate-sized member of the sucker family (Catostomidae), reaching lengths of up to 12 inches. Its mouth is ventral with large lips, and has well-developed cartilaginous scraping edges on the jaws. The coloration is silvery tan to dark greenish above, silvery to yellowish below. During spawning, both sexes may display an orange red lateral stripe.

Desert sucker occurs in the Bill Williams, Salt, Gila, San Francisco, and Verde River drainages in Arizona and New Mexico. It is characteristic of small to moderately large streams, at elevations of about 1,000 to 6,000 feet. Desert sucker does not occur in reservoirs, and dams and diversions of free-flowing streams have diminished its range somewhat. The species is generally common throughout its range, however continuing threats of water development make its future uncertain. This report will analyze effects to desert sucker and its habitat, as it is present in Oak Creek and Sycamore Creek.

Desert sucker is found in rapids and flowing pools of streams, primarily over bottoms of gravel-rubble with sandy silt in the interstices (AGFD 2002a). Adults live in pools, moving at night to swift riffles and runs, where they feed on encrusting algae scraped from stones. Young inhabit riffles throughout the day, feeding on midge larvae. Individuals exhibit little seasonal movement, and resist downstream displacement during floods. The desert sucker is highly adaptive to a wide range of temperatures, tolerating water temperatures as high as 90°F. It may be able to tolerate lower oxygen levels than other native stream fishes.

Chironomid larvae (midges) are the primary food of juveniles (AGFD 2002a). As an adult, the desert sucker is primarily herbivorous, scraping filamentous algae from stones as well as ingesting plant detritus, aquatic insect larvae, and other invertebrates. Individuals often turn completely upside-down as they glean food off surfaces of stones.

Desert suckers spawn in late winter or early spring on riffles, where adults congregate in large numbers. Spawning typically occurs with one larger female and two or more smaller males. Lateral movements of the female's body form a depression in the stream channel substrates, and adhesive eggs are buried in loose gravels. Eggs hatch in a few days, and larvae gather in quiet pools near the bank, moving to swifter waters as they mature. Juveniles are mature by the second year of life at a length of 4 to 5 inches. More information on desert sucker can be found at: https://www.fws.gov/southwest/es/arizona/Desert_Sucker.htm

Habitat in the Analysis Area. Desert sucker occurs in approximately 106 miles of streams within the proposed project area (table 3-**). These eighteen streams are either currently occupied or provide suitable habitat for the species.

Table 69. Miles of Occupied or Suitable Habitat for Desert Sucker by Stream and 6th Code Subwatershed (HUCs) within the Rim Country Project Area

Stream	6th HUC	Miles in Project Area
Bear Canyon		**2.9**
	Upper West Clear Creek	2.9
Buzzard Roost Creek		**2.2**
	Buzzard Roost Canyon	2.2
	Rock Creek	0.0
Canyon Creek		**5.9**
	Canyon Creek Headwaters	5.9
Cherry Creek		**0.7**
	Gruwell Canyon-Cherry Creek	0.7

Stream	6th HUC	Miles in Project Area
Christopher Creek		**7.5**
	Christopher Creek	7.5
Dane Canyon		**9.2**
	Barbershop Canyon	9.2
East Bear Canyon		**2.7**
	Bear Canyon	2.7
East Clear Creek		**13.3**
	East Clear Creek-Clear Creek	13.3
	Leonard Canyon	0.0
Gordon Creek		**4.5**
	Gordon Canyon	4.5
Haigler Creek		**8.9**
	Haigler Creek	8.9
Hunter Creek		**2.6**
	Christopher Creek	2.6
Miller Canyon		**13.2**
	East Clear Creek-Blue Ridge Reservoir	0.0
	Miller Canyon	13.2
Mule Creek		**2.1**
	Canyon Creek Headwaters	2.1
Pine Creek		**8.5**
	Pine Creek	8.5
Rock Creek-Salt		**4.5**
	Rock Creek	4.5
Tonto Creek		**8.7**
	Bull Tank Canyon-Tonto Creek	3.1
	Christopher Creek	0.0

Stream	6th HUC	Miles in Project Area
	Horton Creek-Tonto Creek	5.5
Turkey Creek		**2.1**
	Rock Creek	2.1
Webber Creek		**6.5**
	Webber Creek	6.5
Grand Total		**106.1**

Eighteen watersheds (6th HUCs) contain Desert sucker streams within the project area. Riparian condition within these watersheds ranges from Functioning at Risk (n=8) to Impaired (n=10) (table 3-22). The average riparian condition for Desert sucker watersheds is 2.6, which equates to Impaired.

Table 70. Riparian condition scores from Watershed Condition Framework for 6th Code HUCs with Desert sucker the Rim Country proposed project area.

Occupied 6th HUCs	WCATT Riparian Condition Score	Associated Rating
Barbershop Canyon	3	Poor
Bear Canyon	3	Poor
Bull Tank Canyon-Tonto Creek	3	Poor
Buzzard Roost Canyon	2	Fair
Canyon Creek Headwaters	2	Fair
Christopher Creek	3	Poor
East Clear Creek-Blue Ridge Reservoir	3	Poor
East Clear Creek-Clear Creek	2	Fair
Gordon Canyon	3	Poor
Gruwell Canyon-Cherry Creek	3	Poor
Haigler Creek	2	Fair
Horton Creek-Tonto Creek	2	Fair
Leonard Canyon	3	Poor
Miller Canyon	3	Poor
Pine Creek	3	Poor
Rock Creek-Spring Creek	2	Fair
Upper West Clear Creek	2	Fair
Webber Creek	2	Fair
Average	**2.6**	**Poor**

Sonoran sucker (Catostomus insignus)

Sonora sucker (*C. insignis*), also known as the Gila sucker, is a large, robust member of the sucker family (Catostomidae), commonly reaching lengths between 12 and 24 inches. Its mouth is ventral with large fleshy lips. The body is sharply bi-colored, brownish dorsally and yellow beneath. During breeding season, males develop large nuptial tubercles on their anal and caudal fins, and on the lower, posterior part of the body.

Sonora sucker is widely distributed and common between 1,000 and 6,500 feet elevation in the Gila, Verde, Bill Williams, and San Francisco River Basins of Arizona and New Mexico. It is uncommon in the upper Santa Cruz River in Arizona. Except in Aravaipa Creek, it has been extirpated from the San Pedro River in southern Arizona and northern Sonora, Mexico. The species is intolerant of reservoir conditions (Minckley 1973). Dams and diversions of free-flowing streams, water pollution, and sedimentation of streams have diminished its range, and the status of the species is uncertain. This report will analyze effects to Sonora sucker and its habitat, as it is present in Oak Creek and Sycamore Creek.

Sonora sucker is characteristic of gravelly or rocky pools of creeks and rivers. It can be found in a variety of habitats from warm water rivers to trout streams. Adults tend to remain near cover in daylight, but move to runs and deeper riffles at night. Young Sonora sucker typically live in runs and quiet eddies. Individuals are sedentary, exhibiting little seasonal movement and resisting downstream displacement during floods. Information on temperature tolerances or other habitat preferences has not been obtained.

Foods appear to vary with availability. In Aravaipa Creek it is almost exclusively a carnivore, feeding upon the abundant aquatic insect larvae (primarily mayflies) of that stream. In other places, especially where large populations are concentrated in pools in summer, intestines are filled with plant debris, mud, or algae. Seeds of cottonwood trees are taken seasonally. Young feed along the margins of streams upon tiny crustaceans, protozoans, and other animal and plant groups (Minckley 1973).

Spawning begins in February and extends until July. Eggs are deposited in riffles, and fall into the interstices between gravel particles where they incubate. Larval fish appear within a few days. Areas where suckers have been spawning may often be identified as elongated patches of "cleaned" gravel on riffles, marking the places where algae-covered bottom materials have been shifted about. Spawning does not appear correlated with any specific pattern of stream flow or temperature. Information on age and growth has not been developed. Further information on this species can be found at: https://www.fws.gov/southwest/es/arizona/Sonora_Sucker.htm

Habitat in the Analysis Area. Sonoran sucker occurs in approximately 13.1 miles of streams within the proposed project area (table 3-23). The three streams (Canyon Creek, East Verde River, and Tonto Creek) are either currently occupied by the species or provide suitable habitat.

Table 71. Miles of Occupied or Suitable Habitat for Sonoran Sucker by Stream and 6th Code Subwatershed (HUCs) within the Rim Country Proposed Project Area.

Stream	6th HUC subwatershed	Miles in Project Area
Canyon Creek	Canyon Creek Headwaters	5.9
East Verde River	East Verde River Headwaters	7.1
Tonto Creek	Bull Tank Canyon – Tonto Creek	0.2
Total		**13.1**

Three watersheds (6th HUCs) contain Sonoran sucker streams within the project area. Riparian condition within these watersheds ranges from Functioning at Risk (n=1) to Impaired (n=2) (table 3-24). The average riparian condition for Sonoran sucker watersheds is 2.7, which equates to Impaired.

Table 72. Riparian Condition Scores from Watershed Condition Framework for 6th Code HUCs with Sonoran Sucker within the Rim Country Proposed Project Area.

Occupied 6th HUCs	WCATT Riparian Condition Score	Associated Rating
Bull Tank Canyon-Tonto Creek	3	Poor
Canyon Creek Headwaters	2	Fair
East Verde River Headwaters	3	Poor
Average	**2.7**	**Poor**

Little Colorado sucker (Catostomus sp. 3)

This species is similar to flannelmouth sucker and is endemic to the upper portion of the Little Colorado River and many of its north flowing tributaries at elevations from 2,200 to 7,100 ft. (Minckley 1973). It has also been introduced into the Salt River. It occurs in creeks, small to medium rivers, and impoundments. Predominantly found in pools with abundant cover, and also in riffles. Foods consist of detritus, algae, and aquatic invertebrates. Reduction in distribution is thought to be a result of habitat loss due to stream flows, water diversions, dam construction, channel and watershed erosion, and interactions with non-native fish species.

Habitat in the Analysis Area. Little Colorado sucker occurs in approximately 147 miles of streams within the project area (table 3-25). The eight streams are either currently occupied by the species or provide suitable habitat within the Little Colorado drainage.

Table 73. Miles of occupied or suitable habitat for Little Colorado sucker by stream and 6th Code subwatershed (HUCs) within the Rim Country proposed project area.

Streams	6th HUC Subwatershed	Miles in Project Area
Barbershop Canyon		**14.7**
	Barbershop Canyon	14.7
	East Clear Creek-Clear Creek	0.0
Bear Canyon		**6.6**
	Bear Canyon	6.6
Chevelon Creek		**22.6**
	Durfee Draw-Chevelon Canyon	7.8
	Long Tom Canyon-Chevelon Canyon	7.8
	Upper Chevelon Canyon-Chevelon Canyon Lake	7.0

Streams	6th HUC Subwatershed	Miles in Project Area
East Clear Creek		**38.4**
	East Clear Creek-Blue Ridge Reservoir	18.4
	East Clear Creek-Clear Creek	19.9
	Leonard Canyon	0.0
	Miller Canyon	0.0
Leonard Canyon		**20.6**
	Leonard Canyon	20.6
Miller Canyon		**13.2**
	Miller Canyon	13.2
West Leonard Canyon		**8.5**
	Leonard Canyon	8.5
Willow Creek		**22.5**
	East Clear Creek-Clear Creek	0.0
	Gentry Canyon	0.0
	Lower Willow Creek	13.3
	Upper Willow Creek	9.2
Grand Total		**147.1**

Fourteen watersheds (6th HUCs) contain Little Colorado sucker streams within the project area. Riparian condition within these watersheds ranges from Functioning Properly (n=3) to Impaired (n=8) (table 3-26). The average riparian condition for Little Colorado sucker watersheds is 2.3, which equates to Functioning at Risk.

Table 74. Riparian condition scores from Watershed Condition Framework for 6th Code HUCs with Little Colorado sucker the Rim Country proposed project area.

Occupied 6th HUCs	WCATT Riparian Condition Score	Associated Rating
Barbershop Canyon	3	Poor
Bear Canyon	3	Poor
Durfee Draw-Chevelon Canyon	1	Good
East Clear Creek-Blue Ridge Reservoir	3	Poor
East Clear Creek-Clear Creek	2	Fair
Gentry Canyon-Upper Clear Creek	3	Poor
Leonard Canyon	3	Poor
Long Tom Canyon-Chevelon Canyon	1	Good
Lower Willow Creek	2	Fair
Miller Canyon	3	Poor
Pine Creek	1	Good
Rock Creek-Spring Creek	2	Fair
Upper West Clear Creek	3	Poor
Webber Creek	3	Poor
Average	2.3	**Fair**

Headwater chub (Gila nigra)

Life history, distribution, status of the species range-wide and listing factors are found in documents located on the FWS website: http://www.fws.gov/southwest/es/arizona/Headwater_Chub.htm . An account of the taxonomy, biology, and reproductive characteristics of this species is found in the 2015 Federal Register designating a threatened DPS species status and the Species Status Assessment (USFWS 2015). All these documents are incorporated by reference into this document.

Headwater chubs occupy middle to headwater reaches of medium- sized streams of the Gila River Basin at elevations of 3,035 to 6,651 ft. They are usually found in large pools and associated with cover such as undercut banks, large pools, or deep places created by obstructions such as trees or rocks. Typical adult microhabitat consists of deep, nearshore pools adjacent to swifter riffles and runs. Headwater chub life span is 8-10 years and they can grow rapidly but growth is dependent on water temperature.

Headwater chub inhabit mid-sized headwater streams with warm or cool water in the Gila River Basin and have been documented between 4,000 to 6,500 feet. Maximum water temperatures where chubs were observed were 20 to 26 degrees Celsius (68 to 74 degrees Fahrenheit) which suggests temperature is a limiting factor for distribution of chub species (Bestgen & Propst, 1989). Habitat requirements for adults are deep pools near shorelines and swift riffles, associated with a structure (downed logs or boulders) within pools, undercut banks, overhanging cliff walls, root wads and other types of cover while juveniles prefer relatively shallow, slower moving water with overhead cover and sand substrates. Headwater chub are omnivorous and like the roundtail chub, are known to feed on vegetation, detritus, terrestrial and aquatic insects, and fish (AZGFD, 2010).

Historical distribution of headwater chub is poorly understood because this species was only recently designated as *Gila nigra* in 2000 (Minckely & DeMarais, 2000). The headwater chub is believed to be a hybrid species from the interbreeding of the roundtail chub *Gila robusta* and the Gila chub *Gila intermedia* (AZGFD, 2006). This species was likely distributed throughout the Gila River Basin but likely did not have an extensive range. Recent studies pertaining to the headwater chub indicate that this species is declining across its entire range. Currently, headwater chub only occupy 40 percent of their historic range and today, only exist in four separate drainage basins: the Verde River, San Carlos, Tonto Creek, and upper Gila River Basins (USFWS, 2006).

Threats to headwater chub include a combination of habitat loss and degradation related to dams, diversions, groundwater pumping, mining, recreation, and livestock grazing, and competition and predation from non-native fish.

Habitat in the Analysis Area. Headwater chub occur in approximately 47.8 miles of streams within the project area (Table 148). The nine streams are either currently occupied by the species or provide suitable habitat.

Table 75. Miles Of Occupied Or Suitable Habitat For Headwater Chub By Stream And 6th Code Subwatershed (Hucs) Within The Rim Country Proposed Project Area

Streams	6th HUC Subwatershed	Miles in Project Area
Buzzard Roost Canyon		**2.2**
	Buzzard Roost Canyon	2.2
	Rock Creek	0.0
East Verde River		**1.7**
	East Verde River Headwaters	1.7
Gordon Creek		**4.5**
	Gordon Canyon	4.5
Haigler Creek		**8.8**
	Haigler Creek	8.8
Pine Creek		**8.5**
	Pine Creek	8.5
Rock Creek		**4.8**
	Rock Creek	4.8
Turkey Creek		**2.1**
	Rock Creek	2.1

Upper Tonto Creek		**8.8**
	Bull Tank Canyon-Tonto Creek	3.1
	Horton Creek-Tonto Creek	5.7
Webber Creek		**6.5**
	Webber Creek	6.5
Grand Total		**47.8**

Nine watersheds (6th HUCs) contain Headwater chub streams within the project area. Riparian condition within these watersheds ranges from Functioning at Risk (n=5) to Impaired (n=4) (table 3-28). The average riparian condition for Headwater chub watersheds is 2.4, which equates to Functioning at Risk.

Table 76. Riparian Condition Scores From Watershed Condition Framework For 6th Code HUCs With Headwater Chub The Rim Country Proposed Project Area.

Occupied 6th HUCs	WCATT Riparian Condition Score	Associated Rating
Bull Tank Canyon-Tonto Creek	3	Poor
Buzzard Roost Canyon	2	Fair
East Verde Headwaters	3	Poor
Gordon Canyon	3	Poor
Haigler Creek	2	Fair
Horton Creek-Tonto Creek	2	Fair
Pine Creek	3	Poor
Rock Creek-East Verde River	2	Fair
Webber Creek	2	Fair
Average	2.4	**Fair**

Roundtail chub (Gila robusta)

Roundtail chub utilize slow moving, deep pools for cover and feeding. They are found in the main stems of major rivers and smaller tributary streams. Roundtail chub utilize a variety of substrate types (silt, sand, gravel, and rocks) and prefer murky water to clear. Habitat use varies by life stages (adult, juvenile, and young-of-year). Juveniles and young-of-year are found in quiet water near the shore or backwaters with low velocity and frequent pools rather than glides and riffles. Juveniles use instream boulders for cover, while young-of-year are found in gaps between and under boulders or the slack-water area behind boulders. Adults generally do not frequent vegetation and avoid shallow water cover types, such as overhanging and shoreline vegetation. Adults are found in eddies and pools adjacent to strong current and use instream boulders as cover. Roundtail chub are carnivorous and opportunistic feeders, and food items include aquatic and terrestrial insects, fish, snails, crustaceans, and algae.

Threats to the roundtail chub include habitat alteration and degradation from water diversions, groundwater pumping, dewatering, mining, contaminants, urban and agricultural development, livestock grazing, and predation and competition by non-native aquatic species. Further information on this species can be found at: https://www.fws.gov/southwest/es/arizona/Roundtail.htm

Habitat in the Analysis Area. The five streams are either currently occupied by the species or provide suitable habitat.

Table 77. Miles Of Occupied Or Suitable Habitat For Roundtail Chub By Stream And 6th Code Subwatershed (Hucs) Within The Rim Country Proposed Project Area.

Stream	6th HUC subwatershed	Miles
Canyon Creek		**5.4**
	Canyon Creek Headwaters	5.4
Cherry Creek		**0.8**
	Gruwell Canyon-Cherry Creek	0.8
Chevelon Creek		**7.7**
	Durfee Draw-Chevelon Canyon	7.7
	Upper Chevelon Canyon-Chevelon Canyon Lake	0.0
East Clear Creek		**19.5**
	East Clear Creek-Clear Creek	18.0
	Echinique Draw-Clear Creek	1.5
	Leonard Canyon	0.0
	Wilkins Canyon	0.0
Salome Creek	Upper Salome Creek	**0.9**
		0.9
Grand Total		**34.4**

Nine watersheds (6th HUCs) contain Roundtail chub streams within the project area. Riparian condition within these watersheds ranges from Functioning Properly (n=3) to Impaired (n=3); the remaining watersheds are Functioning at Risk (table 3-30). The average riparian condition for Roundtail chub watersheds is 2.0, which equates to Functioning at Risk.

Table 78. Riparian Condition Scores From Watershed Condition Framework For 6th Code Hucs With Roundtail Chub The Rim Country Proposed Project Area.

Occupied 6th HUCs	WCATT Riparian Condition Score	Associated Rating

Canyon Creek Headwaters	2	Fair
Durfee Draw-Chevelon Canyon	1	Good
East Clear Creek-Clear Creek	2	Fair
Echinique Draw-Clear Creek	1	Good
Gruwell Canyon-Cherry Creek	3	Poor
Leonard Canyon	3	Poor
Upper Chevelon Canyon-Chevelon Canyon Lake	1	Good
Upper Salome Creek	2	Fair
Wilkins Canyon	3	Poor
Average	2.0	**Fair**

A Net-winged midge (Agathon arizonicus)

This species requires swift-moving streams, typically with waterfalls, that supports its larvae. Adults do not leave the riparian corridor. The species is currently known only from Workman Creek in the Sierra Ancha Mountains. Little information exists on the species, but suitable habitat exists.

A stonefly (Capnia caryi)

The newly described species is found in only two high elevation locations in the southern Rocky Mountains of New Mexico and Arizona (Baumann and Jacobi, 2002). It was found in two tiny creeks where substrate consisted of scattered boulders and a mixture of cobble with gravels. The gradient was 3 percent and the water was clear and cool, with low amounts of dissolved materials (Baumann and Jacobi, 2002).

In New Mexico, it has been recorded from New Mexico in Catron Co. (Upper Iron Creek) and Arizona in Apache County (Mamie Creek at Escudilla Mountain); both near the border of southern Arizona and New Mexico (Baumann and Jacobi, 2002). Little information exists on the species, but suitable habitat exists.

Parker's cylloepus riffle beetle (Cylloepus parkeri)

This species is associated with perennial, flowing streams. It is associated with stream riffles and is only known from two creeks in Bloody Basin (TNF 2015). Little information exists on the species, but suitable habitat exists.

A Mayfly (Fallceon eatoni)

Originally collected in 1892 from northern Sonora, Mexico (USFWS 2010). The species had not been recorded since then until a single specimen was identified from collections in 2005 from Salt River Canyon, Gila Co., Arizona (NatureServe). Another occurrence was recently reported from Cottonwood Canyon in the San Bernardino Mountains in Riverside Country, California. Little information exists on the species, but suitable habitat exists.

A Mayfly (Moribaetis mimbresaurus)

This is one of six species of the genus in North and South America, and the only member north of Mexico. The species is only known from a single locality in the Salt River Canyon in Gila County as well as Pumphouse Wash in Oak Creek. It is associated with perennial and ephemeral streams as well as springs associated with Cottonwood Willow Riparian Forest and Mixed

Broadleaf Riparian Forest, given that mayflies have a strictly aquatic larval stage (McCafferty 2006). Little information exists on the species, but suitable habitat exists.

A caddisfly (Lepidostoma apache)

Limited information is known about this recently described species. It is found in freshwater habitat, but the larval habitat is unknown. It has only been found in the Blue River, on the ASNF (Houghton, 2001b). Little information exists on the species, but suitable habitat exists.

A caddisfly (Lepidostoma knulli)

This is a medium-sized caddisfly of the diverse Lepidostoma family, endemic to higher elevation southwestern United States watersheds ranging from 4500 to 8530 feet in elevation. It occurs in cool stream segments with swift flowing water, dominated by large cobbles with low embeddedness of interstitial gravels (Blinn and Ruiter 2009). Threats to the species include limited distribution or endemism in addition to threats to ecosystem or aquatic diversity. It is associated with Mixed Broadleaf Riparian Forest or Cottonwood Willow Riparian Forest.

This species is uncommon in Arizona, Montana, New Mexico, and Mexico. It has been found in eastern Arizona in two sites on the ASNFs and in Pumphouse wash and Indian Gardens in Oak Creek Canyon on the COC. It has been listed in sites in Apache and Coconino County Arizona. Little information exists on the species, but suitable habitat exists.

A caddisfly (Limnephilus granti)

The species is extremely rare. All specimens have been collected from springs and their immediate outlets in the ponderosa pine region of eastern Arizona. It is known only from the type specimen and a few additional specimens found in Grant Creek in Graham County, Government Spring, south of Greer in Apache County, and Rosey Creek, near Greer also in Apache County (Blinn and Ruiter, 2009). Little information exists on the species, but suitable habitat exists within the project area.

Ferris' copper butterfly (Lycaena ferrisi)

The species is the only one in its range that resembles the Ruddy copper butterfly. Its host plant in the larval stage is Arizona dock (also known as wild rhubarb) (*Rumex hymenosepalus*), while the adult feeds on nectar including that of yellow composites. Its primary habitat is open meadows and cienegas springs. Threats include fire suppression because it results in the invasion of meadow habitats by dense conifer forests and an understory of grasses (USFWS 2009).

This species has a very limited distribution, and is known only in the White Mountains of eastern Arizona. It is known to occur in the White Mountains of Apache County, near McNary and Maverick, and in Greer County, Arizona (USFWS 2009). It is critically imperiled globally and in Arizona. There may be only a single metapopulation, and there may be less than 20. Little information exists on the species, but suitable habitat exists.

Nokomis Fritillary (aka Great Basin Silverspot) (Speyeria nokomis nokomis)

This species is associated with permanent spring-fed meadows, seeps, marshes, and boggy streamside meadows with flowing water in arid country. Presence of its larval foodplant (bog violet [*Viola nephrophylla*]) is a critical habitat component. The species is only known from Apache Country, Arizona. There was a recently confirmed locality in Gila County. Little information exists on the species, but suitable habitat exists.

California Floater (Anodonta californiensis)

This mussel prefers shallow areas of clean, clear lakes, ponds and large rivers. It prefers lower elevations and soft, silty substrate to burrow into. The life cycle of California floater includes a parasitic larval stage during which it is dependent upon a host fish, usually a member of the Gila genus, for food and dispersal. The adult and juvenile phases are sedentary, filter-feeders. It is associated with perennial springs and streams in every riparian forest type. There are no occupied locations within the proposed project area, but suitable habitat does exist.

Distribution used to range from southern British Columbia south to northern Baja California, and east to Wisconsin. Today, numbers have been depleted to the point that it is extinct throughout much of its former range, including Utah, the entire Sacramento River system, and most of Arizona. Specimens have been found in Chevelon Creek, East Clear Creek near the confluence of Leonard Canyon, and Show Low Creek. It is believed to have been present historically within the proposed project area in the Beaver Creek, Cherry Creek-Verde River, Fossil Creek-Verde River, Lower Clear Creek, Upper Clear Creek, and West Clear Creek 5th HUC watersheds. There are presently no known extant populations within the proposed project area.

Assumptions and Methodology

Assumptions

Species occurrence geospatial layers utilized for analysis contain up-to-date information as of July 2018 and represent species current occurrence as well as potential suitable habitat.

Species analysis areas represent the drainage network where direct and indirect effects could occur to species or habitat.

Watershed Condition Framework assessments utilized for existing condition accurately reflect indicators for aquatic species and habitats.

Analyzing mechanical vegetation and prescribed burning treatments across vegetation types will address the highest level of effects that may occur; therefore, effects less than that are inherently addressed.

Project implementation will include all applicable Design Features, Best Management Practices, and Conservation Measures which are expected to minimize effects throughout the analysis.

The Aquatic and Watershed Flexible Toolbox Approach is adaptive management and guidance within the document will be implemented, including circumstances on where treatments are applicable, which inherently minimize effects on aquatic species and habitats.

Projects lists and acreages provided for Cumulative Effects analysis accurately represent past, current, and future activities within the project area.

Methodology

This analysis is for a total of 28 endangered, threatened, proposed, candidate, and sensitive aquatic species and their habitats. The species analyzed include twelve fish species, two mollusks, two gartersnakes, and twelve invertebrates. For analysis and discussion purposes, some of the species were grouped together, where appropriate, as this facilitates the comparison of changes between alternatives. Analyses compared and summarized the resource indicators and measures identified below (see table 3-XX). For invertebrate species, more qualitative analyses were required, primarily due to the unknown distributions of most of these species, limited distribution of these species, or the limited effects on these species associated with the proposed actions. Analyses included the changes (i.e., increase, decrease, or change from current conditions) for the indicators or measures, and how they can affect aquatic species and their habitats.

For the purposes of analysis, mechanical vegetation treatments were analyzed across vegetation type (Ecological Restoration Unit) within the project area. Intuitively, mechanical vegetation treatments in forested Ecological Restoration units (ERUs) would be more extensive to move towards desired conditions than treatments in savannas, grasslands, meadows, and riparian areas to reduce encroachment. Prescribed burning was similarly analyzed across the project area regardless of vegetation type (ERUs).

The transportation system (roads) needed to implement Rim Country were analyzed quantitatively and qualitatively. Quantitative analysis was completed based on existing Forest Service roads (existing condition) and the number of ML-1 roads opened (action alternatives). While the analysis assumes all ML-1 roads would be opened for use, intuitively not all the roads would be opened or used at the same time across the project area. Therefore, the analysis is over estimating the potential effects of the action alternatives. The miles of roads (ML-1 thru 5) to be used is the same for both action alternatives as was therefore analyzed only once. Road relocation, decommissioning, and temporary roads were analyzed qualitatively for the action alternatives as the location of these activities is unknown.   Miles proposed for each were based on averages across the three Forests over a given time period. Therefore, a more accurate analysis by species was not feasible. Miles of proposed road relocation and decommissioning were the same for both action alternatives and therefore only analyzed once. Mileage of temporary roads differed between the action alternatives and was analyzed as part of those alternatives.

In-woods processing and storage sites, rock pits, and aquatic/watershed restoration activities do not differ in acreage or mileage between the action alternatives. For those reasons, these three portions of the action alternatives were analyzed only once as Effects Common to Both Action Alternatives. In-woods processing and storage sites were analyzed quantitatively for the Coconino and Tonto NFs where exact locations and acreages of proposed sites were available. A qualitative analysis was completed for the Apache-Sitgreaves NFs because the use of identified processing sites on those forests are not being proposed, only the in-woods drying of biomass as needed. The acres of rock pit use and expansion were analyzed quantitatively, as were miles of general and heavy mechanical stream restoration.

Information Sources

The basis of these effects analyses is the observations and professional judgement of the project fisheries biologist as well as the best available science. Species distribution and habitat data were created specifically for this project based on existing GIS datasets, survey reports, Federal Register listings, 5-Year Reviews, and local knowledge. Species occupied and potential habitat mapping was reviewed collaboratively by state and federal biologists in an effort to be as accurate as possible. The data are based primarily on information obtained from literature and inventory and monitoring conducted by the Arizona Game and Fish Department, U.S. Fish and Wildlife Service, Forest Service, and other agencies and cooperators.

Incomplete and Unavailable Information

The precise distribution of the aquatic organisms or the quality of their habitat is not well known throughout the entire analysis area. Therefore, species occurrence was extrapolated from existing survey information, then reviewed by Arizona Game and Fish Department Fisheries Managers and forest biologists to incorporate local knowledge.   Similarly, recent stream habitat survey information were not available to determine the current habitat conditions for most streams within the project area.

The aquatic macroinvertebrate species (i.e., sensitive species) have had very limited surveys across the project area, and known occurrences are very limited. Information was used from recent Forest level analyses such as Forest Plan Revision or Travel Management Planning in an effort to incorporate the most recent species or habitat distribution. For analyses proposed, these species were assumed to occur throughout the stream(s) where they have been documented.

Because of these imprecisions, the analysis will rely heavily on the Watershed Condition Framework to define existing conditions and the implementation of the Design Features, Best Management Practices, Mitigation and Conservation Measures, and guidance in the Aquatics and Watershed Flexible Toolbox Approach (see Appendix D) to support conclusions and lay the framework for implementation.

Spatial and Temporal Context for Effects Analysis

The spatial analysis area includes the entire Rim Country project Area and adjacent areas that could be affected by activities occurring downstream of the proposed project area, or adjacent lands. The analysis area will vary by the species present within and downstream of Rim Country subwatersheds, and the extent and location of proposed activities within the various alternatives. For GIS quantitative analyses, areas for most of the aquatic species were developed to include all potential effects. Species analysis area boundaries were determined by including all of the subwatersheds within the project area that drain into occupied or suitable habitat, designated or proposed critical habitat, and identified recovery habitat. Additional spatial boundaries within each species analysis areas were defined specifically to delineate direct and indirect effects; these are described below.

Miles of stream identified for general and heavy mechanical stream restoration were identified spatially using factors that promote successful treatments. Potential locations for general stream treatments were identified based on stream gradient. Stream gradient was mapped using LiDAR data and averaging within reaches. Reaches with low (0 to 2 percent) and moderate (2 to 4 percent) stream gradient were used for general stream treatment identification based on Rosgen stream types and gradients where stream restoration is the most successful. Heavy mechanical stream reaches are a subset of the general stream dataset that were then filtered by the ability of machinery to access locations. These were identified by removing reaches with canyon slopes greater than 25 percent and further than 0.25 miles from roads. The canyon slope was used to be in alignment with existing Design Features.

Direct/Indirect Effects Boundaries

A 250-foot buffer on fish species habitat was used for analyzing acreage of direct effects on habitat, as this includes the stream and the adjacent riparian and upland areas that directly influence aquatic habitat and species. For indirect effects, all the analysis area that drains into the fish species habitat was included, as this captures all the potential indirect effects that could occur from any upstream area or activity. For the two gartersnake species a 600-foot buffer was used for analyzing acreage of direct effects because this covers the width of the stream, the width of proposed critical habitat, and the extent of habitat used by the species. For indirect effects, all the analysis area that drains into gartersnake habitat was included, similar to fish species. Percentage of areas affected by direct or indirect effects were calculated using the species analysis areas and the acres or miles proposed within those.

The temporal boundaries for analyzing direct and indirect effects to aquatic species will be 10-15 years, given that habitat conditions and species occupancy can change over that timeframe. Direct effects to species are fairly immediate (e.g., harm or harassment), while indirect effects occur over a longer period as a result Short-term effects to habitat occur over a timeframe of a year to include a monsoon season and spring flow event. This is based on the assumption that monsoonal rain events (by their nature) increase erosion and sedimentation to aquatic habitats, while spring runoff tends to mobilize sediment downstream. Long-term effects to habitat can last for multiple years or seasons.

Cumulative Effects Boundaries

The spatial boundaries for cumulative effects are the combined areas of direct and indirect effects as described above. Additionally, for some species and some activities it can include private lands within the forest boundaries and lands adjacent to, or upstream and downstream of the project area. Temporal boundaries went back 30 years in time to include any activity with geospatial data on for quantitative analysis. Past management activities that did not have geospatial data were described by general resource area along with potential last effects going back further in time.

Issues/Indicators/Topics of Analysis

No issues identified through the scoping process are related to aquatic species or habitat.

Other Resource Concerns

Trout Unlimited and AZGFD have brought forth the concern for resilience of cold water streams to climate change in regards to water temperatures. These concerns are also part of desired conditions for the Forest Plans and are addressed by the purpose and need.

Resource Indicators and Measures

Resource measures were identified for those components that could be spatially defined and carried through the analysis of alternatives. Quantitative analyses were conducting for the following resource measures: 1) acres of mechanical thinning, 2) acres of prescribed burning, 3) miles of open ML-1, 4) acres of In Woods Processing Sites, 5) acres of rock pits use and expansion, 6) miles of general stream restoration, and 7) miles of heavy mechanical stream restoration. For some species (e.g., sensitive aquatic macroinvertebrates) quantitative evaluation is not possible, so the analyses will be more limited and/or qualitative for some species. Qualitative analyses were used for components that could not be spatially defined such as temporary roads, road relocation, and road decommissioning which are part of both action alternatives. Resource indicators will allow for the comparison between the existing condition and each alternative, and how they may directly or indirectly impact aquatic species and their habitats. Resource elements are larger in context and represented by the resource indicators for analysis. For example, riparian condition represents both aquatic habitat quality and quantity. Measures represent the amount effect to the resource indicators; therefore if acres or miles of measures increase then potential effects to resource indicators may increase.   Impacts to indicators will be addressed on the temporal context described previously as well as by direct and indirect impacts. Additional information is provided later for each group of species (i.e., fish, frogs, snakes, and invertebrates) analyzed within the effects sections. The resource indicators, elements, and measures are listed in table 3-XX below.

Several of the aquatic invertebrate sensitive species were not quantitatively analyzed using the resource indicators and measures. This was not possible primarily due to the species limited or unknown distributions, or no or limited impacts that could result from the proposed actions. GIS maps were reviewed for both alternatives to qualitatively assess the impacts that could occur to these species from the proposed actions (i.e., mechanical vegetation treatments and prescribed burning).

Table 79. Resource indicators and measures for assessing effects between alternatives.

Resource Element	Resource Indicator	Measure	Used to address: P/N, or key issue?	Source (LMP S/G; law or policy, BMPs, etc.)?
Habitat Quality Habitat Quantity Impacts to Individuals	1. Riparian Condition -Short and Mid-term effects negative - Long Term effect neutral or positive 2. Modification of Gartersnake Behavior - Short and Mid-term effects negative - Long Term effect neutral or positive 3. Harm of Gartersnakes - Short term effects negative - Mid and Long Term Effects Neutral 4. Pollutants, Exotic Species and/or Disease - Short, Mid-, and Long Term effects negative	Acres of mechanical thinning treatments	Yes	LMP S/G, BMPs
Habitat Quality Habitat Quantity Impacts to Individuals	1. Riparian Condition - Short and Mid-term effects negative - Long Term effect neutral or positive 2. Modification of Gartersnake Behavior - Short and Mid-Term effects negative - Long Term effect neutral or positive 3. Harm of Gartersnakes - Short term effects negative - Mid and Long Term Effects Neutral 4. Pollutants, Exotic Species and/or Disease - Short, Mid-, and Long Term effects negative	Acres of Prescribed Burning	Yes	LMP S/G, BMPs

Resource Element	Resource Indicator	Measure	Used to address: P/N, or key issue?	Source (LMP S/G; law or policy, BMPs, etc.)?
Habitat Quality Habitat Quantity	1. Riparian Condition - Short and Mid-Term effects negative - Long Term effect neutral or positive 2. Habitat Connectivity - Short and Mid-Term effects negative - Long Term effect neutral or positive 4. Pollutants, Invasive Species - Short, Mid-, and Long Term effects negative	Miles of Open ML-1 and Temporary Roads (Road Density and Location)	Yes	LMP S/G, BMPs
Habitat Quality Habitat Quantity	1. Riparian Condition - Short and Mid-term effects negative - Long Term effect neutral	Acres of In Woods Processing Sites (IWPS)	Yes	LMP S/G, BMPs
Habitat Quality Habitat Quantity	1. Riparian Condition - Short and Mid-term effects negative - Long Term effect neutral	Acres of Rock Pits	Yes	LMP S/G, BMPs
Habitat Quality Habitat Quantity	1. Riparian Condition - Short Term effect negative - Mid and Long Term effects neutral or positive	Miles of general stream restoration	Yes	LMP S/G, BMPs
Habitat Quality Habitat Quantity Impacts to Individuals	1. Riparian Condition - Short and Mid-term effects negative - Long Term effect neutral or positive 2. Instream Aquatic Habitat - Short effects negative - Mid and Long Term effects positive 3. Harm of Fish or Gartersnakes - Short effects negative - Mid and Long Term effect neutral or positive 4. Pollutants, Invasive Species - Short, Mid-, and Long Term effects negative	Miles of heavy mechanical stream restoration	Yes	LMP S/G, BMPs

Resource Element	Resource Indicator	Measure	Used to address: P/N, or key issue?	Source (LMP S/G; law or policy, BMPs, etc.)?
Habitat Quality and Quantity for Invertebrates	1. Riparian Condition - Short or Mid-Term effects negative - Long Term effects neutral or positive	Qualitative change in sediment delivery or habitat impacts.	Yes	LMP S/G, BMPs

Riparian Condition

Riparian Condition is being used as a surrogate to indicate potential changes in multiple factors that directly influence aquatic and riparian habitat quality and quantity such as sediment load, streamside canopy cover and structure, large woody debris, stream temperature, and changes in peak flows. The current condition of riparian areas indicates their ability and resiliency to provide the ecosystem services listed above in regards to potential direct and indirect impacts. Therefore, riparian areas in good condition would ameliorate potential short term direct impacts to riparian and aquatic habitat whereas areas in poor condition potentially would not. Additionally, resource measures could lead to positive or negative impacts to riparian condition (and thus aquatic or riparian habitat) depending on the timeframe.

Effects on riparian condition will be assessed quantitatively by alternative by comparing predicted direct, indirect, and cumulative effects by major proposed activities within the project area.

Habitat quality and quantity analysis topics include:

1. Changes in streamside vegetation cover and structure.
2. Changes in sediment delivery to streams altering aquatic habitat and food base.
3. Changes in recruitment of large woody debris from riparian areas to streams altering aquatic habitat.
4. Changes to stream temperatures as a result of warm water runoff from upland sources or reduced streamside canopy cover.
5. Changes to aquatic habitat as a consequence of increased flows caused by removal of upland vegetation resulting in increased storm water runoff.

Riparian and wetland areas are the interface between terrestrial and aquatic ecosystems and are an integral part of the watersheds in which they occur. Consequently, the health of these areas is closely interrelated to the condition of the surrounding watershed (Debano and Schmidt 1989, Hornbeck and Kochenderfer 2000). The health of riparian corridors is dependent on the storage and movement of sediment through the channel system but also the movement of sediment and water from surrounding hillslopes into the channel system. These processes can be altered by human induced and natural disturbances either indirectly to the watershed or directly to riparian areas themselves. Riparian areas provide localized microclimate, stream shading, bank stability, and inputs of large wood and organic matter to streams. They are critical for maintenance of water quality and quantity, contribute to sediment retention and stream bank building and maintenance, and influence in-channel geomorphic processes.

Streamside canopy cover and structure are important to riparian and aquatic habitat by providing riparian habitat for gartersnakes, stream shading, bank stability, and nutrients in the form of organic matter. Removal of trees and shrubs can reduce vegetation structure, canopy cover and stream shading. This can potentially lead to increased stream temperatures, reduced bank stability, and reduced organic matter (allochthonous material) reaching the stream. It can also lead to reduce habitat quality and quantity for riparian obligate species that are dependent upon streamside canopy and structure as part of their life history.

While streams can process normal sediment levels, elevated levels can cause negative impacts. Most streams carry or move sediment and the amount varies seasonally. Sediment transport involves detachment and entrainment of particles, their transport, and their deposition. When additional fine sediments are transported, they can accumulate in relatively clean or porous substrate such as gravels and habitats such as pools. Increased levels of sedimentation can have adverse effects on aquatic species, habitats, and riparian ecosystems. Fine sediment deposited in spawning gravels can reduce egg survival (Hicks et al., 1991) by reducing the availability of dissolved oxygen in the gravel. Primary production, benthic macroinvertebrate abundance, and thus food availability for fish and gartersnakes (prey) may be reduced as sediment levels increase. Large wood in streams is an important roughness element influencing channel morphology, sediment distribution, and water routing. Common sources of large wood include falling of dead trees, wind-throw and breakage, and landslides. Large wood influences channel gradient by creating step pools and dissipating energy, lengthens streams by increasing sinuosity, and serves as an important agent in pool formation. In low order streams, in particular, large wood collects sediment and larger substrates during high flows events and can account for a large proportion of sediment/substrate storage sites. It is also instrumental in nutrient retention.

Stream temperatures can affect the survival and production of fish throughout all life stages. Warm water temperatures can reduce survival of eggs as well as hatching success. For juveniles, growth can decline above certain temperatures, which differs by species, and is accompanied by decreased feeding, increased stress, and increased warm water diseases or parasites. Finally, at a certain point, temperatures become lethal for all fish.

Alteration of flows can have major physical effects on aquatic ecosystems. Increases in peak flows or frequency can increase bed scour or accelerate bank erosion negatively impacting aquatic habitat. Small streams are the more easily altered as they are intimately associated with their riparian zones and are highly responsive to alterations in riparian vegetation and the surrounding watershed. These streams carry water, sediment, nutrients, and large wood from upper portions of the watershed which influence the quality of aquatic habitat downstream.

Potential effects of Mechanical Vegetation Management

Chamberlin et al. (1991) reviewed literature on timber harvest, silviculture and watershed processes, which are relative to potential impacts to riparian condition. Mechanical vegetation treatments can increase erosion, sedimentation, and alter peak streamflows via removal of vegetation and ground disturbance. Forest harvest activities can influence both upland erosional processes and the way that streams process sediment in their channels. The potential for surface erosion is related to the amount of bare compacted soil exposed to rainfall and runoff. If soil infiltration is sufficiently reduced, water runs off rather than through soil resulting in higher peaks flows and increased sediment transport. Therefore, features such as landings and skid trails can contribute large quantities of fine sediment and runoff to stream channels. Patterns of yarding and skidding can alter drainage paths and redirect water onto areas more likely to erode than natural channels. In addition to influencing soil structure, mechanical harvest can influence snow accumulation and melt rates as well as evapotranspiration and soil water which can also alter peak flows.

Potential effects of Prescribed Fire on Riparian Condition

Response of riparian condition and aquatic ecosystems to fire can be highly variable and dependant on fire attributes (e.g. severity, intensity, fire size), magnitude of subsequent storms and snowmelt events, amount of the watershed burned, stream size, and topography (Kerschner 2004; Gresswell 1999). Indirect fire impacts can consist of altered peak flows and hydrologic processes (Minshall and Brock 1991), hillslope erosion and stream sedimentation (Swanson 1981; Megahan 1991; Rinne 1996) (Bisson et al. 2003), disrupted nutrient cycling (Swanson 1981; Megahan 1991; Bozek and Young 1994), loss of streambank vegetation leading to increased stream temperatures (Minshall and Brock 1991), decreased large woody debris, and fragmented aquatic habitat dynamics (Minshall and Brock 1991; Rieman and Clayton 1997; Swanson 1981; Megahan 1991; Bozek and Young 1994). Adverse changes in these attributes can negatively impact riparian condition, as well as aquatic habitat quality and quantity.

Fire related erosion and sedimentation can occur chronically (fine sediment delivery over long periods) or episodically (post-fire ash or sediment pulses, landslides and debris flows). Levels above what a riparian areas and stream can process, based on condition, can lead to negative effects to aquatic habitat quality and quantity. Large increases in sediment can lower pool density, reduce intragravel dissolved oxygen and circulation leading to loss of fish eggs, cover food sources for benthic macroinvertebrates, and reduce the efficiency of filter feeding macroinvertebrates.

Treatments in riparian areas change the vegetative structure, canopy cover, and reduce fuel continuity. This can potentially lead to increased stream temperatures, reduced bank stability, and reduced organic matter (allochthonous material) reaching the stream (Dwire et al. 2016). Reduced fuel continuity provides for resiliency of riparian areas during wildfires by potentially reducing fire intensity and severity. In general, effects of spring or fall prescribed burning on both upland and riparian species composition appear to be either negligible or similar in effects of low-severity wildfire and are generally neutral or beneficial (Dwire et al. 2016). There are indications that the effects of prescribed fires are much smaller and shorter-lived to the effects of wildfire.

Fire also plays an important role in maintaining heterogeneity (riparian condition) in both terrestrial and aquatic habitats (Gresswell 1999). Periodic variations in the influx of sediment and coarse woody debris from riparian areas to the active stream channel contribute to aquatic habitat heterogeneity by creating complex stream morphology and can be reflected in a diverse fish community (Reeves et al. 1995; Rieman and Clayton 1997; Gresswell 1999; Rieman et al. 2003; Robinson et al. 2005).

Fire regimes in riparian areas relative to adjacent uplands vary. In drier areas, similar to the project area, historical fire frequencies in uplands and riparian areas are often comparable (Dwire et al. 2016). Dry ponderosa pine/Douglas-fir forest of central Idaho had similar fire return intervals for upland and riparian stands. Where the vegetation composition of riparian areas is similar to adjacent uplands, streamside areas are likely to burn as frequently as the surrounding uplands. Therefore, the suppression of fires for decades has likely altered riparian areas and made them more susceptible to uncharacteristic wildfire similar to uplands.

Potential effects of Roads on Riparian Condition

Water runoff and sediment yield are key physical processes whereby roads have an impact on streams and other aquatic systems, and the distance of these effects can vary widely. Roads on upper hillslopes concentrate water flow, which can form channels higher on slopes. This process leads to smaller, more elongated first-order drainages and longer total length of the channel network. Water rapidly runs off relatively impervious road surfaces, especially in storm and snowmelt events, increasing runoff. Increased runoff associated with roads may increase the rates and extent of erosion, reduce percolation and aquifer recharge rates, alter channel morphology, and increase peak flows. Increased peak flows can degrade aquatic ecosystems by altering riparian conditions, channel morphology, or aquatic habitat. Surface erosion from forest roads affects the fine sediment budget and may impose a chronic condition of sediment inputs to streams affecting the stream substrate and the health of aquatic life (Luce et al. 2001). Chronic erosion from roads can greatly reduce an aquatic systems integrity, and in some cases can be the primary source of sediment input (Switalski et al. 2004). Sediment concerns are generally highest when roads are not sufficiently drained; with sufficient drainage, water and sediment from upland segments of roads can be diverted, filtered through forest vegetation, and not routed to streams. As such, upland segments of roads can generally be designed to mitigate sediment delivery concerns.

Road density in a watershed affects the collection and transport of water out of the watershed (Burroughs and King 1989). The potential for increases in runoff rates increases with more miles of road. Road closures would be beneficial to water quality if the roads were properly decommissioned and well maintained after closure. A well-maintained, closed road system would result in less sediment from road surface erosion. Roads not proposed for use in the project area may have long-term adverse effects on water quality if they are not properly maintained. For this analysis, it is assumed that when a road is closed it will continue to have impacts on the aquatic system, and both of the action alternatives involve the closure of ML 1 roads and temp roads to use by the public rather than the physical removal of roads.

The primary concern is erosion and sediment delivery from roads that are near streams and that cross streams. Fine sediment is a key physical element to focus on when attempting to delineate land management impacts on aquatic habitat and biota (Rinne 1990). Excessive fine sediment input into a stream can fill pool habitat and reduce both summer and winter rearing habitat for juvenile fish (Heede and Rinne 1990). Stream crossings reduce riparian vegetation and widening of the channel which can also impact water temperature (Poole and Berman 2001, Beschta 1997, and Heede 1980). Not all species and ecosystems are equally affected by roads, but overall the presence of roads is highly correlated with changes in species composition, population sizes, and hydrologic and geomorphic processes that shape aquatic and riparian systems (Trombulak and Frissell 2000).

Impacts to individuals

Impacts to individuals are considered direct impacts and can include mortality and modification of behavior. Mortality would only occur from actions within species habitats. Modification of behavior can include factors such as disruption of social and feeding behavior that could reduce potential breeding or the health of individuals. It also includes displacement from an area temporarily which can also impact breeding or health. Therefore, increased acres or miles of treatments within the direct effects analysis area equates to an increase in potential impacts to individuals.

Habitat Connectivity

This was selected as a resource indicator specifically for roads as they can fragment aquatic or riparian habitat and impede or reduce movement. Therefore, increased miles of open roads equates to decreased habitat connectivity.

Road density has been considered a useful index of several ecological effects of roads in a landscape. Effects are evident for faunal movement, population fragmentation, human access, hydrology, aquatic ecosystems, and fire patterns. Hydrologic effects, such as altered groundwater conditions and altered drainage upslope, are sensitive to road densities. Increased peak flows in streams and macroinvertebrate diversity may be impacted with increasing road densities. Road density is an overall index that averages patterns over an area; its effects probably are sensitive to road type and width, traffic density, and network connectivity.

Pollutants and Invasive Species

This was selected as resource indicator for habitat quality to address the potential for introduction into aquatic habitats. Pollutants and disease introduced into aquatic habitats reduces habitat quality. Use of mechanical equipment and storage of fuels in or around streams or other water bodies can also introduce contaminants. Equipment that is not cleaned or leaking can bring oils or fuel directly into water.

Most chemical transport from roads occurs in storm water runoff through or over soil (Trombulak and Frissell 2000). Runoff pollutants alter soil chemistry, may be absorbed by plants, can affect stream ecosystems, where they are dispersed and diluted over considerable distances. Typical water-quality responses to road runoff include altered levels of heavy metals, salinity, turbidity, and dissolved oxygen. These water quality changes can be sporadic and localized due to fluctuations in water quantity.

Similarly, roads promote the dispersal of exotic or invasive species by altering habitats, stressing native species, and providing movement corridors that further spread these species. Mechanical equipment can carry exotic species or aquatic invasive species from one water body to another. This can spread species such as Didymo *(Didymosphenia geminata)* and Eurasian milfoil which can reduce aquatic habitat quality.

Environmental Consequences

Alternative 1 – No Action

There would be no direct effects on resource indicators for aquatic species and habitats as a result of the no action alternative, however there would be indirect effects by not moving these resources towards desired conditions. Existing conditions for watersheds would remained degraded and associated loss of habitat would continue which could potentially lead to reductions in populations over time.

Under the No Action Alternative, current conditions within subwatersheds could potentially degrade over time. Overstocked and dense stands within the project area would not be treated, leaving a less healthy, less vigorous, and under productive forest. Encroachment of conifers into riparian areas and wetlands would continue which could decrease shrub and herbaceous ground cover as well as soil hydrologic function (Brown 2018). Decreased ground cover and soil function can lead to increased overland flow, erosion, and sedimentation reducing riparian condition and aquatic habitats. Therefore, there is a potential loss of water available for stream flow during dry summer months due to unusually high amounts of water that are lost to overland flow and/or evapotranspiration due to high canopy densities. If current conditions degrade in reference to uplands, then associated riparian condition and aquatic habitat could also degrade, not meeting the need of protection and improvement of aquatic and riparian dependent species habitat. Furthermore, by perpetuating unusually high stand densities the probability for catastrophic fire increases. Uncharacteristic wildfire has the potential to greatly reduce riparian condition and aquatic resources by leaving no shade adjacent to streams (increased stream temperatures), denuding subwatersheds of vegetation thereby leaving exposed soils (increased sediment in streams) and resulting in ash flows.

This alternative would result in no additional acres of ground disturbance or associated actions to riparian condition, habitat connectivity, aquatic habitat, individuals, or increase pollutants/introduced species. Sediment delivery to riparian areas, streams and wetlands would continue at current rates or gradually increase from poor upland conditions. Peak flows may also continue to be altered by reduced soil moisture storage and infiltration capacity producing high peak flows of short duration during high intensity summer precipitation events. Such peak flows can overwhelm riparian areas and streams altering associated riparian and aquatic habitat.

Under the no action alternative, roads would not be decommissioned and the drainage network of a streams remains unnaturally higher. Roads can directly affect the channel morphology of streams by accelerating erosions and sediment delivery and by increasing the magnitude of peak flow. Indirectly, if current conditions degrade then habitat for aquatic species will also degrade. The more roads and stream crossings there are, the higher the probability of sediment delivery to streams, negatively affecting the hydrologic function. In addition, roads affect the hydrograph and drainage density, increasing peak flows and decreasing low flows. This alternative does not meet the need for improvement of aquatic habitat.

The level of risk associated with riparian and watershed conditions as well as species and habitats would be higher with this alternative since the amount and intensity of aquatic restoration would be much less. Furthermore, federally listed native fish would also be at a higher risk of extirpation under current conditions (climate change, low viability, degraded baseline conditions) as it is assumed that minimal aquatic restoration would occur via other projects with the No Action Alternative.

Since no treatments of any kind would be implemented, there would be no direct effects to aquatic resource indicators except for existing Forest Service Roads at road/stream crossings. (table 3-33). However, the potential for substantial indirect effects would exist through failure to reduce current fuel loading conditions that could result in uncharacteristic stand replacing wildfire. This could result in the reduction of riparian condition through loss of canopy cover and structure, increased sedimentation and ash, increased peak flows, and reduction or loss of large wood recruitment. These potential changes in riparian conditions would also result in decreases in food resources, habitat quality, and quantity. Uncharacteristic wildfire in within riparian areas and streams could harm or reduce species populations either directly or indirectly through alteration of habitat.

Under this alternative, conditions in existing or potential habitat that provide for aquatic species would remain in their current condition, notwithstanding natural processes. No restoration of streams, floodplains, wetlands, or riparian areas would occur.   Conifer encroachment would continue into wet and dry montane meadows. Riparian vegetation would reflect conditions that are suited towards a dryer climate such as grasses. Grass species have less root mass than riparian species and therefore do not have the ability to stabilize the incised streambanks. Current riparian and watershed conditions of Functioning at Risk or Impaired would continue to limit the quality of aquatic habitat and therefore species occupancy. Consequently, Alternative 1 would not be beneficial for riparian condition, aquatic habitat quality or quantity.

Table 80. Resource Indicators and Measures for Alternative 1 by Species.

Species	Mechanical Thinning Acres	Prescribed Burning Acres	Miles of Open Forest Service Roads	IWPS Acres	Rock Pit Acres	General /Heavy Mechanical Stream Restoration Miles
Gila trout	0	0	0	0	0	0/0
Gila chub	0	0	0	0	0	0/0
Gila topminnow	0	0	0	0	0	0/0
Little Colorado spinedace	0	0	0	0	0	0/0
Little Colorado spinedace CH	0	0	0	0	0	0/0
Loach minnow	0	0	0	0	0	0/0
Razorback sucker	0	0	0	0	0	0/0
Spikedace	0	0	0	0	0	0/0
Narrow-headed gartersnake & CH	0	0	0	0	0	0/0
Northern Mexican gartersnake & CH	0	0	0	0	0	0/0
Desert Sucker	0	0	0	0	0	0/0
Sonoran Sucker	0	0	0	0	0	0/0
LC sucker	0	0	0	0	0	0/0
Headwater chub	0	0	0	0	0	0/0
Roundtail chub	0	0	0	0	0	0/0

Effects Common to Both Action Alternatives

Opening ML-1 Roads

For Alternatives 2 and 3, it is assumed that all 5,682 miles of existing Forest Service roads within the project area will be utilized to provide access for removal of forest projects generated from the proposed mechanical vegetation activities as well as for other activities (table 3-41). This includes temporarily opening all existing closed roads (ML-1) to utilize them for the time period that they are needed to provide access. These roads shall be closed upon completion of work and returned to a closed status (ML-1). For further explanation see the transportation specialist report (Rich 2018).

Table 81. Change Miles Of Open Forest Service Roads Treatments For Alternatives 2 & 3 As Compared To Alternative 1 Within The Project Area.

Maintenance Level	Alternative 1 Total Open Road Miles	Alternative 2 & 3 Open Road Miles
1- Basic Custodial Care (closed)	0/ 0	2,076
2 - High Clearance	2,864	2,864
3 - Suitable for Passenger Vehicles	669	669
4 - Moderate Degree of User Comfort	71	71
5 - High Degree of User Comfort	2	2
Total System Roads	3,606	5,682

Opening of ML-1 roads has the potential for direct short and mid-term impacts to aquatic indicators. Direct impacts would result if these activities occur in a species habitat. Both Alternatives are proposing treatments in the habitats of nine fish species and both gartersnakes (table 3-42). Increases in miles of open roads ranges from 21% to 127% of the analysis area for direct effects for seven species. The five species that occur downstream of the project have no increases in open roads within their direct effect analysis areas. Increases in road mileage are related to opening ML-1 roads within the direct effects analysis area. Little Colorado spinedace and roundtail chub have the largest increases in mileage; while headwater chub has no change in mileage in relation to direct impacts. Therefore Alternatives 2 and 3 would result in more potential direct impacts by increasing road density than Alternative 1.

Opening ML-1 roads can cause negative short and mid-term impacts to riparian condition, habitat connectivity, individuals, and introduction of pollutants or aquatic invasive species that are similar to new road or trail construction. Direct impacts to riparian condition include reduction riparian vegetation cover or structure removal of vegetation. This would be a direct impact to gartersnake critical habitat as well as some aquatic macroinvertebrate species habitat. The number of stream crossings could also be increased causing a direct effect to fish as well as indirect impacts of increased sedimentation from streambank damage. Indirect impacts of increased stream temperature could also occur from reduction in canopy cover within riparian areas. Associated ground disturbance and increased sedimentation delivery to riparian areas and streams is expected to occur short to mid-term until the roads were closed.

Table 82. Change By Species In Miles Of Open Forest Service Roads For Alternative 2 &3 As Compared To Alternative 1. Percentages Reflect Changes In Acreages Within Species Direct Effects Analysis Areas.

Species	Alternative 1: Miles of Open Forest Service Roads	Alternative 2 & 3: Miles of Open Forest Service Roads/ Percent Increase
Gila trout	7	9/ 26%
Gila chub	0	0
Gila topminnow	0	0
Little Colorado spinedace	18	41/ 121%
Loach minnow	0	0
Razorback sucker	0	0
Spikedace	0	0
Narrow-headed gartersnake	7	9/ 29%
Northern Mexican gartersnake	4	5/ 25%
Desert Sucker	23	45/ 90%
Sonoran Sucker	6	7/ 21%
Little Colorado sucker	18	40/ 114%
Headwater chub	13	13/ 0%
Roundtail chub	5	12/ 127%

Indirect impacts to riparian condition and introduction of pollutants could occur from opening ML-1 roads in upper watersheds for all analyzed species (table 3-43). Increases in miles of open roads range from 4% to 115%. Narrow-headed gartersnake and Sonoran sucker have the largest increases in road mileage. Gila chub and the four species in Fossil Creek (Gila topminnow, Loach minnow, Razorback sucker, and Spikedace) have the lowest increases in open road mileage since only a portion of those subwatersheds are within the project area. Alternatives 2 and 3 would have more direct impacts from opening ML-1 roads within species action areas than Alternative 1.

Table 83. Change By Species In Miles Of Open Forest Service Roads For Alternative 2 &3 As Compared To Alternative 1. Percentages Reflect Changes In Acreages Within Species Analysis Areas. These Are Considered Indirect Impacts.

Species	Alternative 1: Miles of Open Forest Service Roads	Alternative 2 & 3: Miles of Open Forest Service Roads/ Percent Increase

Gila trout	232	324/ 40%
Gila chub*	61	63/ 4%
Gila topminnow*	63	70/ 11%
Little Colorado spinedace	917	1768/ 93%
Loach minnow*	63	70/ 11%
Razorback sucker*	63	70/ 11%
Spikedace*	63	70/ 11%
Narrow-headed gartersnake	170	372/ 119%
Northern Mexican gartersnake	86	142/ 65%
Desert Sucker	1034	1439/ 39%
Sonoran Sucker	112	240/ 115%
Little Colorado sucker	796	1412/ 77%
Headwater chub	354	438/ 24%
Roundtail chub	475	907/ 91%

*While the percentage is high for these species action areas, less than half of entire watershed is within the project area.

Indirect impacts of opening ML-1 roads in the upper watershed could occur to riparian condition and by introduction of pollutants or invasive aquatic species. In general, roads compact soils and reduce infiltration of water leading to increased erosion and runoff. They increase the drainage network to riparian areas and streams and connect these areas to the uplands by altering surface water pathways. This converts dispersed surface runoff and sediment filtering through a riparian area to direct deliveries of accumulated runoff and sediment. Pollutants and aquatic invasive species can be transferred to aquatic systems from machinery or vehicles. Leaking fuels or lubricants can be transferred to aquatic systems from vehicles, machinery, or fuel storage areas. Aquatic invasive species can similarly be transferred from an infected water body to an uninfected waterbody through driving.

Roads not only impact perennial and intermittent streams where aquatic species and riparian areas are present, but influence these habitats where they are located adjacent to or cross ephemeral channels in the watershed. Ephemeral streams indirectly support aquatic populations by providing required nutrients and other materials to the perennial streams (Levick et al. 2008).

Potential indirect effects are expected to vary based on current riparian condition. Species with riparian conditions that are currently impaired are expected to have a higher level of indirect effects from sedimentation and peak flows. They are currently not capturing or processing sediment, indicating more could potentially reach stream from direct delivery. Stream energy from increased peak flows and concentrated flows would not be dissipated potentially altering instream habitats. Riparian areas that are functioning at risk or functioning properly would be capable of processing some levels of sediment and peak flows; however, the concentrated delivery from roads would still have negative impacts over the mid-term timeframe until they were closed.

Opening ML-1 roads will also increase road density during the timeframe that proposed project activities are occurring. This will negatively impact the Roads and Trails indicator for Watershed Condition Framework in the interim impacting one of the five factors associated with aquatic species and habitats.

Design features for roads are expected to reduce some of the potential impacts to aquatic species and habitats. Minimizing disturbance of existing vegetation in ditches and at stream crossings during maintenance. New cross drains will discharge to stable areas where the outflow will quickly infiltrate the soil and not develop a channel to a stream. Whenever possible, use existing stream crossings unless a new crossing would result in less resource damage.

In Woods Processing Sites (IWPS) and Biomass Storage

Twelve processing sites ranging in size from 2 to 21 acres are being proposed on the Coconino and Tonto NFs and analyzed for environmental effects for both Alternative 2 and 3 of Rim Country (table 3-44). Processing site location and siting considerations include: flat uplands less than 5% slope; more than 200 feet from perennial, intermittent, and ephemeral stream channels/ more than 300 feet from meadows, springs, and karst features; more than ¼ mile from Mexican spotted owl Protected Activity Centers, and outside of Northern goshawk Protected Family Areas; more than ¼ mile from system hiking trails, campgrounds, and group event recreation sites; more than ¼ mile from private lands, residences, or offices; and adjacent to roads that are open year-round for product removal. Processing sites were located to provide a buffer of 100 to 300 feet from forest roads and state highways to provide for visual screening from Concern Level 1 and 2 travelways. Site boundaries are approximate and may be further modified during implementation and layout.

The processing of wood at up to twelve different sites within or immediately adjacent to the project area may involve such tasks as drying and debarking of logs; chipping stems, bark, and limbs; cutting logs; sorting logs; producing wood cants (logs sawn flat on one to four sides); scaling and weighing logs; and creating poles from suitable sized logs. Equipment that may be used at processing sites includes circular or band saws, various sizes and types of front-end loaders, log loaders, chippers of several types, mechanized cut to length systems, associated conveyers and log sorting bunks for accumulation and storage of logs, as well as electric motors and gas or diesel generators to provide power. Aboveground fuel storage tanks may be necessary to provide on-site fuel to equipment.

The twelve wood processing sites that have been proposed range in size from 4 to 21 acres. These sites were screened so as to be located outside of meadows where some of the most productive forest soils are found, and in relatively flat areas. The siting of processing sites in relatively flat areas would minimize the need for extensive site grading.

In order to facilitate the types of tasks and equipment that may be used at these sites, they would typically have to be cleared and grubbed (i.e., vegetative cover and trees removed) resulting in displacement of top soil and exposure of subsoil. The operation of equipment on these sites would result in compaction of the soil, reducing the ability of soils to infiltrate water. Areas of exposed soil would have to be covered with aggregate to minimize erosion and facilitate use of the site. The aggregate surfacing would cover the surface soil where it is not graded, and would protect the soil productivity. Various permits would need to be obtained for fuel storage, industrial site use and stormwater pollution prevention.

Following completion of use of processing sites and removal of all equipment and materials, site rehabilitation would have to be accomplished including but not necessarily limited to removal of aggregate, restoration of pre-disturbance site grades, decompaction of soil for seedbed preparation, and seeding and mulching of the site with native grasses and forbs.

Table 84. In woods processing sites and associated acreages

Site Name	Acres
FR 117, 1321	4
FR 137, 96	18
FR 145A, 9615X	7
FR 288, 2781	4
FR 294, 294D	18
3238, 512	20
FR 582, Hwy 87	5
FR 609, 1938	7
FR 74, 64	8
FR 81, 81E	7
9364L, FH 3	21
9731G, Hwy 87	9
Total (13)	142

No direct effects to any aquatic indicators are expected to occur from IWPS (table 3-45). None of the proposed IWPS occur within 0.4 mile of occupied or suitable habitat. In addition, they occur within conifer ERUs (Ponderosa Pine, Ponderosa Pine-Evergreen Oak, Mixed Conifer w/ Aspen, and Mixed Conifer) and not within any riparian areas.

Table 85. Change By Species In The Acres Of In Woods Processing Sites For Alternatives 2 & 3 As Compared To Alternative1. Percentages Reflect Changes In Acreages Within Species Direct Effects Analysis Areas.

Species	Alternative 1: Acres of In Woods Processing	Alternatives 2 &3: Acre of In Woods Processing/ Percentage of Direct Effects Area
Gila trout	0	0/ 0%

Gila chub	0	0/ 0%
Gila topminnow	0	0/ 0%
Little Colorado spinedace	0	0/ 0%
Loach minnow	0	0/ 0%
Razorback sucker	0	0/ 0%
Spikedace	0	0/ 0%
Narrow-headed gartersnake	0	0/ 0%
Northern Mexican gartersnake	0	0/ 0%
Desert Sucker	0	0/ 0%
Sonoran Sucker	0	0/ 0%
Little Colorado sucker	0	0/ 0%
Headwater chub	0	0/ 0%
Roundtail chub	0	0/ 0%

Indirect impacts from IWPS have the potential to occur to seven of the species based on their action areas. Two species (Gila trout and Sonoran Sucker) would have no indirect impacts. Acreages of IWPS range from 3.1 to 57.4 acres for both gartersnakes and desert sucker, respectively (table 3-46). Negative indirect impacts to riparian condition in the form of sedimentation are possible, but limited based on less than 0.5% of any species action area being impacted. In Woods Processing Sites would also have limited negative impacts to aquatic macroinvertebrates based on the very low percentage of IWPS acreage in any of the subwatersheds. For California floater, only two watersheds have the potential for any indirect impacts, with a total of approximately 72 acres of IWPS within those watersheds. The other aquatic macroinvertebrates share similar stream and riparian habitats with fish and gartersnakes; therefore, overall acreages of IWPS are still below 1% combined.

The Apache-Sitgreaves NFs do not have any of the identified IWPS listed above; instead they will allow biomass (needles, tree tops and branches up to 5 inches) waiting to be processed to remain on forest during mechanical operations for up to 90 days. The timeframe allowed may be shortened based on conditions such as fire risk preparedness levels.

Allowing biomass to stay on the Apache-Sitgreaves Forest should not directly impact aquatic species or habitats, but could have indirect impacts. Piling of any kind is not allowed within Aquatic Management Zones; therefore this action should not have any direct effects. Indirect effects could include soil disturbance from machinery moving material to and from the piles as well as hauling. Soil disturbance can lead to erosion and contribute fine sediment to streams negatively impacting aquatic habitat, species, and water quality; particularly eggs and early life stages that occur on or within substrate and aquatic macroinvertebrate community structure. Habitat can be negatively impacted by filling of pools and spawning substrates which can lead to loss of habitat quality and reduced reproductive success. Excessive fine sediment can impact macroinvertebrate prey bases and other food sources such as algae.

Similarly, leaving biomass should not directly impact sensitive invertebrates, but could have direct impacts. For aquatic invertebrate species, increased fine sedimentation can lead to physical effects as well as changes in habitat and food availability and quantity. Physical effects include abrasion, clogging of gills and filter-feeding apparatus, burial, and changes in substrate composition (Jones et al. 2012). Bivalve mollusks, such as California floater, are capable of expelling unwanted particles from their gulls but can also expend more energy doing so than is gain from feeding. Filter feeding caddisfly larvae are generally not present in streams receiving high inputs of fine sediment. Burial presents difficulties for sedentary animals, such as mollusks, but can affect motile invertebrates where rates of deposition are high. When inputs of fine sediment are increased in watersheds, interstices between large particles become filled which reduces refugia from predators or high-flow events. Most aquatic invertebrates are strongly associated with substrate composition; therefore increased fine sediment can alter habitat availability. Increased sedimentation can also decrease the nutritional quality of periphyton (the film of attaches algae, fungi, bacteria, organic matter, and sedimented material found on the surface of stones). Some caddisflies, stoneflies, and mayflies are particularly impacted by sedimentation (Harrison et al. 2007).

Table 86. Change By Species In The Acres Of In Woods Processing Sites For Alternatives 2 & 3 As Compared To Alternative1. Percentages Reflect Changes In Acreages Within Species Analysis Areas. These Are Considered Indirect Impacts.

Species	Alternative 1: Acres of In Woods Processing	Alternatives 2 & 3: Acre of In Woods Processing/ Percentage of Direct Effects Area
Gila trout	0	0/ 0%
Gila chub	0	0/ 0%
Gila topminnow	0	0/ 0%
Little Colorado spinedace	0	25.7/ 0.01%
Loach minnow	0	0/ 0%
Razorback sucker	0	0/ 0%
Spikedace	0	0/ 0%
Narrow-headed gartersnake	0	3.1/ 0%
Northern Mexican gartersnake	0	3.1/ 0.01%
Desert Sucker	0	57.4/ 0.02%
Sonoran Sucker	0	0/ 0%
Little Colorado sucker	0	25.7/ 0.01%
Headwater chub	0	8.5/ 0.01%
Roundtail chub	0	38.5/ 0.02%

In Woods Processing Sites could have negative short and mid-term indirect impacts to riparian condition similar to landings. In general, soils can be compacted and water infiltration reduced leading to increased runoff and sediment delivery to riparian areas and streams. This can reduce riparian condition, aquatic habitat quality and quantity depending on its current condition.

Potential indirect effects are expected to vary based on current riparian condition. Riparian condition for both gartersnakes, desert sucker and Sonoran sucker are currently impaired, therefore indirect effects are expected to be higher. Vegetation in these systems is not adequate to capture or process sediment, indicating more would reach streams. These riparian areas are often disconnected from the water table and are more reflective of upland species; therefore unable to dissipate stream energy associated with increased peak flows. Riparian condition for five species is currently functioning at risk, therefore indirect effects are expected to be less.

Vegetation in these systems has loss of vigor, growth, or changes in composition, but is present and able to process sediment and dissipate flows in a limited capacity. Riparian condition for the remaining four species in Upper Fossil Creek is functioning properly. While indirect effects could occur, these riparian areas are able to process sediment and dissipate flows.

For those species with impaired or functioning at risk riparian condition, elevated sedimentation could negatively impact aquatic habitat, species, and water quality; particularly fish eggs and early life history stages that occur on or within substrate as well as the aquatic macroinvertebrate community structure. Habitat is impacted by filling of pools and spawning substrates which can lead to loss of habitat quality and reduced reproductive success. Peak flows can be increased altering channel forming flows leading to bank erosion and loss of habitat complexity. Reduction in riparian vegetation can lead to decreased organic matter input to support aquatic macroinvertebrates and increases stream temperature.

Potential indirect impacts of IWPS and biomass storage could occur short and mid-term. However, given the low overall acreage within species action areas, indirect effects are considered to be minimal.

Rock Pit Development or Expansion

In order to provide adequate sources of road surfacing material, rock pits will be need to be utilized and expanded within the project area. Eleven existing pits on are proposed for expansion. In order to allow for potential future material needs, all pits are proposed for a 30% expansion of their current foot print. Current acreage and proposed future acreage are shown in table 3-47.

Table 87. Current Acreage Of Proposed Rock Pits For Use And Proposed Acreage Pit Expansion.

Pit Name	Current Acreage	Increase in Acreage	Possible Future Acreage
34T	5	2	7
213	7	2	9
Pias Farm	6	2	8
115	7	2	9
717E	2	1	3
34B	5	2	7
Promontory	16	5	21
Carr Lake	12	4	16
Brookbank	1	1	2
Borrow	12	4	16
Cottonwood Wash	6	2	8
Total	**98**	**33**	**131**

No direct effects to any aquatic species or habitats are expected to occur from Rock Pit use or expansion. Table 3-48 displays this information. None of the proposed rock pits occur within ½ mile of occupied or suitable habitat. In addition, they occur within conifer ERUs (Ponderosa Pine, Mixed Conifer w/ Aspen, and Mixed Conifer) which are not utilized by sensitive invertebrate species, therefore no direct impacts would occur.

Table 88. Change By Species In The Acres Of Existing Rock Pits Sites And Their Expansion For Alternatives 2 & 3 As Compared To Alternative 1. Percentages Reflect Changes In Acreages Within Species Direct Effects Analysis Areas.

Species	Alternative 1: Acres of Rock Pits	Alternative 2 &3: Acre of Rock Pits/ Percentage of Direct Effects Area
Gila trout	0	0/ 0%
Gila chub	0	0/ 0%
Gila topminnow	0	0/ 0%
Little Colorado spinedace	0	0/ 0%
Loach minnow	0	0/ 0%
Razorback sucker	0	0/ 0%
Spikedace	0	0/ 0%
Narrow-headed gartersnake	0	0/ 0%
Northern Mexican gartersnake	0	0/ 0%
Desert Sucker	0	0/ 0%
Sonoran Sucker	0	0/ 0%
Little Colorado sucker	0	0/ 0%
Headwater chub	0	0/ 0%
Roundtail chub	0	0/ 0%

Indirect impacts from rock pit use and expansion within the upper watershed have the potential to occur to six of the species. Three species (Gila trout, Sonoran Sucker, and Desert Sucker) would have no indirect impacts. Acreages of rock pits within species action areas range from 4.6 to 200.6 acres (table 3-49). Little Colorado spinedace and sucker have higher acreages of Rock Pits versus all other species. Overall, potential negative impacts are limited based on less than 1% of any species action area being impacted.

Indirect impacts to aquatic macroinvertebrates could occur from Rock Pit use and expansion similar to fish and gartersnakes. For California floater, only Upper Clear Creek watershed has any rock pits, approximately 177 acres or less than 1% of that 5th Code watershed.

Negative indirect effects from rock pits could potentially occur to riparian condition. Expansion of the pits would result in removal of some additional vegetation (Table 41) and could lead to some increases in erosion and sedimentation. However, design features limiting vegetation removal, erosion control, and reclamation are expected to reduce the potential for any impacts to riparian condition.

Table 89. Change By Species In The Acres Of Existing Rock Pits Sites And Their Expansion For Alternatives 2 & 3 As Compared To Alternative 1. Percentages Reflect Changes In Acreages Within Species Analysis Areas. These Are Considered Indirect Impacts.

Species	Alternative 1: Acres of Rock Pits	Alternative 2: Acre of Rock Pits/ Percentage of Action Area
Gila trout	0	0/ 0%
Gila chub	0	0/ 0%
Gila topminnow	0	0/ 0%
Little Colorado spinedace	20	200/ 0.07%
Loach minnow	0	0/ 0%
Razorback sucker	0	0/ 0%
Spikedace	0	0/ 0%
Narrow-headed gartersnake	0	5/ 0.01%
Northern Mexican gartersnake	0	5/ 0.01%
Desert Sucker	0	5/ 0.00%
Sonoran Sucker	0	0/ 0%
Little Colorado sucker	0	103/ 0.05%
Headwater chub	0	5/ 0%
Roundtail chub	0	0/ 0%

Stream, Riparian, Wet Meadow, and Spring Restoration

Alternatives 2 and 3 includes restoration treatments to improve riparian areas, stream habitat, springs, wet meadows, and reduce upland erosion and excess sediment transport to streams. Approximately 628 miles of streams, 184 springs and 14,720 acres of riparian habitat have been identified for potential restoration activities. In addition, approximately 200 miles of protective barriers around springs, aspen, native willows, and big-tooth maples, as needed for restoration. Methods for stream restoration vary and specific treatments will be determined prior to implementation. The Aquatic and Watershed Flexible Toolbox Approach (AWFTA) outlines the potential treatments that are being analyzed (appendix C).

Restoration of streams, riparian areas, springs, and wet meadows to improve stream habitat, stabilize stream channels and streambanks. There are categories of watershed and stream impairments that are common throughout the project area that may be appropriately addressed with a suite of restoration treatments, referred as “tools”, with predictable effects that can be analyzed as part of this project. Having a suite of tools available for restoration helps account for imperfect information and adjust treatments in a variety of existing conditions, enabling project implementers to find the best solutions for a site-specific problem. Tools that might be appropriate in one area (e.g., stream type) may not be the right tool somewhere else. This flexible toolbox approach provides the ability to adapt treatments to unanticipated conditions and applies to both alternatives 2 and 3; the complete toolbox can be found in appendix C. Prescribed burning, mechanical vegetation thinning, and roads work in the toolbox are analyzed and addressed as part of alternatives 2 and 3.

Proposed stream restoration was categorized as either general stream treatments or heavy mechanical stream treatments based on the methods of implementation. General stream treatments are described as any methods in the AWFTA that do not involve heavy mechanical equipment in or near a stream. Examples would include methods such as: fencing, planting, tools for improving spring outflows, and Zuni bowls or one rock dams as described in the AWFTA. Heavy mechanical stream treatments are reflective of treatments such as, but not limited to, channel reconstruction, channel realignment, and floodplain reconnection. The majority of the heavy mechanical treatments are described in appendix C under the heading "Tools for improving the form and function of stream channels and floodplains".

General stream treatments could have direct and indirect impacts to aquatic indicators. Miles of proposed treatments range from 5 miles for Sonoran sucker to 179 miles for Little Colorado spinedace (table 3-50). No direct or indirect impacts are expected to occur for 7 species as no treatments are proposed within their habitats, this includes both gartersnakes. The proposed activities are intended to enhance riparian and aquatic conditions at the site scale. All of these actions may result in some degree of short and mid-term negative effects to aquatic species and their habitats.

Direct effects to riparian condition would include ground disturbance reducing riparian vegetation cover or structure short to mid-term. Ground disturbance would lead to indirect impacts increased sedimentation during project implementation. These impacts are considered short-term (a few weeks) and sediment should be moved downstream during the first high stream flow. Beneficial impacts of general stream treatments can be immediate and long-term. Stabilizing headcuts has an immediate impact of stabilizing a stream and improving fish passage upstream. Riparian planting increases bank stability, shade, and organic matter inputs to streams improving stream habitat.

Table 90. Change By Species In The Miles Of General And Heavy Mechanical Stream Restoration For Alternatives 2 & 3 As Compared To Alternative 1. Percentages Reflect Changes In Acreages Within Species Analysis Areas. These Are Considered Direct And Indirect Impacts.

Species	Alternative 1	Alternatives 2 & 3: General Stream Treatment Miles/ Percentage of Action Area.	Alternatives 2 & 3: Heavy Mechanical Stream Treatment Miles/ Percentage of Project Area
Gila trout	0	7/ 22%	4/ 13%
Gila chub	0	0/ 0%	0/ 0%
Gila topminnow	0	0/ 0%	0/ 0%

Species	Alternative 1	Alternatives 2 & 3: General Stream Treatment Miles/ Percentage of Action Area.	Alternatives 2 & 3: Heavy Mechanical Stream Treatment Miles/ Percentage of Project Area
Little Colorado spinedace	0	179/ 96%	24/ 13%
Loach minnow	0	0/ 0%	0/ 0%
Razorback sucker	0	0/ 0%	0/ 0%
Spikedace	0	0/ 0%	0/ 0%
Narrow-headed gartersnake	0	0/ 0%	0/ 0%
Northern Mexican gartersnake	0	0/ 0%	0/ 0%
Desert Sucker	0	51/ 48%	18/ 17%
Sonoran Sucker	0	5/ 37%	3/ 26%
Little Colorado sucker	0	123/ 84%	14/ 10%
Headwater chub	0	9/ 19%	7/ 14%
Roundtail chub	0	23/ 66%	3/ 10%

Heavy mechanical stream treatments could have negative direct and indirect impacts to aquatic indicators. These treatments inherently include disturbance in streams, their floodplains, and associated riparian areas in order to improve form and function. Miles of proposed treatments range from 3 to 24 miles, which encompasses 10% to 26% of occupied habitats. No direct and indirect impacts are expected to occur for 7 species as no treatments and proposed within their habitats, this includes both gartersnakes. Sonoran sucker and Desert sucker have the highest percentage of occupied/suitable habitat within proposed heavy mechanical stream treatments.

Short-term direct impacts of heavy mechanical stream restoration could occur to individuals, while indirect impacts to riparian condition, introduction of contaminants, and spreading of aquatic invasive species or disease could occur during project implementation.

Direct impacts in the form of mortality could occur from heavy machinery in and around streams, springs and wetlands. These are considered short-term effects as they would only occur while heavy equipment was operating. Conservation measures to look for and move gartersnakes, remove and isolate fish from instream construction, and in water work periods are expected minimize the potential for direct impacts. In water work periods will be determined on a project specific basis and jointly by Forest Service, U.S. Fish and Wildlife Service and Arizona Game and Fish Department due to the overlapping of federally listed and sensitive species.

Short-term negative impacts of temporarily restricting habitat or habitat access (displacement) could occur during project implementation. Coffer dams and bypass systems associated with heavy mechanical restoration activities may temporarily block (few weeks) fish movement up and/or downstream through the construction area. Up and downstream fish movement is provided by ditch bypass systems, downstream movement is provided with plastic-culvert bypass systems, and no fish movement is provided with pump bypass systems. Headcuts and existing structures to be repaired may serve as exiting fish-passage barriers; therefore, coffer dams and diversion structures may not be any more of a barrier than the pre-restoration baseline.

Riparian condition could be negatively impacted short-term inputs of increased sedimentation from instream structure placement, opening of side channels, road crossing treatments, and other projects inside or near the bankfull channel. The sediment plume from activities will be most concentrated in the immediate project vicinity and should dissipate throughout the stream channel within a few hours. The amount, extent, and duration of fine sediment inputs and turbidity relate to the following: the type and duration of heavy machinery used within or near a bankfull channel; soil type; the amount of soil disturbance; whether restoration is in or out of the wetted channel; the sensitivity of the channel banks to erosion and other disturbances; the amount of time it takes for disturbed areas to revegetate and stabilize; and the probability of precipitation events before disturbed areas are re-vegetated or stabilized.

The increased stream turbidity may deposit fine coats of sediment on channel substrate a short distance downstream, encourage fish and other aquatic species to move downstream, and alter fish behavior patterns for a short time. It is anticipated that all project related sediment will be flushed out during the first fall/winter/spring high flows after project completion, and site restoration conservation measures are expected to prevent future project related sediment inputs into the stream. Therefore, long-term negative impacts to substrate are not expected.

Contaminants and aquatic invasive species or diseases could be introduced into the stream from large equipment causing negative indirect impacts to aquatic species. Chemical transport could be direct into streams from equipment or from storm water runoff through or over soil. Pollutants alter soil chemistry, may be absorbed by plants, can affect stream ecosystems, where they are dispersed and diluted over considerable distances. Typical water-quality responses to pollutants include altered levels of heavy metals, salinity, turbidity, and dissolved oxygen. These water quality changes can be sporadic and localized due to fluctuations in water quantity. Aquatic invasive species or diseases could similarly be introduced to streams or waterbodies. Best management practices and conservation measures requiring cleaning equipment, checking for leaks, storage of fuels, and staging areas for equipment of AMZs minimizes or precludes the likelihood of either occurring.

Benefits from heavy mechanical stream restoration can be immediate and long-term by improving or restoring riparian condition via one of the following: stream structure/complexity, stream sinuosity and length, bank stability, floodplain connectivity. Such results will promote conditions that maintain or decrease stream temperature, reduce turbidity (via stable banks, improved sediment retention through increased channel structure, riparian areas, and floodplains), and improved nutrient input (via increases riparian organic input sources) and retention (via increased channel structure, sinuosity, and floodplain areas). It is anticipated that the project related sediment will be flushed out during the first spring high flows after project completion, and site restoration conservation measures are expected to prevent future project related sediment inputs into the stream. Therefore, long-term sediment impacts to sediment and turbidity are not expected.

Human constructed or caused physical barriers within the stream channel such as culverts and headcuts can impair sediment and debris transport, migration routes, life history patterns, and population viability. First and second order streams are the sources of water, nutrients, woods, another vegetative material for streams inhabited by fish and other aquatic organisms. Fish

Passage Culvert Projects, Headcut stabilization and Associated Fish Passage, and Legacy Structure Removal treatments would result in benefits such as uninhibited stream access for migrating and rearing fish, restored or improved continuous paths for wood, nutrients, sediments, and other vegetative material essential for quality fish habitat.

Upland soil restoration structures (e.g. Zuni bowls or native rock check dams) may be used to address site specific erosion/channelization resource issues within project watersheds. The number that may be installed will vary based on watershed needs. These structures will have a long term benefit of reducing erosion and sedimentation to stream by holding and stabilizing soils in the uplands and improving hydrologic condition and function. Riparian and rare plant planting and enclosures to protect existing or planted areas could occur where site-specific needs are identified in riparian areas, wet meadows, springs, and uplands areas such as where aspen or big-toothed maple occur. Riparian planting and enclosures along streams can improve bank stability, stream shading and aquatic habitat.

Aquatic Macroinvertebrates

Stoneflies, caddisflies, mayflies, midges, and riffle beetles are strongly associated with streams and riparian areas. Based on the biology and ecology of these four groups of species, stream and watershed restoration in accordance with the AWFTA could have negative direct and indirect impacts. Direct impacts to individuals and their habitats could occur short-term during project implementation. General stream treatments would have a low potential for direct and indirect impacts to these sensitive species given the methods included (e.g. fencing, planting). Heavy mechanical stream treatments have the potential for more direct effects as they include short-term habitat alteration in streams and riparian areas that could also impact individuals. Indirect effects of sedimentation from the AWFTA restoration treatments would last as long as the first few flushing flow events. Beneficial effects would occur from improved stream habitats and riparian vegetation long term.

Nokomis Fritillary is a sensitive species that utilizes meadows, seeps, and boggy streamside vegetation. General stream treatments would have a low potential for direct or indirect impacts to the species. Heavy mechanical stream treatments could have direct and indirect impacts. Short-term direct impacts to individuals and their habitat could occur during implementation. Indirect effects of habitat alteration would last until vegetation was restored or had regrown that supports the species. Beneficial effects would occur from improved stream-riparian interaction and riparian habitat.

For California Floater, general stream restoration treatments would have a low potential for direct or indirect impacts. Fencing across streams could directly impact the species, but is unlikely. Indirect impacts of sedimentation from these methods would also be considered negligible. Heavy mechanical stream treatments are proposed in Upper Clear Creek (49 miles) and West Clear Creek (2.9 miles) where the species historically or currently occurs. Short-term direct impacts would occur during implementation of instream treatments that could also impact individuals. Indirect impacts of sedimentation are expected to persist until first few flushing flows mobilize any sedimentation downstream. Beneficial effects would occur from improved stream habitats long term.

For all sensitive aquatic macroinvertebrates, streams and riparian areas could have short-term negative indirect impacts from proposed stream restoration as part of Alternatives 2 and 3. Short-term indirect effects of heavy mechanical stream restoration include increased sedimentation and turbidity, introduction of contaminants, and spreading of aquatic invasive species or disease during project implementation. Project level best management practices and mitigations would minimize the potential for introduction of contaminants or spread of aquatic invasive species or disease.

Road Relocation and Decommissioning

Road relocation and decommissioning include restoring a road surface to a more natural state. Short-term negative impacts to individuals and riparian condition would be similar to those discussed above for aquatic restoration. Direct impacts to individuals could occur for any work within species habitats. Riparian condition could be negatively impacted short to mid-term by increased sediment delivery until vegetation reestablished.

However, long term benefits of reducing road density have a cascade of effects: improved riparian condition from reduction in runoff and sedimentation, fewer roads crossings, and the ability for riparian vegetation to be restored, and decreased mortality or disturbance of species. Road density is a major factor in the current condition of most subwatersheds with aquatic species in the project area. Reducing road density by decommissioning roads could help improve that particular Watershed Condition Framework indicator. Relocating roads does not reduce overall road density, but can alleviate direct versus indirect impacts, particularly if move a road further from a stream or riparian area.

Design features for road relocation are expected to reduce some of the potential impacts. Relocated roads should be constructed in a manner that does not hydrologically connect them to streams to extent practicable. They will also have sufficient drainage features to maintain the integrity of the travel, thereby reducing erosion and sedimentation. New cross drains will discharge to stable areas where the outflow will quickly infiltrate the soil and not develop a channel to a stream. When feasible, relocate roads out of drainage bottoms to upland locations; if this is not possible rock armor outfall of drainage features to dissipate water energy. Contaminants and aquatic invasive species or diseases could be introduced into the stream from large equipment causing negative indirect impacts to aquatic species. Chemical transport could be direct into streams from equipment or from storm water runoff through or over soil. Pollutants alter soil chemistry, may be absorbed by plants, can affect stream ecosystems, where they are dispersed and diluted over considerable distances. Typical water-quality responses to pollutants include altered levels of heavy metals, salinity, turbidity, and dissolved oxygen. These water quality changes can be sporadic and localized due to fluctuations in water quantity. Aquatic invasive species or diseases could similarly be introduced to streams or waterbodies. Best management practices and conservation measures requiring cleaning equipment, checking for leaks, storage of fuels, and staging areas for equipment of AMZs minimizes or precludes the likelihood of either occurring.

Direct and Indirect Effects - Alternative 2

Mechanical Vegetation Treatments

For Alternative 2, acres of mechanical vegetation treatments has the potential for negative short and mid-term impacts to riparian condition and individuals. Direct negative short term impacts would result if these activities occur in a species habitat from actions such as yarding, skidding, or harm to gartersnakes during mechanical operations. Alternative 2 is proposing treatments within the habitats of seven fish species and both gartersnakes. Increases in acreages of treatments ranges from 203 to 3,891 acres which equates to 1% - 100% of the analysis area for direct effects for those species. Five fish species would not be directly impacted by mechanical vegetation treatments under Alternative 2. Table 3-34 displays this information for each species.

Table 91. Change by species in the acres of mechanical vegetation treatments for Alternative 2 as compared to Alternative1. Percentages reflect increases in acreage within direct effects analysis areas for species.

Species	Alternative 1: Acres of Mechanical Vegetation Treatment Acres	Alternative 2: Acre of Mechanical Vegetation Treatment Acres/ Percentage of Direct Effects Area
Gila trout	0	1,398/ 52%
Gila chub	0	0/ 0%
Gila topminnow	0	0/ 0%
Little Colorado spinedace	0	203/ 1%
Little Colorado spinedace CH	0	161/
Loach minnow	0	0/ 0%
Razorback sucker	0	0/ 0%
Spikedace	0	0/ 0%
Narrow-headed gartersnake & CH	0	2,266/ 93%
Northern Mexican gartersnake & CH	0	1,249/ 100%
Desert Sucker	0	3,891/ 29%
Sonoran Sucker	0	573/ 39%
Little Colorado sucker	0	3,292/ 25%
Headwater chub	0	1,939/ 55%
Roundtail chub	0	1,581/ 26%

Mechanical vegetation treatments can negatively impact riparian condition short to mid-term when they occur within the direct effects analysis area. Direct impacts of reduced riparian vegetation cover or structure could occur by removal of trees or crushed by machinery. These are also direct impacts to gartersnake critical habitat as well as habitat for some aquatic macroinvertebrates species. Indirect impacts of increased stream temperature from loss of canopy cover could occur, but should be limited based on design features associated with providing for and protection of existing stream shade. Indirect impacts of ground disturbance and increased sediment delivery to streams is expected to occur short to mid-term until ground cover is reestablished. Stream banks can be also be damaged, which are primary constituent element for some fish, however design features for mechanical vegetation treatments including restrictions for skid trails and yarding within riparian areas as well as protecting stream banks would minimize potential impacts.

Riparian condition for both gartersnakes, desert sucker and Sonoran sucker are currently impaired, therefore direct and indirect effects are expected to be higher. Vegetation in these systems is not adequate to capture sediment, are often disconnected from the water table and are more reflective of upland species. Riparian condition for the remaining species is functioning at risk, therefore direct and indirect effects are expected to be less. Vegetation in these systems has loss of vigor, growth, or changes in composition, but is present and functioning at some level.

Impacts to individuals in the form of harm or modification of behavior could also occur short to mid-term. Mechanical vegetation treatments within gartersnake habitat could result in harm of individuals as a direct effect. Indirectly, gartersnakes may avoid or move out of these areas while work is occurring causing displacement or disruption of social and feeding behavior. These indirect effects have the potential to reduce the health or reproductive capability of individuals.

Long term, mechanical vegetation treatments could have a neutral or positive effect on aquatic indicators. Riparian condition could be improved by removing encroachment and restoring streamside vegetation. Conifers can impede the growth the riparian woody and herbaceous species; therefore it is expected they would increase in cover and structure. This would provide for large woody debris over time as well as decreasing sediment delivery and peak flows. Impacts to individuals would cease once activities were completed and therefore have a neutral effect long term.

For Alternative 2, increased acres of mechanical vegetation treatments also has the potential for indirect occur short to mid-term impacts riparian condition from treatments in the upper watershed. These are indirect impacts that can occur within a species action area (i.e., project watershed area that drains into a species occupied habitat) by changes in the uplands and on tributaries and drainages. Increases in percent of action areas treated under Alternative 2 range from 54% to 94%. Table 138 displays these species habitats as compared to the existing condition (Alternative 1).

Table 92. Change by species in acres of mechanical vegetation treatments for Alternative 2 as compared to Alternative 1. Percentages reflect increases in acreage within species analysis areas. These are considered indirect impacts.

Species	Alternative 1: Acres of Mechanical Vegetation Treatment Acres	Alternative 2: Mechanical Vegetation Treatment Acres/ Percentage of Action Area
Gila trout	0	89,699/ 81%
Gila chub*	0	12,325/ 57%
Gila topminnow*	0	11,628/ 94%
Little Colorado spinedace	0	150,627/ 55%
Loach minnow*	0	11,628/ 94%

Razorback sucker*	0	11,628/ 94%
Spikedace*	0	11,628/ 94%
Narrow-headed gartersnake	0	65, 851/ 74%
Northern Mexican gartersnake	0	38,171/ 79%
Desert Sucker	0	207,340/ 65%
Sonoran Sucker	0	37,108/ 71%
Little Colorado sucker	0	121,732/ 54%
Headwater chub	0	117,548/ 83%
Roundtail chub	0	122,186/ 76%

*While the percentage is high for these species action areas, less than half of entire watershed is within the project area.

Mechanical vegetation treatments in uplands can indirectly impact riparian condition short to mid-term from increased sediment delivery and peak flows via removal of vegetation and ground disturbance. Soils can be compacted and water infiltration reduced from landings and skid trails leading to increased overland flow and erosion. Yarding and skidding can redirect water onto areas more likely to erode than natural channels. In turn, increased sedimentation and peak flows can occur reducing riparian condition, aquatic habitat quality and quantity.

Riparian condition for both gartersnakes, desert sucker and Sonoran sucker are currently impaired, therefore indirect effects are expected to be higher. Vegetation in these systems is not adequate to capture or process sediment, indicating more would reach streams. These riparian areas are often disconnected from the water table and are more reflective of upland species; therefore likely unable to dissipate stream energy associated with increased peak flows. Riparian condition for five species is currently functioning at risk, therefore indirect effects are expected to be less. Vegetation in these systems has loss of vigor, growth, or changes in composition, but is present and able to process sediment and dissipate flows in a limited capacity. Riparian condition for the remaining four species in Upper Fossil Creek is functioning properly. While indirect effects could occur, these riparian areas are able to process sediment and dissipate flows.

For those species with impaired or functioning at risk riparian condition, elevated sedimentation could negatively impact aquatic habitat, species, and water quality; particularly fish eggs and early life history stages that occur on or within substrate as well as the aquatic macroinvertebrate community structure. Habitat is impacted by filling of pools and spawning substrates which can lead to loss of habitat quality and reduced reproductive success. Peak flows can be increased altering channel forming flows leading to bank erosion and loss of habitat complexity. Reduction in riparian vegetation can lead to decreased organic matter input to support aquatic macroinvertebrates and increases stream temperature.

Design features related to mechanical vegetation treatments are expected to minimize the potential effects described above. The project includes spreading treatments in time and space within a watershed as well as for skid trails, yarding, and landings are expected to reduce these impacts.

Pollutants in the form of fuels and lubricants have the potential to be introduced into aquatic systems from staging areas and equipment. Spills and leaks can introduce pollutants to soils and then to streams and riparian areas reducing riparian condition and habitat quality. Design features for storm water protections plans, staging areas, fuel storage and checking equipment for leaks minimizes the potential for introduction of pollutants.

Long term, mechanical vegetation treatments are expected to improve overall watershed condition as well as riparian condition. Moving forests towards desired conditions of more a healthy, resilient state will provide for improved watershed function over time. It will also reduce the risk of uncharacteristic wildfire which can greatly impact all resource indicators and reduce aquatic habitat quality, quantity and populations. Alternative 2 will have more long term improvements to riparian condition than Alternatives 1 and 3 due to the increased overall acreage.

Prescribed Burning

For Alternative 2, acres of prescribed burning has the potential for negative short and mid-term impacts to riparian condition and harm to individuals. Direct short term impacts would result if these activities occur within species habitat from firelines, removal or reduction of vegetation due to burning or harm to gartersnakes. Alternative 2 is proposing treatments in the habitats of seven fish species and both gartersnakes (table 3-35). Increases in acreage of treatments ranges from 0 to 9,405 which equates to 0%-100% of the analysis area for direct effects for those species. Five fish species directly impacted by prescribed burning under Alternative 2.

Prescribed burning can negatively impact riparian condition short to mid-term when it occurs in the direct effects analysis area. Direct impacts of reduced riparian vegetation cover or structure and decreases in large wood recruitment could occur from burning. Decreases in willows and other shrubby species reduces hiding and thermal cover for gartersnakes. This would be a direct alteration of gartersnake critical habitat as well as potentially impacting some aquatic macroinvertebrate species. This reduction is only expected to occur until vegetation recovers. Reduction in canopy cover also reduces stream shading and can increase stream temperatures. It also reduces organic matter inputs to streams which can alter food webs and prey base for fish and gartersnakes. Indirect impacts of increased stream temperature from loss of canopy cover could also occur, but should be limited based on design features associated with limiting high burn severity (mortality) and ignitions within riparian areas.

Riparian condition for both gartersnakes, desert sucker and Sonoran sucker are currently impaired, therefore direct and indirect effects are expected to be higher. Vegetation in these systems is not adequate to capture sediment, are often disconnected from the water table and are more reflective of upland species. They already lack adequate streamside cover and structure, therefore those factors could be more susceptible to impacts. Riparian condition for the remaining species is functioning at risk, therefore direct and indirect effects are expected to be less as they have more cover and structure. Vegetation in these systems has loss of vigor, growth, or changes in composition, but is present and functioning at some level.

Long term effects of prescribed burning are expected to be positive for riparian condition. Reduced fuel loading would protect these areas from uncharacteristic wildfire in the future. Large woody debris recruitment and streamside cover or structure can also improve with prescribed fire. Fire plays an important role in maintaining heterogeneity in riparian and aquatic systems that has been excluded similar to surrounding uplands (Gresswell 1999); therefore, restoring the fire regime would have some benefits to riparian condition.

Impacts to individual gartersnakes in the form of mortality or modification of behavior could also occur short to mid-term. Mortality could occur during prescribed burning; however, gartersnakes are mobile and design features of no burn piles within their habitat reduces that potential. While gartersnakes are more susceptible to exposure during a prescribed fire, it is more likely that harm or displacement would occur until the burns were completed. Long term impacts to individuals would be neutral or potentially positive if habitat improved and similarly increased social or feeding behavior.

Table 93. Affected acres by species and the percent of change in the acres of prescribed burning for Alternative 2 as compared to Alternative 1. Percentages reflect changes in acreages within species direct effects analysis areas.

Species	Alternative 1: Acres of Prescribed burning	Alternative 2: Acres of Prescribed Burning/ Percent of Direct Effect Area
Gila trout	0	1,541/ 57%
Gila chub	0	0/ 0%
Gila topminnow	0	0/ 0%
Little Colorado spinedace	0	9,405/ 70%
Loach minnow	0	0/ 0%
Razorback sucker	0	0/ 0%
Spikedace	0	0/ 0%
Narrow-headed gartersnake	0	2,437/ 100%
Northern Mexican gartersnake	0	1,249/ 100%
Desert Sucker	0	4,542/ 34%
Sonoran Sucker	0	630/ 43%
Little Colorado sucker	0	6,734/ 52%
Headwater chub	0	2,090/ 60%
Roundtail chub	0	1,900/ 31%

Prescribed burning in uplands can indirectly impact riparian condition short to mid-term from increased sediment delivery and peak flows for all analyzed species. For Alternative 2, the increases in percentage of action areas treated range from 57% to 97%. Table 3-36 displays these species habitats as compared to the existing condition (Alternative 1). However, while the five species (denoted with an asterisk) show increases, it is important to note the overall acreage is small. This is due to less than half of their overall watershed occurring within the project. Therefore, while the percent increase is large the overall potential acres of impacts are much smaller than all other species. Overall impacts would be highest for both Gila Trout and Headwater Chub as most of their action area is encompassed and lowest for Gila Chub and the four species that occur in Fossil Creek.

Prescribed burning can indirectly impact riparian condition short to mid-term from increased sediment delivery and peak flows. Loss of ground cover from burning can increase erosion and overland flow which leads to increased sedimentation and peak flows. This could reduce riparian condition, aquatic habitat quality and quantity. However, these impacts are only expected to occur until ground cover vegetation recovers and has the ability to dissipate flows and trap sediment. Design features for extent of high burn severity as well as spatial and temporal spacing of activities within a watershed are expected to minimize potential impacts.

Riparian condition for both gartersnakes, desert sucker and Sonoran sucker are currently impaired, therefore indirect effects are expected to be higher. Vegetation in these systems is not adequate to capture or process sediment, indicating more could potentially reach streams. These riparian areas are often disconnected from the water table and are more reflective of upland species; therefore unable to dissipate stream energy associated with increased peak flows. Riparian condition for five species is currently functioning at risk, therefore indirect effects are expected to be less. Vegetation in these systems has loss of vigor, growth, or changes in composition, but is present and able to process sediment and dissipate flows in a limited capacity. Riparian condition for the remaining four species in Fossil Creek is functioning properly. While indirect effects could occur, these riparian areas are able to process sediment and dissipate flows. Overall acres of treatment for Gila chub, loach minnow, spikedace, razorback sucker, and Gila topminnow are less than half of the watersheds in which they occur further reducing potential indirect effects. Additionally, prescribed burning would only occur in the upper watershed within the project area.

For those species with impaired or functioning at risk riparian condition, elevated sedimentation could negatively impact aquatic habitat, species, and water quality; particularly fish eggs and early life history stages that occur on or within substrate as well as the aquatic macroinvertebrate community structure. Habitat is impacted by filling of pools and spawning substrates which can lead to loss of habitat quality and reduced reproductive success. Potential reductions in fish prey base could also indirectly impact gartersnakes. Peak flows can be increased altering channel forming flows leading to bank erosion and loss of habitat complexity. Reduction in riparian vegetation can lead to decreased organic matter input to support aquatic macroinvertebrates and increases stream temperature.

Long term effects of prescribed burning in the upper watersheds are expected to be positive for riparian condition. Reduced fuel loading would protect these areas from uncharacteristic wildfire in the future that can impact entire watersheds and have long lasting negative impacts on riparian condition, aquatic habitat quality and quantity, as well as populations of species.

Table 94. Change by species in the acres of prescribed burning for Alternative 2 as compared to Alternative 1. Percentages reflect changes in acreages within species analysis areas. These are considered indirect impacts.

Species	Alternative 1: Acres of Prescribed burning	Alternative 2: Acres of Prescribed Burning/ Percentage of Action Area
Gila trout	0	97,258/ 88%

Species	Alternative 1: Acres of Prescribed burning	Alternative 2: Acres of Prescribed Burning/ Percentage of Action Area
Gila chub*	0	12,328/ 57%
Gila topminnow*	0	11,990/ 97%
Little Colorado spinedace	0	172,583/ 63%
Loach minnow*	0	11,990/ 97%
Razorback sucker*	0	11,990/ 97%
Spikedace*	0	11,990/ 97%
Narrow-headed gartersnake	0	73,184/ 82%
Northern Mexican gartersnake	0	41,628/ 86%
Desert Sucker	0	230,200/ 73%
Sonoran Sucker	0	41,398/ 79%
Little Colorado sucker	0	141,334/ 63%
Headwater chub	0	127,710/ 90%
Roundtail chub	0	135,344/ 84%

*While the percentage is high for these species action areas, less than half of entire watershed is within the project area.

Temporary Roads

Temporary roads can cause negative impacts to riparian condition, habitat connectivity, as well as potentially introduce pollutants and or invasive species. Under Alternative 2, up to 330 miles of temporary roads could be utilized to facilitate mechanical vegetation activities. These may be new locations and/or utilizing non-system roads and they will be decommissioned when work is completed in the area that the access.

Temporary have the potential for direct short and mid-term impacts to aquatic indicators. Direct negative short and mid-term impacts would result if these activities occur within a species habitat to riparian condition, habitat connectivity, individuals, and introduction of pollutants or aquatic invasive species that are similar to new road construction. Direct impacts to riparian condition include reduction riparian vegetation cover or structure removal of vegetation which are components of gartersnake critical habitat as well as some aquatic macroinvertebrate species habitat. Reduction in canopy cover could subsequently lead to localized increases stream temperature. The number of stream crossings could also increase which can fragment habitat unless they allow for fish passage and lead to increased sedimentation from streambank damage. Harm could potentially occur to individual site specifically at stream crossings or within riparian areas. Associated ground disturbance and increased sedimentation delivery to riparian areas and streams is expected to occur short to mid-term until the roads were decommissioned. Design features for limiting stream crossings, not creating new temporary roads in Aquatic Management Zones, and reducing impacts of crossings on existing temporary roads are expected to minimize the potential impacts discussed above.

Indirect negative impacts of opening temporary roads in the upper watershed could also occur to riparian condition. In general, roads compact soils and reduce infiltration of water leading to increased erosion and runoff. They increase the drainage network to riparian areas and streams and connect these areas to the uplands by altering surface water pathways. This converts dispersed surface runoff and sediment filtering through a riparian area to direct deliveries of accumulated runoff and sediment. Decreases in riparian condition from increased in peak flows and sedimentation could occur, but would vary based on their current condition.

Pollutants and aquatic invasive species can be introduced directly or indirectly to aquatic systems from machinery or vehicles creating or using temporary roads. Pollutants in the form of fuels and lubricants have the potential to be introduced into aquatic systems from staging areas and equipment. Spills and leaks can introduce pollutants to soils and then to streams and riparian areas reducing riparian condition and habitat quality. Design features for storm water protections plans, staging areas, fuel storage and checking equipment for leaks minimizes the potential for introduction of pollutants. Aquatic invasive species can similarly be transferred from an infected water body to an uninfected waterbody through driving or placement of materials from an infected source. However, design features for decontamination of equipment and not transferring water are expected to minimize potential introduction or spread of invasive species.

Long term, potential direct and indirect negative impacts of temporary roads would cease as roads were decommissioned and revegetated. Therefore, long term effects are considered neutral to aquatic resource indicators. Overall, the potential short and mid-term negative impacts of temporary roads would be more than Alternatives 1 and 3.

Sensitive Species not Covered by Resource Indicators and Measures

Aquatic Macroinvertebrates

Stoneflies, caddisflies, mayflies, midges, and riffle beetles have diverse diets and feeding strategies, occupy different trophic levels and functional feeding groups from predators to filter feeders. Nymphs of the four groups are aquatic while adults stay in the riparian areas for reproduction.

Caddisflies are one of the largest groups of aquatic insects and are adapted to a wide range of microhabitats. Larval caddisflies have very diverse diets and feeding strategies, and occupy different trophic levels and functional feeding groups, including predators and filter feeders. Larvae are mainly herbivorous scavengers, feeding mainly on plant fragments and other living and dead organisms. Functionally, they can be collectors, shredders, scrapers, and predators. Feeding strategies may vary seasonally depending on items available and size of the caddisfly larvae. The larvae of most caddisfly species can be found in a variety of benthic habitats, including temperate lakes, streams, and ponds. Larvae of some species can tolerate low oxygen concentrations. Habitats can include benthic areas of streams, both cool and warm, lakes, marshes, and ponds. Caddisfly larvae are adapted to species-specific water temperatures and velocities, mineral and pollutant concentrations, and sunlight exposure. Because of this, many species can occur together in a single stream or river. Adult caddisflies are terrestrial, nocturnal, and hide in cool, moist habitats (e.g., riparian vegetation) during the day.

Mayflies are relatively primitive insects and exhibit a number of ancestral trails that were likely present in the first flying insects. Nymphs live primarily in streams under rocks, in decaying vegetation, or in sediments (substrate). Larval mayflies are mostly herbivores or detritivores feeding on algae, diatoms, or detritus but a few are predators. Adults do not feed, but stay near water for reproduction as eggs are laid in the water.

Net-winged midge larvae live in clean, cool, well-oxygenated rapid streams (cascades, rapids, waterfalls) attached to rocks or other smooth hard substrate. Adults usually stay in the riparian zone and are often seen resting on the undersides of leaves on riparian trees or on wet overhanging rock faces. Larvae are highly specialized scapers, grazing on periphyton and other organic matter on submerged rocks; diatoms are a major component of their diet.

Riffle beetles are frequent members of the invertebrate community of running water (streams). All species have aquatic larvae; some species adults are terrestrial but most are aquatic. Most species occur in well-aerated streams, but can occur on wave-washed lake shores. Little is known about the food of adults or larvae, but they appear to be collector-gathers and scrapers that feed chiefly on algae and detritus.

Based on the biology and ecology of these four groups of species, streams and riparian areas could have negative direct and indirect impacts from Alternative 2. Mechanical vegetation treatments, prescribed burning, and roads can increase erosion and sedimentation, alter riparian vegetation, and alter stream habitats leading to impacts as described for fish and gartersnake species above. Alternative 2 would potentially having long-term benefits from reducing the risk of uncharacteristic wildfire and reduced road densities.

Nokomis Fritillary is a sensitive species that utilizes meadows, seeps, and boggy streamside vegetation. Alternative 2 could have negative direct and indirect negative impacts to the species and its habitat. Mechanical vegetation treatments, prescribed burning, and roads can increase erosion and sedimentation, alter riparian vegetation, and alter stream habitats as described for fish and gartersnake species above. It could also reduce the availability of the butterflies host plant (*Viola nephrophylla*) short-term. Alternative 2 would potentially having long-term benefits from reducing encroachment into its habitat, reducing the risk of uncharacteristic wildfire and lowering road densities.

The California Floater was once present in Fossil Creek, West Clear Creek, and Upper Clear Creek and it is possible that it may still occur within Chevelon Creek below Chevelon Dam. Direct and indirect negative impacts could occur in two of the watersheds, while only indirect impacts would likely occur in Chevelon Creek and Fossil Creek. Mechanical vegetation treatments, prescribed burning, and roads can increase erosion and sedimentation, alter riparian vegetation, and alter stream habitats as described for fish and gartersnake species above. Alternative 2 would potentially having long-term benefits from reducing the risk of uncharacteristic wildfire and reduced road densities.

Direct and Indirect Effects - Alternative 3

Mechanical Vegetation Treatments

For Alternative 3, acres of mechanical vegetation treatments has the potential for negative short and mid-term impacts to riparian condition and individuals. Direct negative short term impacts would result during mechanical operations if these activities occur in a species habitat from yarding, skidding, or harm to gartersnakes. Alternative 3 is proposing treatments in the habitats of seven fish species and both gartersnakes. Increases in acreage of treatments ranges from 566 to 4,881 which equates to 19% - 100% of the analysis area for direct effects for those species. The two gartersnakes have the highest percentage of potential area impacted. Five fish species will not be directly impacted by mechanical vegetation treatments under Alternative 3. Table 3-37 displays this information for each species.

Table 95. Change by species in the acres of mechanical vegetation treatments for Alternative 3 as compared to Alternative1. Percentages reflect changes in acreages within species direct effects analysis areas.

Species	Alternative 1: Acres of Mechanical Vegetation Treatment Acres	Alternative 3: Acre of Mechanical Vegetation Treatment Acres/ Percentage of Direct Effects Area
Gila trout	0	1,319/ 49%
Gila chub	0	0/ 0%
Gila topminnow	0	0/ 0%
Little Colorado spinedace	0	4,881/ 36%
Loach minnow	0	0/ 0%
Razorback sucker	0	0/ 0%
Spikedace	0	0/ 0%
Narrow-headed gartersnake	0	2,040/ 92%
Northern Mexican gartersnake	0	1,196/ 100%
Desert Sucker	0	3,744/ 28%
Sonoran Sucker	0	566/ 38%
Little Colorado sucker	0	2,986/ 23%
Headwater chub	0	1,806/ 52%
Roundtail chub	0	1,180/ 19%

Mechanical vegetation treatments can negatively impact riparian condition short to mid-term when they occur within the direct effects analysis area. Direct impacts of reduced riparian vegetation cover or structure could occur by removal of trees or crushed by machinery. These are also direct impacts to gartersnake critical habitat as well as habitat for some aquatic macroinvertebrates species. Indirect impacts of increased stream temperature from loss of canopy cover could occur, but should be limited based on design features associated with providing for and protection of existing stream shade. Indirect impacts of ground disturbance and increased sediment delivery to streams is expected to occur short to mid-term until ground cover is reestablished. Stream banks can be also be damaged, which are primary constituent element for some fish, however design features for mechanical vegetation treatments including restrictions for skid trails and yarding within riparian areas as well as protecting stream banks would minimize potential impacts.

Riparian condition for both gartersnakes, desert sucker and Sonoran sucker are currently impaired, therefore direct impacts are expected to be higher. Vegetation in these systems is not adequate to capture sediment, are often disconnected from the water table and are more reflective of upland species. Riparian condition for the remaining species is functioning at risk, therefore direct and indirect effects are expected to be less. Vegetation in these systems has loss of vigor, growth, or changes in composition, but is present and functioning at some level.

Impacts to individuals in the form of harm or modification of behavior could also occur short to mid-term. Mechanical vegetation treatments within gartersnake habitat could result in harm of individuals as a direct effect. Gartersnakes may avoid or move out of these areas while work is occurring causing displacement or disruption of social and feeding behavior. This could potentially reduce the health or reproductive capability of individuals.

Long term, mechanical vegetation treatments could have a neutral or positive effect on aquatic indicators. Riparian condition could be improved by removing encroachment and restoring streamside vegetation. Conifers can impede the growth the riparian woody and herbaceous species; therefore it is expected they would increase in cover and structure. This would provide for large woody debris over time as well as decreasing sediment delivery and peak flows. Impacts to individuals would cease once activities were completed and therefore have a neutral effect long term.

For Alternative 3, increased acres of mechanical vegetation treatments as compared to Alternative 1 also has the potential for indirect occur short to mid-term impacts to riparian condition from treatments in the upper watershed. These are indirect impacts that can occur within a species action area (i.e., project watershed area that drains into a species occupied habitat) by changes in the uplands and on tributaries and drainages. For Alternative 3 the increases in percentage of action areas treated range from 11% to 68%. Headwater chub and Gila trout have the highest percentage of potential area impacted. Table 3-38 displays these species habitats as compared to Alternative 1. Five species have increases of 11%, but it is important to note the overall acreage is comparatively small due to approximately half of the overall watersheds occurring within the project area.

Table 96. Change by species in acres of mechanical vegetation treatments for Alternative 3 as compared to Alternative 1 within the species action area. Percentages reflect changes in acreages within species analysis areas. These are considered indirect impacts.

Species	Alternative 1: Acres of Mechanical Vegetation Treatment Acres	Alternative 3: Mechanical Vegetation Treatment Acres/ Percentage of Action Area
Gila trout	0	71,921/ 65%
Gila chub*	0	2,489/ 11%
Gila topminnow*	0	1,327/ 11%
Little Colorado spinedace	0	121,836/ 44%
Loach minnow*	0	1,327/ 11%

Species	Alternative 1: Acres of Mechanical Vegetation Treatment Acres	Alternative 3: Mechanical Vegetation Treatment Acres/ Percentage of Action Area
Razorback sucker*	0	1,327/ 11%
Spikedace*	0	1,327/ 11%
Narrow-headed gartersnake	0	41,711/ 47%
Northern Mexican gartersnake	0	31,051/ 64%
Desert Sucker	0	169,502/ 54%
Sonoran Sucker	0	30,623/ 59%
Little Colorado sucker	0	95,251/ 42%
Headwater chub	0	97,295/ 68%
Roundtail chub	0	82,835/ 52%

*While the percentage is high for these species action areas, less than half of entire watershed is within the project area.

Mechanical vegetation treatments in uplands can indirectly impact riparian condition short to mid-term from increased sediment delivery and peak flows via removal of vegetation and ground disturbance. Soils can be compacted and water infiltration reduced from landings and skid trails leading to increased overland flow and erosion. Yarding and skidding can redirect water onto areas more likely to erode than natural channels. In turn, increased sedimentation and peak flows can occur reducing riparian condition, aquatic habitat quality and quantity.

Potential indirect effects are expected to vary based on current riparian condition. Riparian condition for both gartersnakes, desert sucker and Sonoran sucker are currently impaired, therefore indirect effects are expected to be higher. Vegetation in these systems is not adequate to capture or process sediment, indicating more would reach streams. These riparian areas are often disconnected from the water table and are more reflective of upland species; therefore unable to dissipate stream energy associated with increased peak flows. Riparian condition for five species is currently functioning at risk, therefore indirect effects are expected to be less. Vegetation in these systems has loss of vigor, growth, or changes in composition, but is present and able to process sediment and dissipate flows in a limited capacity. Riparian condition for the remaining four species in Upper Fossil Creek is functioning properly. While indirect effects could occur, these riparian areas are able to process sediment and dissipate flows.

For those species with impaired or functioning at risk riparian condition, elevated sedimentation could negatively impact aquatic habitat, species, and water quality; particularly fish eggs and early life history stages that occur on or within substrate as well as the aquatic macroinvertebrate community structure. Habitat is impacted by filling of pools and spawning substrates which can lead to loss of habitat quality and reduced reproductive success. Peak flows can be increased altering channel forming flows leading to bank erosion and loss of habitat complexity.

Reduction in riparian vegetation can lead to decreased organic matter input to support aquatic macroinvertebrates and increases stream temperature.

Design features related to mechanical vegetation treatments are expected to minimize the potential effects described above. The project includes spreading treatments in time and space within a watershed as well as for skid trails, yarding, and landings are expected to reduce these impacts.

Pollutants in the form of fuels and lubricants have the potential to be introduced into aquatic systems from staging areas and equipment. Spills and leaks can introduce pollutants to soils and then to streams and riparian areas reducing riparian condition and habitat quality. Design features for storm water protections plans, staging areas, fuel storage and checking equipment for leaks minimizes the potential for introduction of pollutants.

Long term, mechanical vegetation treatments are expected to improve overall watershed condition as well as riparian condition. Moving forests towards desired conditions of more a healthy, resilient state will provide for improved watershed function over time. It will also reduce the risk of uncharacteristic wildfire which can greatly impact all resource indicators and reduce aquatic habitat quality, quantity and populations.

The direct and indirect negative impacts of Alternative 3 to resource indicators are expected to be higher than Alternative 1, but less than Alternative 2 due to fewer acres of treatment. However, Alternative 3 would have less potential improvement to riparian condition, watershed condition, and reduced risk of uncharacteristic wildfire than Alternative 2.

Prescribed Burning

For Alternative 3, acres of prescribed burning has the potential for negative short and mid-term impacts to riparian condition and individuals. Direct impacts would result if these activities occur in a species habitat from firelines, removal or reduction of vegetation due to burning or harm to gartersnakes. Alternative 3 is proposing treatments in the habitats of seven fish species and both gartersnakes. Increases in acreage of treatments ranges from 623 to 8,819 which equates to 24% to 100% of the analysis area for direct effects for those species (table 3-39). The two gartersnakes have the highest percentage of potential area impacted. Five fish species will not be directly impacted by prescribed burning under Alternative 3.

Prescribed burning can negatively impact riparian condition short to mid-term when it occurs in the direct effects analysis area. Direct impacts of reduced riparian vegetation cover or structure and decreases in large wood recruitment could occur from burning. Decreases in willows and other shrubby species reduces hiding and thermal cover for gartersnakes. This would be a direct alteration of gartersnake critical habitat as well as potentially impacting some aquatic macroinvertebrate species. This reduction is only expected to occur until vegetation recovers. Reduction in canopy cover also reduces stream shading and can increase stream temperatures. It also reduces organic matter inputs to streams which can alter food webs and prey base for fish and gartersnakes. Indirect impacts of increased stream temperature from loss of canopy cover could also occur, but should be limited based on design features associated with limiting high burn severity (mortality) within riparian areas.

Riparian condition for both gartersnakes, desert sucker and Sonoran sucker are currently impaired, therefore direct and indirect effects are expected to be higher. Vegetation in these systems is not adequate to capture sediment, are often disconnected from the water table and are more reflective of upland species. They already lack adequate streamside cover and structure, therefore those factors could be more susceptible to impacts. Riparian condition for the remaining species is functioning at risk, therefore direct and indirect effects are expected to be less as they have more cover and structure. Vegetation in these systems has loss of vigor, growth, or changes in composition, but is present.

Long term effects of prescribed burning are expected to be positive for riparian condition. Reduced fuel loading would protect these areas from uncharacteristic wildfire in the future. Large woody debris recruitment and streamside cover or structure can also improve with prescribed fire. Fire plays an important role in maintaining heterogeneity in riparian and aquatic systems that has been excluded similar to surrounding uplands (Gresswell 1999); therefore, restoring the fire regime would have some benefits to riparian condition.

Impacts to individual gartersnakes in the form of mortality or modification of behavior could also occur short to mid-term. Mortality could occur during prescribed burning; however, gartersnakes are mobile and design features of no burn piles within their habitat reduces that potential. While gartersnakes are more susceptible to exposure during a prescribed fire, it is more likely that harm or displacement would occur until the burns were completed. Long term impacts to individuals would be neutral or potentially positive if habitat improved and similarly increased social or feeding behavior.

Table 97. Change By Species In The Acres Of Prescribed Burning For Alternative 3 As Compared To Alternative 1. Percentages Reflect Changes In Acreages Within Species Direct Effects Analysis Areas.

Species	Alternative 1: Acres of Prescribed burning	Alternative 3: Acres of Prescribed Burning/ Percent of Direct Effect Area
Gila trout	0	1,462/ 54%
Gila chub	0	0/ 0%
Gila topminnow	0	0/ 0%
Little Colorado spinedace	0	8,819/ 65%
Loach minnow	0	0/ 0%
Razorback sucker	0	0/ 0%
Spikedace	0	0/ 0%
Narrow-headed gartersnake	0	2,211/ 100%
Northern Mexican gartersnake	0	1,196/ 100%
Desert Sucker	0	4,395/ 33%
Sonoran Sucker	0	623/ 42%
Little Colorado sucker	0	6,244/ 48%
Headwater chub	0	1,957/ 56%
Roundtail chub	0	1,470/ 24%

Short to mid-term negative indirect impacts from prescribed burning in uplands can occur within a species action area (i.e., watershed area that drains into a species occupied habitat) for all analyzed species. For Alternative 3 the increases in percentage of action areas treated range from 11% to 100%. However, while the five species (denoted with an asterisk) show increases, it is important to note the overall acreage is small. Table 3-40 displays these species habitats as compared to Alternative 1. Impacts would be highest for both Narrow-headed gartersnake and lowest for four species in Fossil Creek outside the project area.

Prescribed burning can indirectly impact riparian condition short to mid-term from increased sediment delivery and peak flows. Loss of ground cover from burning can increase erosion and overland flow which leads to increased sedimentation and peak flows. This could reduce riparian condition, aquatic habitat quality and quantity. However, these impacts are only expected to occur until ground cover vegetation recovers and has the ability to dissipate flows and trap sediment. Design features for extent of high burn severity as well as spatial and temporal spacing of activities within a watershed are expected to minimize potential impacts.

Potential indirect effects from increased peak flows and sedimentation are expected to vary by riparian condition. Indirect effects are expected to be higher for the four species with riparian condition that is currently impaired. Vegetation in these systems is not adequate to capture or process sediment, indicating more could potentially reach streams. These riparian areas are often disconnected from the water table and are more reflective of upland species; therefore unable to dissipate stream energy associated with increased peak flows. Riparian condition for five species is currently functioning at risk, therefore indirect effects are expected to be less. Vegetation in these systems has loss of vigor, growth, or changes in composition, but is present and able to process sediment and dissipate flows in a limited capacity. Riparian condition for the remaining four species in Fossil Creek is functioning properly. While indirect effects could occur, these riparian areas are able to process sediment and dissipate flows. Overall acres of treatment for Gila chub, loach minnow, spikedace, razorback sucker, and Gila topminnow are less than half of the watersheds in which they occur further reducing potential indirect effects. Additionally, prescribed burning would only occur in the upper watershed within the project area.

For those species with impaired or functioning at risk riparian condition, elevated sedimentation could negatively impact aquatic habitat, species, and water quality; particularly fish eggs and early life history stages that occur on or within substrate as well as the aquatic macroinvertebrate community structure. Habitat is impacted by filling of pools and spawning substrates which can lead to loss of habitat quality and reduced reproductive success. Potential reductions in fish prey base could also indirectly impact gartersnakes. Peak flows can be increased altering channel forming flows leading to bank erosion and loss of habitat complexity. Reduction in riparian vegetation can lead to decreased organic matter input to support aquatic macroinvertebrates and increases stream temperature.

Long term effects of prescribed burning in the upper watersheds are expected to be positive for riparian condition. Reduced fuel loading would protect these areas from uncharacteristic wildfire in the future that can impact entire watersheds and have long lasting negative impacts on riparian condition, aquatic habitat quality and quantity, as well as populations of species.

Overall, Alternative 3 would have less potential direct and indirect impacts from prescribed burning than Alternative 2, but more than Alternative 1. This alternative would also not improve riparian condition as much as Alternative 2 nor reduce the risk of uncharacteristic wildfire across as many acres.

Table 98. Change By Species In The Acres Of Prescribed Burning For Alternative 3 As Compared To Alternative 1 Within The Species Action Area. Percentages Reflect Changes In Acreages Within Species Analysis Areas. These Are Considered Indirect Impacts.

Species	Alternative 1: Acres of Prescribed burning	Alternative 3: Acres of Prescribed Burning/ Percentage of Action Area
Gila trout	0	79,480/ 72%
Gila chub*	0	2,492/ 12%
Gila topminnow*	0	1,328/ 11%
Little Colorado spinedace	0	140,659/ 51%
Loach minnow*	0	1,328/ 11%
Razorback sucker*	0	1,328/ 11%
Spikedace*	0	1,328/ 11%
Narrow-headed gartersnake	0	47/315/ 53%
Northern Mexican gartersnake	0	34,621/ 72%
Desert Sucker	0	190,190/ 60%
Sonoran Sucker	0	34,202/ 66%
Little Colorado sucker	0	113,047/ 50%
Headwater chub	0	106,923/ 75%
Roundtail chub	0	94,401/ 59%

*While the percentage is high for these species action areas, less than half of entire watershed is within the project area.

Temporary Roads

For Alternative 3, up to 170 miles of temporary roads could be utilized to facilitate mechanical vegetation activities. These may be new construction and/or utilizing non-system roads and they will be decommissioned when work is completed in the area that the access.

Temporary roads have the potential for direct short and mid-term impacts to aquatic indicators. Direct impacts would result if these activities occur in a species habitat. Direct negative short and mid-term impacts could occur to riparian condition, habitat connectivity, individuals, and introduction of pollutants or aquatic invasive species that are similar to new road or trail construction. Direct impacts to riparian condition include reduction riparian vegetation cover or structure removal of vegetation. This would be a direct impact to gartersnake critical habitat as well as some aquatic macroinvertebrate species habitat. The number of stream crossings could also be increased causing a direct effect to fish as well as indirect impacts of increased sedimentation from streambank damage. Indirect impacts of increased stream temperature could also occur from reduction in canopy cover within riparian areas. Associated ground disturbance and increased sedimentation delivery to riparian areas and streams is expected to occur short to mid-term until the roads were decommissioned.

Indirect impacts of opening temporary roads in the upper watershed could occur to riparian condition and by introduction of pollutants or invasive aquatic species. In general, roads compact soils and reduce infiltration of water leading to increased erosion and runoff. They increase the drainage network to riparian areas and streams and connect these areas to the uplands by altering surface water pathways. This converts dispersed surface runoff and sediment filtering through a riparian area to direct deliveries of accumulated runoff and sediment. Pollutants and aquatic invasive species can be transferred to aquatic systems from machinery or vehicles. Leaking fuels or lubricants can be transferred to aquatic systems from vehicles, machinery, or fuel storage areas. Aquatic invasive species can similarly be transferred from an infected water body to an uninfected waterbody through driving. All of these impacts could occur and continue while the temporary roads were in use and continue for a short period of time after decommissioning.

Long term, temporary roads would be decommissioned and revegetate. Therefore, direct and indirect effects would cease. Therefore, long term effects are considered to be neutral.

The direct and indirect negative impacts of temporary roads would be more than alternative 1, but less than alternative 2.

Sensitive Species not Covered by Resource Indicators and Measures

Aquatic Macroinvertebrates

Stoneflies, caddisflies, mayflies, midges, and riffle beetles are strongly associated with streams and riparian areas. Based on the biology and ecology of these four groups of species, streams and riparian areas could have negative direct and indirect impacts from Alternative 3, but less than Alternative 2. Mechanical vegetation treatments, prescribed burning, and roads can increase erosion and sedimentation, alter riparian vegetation, and alter stream habitats as described for fish and gartersnake species above.

Nokomis Fritillary is a sensitive species that utilizes meadows, seeps, and boggy streamside vegetation. Alternative 3 could have negative direct and indirect negative impacts to the species and its habitat, but less than Alternative 2. Acres of riparian, grassland, and meadow treatments are the same between Alternatives 2 and 3, therefore direct impacts would be the same. Acres of upland mechanical treatments, prescribed fire, and miles of temporary roads are reduced in Alternative 3 leading to decreased indirect impacts. Mechanical vegetation treatments, prescribed burning, and roads can increase erosion and sedimentation, alter riparian vegetation, and alter stream habitats utilized by these sensitive species.

The California Floater was once present in Fossil Creek, West Clear Creek, and Upper Clear Creek and it is possible that it may still occur within Chevelon Creek below Chevelon Dam. Direct and indirect negative cumulative impacts could occur in two of the watersheds, no direct impacts would occur in Fossil Creek or Chevelon Creek. Increases in mechanical vegetation treatments, prescribed burning, and roads could increase erosion and sedimentation, alter riparian vegetation, and alter stream habitats short- and long-term.

For all sensitive aquatic macroinvertebrates, streams and riparian areas could have negative direct and indirect impacts from Alternative 3, but less than Alternative 2 given the decrease in acres treated. Direct and indirect negative impacts for road use, relocation and decommissioning would be the same for both Alternative 2 and 3. Direct and indirect impacts from temporary roads would be less in Alternative 3 than Alternative 2 given the reduction in proposed miles. Mechanical vegetation treatments, prescribed burning, and roads can increase erosion and sedimentation, alter riparian vegetation, and alter stream habitats that negatively impact these sensitive species as described for fish and gartersnake species above. Alternative 3 would potentially having long-term benefits from reducing the risk of uncharacteristic wildfire and reduced road densities.

Cumulative Effects

Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

The cumulative effects analysis geographic boundary is the Rim Country project area boundary as this area includes all actions associated with implementation for this analysis. The following list summarizes the past, present, and future activities that would add to the total cumulative effects. Since the implementation of the Rim Country is so large, the activities will be discussed generally.

1. *Timber Harvest and Vegetation Management:* These types of projects include timber harvest, vegetation treatments, fuel reductions and treatments, wildland urban interface treatments, salvage logging, forest restoration treatments, energy corridor maintenance, and fuelwood harvesting. Past timber harvest activities have resulted in substantial impacts to watersheds, hydrologic conditions, riparian and aquatic habitat, and fish species across the proposed project area (especially in vegetated areas with high timber resources (e.g., ponderosa pine, mixed-conifer, spruce-fir, etc.). This activity has resulted in most of the existing transportation system present today, especially management level 1 and 2 roads. More recent vegetation treatments likely have had less impacts, but can still contribute cumulative effects, especially given resource conditions and ecological processes that have been highly altered from legacy impacts. Fuelwood collecting and harvesting is also a very widespread activity occurring across the project area. It occurs extensively within timber harvest areas, but also occurs as part of or within vegetation treatments in woodland areas as well. Projects such as Upper Beaver Creek, Larson, Rim Lakes, and Upper Rocky Arroyo have been occurring and will continue into the future; whereas CC Cragin is a future project.

2. *Recreation and Recreation Management:* Recreational activities occur throughout the proposed project area, and are continuing to increase. Developed recreation sites, dispersed camping, hiking, fishing, hunting, driving, boating, wildlife viewing, and many other types of recreational activities occur across proposed project area. Riparian areas, lakes, and streams are very popular areas for recreational activities and dispersed camping; this can result in deteriorated resource conditions from the concentrated use (e.g. loss of vegetation and soil compaction), and can also impact water quality.

3. *Fire Suppression and Fire Management Projects:* Fire suppression activities have been in place for decades, and have resulted in unnatural vegetative conditions and have altered ecological processes across most of the proposed project area. Suppression activities are ongoing and will continue well into the future, as vegetation structure and composition has been altered so that allowing it to burn will result in uncharacteristic and unacceptable resource impacts. Fire suppression activities can also impact water resources and species dependent upon them by removing water, which usually occurs during the driest part of the year. Prescribed fire and burns have been occurring for the last 10-20 years, and have increased considerably in their extent and impacts over the last

5-10 years. Fire management can have both short and long term impacts that are both positive and negative, and cumulatively these impacts will be dependent on the existing resource conditions and the future environmental conditions. It should also be noted that significant levels of wildfire activities have occurred across the proposed project area in the last 20-25 years, especially associated with large wildfires such as Rodeo-Chediski Fire (2002) that burned within the proposed project area.

4. *Livestock Grazing:* Grazing livestock has likely occurred for over a century across the proposed project area. Historically unrestricted and unregulated resulted in overgrazing, especially within riparian areas, has likely contributed to the degraded riparian and aquatic habitat conditions that currently occur. Livestock grazing is continuing over most of the proposed project area, although some areas are excluded for resource recovery reasons. Infrastructure development and maintenance associated with livestock grazing allotments is substantial. Thousands of miles of fences and thousands of stock tanks occur throughout the proposed project area. Impacts to aquatic habitat and species, hydrologic conditions and processes, and riparian and upland conditions have occurred; and this will continue as long as livestock management and the associated infrastructure remains in place, and contributes cumulative effects to aquatic species and their habitats.

5. *Road and Trail Construction, Maintenance, and Closure:* As previously stated past timber activities and harvest primarily accounted for road development and placement, and this is still reflected in the existing transportation system. Approximately 5,682 miles of roads and almost many miles of hiking trails occur within Rim Country. While roads and trails are necessary for the use, enjoyment, and management, they also are responsible for considerable landscape scale changes to the functioning and maintaining of ecological processes and values. Maintenance activities for roads and trails are limited by available funding, and can result in both positive and negative benefits, depending on when it occurs and how often. These impacts will continue as long as the roads/trails are in place, and are a major contributor to cumulative effects. The Coconino NF has closed over 90 miles of roads as part of focused watershed restoration activities in the Little Colorado River watershed.

6. *Special Uses and Permits/Minerals Management/Land Exchanges:* Hundreds of special uses permits have been issued across the proposed project area. These include permits for outfitter and guiding activities fuelwood and Christmas tree cutting, road easements, plant and minerals collection, church and youth camps, gravel and cinder pits, ditch bill easements, communications sites, and other uses as well. All of these activities can result in impacts to watersheds riparian areas, and aquatic habitat and species; and contribute to cumulative effects, especially water development and diversion projects. Land exchanges have resulted in the acquisition of riparian habitat (and in some cases associated water rights) that could help improve or maintain the status of some aquatic species.

7. *Dam and Reservoir Development/Water Developments and Diversions:* These projects have resulted in considerable impacts to aquatic habitat and species both directly and indirectly. Dam and reservoir development began in the late 1800’s and continued into the 1960’s across the project area. Most of this activity was to provide for downstream (and off Forests) water use and irrigation, and to provide for recreational opportunities. Blue Ridge Reservoir is part of an interbasin transfer to the Verde River to provide water

downstream. Most dams and water diversions have detrimental impacts to aquatic species and habitats, and have isolated or separated populations, and dewatered or introduced non-native species into upstream and downstream habitats.

8. *Fisheries and Wildlife:* Fisheries habitat improvement work in streams began in the 1930s on the ASNFs. These efforts were in response to degraded habitat conditions (likely from grazing livestock) and were focused on higher elevation trout streams, and intended to stabilize streams and provide pool habitat that had been reduced. Later efforts did not occur until the1970s thru the 1980s, and these efforts were largely focused on areas that had been heavily impacted by past management activities and concentrated recreational use. The Coconino NF began improving streams, springs and watersheds in the 1960s thru the 1990's in response to the degraded conditions. This included instream rock structures and aspen and riparian enclosures. Spring and stream restoration efforts began in the early 2000's as part of watershed planning for West and East Clear Creek as well as Barbershop Canyon.

Current, ongoing, and foreseeable cumulative effects projects within the Rim Country project area are shown in tables 3-51 to 3-53 below. Some of these projects are in the early stages of proposal development or are on hold, so their implementation is reasonably foreseeable but not assured. The acreages shown under mechanical vegetation management and fuels treatments are not all mutually exclusive. There are many acres on which proposed fuels treatments (mechanical and prescribed fire) overlap with proposed mechanical vegetation management treatments. Therefore, all acreages or miles are approximate.

Mechanical Vegetation Treatments

The total cumulative acres of mechanical vegetation treatments potentially impacting aquatic indicators for all alternatives are displayed in table 3-51 below. The resource measure for all species are expected to result in increased cumulative impacts that are primarily potential impacts to riparian condition. This is also reflective of multiple treatments over time in some subwatersheds that result in treatment acres above the watershed acreage itself.

Alternatives 2 and 3 are expected to have more cumulative effects compared to alternative 1. Alternative 2 would have more cumulative effects from mechanical vegetation treatments than alternative 3. For both alternative 2 and 3, gartersnakes have the potential for the largest increases in cumulative effects.

Table 99. Acres Of Mechanical Vegetation Treatments For Cumulative Effects (Alternative 1) And Changes In Acres Of Mechanical Vegetation Treatments For Alternative 3. Percentages Reflect Changes In Acreages Within Species Analysis Areas.

Species	Alternative 1: Total Acres of Mechanical Vegetation Treatment	Alternative 2: Total Acres of Mechanical Vegetation Treatment	Alternative 3: Total Acres of Mechanical Vegetation Treatment/ Percent
Gila trout	25,926	123,399/ 376%	99,918/ 285%
Gila chub*	7,058	19,389/ 175%	9,541/ 35%
Gila topminnow*	2,328	14,311/ 515%	3,662/ 57%

Little Colorado spinedace	64,982	236,372/ 264%	197,769/ 204%
Loach minnow*	2,328	14,311/ 515%	3,662/ 57%
Razorback sucker*	2,328	14,311/ 515%	3,662/ 57%
Spikedace*	2,328	14,311/ 515%	3,662/ 57%
Narrow-headed gartersnake	8,542	81,844/ 858%	46,371/ 443%
Northern Mexican gartersnake	6,290	48,036/ 664%	37,426/ 495%
Desert Sucker	56,287	286,825/ 410%	234,258/ 316%
Sonoran Sucker	17,120	58,527/ 242%	48,865/ 185%
Little Colorado sucker	43,784	184,216/ 321%	149,621/ 242%
Headwater chub	27,131	160,773/ 493%	129,199/ 376%
Roundtail chub	30,663	166,010/ 441%	119,153/ 289%

*While the percentage is high for these species action areas, less than half of entire watershed is within the project area.

Mechanical vegetation treatments can negatively impact riparian condition when they occur within riparian areas. Reduction in riparian vegetation cover or structure could occur which are direct impacts to gartersnake critical habitat as well as some aquatic macroinvertebrates species. Indirect impacts of increased stream temperature from loss of canopy cover could occur and associated ground disturbance could increase sediment delivery to streams.

Mechanical vegetation treatments in the upper watershed can indirectly impact riparian condition from increased sediment delivery and peak flows. Soils can be compacted and water infiltration reduced leading to increased overland flow and erosion. In turn, increased sedimentation and peak flows can occur reducing riparian condition, aquatic habitat quality and quantity.

Potential increases in sediment delivery and peak flows are expected to vary based on current riparian condition. Cumulative impacts for species with impaired riparian condition are expected to be higher as compared to riparian conditions that are functioning properly or functioning at risk. To reduce potential cumulative impacts, design features assessing Equivalent Disturbed area, spacing treatments spatially and temporally are part of both action alternatives.

Long term, alternative 2 has the greatest potential to improve overall riparian condition as well as watershed condition. Alternative 3 would maintain or improve conditions, but at a smaller scale. Alternative 1 not provide for improved riparian condition or watershed condition. Overstocked forests would remain susceptible to uncharacteristic wildfire from canopy closure which would also maintain current states of reduced ground cover from shading. Conifer encroachment would continue into riparian areas reducing streamside vegetation cover and structure normally associated with streams and wetlands.

Prescribed Burning

The total cumulative acres of wildand fire (prescribed and wildfire) potentially impacting aquatic indicators for all alternatives are displayed in table 3-52 below. Increased resource measures for all species are expected to result in increased cumulative impacts to riparian condition and individuals. This is also reflective of how frequently some subwatersheds experience wildfire cumulatively adding acreages above the watershed acreage itself.

Alternatives 2 and 3 are expected to have more cumulative effects compared to alternative 1. Alternative 2 would have more cumulative effects from prescribed burning than alternative 3. For alternative 2, Northern Mexican gartersnake and Headwater chub have the potential for the largest increases in cumulative effects, while Roundtail chub and Gila trout have the largest increases under alternative 3.

Table 100. Acres Of Burning And Wildfire For Cumulative Effects (Alternative 1) And Changes In Acres Of Prescribed Burning For Alternative 3. Percentages Reflect Changes In Acreages Within Species Analysis Areas.

Species	Alternative 1: Acres of Burning	Alternative 2: Acres of Prescribed Burning/ Percent Increase	Alternative 3: Acres of Prescribed Burning/ Percent Increase
Gila trout	60,777	158,250/ 160%	142,481/ 134%
Gila chub*	7,992	20,323/ 154%	10,485/ 31%
Gila topminnow*	8,043	12,726/ 58%	9,377/ 17%
Little Colorado spinedace	158,178	329,568/ 108%	308,616/ 95%
Loach minnow*	8,043	12,726/ 58%	9,377/ 17%
Razorback sucker*	8,043	12,726/ 58%	9,377/ 17%
Spikedace*	8,043	12,726/ 58%	9,377/ 17%
Narrow-headed gartersnake	99,508	172,810/ 74%	142,964/ 44%
Northern Mexican gartersnake	26,036	99,338/ 282%	60,774/ 133%
Desert Sucker	155,830	386,368/ 148%	355,831/ 128%
Sonoran Sucker	44,650	86,057/ 93%	80,117/ 79%
Little Colorado sucker	97,073	237,505/ 145%	219,583/ 126%
Headwater chub	50,610	184,252/ 264%	162,445/ 221%
Roundtail chub	71,229	206,576/ 190%	171,036/ 140%

*While the percentage is high for these species action areas, less than half of entire watershed is within the project area.

Wildfire can negatively impact riparian condition within species habitats. Riparian vegetation cover or structure can be reduced as well as large wood recruitment. Decreases in willows and other shrubby species reduces hiding and thermal cover for gartersnakes, which is an alteration of gartersnake critical habitat as well as some aquatic macroinvertebrate habitats. Prescribed fire would only cause these reductions until vegetation recovers, while wildfires can have a much greater impact due to moderate and high burn severity. Reduction in canopy cover also reduces stream shading and organic matter inputs to streams which can alter food webs and prey base for fish and gartersnakes. Indirect impacts of increased stream temperature from loss of canopy cover could also occur, but should be limited based on design features associated with limiting high burn severity (mortality) within riparian areas.

Wildfires in the upper watershed can also cumulatively effect riparian to a greater extent due to increased sedimentation and peak flows. Prescribed fires generally limit moderate and high severity within watersheds; while wildfire does not. Therefore cumulative effects would vary depending on what type of fire occurred. In turn, increased sedimentation and peak flows can occur reducing riparian condition, aquatic habitat quality and quantity.

Potential increases in sediment delivery and peak flows are expected to vary based on current riparian condition. Cumulative impacts for species with impaired riparian condition are expected to be higher as compared to riparian conditions that are functioning properly or functioning at risk. To reduce potential cumulative impacts, design features assessing Equivalent Disturbed area, spacing treatments spatially and temporally are part of both action alternatives.

Impacts to individual gartersnakes in the form of mortality or modification of behavior could also occur from wildfire. Mortality is less likely to occur during prescribed burning than from wildfire. Wildfires tend to occur during the driest time of year, can move rapidly and have increased fire behavior. Riparian areas generally have high fuel loading and continuity from being buffered from any treatments for decades and can therefore carry wildfire leading to potential mortality.

Long term effects of prescribed burning are expected to be positive for riparian condition for alternative 2 and 3. Reduced fuel loading would protect these areas from uncharacteristic wildfire in the future. Large woody debris recruitment and streamside cover or structure can also improve with prescribed fire. Alternative 1 could potentially lead to reduced riparian condition from the susceptibility to wildfire, particularly uncharacteristic wildfire.

Stream, Riparian, and Wet Meadow Restoration

The total cumulative miles of aquatic restoration potentially impacting aquatic indicators could not be identified spatially. Therefore, table 3-53 below reflects the restoration between the three alternatives. Aquatic restoration activities have been individual small efforts described above. In general, these activities have a small footprint and any negative effects are short-lived by their very nature.

Table 101. A comparison of the total miles of general and heavy mechanical stream treatments for all three alternatives.

Species	Alternative 1	Alternative 2&3 General Stream Treatments	Alternative 2&3 Heavy Mechanical Stream Treatments
Gila trout	0	7	4

Gila Chub	0	0	0
Gila topminnow	0	0	0
Little Colorado spinedace	0	179	24
Loach minnow	0	0	0
Razorback sucker	0	0	0
Spikedace	0	0	0
Narrow-headed gartersnake	0	0	0
Northern Mexican gartersnake	0	0	0
Desert Sucker	0	51	0
Sonoran Sucker	0	5	0
Little Colorado sucker	0	123	0
Headwater chub	0	9	18
Roundtail chub	0	23	3

Additional Species not Covered by Resource Indicators and Measures

Aquatic Macroinvertebrates

Stoneflies, caddisflies, mayflies, midges, and riffle beetles are strongly associated with streams and riparian areas. Based on the biology and ecology of these four groups of species, streams and riparian areas could have negative cumulative impacts from Alternative 3, but less than Alternative 2 given the reduced mechanical vegetation treatments, prescribed burning, and temporary roads. Mechanical vegetation treatments, prescribed burning, and roads can negatively impact riparian condition, aquatic habitat quality and quantity utilized by these sensitive species. However, alternative 1 has the greatest potential long term risk to habitat for aquatic macroinvertebrates. By not making forests more resilient, the landscape remains susceptible to wildfires which have an even greater overall impact. Alternative 1 would also not reduce road density by decommissioning roads or reduce impacts to riparian condition by relocating roads. Alternatives 2 and 3 have the potential to improve riparian conditions by restoring form and function of streams, wet meadows and springs which are the primary habitat of these sensitive species.

Aquatic Threatened, Endangered, and Sensitive Species and Habitat Determinations

Table 102. Preliminary Determinations for Threatened, Endangered, and Candidate Species within Rim Country Analysis Area for Both Action Alternatives. MA= May Affect; MII = May Impact Individuals

Species Status	Status	Species Determination	Critical Habitat Determination
Gila trout	Threatened	Alternative 2: MA Alternative 3: MA	N/A
Gila chub	Endangered with Critical habitat	Alternative 2: MA Alternative 3: MA	Alternative 2: MA Alternative 3: MA
Gila topminnow	Endangered	Alternative 2: MA Alternative 3: MA	N/A
Little Colorado Spinedace	Threatened with Critical Habitat	Alternative 2: MA Alternative 3: MA	Alternative 2: MA Alternative 3: MA
Razorback sucker	Endangered with Critical Habitat	Alternative 2: MA Alternative 3: MA	Alternative 2: MA Alternative 3: MA
Loach minnow	Endangered with Critical Habitat	Alternative 2: MA Alternative 3: MA	Alternative 2: MA Alternative 3: MA
Spikedace	Endangered with Critical Habitat	Alternative 2: MA Alternative 3: MA	Alternative 2: MA Alternative 3: MA
Narrow-headed gartersnake	Threatened with proposed Critical Habitat	Alternative 2: MA Alternative 3: MA	Alternative 2: MA Alternative 3: MA
Northern Mexican gartersnake	Threatened with proposed Critical Habitat	Alternative 2: MA Alternative 3: MA	Alternative 2: MA Alternative 3: MA
Desert sucker	Sensitive	Alternative 2: MII Alternative 3: MII	N/A
Sonoran sucker	Sensitive	Alternative 2: MII Alternative 3: MII	N/A
Little Colorado sucker	Sensitive	Alternative 2: MII Alternative 3: MII	N/A
Headwater chub	Sensitive	Alternative 2: MII	N/A

Species Status	Status	Species Determination	Critical Habitat Determination
		Alternative 3: MII	
Roundtail chub	Sensitive	Alternative 2: MII Alternative 3: MII	N/A
Netwing Midge	Sensitive	Alternative 2: MII Alternative 3: MII	N/A
A Stonefly	Sensitive	Alternative 2: MII Alternative 3: MII	N/A
Parker’s cylloepus riffle beetle	Sensitive	Alternative 2: MII Alternative 3: MII	N/A
A Mayfly	Sensitive	Alternative 2: MII Alternative 3: MII	N/A
A Mayfly	Sensitive	Alternative 2: MII Alternative 3: MII	N/A
A Caddisfly	Sensitive	Alternative 2: MII Alternative 3: MII	N/A
A Caddisfly	Sensitive	Alternative 2: MII Alternative 3: MII	N/A
A Caddisfly	Sensitive	Alternative 2: MII Alternative 3: MII	N/A
Ferris’ Copper	Sensitive	Alternative 2: MII Alternative 3: MII	N/A
Nokomis Fritillary (aka Great Basin Silverspot)	Sensitive	Alternative 2: MII Alternative 3: MII	N/A
California floater	Sensitive	Alternative 2: MII Alternative 3: MII	N/A

Noxious and Invasive Weeds

The noxious and invasive weed analysis is part of the Botany and Weeds Report (Crisp 2018), which is incorporated by reference.

Assumptions and Methodology

Assumptions

This analysis is based on the following assumptions.

1. All management activities will occur as analyzed in the various specialists reports and described in the FEIS.
2. The mitigation measures, design features, and Best Management Practices will be incorporated into project design and implementation. See table 4 above for these features.
3. Areas to be treated will be surveyed for noxious or invasive weeds before treatments are implemented.
4. These factors should be considered when identifying survey needs:
    - Likelihood of any of the species addressed in this document occurring within the treatment area
    - Amount of disturbance. For example, surveys may not be needed in areas scheduled for prescribed burning if the treatments are scheduled to be of low intensity.
5. The acreage of potential disturbance in this project is much larger than generally analyzed in similar projects, necessitating more noxious or invasive weed treatments to control invasive species. This will lead to increases in personnel and budget to accomplish this need.

Affected Environment

Each of the three forests has separate noxious or invasive weed treatment analyses. As a result, the targeted species and treatment methods may differ across forests. The Coconino NF was the first of the three forests to complete a noxious or invasive weed treatment analysis the *Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds, Coconino, Kaibab, and Prescott National Forests*; (USDA Forest Service 2005), analyzing 29 species for treatment. The Apache-Sitgreaves NF completed the *Environmental Assessment for the A-SNFs Integrated Forest-Wide Noxious or Invasive Weed Management Program* (USDA Forest Service 2008). It analyzed 53 species and included a variety of treatments including chemical, cultural, mechanical/physical and biological control. . The Tonto NF completed the *Environmental Assessment for Integrated Treatment of Noxious or Invasive Plants* in 2012 and addressed 68 species. It includes manual, mechanical, prescribed burning, cultural, use of biological control agents, and use of herbicides. The noxious or invasive weeds throughout the Region have been rated on the basis of their known distributions and threats to ecosystems (USDA Forest Service 2014). There are four levels defined by regional guidance.

Class A species are newly established or have the potential to become established in the area. These may pose an unacceptable threat to rare species, watershed condition, wilderness or other natural and economic resources. These species should receive the highest priority prevention, eradication, containment, control, and/or restoration. Management emphasis is to prevent and eradicate whenever possible or else use containment as a last resort.

Class B species have limited distribution on the forest, district, or else within a particular watershed but still pose a substantial threat to rare species, watershed condition, wilderness or other natural and economic resources. Weed species in this classification receive a lower priority for eradication, control, or restoration as compared to Class A species. Management emphasis is to eradicate on a local basis or else control established infestations by using an adaptive management approach.

Class C species are widely distributed but do not pose additional threats to rare species, watershed condition, wilderness or other natural and economic resources. (e.g., widely scattered cheatgrass infestations that do not unduly affect native vegetation or contribute to periodic fire cycles). Weed species in this classification generally receive the lowest priority for control or restoration as compared to species in other classes. Management emphasis is to use a control strategy with an adaptive management approach on a local basis only when necessary to achieve desired goals and/or objectives and to limit overall effects.

Class E species are widely distributed across the forest, district, or else within a particular watershed and can cause overwhelming damage to natural resources. . These particular wide-ranging species must be controlled continuously to prevent overwhelming damage to natural. Management emphasis is to control on a broad-scale basis by using a control strategy with an adaptive management approach to achieve desired goals and/or objectives and limit overall effects.

Noxious or invasive weeds are present within all three forests in the project area. The presence of noxious or invasive weed species have been documented by various surveyors including Forest employees. Disturbances such as wildfires, management activities, roadways and activities by the general public but not regulated by the Forest Service have contributed the introduction and spread of various species. The following tables show the species present on each forest and the objectives by forest for each species.

Table 103. Noxious or invasive weeds on Apache Sitgreaves NF

Scientific name	Common name	Infested acres	Management goal/treatment objective	Regional Ranking	Comment
Acroptilon repens	Russian knapweed	0.1	Prevent/eradicate	A	Within project boundary but not in treatment units
Carduus nutans	musk thistle	0.1	Prevent/control/eradicate	A	
Centaurea solstitialis	yellow star-thistle	100	Prevent/eradicate	A	
Centaurea biebersteinii	spotted knapweed	3.0	Prevent/eradicate	A	
Cirsium vulgare	bull thistle	2.5	Prevent/control/eradicate	B	
Linaria vulgaris	butter and eggs	25.0	Prevent/eradicate	A	

Tamarix ramosissima	salt cedar	250.0	Prevent/control/eradicate	E

Table 104. Noxious or invasive weeds on the Coconino NF

Scientific name	Common name	Infested acres	Management goal /treatment objective	Regional Ranking	Comment
Acroptilon repens	Russian knapweed		Contain/Control	B	Most infestations are along or near highways
Alhagi maurorum	camelthorn	2.7	Contain/Control	B	All infestations are along highways except on FSR 316 which leads to private property
Bothriochloa ischaemum	yellow bluestem		Not ranked*	B	All infestations are along Highway 260
Bromus arvensis	Japanese brome		Not ranked*	B	
Bromus tectorum	cheatgrass		Contain/control certain populations	B	
Carduus nutans	musk thistle		Eradicate	A	
Centaurea biebersteinii	spotted knapweed		Eradicate	B	Mostly along FH 3 and Highway 87
Centaurea diffusa	Diffuse knapweed		Contain/control	B	Mostly along roadways
Cirsium vulgare	Bull thistle		Contain/control	B	Most infestation are 1 acre or less and are on severely disturbed sites.
Eleagnus angustifolia	Russian olive		Contain/control	B	Single location along Highway 87
Euphorbia esula	Leafy spurge		Eradicate	B	

Scientific name	Common name	Infested acres	Management goal /treatment objective	Regional Ranking	Comment
Linaria dalmatica	Dalmatian toadflax		Contain/control	B	Widespread weed in pine type on Coconino NF
Linaria vulgaris	butter and eggs		Not ranked*	A	One location near Happy Jack administrative site.
Onopordum acanthium	Scotch thistle		Eradicate/control	B	
Tamarix ramosissima	Salt cedar		Contain/control	B	Along Rds. 316 and 625 from Hwy 87 to private land

Table 105. Noxious or invasive weeds on Tonto NF and within the project area boundary

Scientific name	Common name	Infested acres	Management goal /treatment objective	Regional Ranking	Comment
Acroptilon repens	Russian knapweed		A -Eradicate	B	
Alhagi maurorum	Camelthorn		A - Eradicate	B	
Arundo donax	Giant reed		B –Contain spread/reduce population	B	
Brassica tournefortii	Asian mustard		C – control outlying populations with long term goal of eradication	B	
Bromus japonicus	Japanese brome		C – Strategic treatment of certain populations.	B	
Bromus rubens	Red brome		C– Strategic treatment of certain populations	B	
Bromus tectorum	Downy brome		C– Strategic treatment of certain populations	B	

Scientific name	Common name	Infested acres	Management goal /treatment objective	Regional Ranking	Comment
Carduus nutans	Musk thistle		A - Eradicate	A	
Centaurea diffusa	Diffuse knapweed		B – Contain/Eradicate	B	
Centaurea melitensis	Malta starthistle		C - Contain	A	
Centaurea solstitialis	Yellow starthistle		B – Contain existing populations, treat new detections first.	B	
Cirsium vulgare	Bull thistle		C –Treat priority sites	B	
Convolvulus arvensis	Field bindweed		C – Low priority for treatment	C	
Eragrostis curvula.	Weeping lovegrass		C – Widespread distribution, prevent new introductions.	B	Severe infestation covers most of Dude Fire below the Mogollon Rim
Eragrostis Lehmanniana	Lehmann’s lovegrass		C – Widespread distribution, prevent new introductions.	B	
Erysimum repandum	Spreading wallflower		A -Eradicate	B	
Linaria dalmatica	Dalmatian toadflax		A Eradicate	B	
Onopordum acanthium	Scotch thistle		B - Contain/Eradicate	B	
Tamarix ramosissima	Saltcedar		C –Treat priority sites	B	
Ulmus pumila	Siberian elm		A – Treat new sites aggressively	B	

Tonto Weed List: Class A weeds are of limited distribution in Arizona, or unrecorded in the state. They pose a serious threat. Management goal is eradication. **Class B weeds** are of limited distribution in Arizona, common in some places in the state. Management goal is to contain their spread, decrease population size, then eliminate. **Class C weeds** have spread beyond our capability to eradicate them. Management goal is to contain spread to present size, then decrease the population, if possible.

Environmental Consequences

Alternative 1 – No Action

There would be no effects to noxious or invasive weeds from management activities because none would occur. Alternative 1 would not increase forest resiliency and sustainability or reduce the risk of undesirable fire effects.

There would be no improvement in terrestrial habitat. There would be no surveys for or treatments of noxious or invasive weeds. Survey and treatment would continue in other projects, as part of the forests' noxious weed program, and by other entities such as Arizona Department of Transportation.

For the Apache-Sitgreaves NF, the guidance of *Environmental Assessment for the A-SNFs Integrated Forest-Wide Noxious or Invasive Weed Management Program* would not be followed in this project. The guidelines for soil and high use developed recreation areas as they apply would not apply.

For the Coconino NF, the guidance of the Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds, Coconino, Kaibab, and Prescott National Forests; (USDA Forest Service 2005). The guidelines for invasive species, guidelines for all recreation or desired conditions for developed recreation that apply to the management of noxious or invasive weeds would not apply,

For the Tonto NF, the guidance of the Environmental Assessment for Integrated Treatment of Noxious or Invasive Plants (2012) would not apply.

Weed infestations that would have been detected and treated would go unnoticed and continue to expand unless detected by other surveys or independent observations. Treatments that would have been part of the mitigating actions not be accomplished. As a result, treatment of weed infestations would not occur unless the locations are included in another project area or are treated by a cooperating agency. For example, treatments along highways or roadways in coordination other agencies would continue but would not expand outside of highway right of ways.

The following design features and mitigations would not be used BT009, FE004, NW001, NW002, NW003, NW004, NW005, NW006, NW007, NW008, NW009, NW010, SU018, SW005 and SW102. These design features provide an integrated approach to noxious or invasive weed management but would not be incorporated into management activities on the forests if the no action alternative is selected.

Effects Common to Both Action Alternatives

The purpose of the Rim Country Project is to reestablish and restore forest structure and pattern, forest health, and vegetation composition and diversity in ponderosa pine ecosystems to conditions within the natural range of variation. Preventing, controlling, and eradicating noxious or invasive weeds is complementary to the purpose and need and would improve native vegetation composition. Management of noxious or invasive weeds is consistent with the purpose and need because management of them would contribute to the vegetation composition and diversity of the native plant community in the project area.

The action alternatives would be consistent with the LRMPs and would move toward the desired conditions for native plant communities and noxious or invasive weed control. Noxious or invasive weed management would be guided by each forest's weed management NEPA. Surveys for noxious or invasive weeds would be conducted before management activities areas and needed treatments would follow the guidance of each forest's noxious or invasive weed assessment. Post implementation monitoring and treatment would occur.

To prevent the introduction and spread of noxious or invasive weeds by vehicles used in management activities, vehicles and equipment would be washed to remove soil, seeds and other debris from them before entering the area or when moving from one area to the other. Ideally, this would occur before the equipment comes onto the forest but it can also be facilitated with the approval of the contracting officer or timber sale administrator.

The direct effects of management activities on noxious or invasive weeds include ground-disturbing activities that have the potential to increase the acreage and/or density of the existing infestations within the project area. Disturbance may contribute to the spread of weeds by eliminating competition from existing vegetation and creating bare ground that is more easily invaded than undisturbed areas. Severe disturbance removes competitive vegetation, alters nutrient composition, and creates bare soil making potential sites for the invasion or spread of noxious or invasive weeds. Examples of management activities that would create localized severe disturbance include burned areas from slash piles, creation of log decks, bare soil created through road reconstruction, decommissioning, temporary road construction, in woods processing areas and rock pits.

Tree removal indirectly affects noxious or invasive weeds by reducing tree canopy and stand density. Treatments that reduce the tree canopy and lower the stand density would affect all understory plants, including noxious or invasive weeds by allowing more sunlight, increasing available nutrients and temporarily decreasing competition. The increased availability of resources and decrease in competition can also provide favorable conditions for noxious or invasive weeds and could increase the size and density of existing populations, especially in areas where weed infestations already exist. These effects are reduced to a non-significant level by incorporating the mitigation measures and design features and by incorporating survey and treatment in the project. Design features which limit the amount of soil disturbance permitted during timber sales and regulate the depth of rutting by vehicles when soil conditions are wet, minimizing soil disturbance, would help reduce the amount of disturbance during operations, reducing the amount of bare ground for noxious or invasive weeds to occupy.

Burning can release nutrients, reduce plant competition, increase the amount of available sunlight and increase bare soil. Most prescribed burning would be of low severity with low soil heating, retention on most ground litter and little or no change in mineral soil. These assumptions are supported by the conclusions of Fowler et al (2008) who conducted a local study on the Coconino, Kaibab and Apache-Sitgreaves NFs and by Collins et al (2007). They concluded that low intensity fires in open ponderosa pine forest had minimal effects on the abundance of noxious or invasive weeds. McGlone and Egan (2009) found similar results in studies they reviewed. Prescribed or managed fires generally result in lower severity and result in lower levels of noxious or invasive weed invasion as compared to uncontrolled wildfire. In some situations, prescribed fire may result in moderate to higher severity (McGlone and Egan, 2009). The effects in these areas would be more severe and would be similar to slash pile burning or wildfire. The action alternatives would incorporate a series of design features and mitigations that would focus on reducing the risk of activities that would increase existing weed populations or introduce new weeds. Design features provide for collaboration between resources before the implementation of a prescribed fire. The purpose of this collaboration is to identify the appropriate mitigations and treatment of noxious or invasive weeds. Follow-up monitoring would be conducted in areas of heavy disturbance such as large slash piles. Design features provide direction to conduct prescribed fires under conditions that promote native plant communities, hinder weed species germination, aid with controlling existing weed infestations, and prevent the spread of existing weeds.

Direct and indirect effects of temporary road construction, road reconstruction and maintenance or road decommissioning include disturbance and increased risks of dispersal of existing weed species and populations and introduction of new species. These would be mitigated by following the mitigation measures and design features in Appendix C. Roads that are decommissioned as part of the Rim Country Project would be complementary to the goals of Travel Management objectives for the forests. Design features provide for the use of existing travel courses and stream crossings unless new construction would result in less disturbance. This would help to minimize disturbance from road construction and result in fewer disturbed areas where noxious or invasive weeds would be able to become established. .

Management activities associated with aquatic and channel restoration would increase disturbance in the treated areas. Actions such as digging, soil disturbance and related activities associated with spring restoration would be the sources of this disturbance. These effects would be mitigated by following the mitigation measures and design features in Appendix C. Design features establish designated staging areas outside of aquatic management zones (AMZs). This reduces the risk of the spread of noxious or invasive weeds into AMZs while reducing the risk of aquatic diseases and petroleum contamination into aquatic systems and habitats.

A series of rock or gravel pits would be needed to provide materials for road maintenance in the project area. The activities associated with the operation of these are sources of disturbance. A series of mitigations are provided in the action alternatives to reduce the risks of introducing or spreading noxious or invasive weeds in the project area. Design features provide for inspection of sites to assure they are weed-free before use or transport. Noxious or invasive weeds would be treated before use of the pits. If these treatments are not successful or possible then the operators would be informed of the weed locations and fill would be obtained from areas of the pit not near the weed infestation. Equipment used in the pit would be inspected and cleaned before entering the pit area. If pits are expanded soil and vegetation disturbance would be avoided to the extent possible and only the area needed would be cleared of vegetation. This would help minimize disturbance, reducing the amount of unoccupied sites that could then be invaded by noxious or invasive weeds. The risk of introducing noxious or invasive weeds from contaminated fill can be mitigated by maintaining stockpiled, weed-free material.

Processing areas are likely to be locations where invasive weeds are established during their operation. These areas would be managed under the timber sale or special use permit. To minimize the potential for invasive species spread and transport, these would be treated as part of the reclamation once operations are complete. Implementation of the design features would reduce introduction and spread of noxious and invasive weeds. Thus, while these areas would result in localized weed populations, the spread is expected to be limited. Design features provides for rehabilitation of processing areas after they are no longer used including seeding of sites with native seed which would help re-establish native plant communities and reduce the risk if noxious or invasive weed infestations. Seed mixes of native species used for post-thinning erosion would be certified as weed-free in accordance with Region 3's guidance for weed-free materials (USDA 2018) with a minimum of five pounds of pure live seed per acre (USDA 2018).

The action alternatives are expected to limit the establishment and spread of invasive species within and adjacent to the project area over the next several decades by decreasing the risk of high intensity wildfire. In the ponderosa and mixed conifer habitat types within the project area, nonnatives have been shown to increase with increasing fire intensity (McGlone and Egan 2009).

By decreasing fire intensity, these alternatives would result in increased understory abundance and diversity which would be more resistant to invasive species over the next 10 to 20 years.

Cumulative Effects

The cumulative effects analysis area for noxious or invasive weeds includes the project area plus surrounding major arteries of transportation and utility corridors that enter the project area. Major roads and utility corridors were included because of their roles in providing corridors for dispersal of noxious or invasive weeds. The timeframe for cumulative effects on noxious or invasive weeds is twenty years prior and twenty years into the future.

The distribution of noxious or invasive weeds on the project has been shaped by past management activities and natural disturbances in the project area. Activities such as firewood cutting have occurred in the past and would continue into the future. Fuel wood cutters can introduce weeds into the area through their actions. These actions occur under permit but the forests have limited control over where these activities would occur.

Wildfires can be sources of high levels of disturbance depending on fire severity. Severely disturbed areas can be more easily invaded by noxious or invasive weeds than less severely disturbed or undisturbed areas. Numerous wildfires have occurred in the project area (see cumulative effects document). Some of these, such as the Rodeo-Chediski (2002), Juniper (2016) and Pot Fire (1996) have covered large acreages. These have resulted in large acreages of severe fire effects such as almost complete removal of the plant communities and soil erosion, leaving large areas of disturbance prone to noxious or invasive weed invasions. Some remedial actions for large fires have resulted in large acreages of non-native species that are now problematic and would be challenging to restore to native plant communities. An example of this is the large infestation of Lehmann's lovegrass that now infests the Dude Fire (1990) on the Tonto National Forest.

Fire exclusion has contributed to the risk of noxious or invasive weed invasion by promoting very dense forests with little or no resilient understory community. The lack of native vegetation to compete with noxious or invasive weeds increases the risk of weed invasion. Fire exclusion also increases the risk of severe stand replacing fires and its accompanying severe disturbance.

There are numerous grazing allotments in the project boundary. The past effects of grazing and the associated activities are not completely known but may include temporary reduction of the native plant community in certain areas (especially near water sources) which would allow for plants such as the noxious or invasive weeds discussed above to enter the plant community and introduction of weeds through feed or manure. Human actions associated with range management such as driving in the area, constructing livestock improvements, and transporting livestock have also been part of the past actions.

A wide variety of recreation activities occur within the boundary of the project area including hiking, camping, hunting and recreational driving. Users can introduce noxious or invasive weeds from other areas on vehicles and personal equipment. The effects of livestock such as horses or pack animals used in recreation are similar to those in grazing and include temporary reduction of the native plant community in localized areas where animals are allowed to graze and introduction of weeds through feed or manure. Trampling and compaction can also occur if the same campsites are used repeatedly.

In the past there were few restrictions on off-road motorized travel whether for recreational or other purposes On the Coconino NF, most off-road motorized travel was prohibited with the implementation of the Travel Management Rule (TMR) in 2012. Implementation of the 2012 travel plan also reduced the number of roads open to public motorized travel, reducing the risk of dispersal of noxious or invasive weeds in some areas. The Tonto NF completed a similar analysis in 2016, restricting motor vehicle travel to roadways in some areas while allowing cross-country travel in other areas. The effects to noxious or invasive weeds were addressed in the analysis. The Apache-Sitgreaves NFs is currently in the process of analyzing travel management. A final EIS for the project is expected in October 2019. The effects of this project to resources such as noxious or invasive weeds are unknown.

Major highways tend to be corridors for weed dispersal by providing a source to vector weeds into the area. Management activities associated with the highway can create disturbance and spread existing weeds. Examples include past activities such as blading of road ditches where equipment passed through existing weed infestations, spreading them along the road corridor. In 2003, the Southwestern Region of the Forest Service completed the Environmental Assessment for Management of Noxious Weeds and Hazardous Vegetation on Public Roads on National Forest System Lands in Arizona. The decision, which followed in 2004, allowing treatment of noxious or invasive weeds along state and federal highway rights-of-way through all National Forests in Arizona. Some treatments have occurred along state and federal highways as a result but the extent of these treatments are not known.

The Apache-Sitgreaves NF has surveyed and treated numerous infestations of noxious or invasive weeds within the project area since 2004. All of the treatments prior to the approval of the *Environmental Assessment for the A-SNFs Integrated Forest-Wide Noxious or Invasive Weed Management Program* (USDA Forest Service 2008) were mechanical treatments accomplished using hand tools. Herbicide use on the forest began in 2009 after the approval of the document. Some of the major areas of past treatment include Bison East, Bison West, Buckskin Wash, Decker Wash, and Hart Canyon. These and other areas would need repeated monitoring and treatment. The Coconino NF began weed survey and treatments in about 1995 and like the Apache-Sitgreaves, they relied on non-herbicide methods to control isolated occurrences using mechanical control and alternatives such as grazing. Using sheep to control leafy spurge was utilized before the approval of the *Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds, Coconino, Kaibab, and Prescott National Forests*; (USDA Forest Service 2005). The EIS allowed use of herbicide as well as biological control. Many of the treatments have been focused on particular species or areas of concern such as the leafy spurge, various species of knapweed and non-native thistles.

There are records of surveys along roadways on the Tonto NF beginning in 1999. These surveys were generally by Arizona Department of Transportation. The forest began surveying for weeds in 2003. Many of the treatment prior to the approval of the *Environmental Assessment for Integrated Treatment of Noxious or Invasive Plants* (2012) were done using hand tools.

The disturbance resulting from the management activities in this project would continue to be sources of disturbance that may contribute to the threat of noxious or invasive weed occurrences and would be additive to the activities discussed in this section of the report.

Numerous management activities and wildfires have occurred in the project area in the past (see cumulative effects document). These activities have contributed to the existing condition of this analysis. Ground disturbing activities such as timber sales and large wildfires may have contributed to the introduction, spread or persistence of some noxious or invasive weed invasions.

Heritage Resources

A summary of the heritage resource analysis is presented here and the complete heritage specialist report (Hangan 2018) is incorporated by reference.

Affected Environment

Within the Rim Country project area, cultural resources range temporally from prehistoric times through the historic period and into modern times. Prehistoric sites can include rock art, cliff dwellings, pithouses, multiple room pueblos and artifact scatters. Historic resources may consist of logging railroad grades, trails and historic roads, cabins and homesteads, Forest Service administrative sites, Basque sheep camps, mining camps, Civilian Conservation Corps sites, and Native American shelters such as sweat lodges and brush shelters. Cultural resources also include Native American traditional use areas and places known as Traditional Cultural Properties. These hold a central and important place in Native American culture.

The existing condition for cultural resources is determined by the number of existing heritage inventories within the analysis area, in addition to the amount and/or types of resources, and cultural periods represented by those resources, that have been identified within the boundaries of the EIS. Table 3-** was generated by the Apache-Sitgreaves and Coconino National Forests using their heritage GIS databases, while the Tonto used their hard copy heritage atlases.

Table 106. Cultural resource sites and surveys

Forest Name	Acres Previous Survey	Cultural Resources Recorded	National Register Listed Sites	NR eligible Sites	Unevaluated Sites	Site Previously Evaluated Ineligible
Apache-Sitgreaves	104,474	3,012	6	795	2,026	57
Coconino	97,900	946	2	148	774	22
Tonto	29,226	1100	2	388	621	91

Apache-Sitgreaves National Forests

The Rim Country EIS Area of Potential Effect includes 539,942 acres of the Apache-Sitgreaves National Forests, 401,911 acres on the Black Mesa Ranger District (65 percent of the district) and 138,031 acres on the Lakeside Ranger District (51 percent of the district). According to current geographic information systems (GIS) data, forest archaeologists have surveyed 90,929 acres, approximately 17percent of the 539,942 acres in the Rim Country project area.

Three thousand and twelve (3,012) cultural resources have been recorded, 1,694 on the Black Mesa Ranger District and 1,318 on the Lakeside Ranger District, of which six are listed on the National Register of Historic Places, 795 were determined eligible for inclusion on the National Register, 2,026 are unevaluated for eligibility, and 27 have been determined not eligible for inclusion on the National Register. Most of the sites recorded are prehistoric or protohistoric in nature (84 percent), followed by historic sites (12 percent), 74 sites of unknown affiliation (2½ percent), and multi-component sites with historic and prehistoric artifacts/features (1½ percent). Site types represent a full range of human occupation, from Paleoindian sites of the Pleistocene to a wide variety of historic period sites dating to 50 or more years ago.

Coconino National Forest

The Rim Country EIS Area of Potential Effect includes 398,860 acres of the Coconino National Forest, 389,482 acres on the Mogollon Rim Ranger District and 9,378 acres on the Red Rock Ranger District. Within this area, forest archaeologists have surveyed 97,900 acres, approximately 25 percent of the 398,860 acres in the Rim Country project area. Archaeologists have identified 946 cultural resources, of which two are listed on the National Register of Historic Places, 148 were determined eligible for inclusion on the National Register, 774 are unevaluated for eligibility, and 22 have been determined not eligible for inclusion on the National Register.

Most of the sites recorded on the Coconino are prehistoric in nature (78 percent), followed by historic sites (20 percent), multi-component sites with historic and prehistoric artifacts/features (16 percent), and four sites of unknown affiliation. The majority of the prehistoric sites are lithic scatters (47 percent) and scatters with lithic artifacts and ceramics (21 percent). Other prehistoric sites include sites with house features: field houses, pueblos, pithouses, cliff dwellings, or other house features (20 percent), caves/rockshelters/cavates (3 percent), agricultural fields (3 percent), and rock art sites (4 percent). The 189 historic sites include those associated with national forest management (21 percent), logging or sawmills (7 percent), ranching (47 percent), historic trails or wagon roads (6 percent), mining (3 percent), military (3 percent), historic burials (3 percent), and trash dumps that may be related to one or several of these historic activities (10 percent).

Tonto National Forest

The Rim Country EIS Area of Potential Effect includes 290,090 acres on the Payson and Pleasant Valley Ranger Districts of the Tonto National Forest. Within this area, forest archaeologists have surveyed 29,226 acres, approximately 10 percent of the 290,090 acres in the Rim Country project area. Archaeologists have identified 1100 cultural resources, of which two are listed on the National Register of Historic Places, 388 were determined eligible for inclusion on the National Register, 621 are unevaluated for eligibility, and 91 have been determined not eligible for Assumptions and Methodology

Assumptions and Methodology

The primary assumption for this effects analysis is that the removal of fuel from archaeological sites and improving or decommissioning roads is a benefit to cultural resources. These activities could protect cultural resources from the effects of extremely hot, highly destructive wildfires by removing fuel from around and off of archaeological sites. Improving or decommissioning roads could protect archaeological sites by removing roads that go through sensitive sites. Improving rough, impassible roads could reduce the threats to archaeological sites from off-road driving. This would also encourage drivers to remain on roads rather than drive cross-country to avoid bad spots in roads. However, the methods for accomplishing these tasks, such as mechanical thinning or ripping of roads, also has the potential to adversely affect cultural resources.

The secondary assumption is that cultural resources will be present at the proposed spring, riparian, or stream restoration locations. Cultural resources are frequently found in association with water sources such as springs, streams, and riparian areas. Water sources would have been exploited prehistorically and during historic periods. A reliable spring, for example, would likely have been developed to supply stock grazing, logging operations, or farming.

The final assumption is that all activities proposed with the Rim Country EIS will meet the criteria of a No Adverse Effect determination as defined in the Programmatic Agreement and/or 36 CFR 800.6 where appropriate.

In consultation with the AZ SHPO, the forests are going to rely on multiple guidance documents and strategies to assist in reaching a No Adverse Effect determination. The primary guidance will be Appendix J of the Programmatic Agreement. Appendix J of that agreement outlines the consultation protocols and strategies for implementing large-scale fuels reduction, vegetation treatment, and habitat improvement projects.

To supplement Appendix J, in consultation with the AZ SHPO and tribes, the Rim Country forests created a sample survey strategy specifically for vegetation projects that would involve mechanical treatments (Morgan et al 2017). Appendix J of the Programmatic Agreement provides guidance for mechanical treatment. However, it does not distinguish between the various types of mechanical treatment options, e.g., feller-buncher versus agra-ax, nor does it take into account existing site inventory data or identified high and low site densities areas. A model was created using terrestrial ecological unit strata and known site densities within the project area. The model, amount of existing inventory within a task area and the type of proposed mechanical treatment will all be taken into account when determining the amount of inventory necessary and any standard mitigation measures that need to be implemented to meet the criteria of No Adverse Effect.

The Programmatic Agreement will guide the analysis for the remaining activities proposed in the Rim Country EIS. The one exception will be road improvement and decommissioning. Some Forest roads are known to cross archaeological sites and they often have exposed artifacts and cultural features in the road beds. Improving or decommissioning roads usually involves some level of mechanical work such as grading or ripping road beds. The forests, in consultation with the AZ SHPO and tribes, developed a road plating protocol. This protocol outlines procedures for “plating” or covering the portions of sites within road beds that have remaining features or intact cultural deposits. This would help to protect intact cultural remains in the roads from blading or other types of maintenance or decommissioning activities.

Phased Section 106 Compliance

Because of the size of the undertaking, implementation would be phased over several years. Appendix J, reviewed by the AZ, NM, TX and OK SHPOs, the ACHP, and tribes, allows for the phasing of the Section 106 compliance. Appendix J of the Programmatic Agreement and the Rim Country Sampling Strategy, developed in consultation with tribes and the AZ SHPO, describes the methods to be used to achieve a No Adverse Effect determination for the Rim County analysis as a whole, while providing a strategy for a phased Section 106 evaluation for individual task orders.

Individual task orders, or undertakings, will be inventoried when each specific project area is identified. A Section 106 report will be produced for each proposed individual undertaking, and all consultation with the AZ SHPO and appropriate tribes will be completed prior to implementing the task order.

Environmental Consequences

Alternative 1 – No Action

Under Alternative 1, existing fuels in and around archaeological sites would continue to increase. This could result in more frequent and intense wildfires which could result in site and artifact damage such as spalling of rock art and cracking of artifacts. Fire suppression actions, particularly bulldozer operations, could damage or completely destroy surface and subsurface (pit houses/kivas) archaeological sites, resulting in the loss of those resources and their research potential.

Soil erosion due to uncharacteristic wildfires could have both direct and indirect effects on heritage resources. Rain and snow melt could cause channels to form within denuded sites, or mud slides from nearby slopes could deposit soil and debris within site boundaries, leading to the loss of data potential and the characteristics that would make a heritage property eligible for the National Register of Historic Places.

Archaeological sites located within open grass lands would be affected by an increased number of trees growing inside the site boundaries. The trees and their root systems might displace surface and subsurface artifacts and features. Also the trees would increase the amount of fuel on the sites. This might result in effects from intense wildfires.

Forest system roads that cross archaeological sites would continue to affect the sites by degrading cultural deposits and features within road beds located inside site boundaries. Also, when roads are not well maintained, users may drive off existing roads to avoid “bad spots” and could affect cultural sites adjacent to the roads.

No action might also result in the reduction over time of pre-European settlement-adapted native plants, some of which have been collected since historic times by Native Americans for food and medicine. Additionally, springs, seeps, and riparian areas are important locations to Native Americans and other members of the public, and increasingly overstocked forests might have some effects on those historic water sources.

Effects Common to Both Action Alternatives

Each of the alternatives recommends a substantial amount of ground disturbance, particularly mechanical treatments as part of thinning trees, grassland restoration, blading in new temporary roads, maintaining existing roads, or decommissioning roads. Other activities such as stream and riparian restoration, and the installation of barriers around springs, aspen, and other native trees may also include-ground disturbing activities. Riparian areas and water sources like streams and springs tend to be locations where the presence of cultural resources can be reliably predicted. All of these activities have the potential to adversely affect cultural resources. Effects could include rutting, erosion, dislocation, or breakage of artifacts and features, and destruction of sites and site stratigraphy.

Prescribed burning also has the potential to affect sites. If the burning is low to moderate in heat intensity, and there is little fuel on the sites, most sites located inside the project area would be minimally affected, if at all, with the exception of sites that include wood elements or rock art. Sites within the project area with a significant amount of fuel in a prescribed burn area could be affected by heat damage in the same manner as a wildfire if the fuel is not removed prior to burning. Effects from heat damage would include breaking, pocking, and spalling of ground stone tools and architectural features. Excessive heat could alter obsidian hydration rinds, destroying their dating potential and the associated loss of scientific information. Effects on structural components such as rock walls or rock faces include discoloration, cracking, and spalling, making the rocks susceptible to accelerated deterioration. There is also the potential for effects from soil erosion due to the removal of vegetation. Rain and snow melt, for example, could cause channels to form within denuded sites. Mud slides from nearby slopes could deposit soil and debris inside site boundaries, leading to the loss of data potential and the characteristics that would make a heritage property eligible for the National Register of Historic Places. The majority of the effects listed above can be mitigated through project design, avoidance, removing fuel from sites prior to project implementation, and implementing site protection measures (see Appendix C).

Thinning and prescribed burning should reduce unnatural fuel loading around and inside the boundary of National Register listed or eligible heritage resources. Uncharacteristic fire behavior should also be reduced by these treatments, which would help to prevent extensive heat damage from future wildfires. There would be less need for fire suppression activities during a wildfire, and consequently less of a threat from ground-disturbing activities, such as bulldozer fire-line construction.

Initial reduction of heavy fuels may lead to an increase in site visibility, public visitation, and possible vandalism. Those issues are mitigated through management actions that include project-specific as well as long-term monitoring. Initial entry prescribed burns should be periodically revisited and burned to reduce natural fuel accumulations, and archaeological site monitoring is part of that process. Road decommissioning can also assist in limiting access to some archaeological sites, thus minimizing post-burn visibility and visitation issues at those sites.

The proposed temporary road construction, road maintenance, and road decommissioning do have the potential to affect cultural resources. The Programmatic Agreement includes mitigation measures that would help protect cultural resources affected by system roads identified for maintenance or decommission. The locations of temporary roads would be inventoried prior to implementation and any potential effects to sites would be mitigated through avoidance or project redesign. Decommissioning activities, if contained within the road beds and not inside site boundaries, should have no effects on cultural resources. In those cases where road maintenance or decommissioning might occur within National Register listed or eligible cultural resources, a site plating strategy should be used that has been developed in consultation with the AZ SHPO and tribes[1]. The protocol includes mitigation measures to protect any existing cultural deposits or features present within the road beds or along road cuts.

Restoration activities for grasslands, riparian areas, and streams do have the potential to effect cultural resources. Grasslands tend to contain low densities of archaeological sites. Some restoration activities, such as the use of an agra-ax to remove encroaching trees, though a mechanical treatment, are known to disturb little of the ground surface. Therefore grassland restoration activities are less likely to adversely affect cultural resources. Where sites are present, mitigation measures listed in the Programmatic Agreement and design features in Appendix C will be implemented.

Springs, streams, and riparian areas are known to be very sensitive for the presence of cultural sites and culturally important plants. Restoration activities that are highly ground-disturbing would affect cultural resources. The Programmatic Agreement lists mitigation measures that should be implemented to minimize effects on cultural sites.

Project implementation may affect some Native American uses as tribal members commonly access forest lands for ceremonial activities and to gather forest products. Access concerns can be addressed through on-going consultation between the Forest Service and Native American groups.

There is the possibility that cultural resources would be discovered during project implementation. These inadvertent discoveries would be handled, in consultation with AZ SHPO and tribes, following the guidance in Appendix J of the PA and 36 C.F.R 800.12., if appropriate.

Effects Unique to Each Action Alternative

The action alternatives propose essentially the same activities, ranging from various mechanical treatments, comprehensive restoration, and various types of road work. The major differences involve the amount of each activity being proposed. From a cultural resources stand point, there are no effects that are unique or different between the alternatives. Effects on cultural resources

1 The region is in the process of working on adding this strategy as a protocol to the R3 PA. Until that time, AZ SHPO agreed that this plating strategy can be used within the 4FRI Rim Country area.

are highly dependent upon the proposed activity, its location, and the likelihood of the presence or absence of cultural resources in the proposed treatment area. Therefore, mechanically thinning *899,340 acres versus *474,930 acres only matters in that fewer acres proposed for mechanical treatment means less of a threat of effects on cultural resources from this activity. However, it also means less fuel removed, thus less protection to cultural resources from the effects of high intensity wildfires.

Effects from Rock Pit Use and Expansion

Approximately nine existing rock pits on the Coconino NF are being proposed for use within the Rim Country project area. On the Apache-Sitgreaves NF, 11 sites are proposed for use.

The rock pits would be used as a source of gravel for various road maintenance activities. Their access roads might undergo some level of maintenance and the pits might be expanded in various directions to a maximum of 500 feet, where needed to increase their capacity to yield material. The rock pit locations on the Coconino were evaluated for Section 106 as part of the Rock Pits EA (USDA 2016). Unlike the pits on the Coconino, the rock pits on the Apache-Sitgreaves have not been evaluated for Section 106 compliance beyond their current operations. According to the forest’s cultural resource database, Carr Lake, Brookbank, Borrow, and Cottonwoods Wash pits all have cultural resources that would need to be mitigated before and expansion of the pits.

Rock pit operations and expansions have the potential to affect cultural resource sites adjacent to the rock pits and their access road locations. Erosion by mass wastage, slope wash, and wind over many years can strip cultural deposits from archaeological sites, remove or displace artifacts, and undermine historical structures. Ground disturbances adjacent to cultural resource sites may accelerate erosion by damaging vegetation, loosening stable soil surfaces, or compacting soils, and thereby promote surface runoff. Vehicle tracks tend to channel surface runoff, causing down-cutting and increased soil erosion. These effects are expected to be avoided at cultural sites near rock pits through pit expansion design and avoidance measures such as erecting temporary fences around sites during periods of operation.

It is possible that increased truck traffic to and from proposed rock pits could result in indirect erosion effects on a small number of sites that occur adjacent to access roads. Keeping these roads well maintained would be expected to limit these effects.

The risk of unauthorized collection of artifacts would increase due to the presence of project personnel in areas where the locations of heritage resource sites are clearly marked. Unauthorized removal of materials from heritage resource sites could result in the loss of objects with cultural importance to Native American groups, or of artifacts needed to determine the age and nature of the occupation at prehistoric sites. This would be mitigated by requiring that sites identified near the pit operation areas are recorded in detail, then monitored after the operations are completed.

Effects from Use of In-woods Processing and Storage Sites

Twelve locations have been identified as potential processing and storage areas within the Rim Country project area on the Coconino and Tonto National Forests.

The storage and processing areas located on the Coconino NF are within the Cragin Watershed Protection project area. These areas were assessed as part of the Cragin heritage evaluation. Mitigation measures and design features for the Cragin Environmental Assessment parallel those listed in the Programmatic Agreement and Appendix C of this Rim Country EIS and will be implemented prior to project implementation. If the proposed processing and storage areas are selected for use, the Mogollon Rim Ranger District archaeologist would review the existing inventory for that location and would ensure that mitigation measures for the Cragin Project are implemented, if needed.

The potential locations on the Tonto NF would likely be utilized for task orders or contracts in those areas. The evaluation for all of the processing and storage locations would follow the processes outlined in the design features in Appendix C. Otherwise the guidance within the Programmatic Agreement would be used. Proposed mitigation measures would be implemented prior to the areas being used. With the implementation of standard mitigation measures and design features, there should be no adverse effects on cultural resources due to the use of these locations as storage and processing areas.

Effects from Forest Plan Amendment(s)

Three plan amendments were added to the Tonto National Forest Plan. They removed language restricting mechanical equipment on slopes of over 40 percent, amended Plan language and components to align with the Mexican Spotted Owl Recovery Plan, and redefined the treatment for ponderosa pine vegetation types. Of these three amendments, removing restrictions for mechanical equipment on slopes of less than 40 percent has the most potential to affect cultural resources and the methods for conducting Section 106 analysis.

Sensitive cultural resources such as rock art and rock shelters tend to be located on 40 percent or greater slopes of small hills, rock out-croppings and mountain slopes. However, because steeps slopes are typically not treated mechanically, Appendix J includes provisions that would allow for exempting slopes 40 percent or greater from intensive archaeological inventory. The Rim Country alternatives will include treatment of slopes up to 40 percent. This increases the likelihood of impacts to the types of cultural resources found in those locations. It also means that the archaeological analysis will need to include an intensive inventory of the steep slope treatment locations.

Cumulative Effects

The cumulative effects analysis area is the Area of Potential Effect for the Rim Country EIS.

Alternative 1 – No Action

If this proposed large scale, landscape level forest health project is not implemented, there would still be some serious cumulative effects on heritage resources. High intensity wildfires and the construction of fire breaks using bulldozers during a wildfire could severely damage sites. Wildfires could also sterilize the soil or completely remove ground fuels, making the sites vulnerable to soil erosion. Also, because sites are more visible after a fire, they are much more susceptible to vandalism. Soil erosion from dry channels that are within or adjacent to sites could continue to affect a site’s cultural stratigraphy and displace much cultural material. Roads through sites would continue to degrade cultural deposits and features. Trees would continue to encroach into grasslands and displace artifacts and cultural deposits within sites.

Effects Common to Both Action Alternatives

Cumulative effects from mechanical treatments, temporary road construction, and other ground-disturbing activities, as well as effects caused by prescribed burning, would be mitigated using site protection measures identified in Appendix C, Appendix J of the Programmatic Agreement, the Rim Country Sample Survey Strategy, and the Site Plating Strategy. These include archaeological monitors during mechanical activities, keeping ground-disturbing activities out of sites by flagging and avoiding the sites, and post prescribed burn site monitoring to assess the effects of the low-intensity burns. Covering cultural deposits and features in road beds within cultural sites prior to maintenance activities or during decommissioning would protect buried cultural deposits and features. Also, well-maintained roads would encourage the public to remain on roads and deter cross-country travel which could damage sites located near roads. Because all ground-disturbing and prescribed fire undertakings go through the Section 106 review process, and identified potential effects would be mitigated, the overall cumulative effects from these undertakings should be minimal. Therefore, there should be few cumulative effects on cultural resources as a result of the activities proposed for the Rim Country Project.

There is the possibility of cumulative effects from archaeological site vandalism that results from increased visibility once the project is implemented. However, the management practice of implementing low to moderate-intensity prescribed fire typically does not sterilize soil or completely remove ground fuels, as does a high-intensity wildfire. Low-intensity fires also tend to leave some trees in place that will eventually cover the surface with a recurring needle cast. Sites are also periodically monitored both during project implementation, as well as for NHPA Section 110 purposes, by agency and volunteer personnel. Proposed road closures would also reduce public access to some of these areas.

The likelihood of erosion on cultural resources is also minimal. Reducing fuel loads and implementing low to moderate-intensity prescribed fires does not cause soil sterilization or hydrophobic soils like high-intensity wildfires. As noted previously, low-intensity prescribed fires leave some vegetation in place and re-vegetation occurs soon afterwards if soils are not sterilized. However, as implementation occurs, archaeologists would monitor for erosion concerns, examining sites in the project areas, especially focused on slopes, drainages, and other high probability areas where cultural resources maybe present.

The proposed restoration activities in grasslands, riparian, streams, and seeps would also have a very limited ability to cause cumulative effects. All of these activities can easily be modified to minimize effects on cultural resources through avoidance or prescription modification. In the case of grasslands, the physical removal of encroaching trees and other fuels would have the added benefit of protecting sites from the effects of wildfire.

Socio-Economics

A summary of the Socioeconomic Report is presented here. The complete specialist report (Jaworski 2018) is incorporated by reference. The analysis describes the current conditions and trends related to the social and economic environment of the planning area, including: population and demographic changes, potential environmental justice populations, and employment and income conditions.

Affected Environment

Population Growth

The planning area counties are home to approximately 530,000 people, which is approximately eight percent of Arizona's population (U.S. Census Bureau 2017). Table 3-** displays annual population estimates for the planning area counties and the state.

Table 107. Population Estimates, 2010 to 2016

Location	2010	2011	2012	2013	2014	2015	2016
Coconino County	134,624	134,186	135,999	136,641	137,695	139,076	140,908
Gila County	53,539	53,486	53,036	53,039	53,124	53,138	53,556
Navajo County	107,714	107,735	107,037	107,443	108,178	108,363	110,026

Location	2010	2011	2012	2013	2014	2015	2016
Yavapai County	211,139	211,138	212,350	215,027	218,405	221,584	225,562
Arizona	6,408,312	6,467,163	6,549,634	6,624,617	6,719,993	6,817,565	6,931,071

Source: U.S. Census Bureau, Population Estimates, 2017

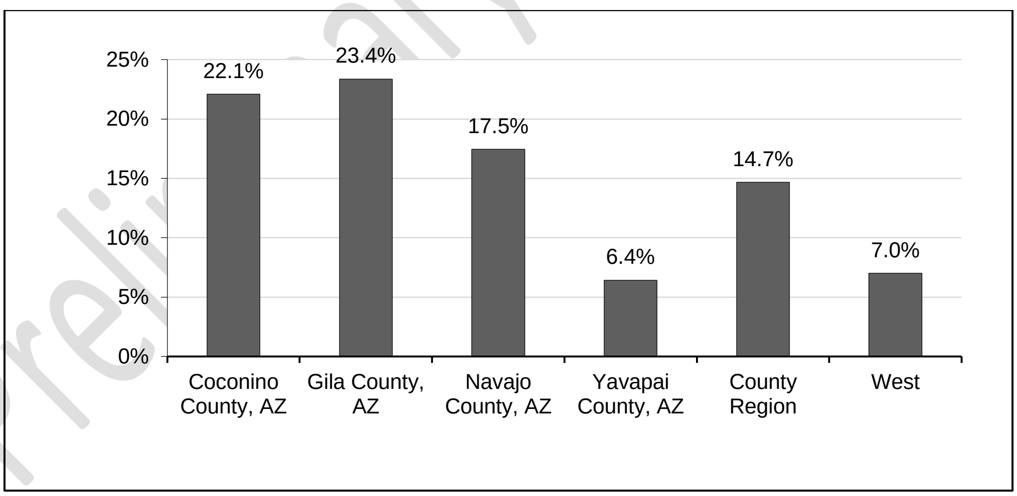
Arizona was among the fastest growing states between 2010 and 2016, over which period Arizona grew 8.2 percent (U.S. Census Bureau 2017). The counties in the planning area grew more slowly over this period, ranging from 6.8 percent population growth in Yavapai County to no growth in Gila County (U.S. Census Bureau 2017).

Population growth in the planning area may interact with forest management activities. For example, population growth may increase the size of the wildland-urban interface. Wildland-urban interface growth can affect ecological integrity, wildfire suppression costs, and the number of people exposed to smoke emissions.

Wildland-Urban Interface

The wildland-urban interface is the area where urban development contacts natural or undeveloped land. This wildland-urban interface is especially vulnerable to wildland fire. 3-** displays the share of homes in the wildland-urban interface in the planning area. Approximately one-fifth of homes in Coconino, Gila, and Navajo Counties are in the wildland-urban interface. Only 6.4 percent of homes in Yavapai County are in the wildland-urban interface. These data reveal that a sizeable share of residents in the planning area have homes in the wildland-urban interface. Homes in the wildland-urban interface are about twice as common in the planning area as they are West-wide (14.7 percent compared to 7 percent). Nearly half of the homes in the planning area's wildland-urban interface are second homes, suggesting that many of their owners are part-year residents (Headwaters Economics 2017).

Table 108. Percent of total homes built in the wildland-urban interface, 2010



Source: Headwaters Economics, 2017

Table 1-** below represents the risk of wildfire for lands already developed in the wildland-urban interface. This risk is measured using the 11 westernmost states in the contiguous U.S. and their counties. There are 414 counties, therefore a rank of 1 in 414 indicates that it is considered the most at-risk county for wildland fire, whereas a rank of 414 would indicate very low risk.

Coconino County is the most at-risk county in the planning area, however, all three counties are extremely vulnerable to wildland fires in the wildland-urban interface and rank among the top quartile for all 414 counties. In addition, all three counties rank in the top five for the 15 counties in the state of Arizona.

Table 109. Wildfire Risk to Development, West-wide and State-wide County Rankings, 2010

Location	West-wide Rank by Existing Risk	State-wide Rank by Existing Risk
Coconino County	65 of 414	1 of 15
Gila County	101 of 414	5 of 15
Navajo County	99 of 414	4 of 15
Yavapai County	87 of 414	2 of 15

Source: Headwaters Economics, 2017

Wildfire Costs

In 2015 and 2016, federal wildland fire suppression cost approximately $2 billion annually, $1.7 billion of which was spent by the USFS (NIFC 2017). That is a nearly 300 percent increase in cost (inflation adjusted) since 1985 (NIFC 2017). Much of the cost increase has been attributed to the further development of the wildland-urban interface, climate change, and management of forests (suppression, prescribed burns, etc.). Past large wildfires in and around the Rim Country project area have cost tens of millions of dollars to fight. The 2005 Cave Creek Complex Fire alone cost the Forest Service approximately $18 million to fight. In 2016, the Forest Service spent $12 million on the Juniper and Fulton Fires (N. Hale, personal communication, June 7, 2017).

Between 1995 and 2015, the percentage of the Forest Service budget spent on fire expanded from 16 to 52 percent (USFS 2015). Furthermore, suppression costs account for only a fraction of the total cost of wildfires. Wildfires often entail costs associated with rehabilitation, lost property, decreased business revenue, and human health effects. The Western Forestry Leadership Coalition estimates that total wildfire-related expenses, when accounting for a variety of direct and indirect costs, range from two to thirty times the reported suppression expenditures (WFLC 2010).

The rising cost of federal wildland fire operations has caused a shift of agency expenditures from other mission critical activities (e.g., restoration, research, and recreation) toward firefighting and fire management (USFS 2015). Reduced funding for recreation, vegetation and watershed management, wildlife and fisheries habitat management, and other non-fire activities limits the ability of the Forest Service to contribute to improvements in ecosystem services and quality of life in nearby communities (USFS 2015). For example, between fiscal years 2014 and 2015, the agency's fire suppression expenditures increased by $115 million while non-fire programs were reduced by the same amount (USFS 2015). Climate change and continued population growth in the wildland-urban interface are expected to contribute to rising fire suppression costs.

Beginning in fiscal year 2020 through fiscal year 2027, the Forest Service fire suppression spending from its regular budget will be capped at just over $1 billion and fire suppression costs in excess of this amount will be funded through an emergency wildland firefighting account rather than through borrowing from other Forest Service program areas (USDA 2018).

Forest Products Industry

Table 3-** shows the number of employees in four forestry-related sectors in the project area. According to the IMPLAN data, the counties in the project area currently have few jobs in forestry-related sectors. Navajo County has the largest numbers of employees in commercial logging, biomass generation, and sawmills. Gila County has the fewest employees in these sectors. The four counties in the project area have approximately 30 percent of commercial logging and sawmill employees and seven percent of wood product manufacturing employees in the state. As of 2015, the only biomass power generation facility in the state was in Navajo County (IMPLAN 2015).

Table 110. Employment in Forestry-Related Sectors, 2015

Location	Commercial Logging	Biomass Power Generation	Sawmills	Wood Product Manufacturing
Coconino County	17.6	0.0	2.4	137.1
Gila County	8.5	0.0	0.0	60
Navajo County	42.0	0.5	39.8	146.6
Yavapai County	41.9	0.0	4.2	19.2
Arizona	379.7	0.5	162.5	5,539.8

Source: IMPLAN, 2015

In terms of employment, only Navajo County is more specialized in forestry-related sectors than the nation overall (Headwaters Economics 2017). These data indicate where existing capacity – in terms of infrastructure and skilled labor – to implement 4FRI activities may exist in the project area.

The vast majority (97 percent) of timber harvested in Arizona is processed in the state, though very little timber from other states flows into Arizona for processing (Sorenson et al. 2016). In 2012, there were 25 active wood product manufacturers, including sawmills, house log and viga manufacturers, bioenergy facilities, and other plants (Sorenson et al. 2016). These facilities are concentrated near the Rim Country project area. The number of primary wood processing facilities in Arizona increased by approximately 50 percent between 2007 and 2012 (Sorenson et al. 2016). Proximate wood processing facilities are essential for forest restoration activities, since transportation costs can erode the financial feasibility of removing small diameter and low value forest products.

4FRI Phase One Implementation

Implementation of phase one of 4FRI contributed jobs and labor income to the regional area. This is important because it sets the stage for future implementation activities under the Rim Country 4FRI. This section will demonstrate how the social and economic affected environment has changed since phase one was implemented in FY 2017.

Implementation activities for phase one were assessed using primary employment data gathered via surveys of wood contractors in the area. In FY 2017, the economic activities related to implementation of 4FRI phase one were 12,000 acres mechanically thinned and the removal of about 400,000 green tons of sawlogs and biomass for processing. These activities generated almost 1,000 full and part-time jobs and $50 million in labor income in FY 2017 in Apache, Coconino, Gila, Greenlee, and Navajo counties in northern Arizona (Hjerpe 2018).

While these economic contributions from phase one 4FRI activities are substantial, the growth in contributions has been limited and are less than original project objectives (Hjerpe 2018). Hjerpe (2018) also found that “the main barrier to ramping up 4FRI mechanical thinning accomplishments is the lack of profitability in thinning and processing small diameter ponderosa pine.” Ways to boost the economic contributions from 4FRI activities include “to increase the scale of acres treated, which would result in greater thinning and wood utilization employment” and “to decrease the amount of contributions leaked from the region” (Hjerpe 2018). Contributions leave the region when there is inadequate infrastructure to process the harvested wood in the region. Any regional response to these barriers and solutions would affect how wood is processed and how the resulting economic contributions accrue to the region under this current Rim Country 4FRI.

Ecosystem Services

The economic value of Forest Service resources, uses, and management is not entirely captured in market transactions. Much of the value of national forests is “non-market” in nature – meaning that many of the benefits that forests provide to humans do not have a price. The lack of a price, however, should not be conflated with an absence of value. Indeed, non-market values from forests provide economic benefits to adjacent communities and forest visitors.

Ecosystem services are “components of nature, directly enjoyed, consumed, or used to yield human well-being” (Boyd and Banzhaf 2007). Healthy forests provide numerous ecosystem services, including clean water and air, biodiversity, forest products, and many other goods and services.

Wildfire has the potential to reduce ecosystem service values through: (1) destruction of wildlife habitat, (2) water quality and watershed impacts, (3) damage to cultural and archaeological sites, and (4) soil erosion and impacts to water quality (Morton et al. 2003). Furthermore, post-fire effects, such as flooding, can threaten life and property and further degrade ecosystem services.

Socioeconomic Vulnerability

Individuals, households, and communities have different abilities to adapt to changing environmental, social, and economic conditions. The same Forest Service management action may have different effects on individuals within the same community or on communities across the project area. A number of characteristics, such as wealth, education, and age affect households’ ability to adapt to change. Community characteristics, such as social networks, governance, and institutions also contribute to the ability of people to adapt to social, economic, and environmental change (Hand et al., forthcoming).

A social vulnerability index for all counties in the Southwestern Region of the Forest Service reveals that Navajo County has among the lowest adaptive capacity of counties in the region. Households in Navajo County are likely to have fewer resources available to them. In contrast, Coconino and Yavapai counties have among the highest adaptive capacity of counties in the region. Households in these counties are likely to have many more resources available to them (Hand et al., forthcoming). Displacement due to wildfire, for instance, may be more difficult for households in Navajo County than households in Coconino and Yavapai counties. These findings reveal a great deal of socioeconomic diversity across the planning area.

Environmental Justice

In 1994, President Clinton issued Executive Order 12898. This order directs federal agencies to consider the human health and environmental conditions in minority and low-income communities. The purpose of Executive Order 12898 is to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority and low-income populations (Executive Office of the President 1994).

Environmental justice is the fair treatment and meaningful involvement of people of all races, cultures, and incomes, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. The goal of environmental justice is for Federal agency decision-makers to identify impacts that are disproportionately high and adverse with respect to minority and low-income populations and identify alternatives that will avoid or mitigate those impacts. According to USDA DR5600-002 (USDA 1997), environmental justice, minority, minority population, low-income, and human health and environmental effects, are defined as follows:

Environmental Justice means that, to the greatest extent practicable and permitted by law, all populations are provided the opportunity to comment before decisions are rendered on, are allowed to share in the benefits of, are not excluded from, and are not affected in a disproportionately high and adverse manner by, government programs and activities affecting human health or the environment.

Minority means a person who is a member of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic.

Minority Population means any readily identifiable group of minority persons who live in geographic proximity to, and, if circumstances warrant, migrant farm workers and other geographically dispersed/transient persons who will be similarly affected by USDA programs or activities.

Low-Income Population means any readily identifiable group of low-income persons who live in geographic proximity to, and, if circumstances warrant, migrant farm workers and other geographically dispersed/transient persons who will be similarly affected by USDA programs or activities. Low-income populations may be identified using data collected, maintained and analyzed by an agency or from analytical tools such as the annual statistical poverty thresholds from the Bureau of the Census' Current Population Reports, Series P-60 on Income and Poverty.

Human Health and/or Environmental Effects as used in this Departmental Regulation include interrelated social and economic effects.

The emphasis of environmental justice is on health effects and/or the benefits of a healthy environment. The CEQ has interpreted health effects with a broad definition: “Such effects may include ecological, cultural, human health, economic or social impacts on minority communities, low-income communities or Indian Tribes …when those impacts are interrelated to impacts on the natural or physical environment” (CEQ 1997).

According to U.S. Census Bureau (2016a) data reported in Table X, planning area counties differ substantially in their racial and ethnic composition. The table shows the percentage of residents who self-identify in each of the racial and ethnic categories.

Table 111. Percent of Population by Race and Ethnicity, 2011-2015

Location	White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races	Hispanic or Latino[2]
Coconino County	62.8	1.6	26.9	0.3	0.1	3.6	3.3	13.8
Gila County	79.1	0.7	15.1	0.1	0.1	2	2.5	18.6
Navajo County	48.4	0.7	43.9	0.1	0.1	3.4	3	11.1
Yavapai County	91.6	0.6	1.8	0.1	0.1	2.7	2.3	14.1
Arizona	78.4	4.2	4.4	0.4	0.1	6.5	3.2	30.3

Source: U.S. Census Bureau, 2016a

Coconino, Gila, and Navajo counties have high concentrations of American Indian residents, due to the large share of tribal lands in these three counties. The majority of land in Navajo County is tribal land. Yavapai County also contains tribal lands, though the areas are quite small. [3] As a result, environmental justice issues are more likely to occur in Coconino, Gila, and Navajo counties than Yavapai County. However, a finding of low racial or ethnic diversity does not eliminate the need to consider potential disproportionate impacts of Forest Service management actions. A county may have a low overall concentration of minority residents, but still have areas with a high concentration of minority residents who could be adversely affected by management actions.

Table 3-** displays the share of people living in poverty in each Rim Country county. The poverty rate in Arizona is also presented for comparison. Gila and Navajo counties have meaningfully greater[4] shares of people living in poverty than the state overall. More than one-fifth of Gila County residents and more than one-quarter of Navajo County residents live in poverty.

Table 112. Percent of people living in poverty, 2015

Location	Poverty Rate (%)
Coconino County	19.5

[2] Hispanic/Latino is an ethnicity, not a race. Individuals who identify as Hispanic/Latino also select a racial category in the survey (e.g., White and Hispanic/Latino or some other race and Hispanic/Latino). Therefore, sums of these rows will exceed 100 percent.

3 Coconino County contains all or part of the Navajo Indian Reservation, Hualapai Indian Reservation, Hopi Indian Reservation, Havasupai Indian Reservation, and Kaibab Indian Reservation. Navajo County contains part of the Navajo Indian Reservation, Hopi Indian Reservation, and Fort Apache Indian Reservation. Gila County contains part of the Fort Apache Indian Reservation, the Tonto Apache Reservation, and the San Carlos Indian Reservation. Yavapai County contains all or part of the Yavapai-Prescott Indian Reservation, the Yavapai-Apache Nation Indian Reservation, the Hualapai Indian Reservation, and the Camp Verde Indian Reservation.

4 In this case, meaningfully greater indicates that the 90% confidence interval of the county's poverty rate does not overlap with the 90% confidence interval of the state's poverty rate.

Location	Poverty Rate (%)
Gila County	21.3
Navajo County	28.1
Yavapai County	15.1
Arizona	17.4

Source: U.S. Census Bureau, 2016b

Based on the minority status and poverty data presented above, Coconino, Gila, and Navajo counties appear most at risk for environmental justice issues. The largest minority group in these counties – American Indians – also experience a very high poverty rate. Between one-third and one-half of American Indians in the planning area counties live in poverty (U.S. Census Bureau 2016a).

Numerous tribes were invited to consult on the 4FRI project. The process for tribal consultation is outlined in the EIS in Chapter 1 under Public Involvement. In addition, the tribal relations section in chapter 3 of the EIS and tribal relations specialist report provide more information and complete documentation of consultation.

The conditions described in this section underscore the importance of evaluating environmental justice consequences. The economic data suggest that Navajo County is both the most underserved county (in terms of economic opportunities) and also the most reliant on forest-related employment in the study area. Therefore, Navajo County may be particularly influenced by economic changes related to 4FRI. The potential for disproportionately high and adverse impacts on minority and low-income individuals due to Forest Service management actions are evaluated in the environmental consequences section of this document.

Assumptions and Methodology

This analysis addresses the implementation of Rim Country treatments on the Apache-Sitgreaves, Coconino, and Tonto NFs. Unless specifically indicated otherwise, all estimates of economic and social consequences are based on only the implementation of 4FRI Rim Country.

Data are typically reported to the nearest acre, mile, or percentage. Most values have been rounded from their actual decimal values. Totals were calculated before any values were rounded in order to give the most accurate sum. Any apparent inconsistency between the total values reported in a table and a sum resulting from adding up individual values in a table typically accounts for a discrepancy of about one percent in the case of rounding percentages or miles, and less than two acres in the case of acres.

Economic Impact Methodology

Economic impacts were modeled using IMPLAN Professional Version 3.1 with 2016 data. IMPLAN is an input-output model, which estimates the economic impacts of projects, programs, policies, and economic changes on a region. IMPLAN analyzes the direct, indirect, and induced economic impacts. Direct economic impacts are generated by the activity itself, such as forest product harvesting. Indirect employment and labor income contributions occur when a sector purchases supplies and services from other industries in order to produce their product. Induced contributions are the employment and labor income generated as a result of spending new household income generated by direct and indirect employment. The employment estimated is defined as any part-time, seasonal, or full-time job. In the economic impact tables, direct, indirect and induced contributions are included in the estimated impacts. The IMPLAN database describes the economy in 536 sectors using federal data from 2016.

The IMPLAN model area includes Coconino, Gila, Navajo, and Yavapai Counties. Maricopa County is also included in the economic impact model due to the economic linkages between Maricopa County and the project area. The firms and employees that will support Rim Country activities are located in these counties (both primary and supplier firms).

Data on use levels under each alternative were collected from the forests' resource specialists. In most instances, the precise change is unknown. Therefore, the changes are based on the professional expertise of the forests' resource specialists. Regional economic impacts are estimated based on the assumption of full implementation of each alternative. The actual changes in the economy would depend on individuals taking advantage of the resource-related opportunities that would be supported by each alternative. If market conditions or trends in resource use were not conducive to developing some opportunities, the economic impact would be different from what is estimated in this analysis.

Economic Efficiency Methodology

Economic efficiency analysis follows Forest Service and Office of Management and Budget guidance. A four percent discount rate is commonly used for evaluations of long-term investments and operations in land and resource management by the Forest Service (FSM 1971.21). This discount rate is used in the calculation of net present value (NPV). Inflation can affect NPV; however, due to the uncertainty of future inflation, OMB Circular A-94 recommends avoiding assumptions about the inflation rate whenever possible. Thus, for the purposes of this analysis, inflation is left at zero. Data on program revenues and program expenditures were provided by the national forests' resource specialists and budget staff.

Assumptions

1. The IMPLAN model assumes a static economy – in other words, the industry composition and trade linkages in the economy today will be the same in the future.
2. The IMPLAN model does not impose supply constraints when estimating employment and labor income effects. It assumes that local industry will be able to harvest and process all of the forest product volume from the Rim Country project. If some of the forest product volume is harvested or processed by firms outside the model area, the employment and labor income effects would be lower than those estimated here.
3. The economic analysis assumes that all project activities are implemented over a 20-year period. If the implementation period is longer, the average annual number of jobs and amount of labor income would be lower than estimated in this report.
4. The economic analysis assumes that firms bid on 4FRI Rim Country contracts and that the activities are fully implemented. Full implementation relies on private sector interest in bidding on contracts. A slower pace and/or lower forest product volume removal would produce less economic activity than estimated in the analysis.
5. The economic analysis uses forest product distribution data from the 4FRI implementation team to classify forest product types in the economic modeling program. The economic analysis assumes the following distribution: 30 percent sawn products, 6 percent poles, 4 percent firewood, and 60 percent other forest products (including biomass).
6. The economic analysis assumes that forest products are harvested outside of protected activity centers (PACS) with mean slopes less than 40 percent.

7. The economic analysis assumes that the cost of prescribed fire treatment is $175 per acre and the cost of mechanical treatment is $400 per acre. The analysis also assumes that treatments are evenly distributed across 20 years.

Incomplete and Unavailable Information

Communities in the project area are tied to national and global markets. Future economic conditions are unknown. In particular, the following could substantially affect the economic feasibility of the Rim Country project:

1. Global demand for forest products
2. Global supply of forest products
3. Technological change
4. Economic development in the Rim Country region
5. Infrastructure development in the Rim Country region
6. Energy prices
7. Population distribution across the U.S.
8. Federal, state, and local policy changes

The characteristics of the firm(s) that will bid on the Rim Country contracts are unknown. Firm size, location, and other characteristics may affect the number, type, and location of jobs attributable to the Rim Country project.

Issues/Indicators/Analysis Topics

Economics is an issue for the Rim Country Project. Stakeholders are concerned that the lack of existing markets and the low value of material generated by proposed treatments may make project implementation economically infeasible. This report analyzes the economically feasibility of proposed activities across a range of alternatives.

Table 185 displays the resource indicators and measures used to evaluate the economic consequences of the Rim Country project.

Table 113. Resource indicators and measures for assessing effects

Resource Element	Resource Indicator	Measure	Used to address: P/N, or key issue?
Economic feasibility	Forest product volume removal	Forest Products (ccf)) harvested per year	Yes
Economic feasibility	Economic efficiency	Project benefits less project costs	Yes
Economic impact	Employment and labor income	Number of jobs and amount of labor income	Yes
Environmental justice	Effects to low-income and minority populations	Qualitative evaluation of disparate treatment	No

Resource Element	Resource Indicator	Measure	Used to address: P/N, or key issue?
		and/or disparate effects	

Environmental Consequences

Alternative 1 – No Action

Forest Products: Under Alternative 1, the three national forests would continue to provide forest products and support restoration activities. However, the scale of these activities would be substantially smaller than activities under the Rim Country Project. The provision of forest products unrelated to Rim Country treatments would be the same under all alternatives, and therefore are not described in detail in this EIS.

Economic Efficiency: Under Alternative 1, wildfire suppression costs would, on average, increase due to fuel buildup and the expanding wildland-urban interface. The per-acre administrative burden (cost of time and other resources) of planning, implementing, and monitoring forest restoration activities would be highest under Alternative 1. The Rim Country Project benefits from economies of scale – a single environmental compliance document addresses more than one million acres. Furthermore, the large project area reduces cost to government through increased private sector interest in engaging in harvesting and restoration activities on the forests. In contrast, restoration activities under Alternative 1 would occur piecemeal – requiring numerous environmental compliance documents and increased administrative costs.

Employment and Labor Income: The three national forests would continue to provide opportunities for forest product harvesting, livestock grazing, recreation, and other activities that support employment and labor income in communities in the project area. The extent of these contributions are not expected to differ from current conditions. Forestry-related sectors would remain a relatively minor part of the project area's economy.

Environmental Justice: The communities that surround the project area, particularly in Navajo County, have large minority populations, high poverty rates, and individuals vulnerable to smoke. Minority and low income residents may experience differential exposure to wildland fire, changes in employment opportunities, or changes in the provision of ecosystem services. None of the alternatives eliminates smoke – either from wildfire or prescribed burns. Alternative 1 would treat the fewest acres with prescribed fire; however, it would also do the least to restore fire-adapted forests. As a result, smoke from uncharacteristic wildfire is most likely under Alternative 1. Smoke emissions from prescribed burning would be lower under Alternative 1. Smoke emissions resulting from wildfires and prescribed burns may produce health and quality of life consequences. Smoke is most likely to affect vulnerable populations – children, the elderly, and individuals in poor health.

Alternative 1 would not affect the potential for wildland fire to threaten human safety and property in the project area. Low income individuals have fewer resources to engage in averting behavior (e.g., leaving town during a wildfire to avoid smoke emissions). However, since approximately half of homes in the wildland-urban interface in the project area are second homes, the individuals with the highest exposure to wildfire risk are expected to be relatively affluent (Headwaters Economics 2017).

Alternative 1 would not affect employment or labor income in the project area. Therefore, no disproportionate or adverse effects related to changes in economic opportunities would occur as a result of this alternative.

The provision of ecosystem services may be affected by Alternative 1; however, these effects would not disproportionately affect low income and minority residents.

Table 114. Resource indicators and measures for Alternative 1

Resource Element	Resource Indicator	Measure	Alternative 1
Economic feasibility	Forest product volume removal	Forest Products(ccf) harvested	Forest products would continue to be harvested from all three national forests, consistent with current conditions
Economic feasibility	Economic efficiency	Project benefits less project costs	No direct project benefits or costs; no economies of scale in forest restoration activities
Economic impact	Employment and labor income	Number of jobs and amount of labor income	Three national forests would continue to support local employment and labor income associated with harvesting, grazing, and recreation at levels similar to current conditions
Environmental justice	Effects to low-income and minority populations	Qualitative evaluation	Smoke emissions from wildfire are most likely to adversely affect vulnerable populations, including children, the elderly, and individuals in poor health

Effects Common to All Action Alternatives

Environmental Justice: The employment and labor income associated with the Rim Country Project are expected to have a small, but positive, effect on employment and labor income in minority and low income communities.

Smoke emissions from both prescribed fire and wildfire can have health effects, particularly on the young, elderly, and individuals with existing health issues. Tribal elders may be more likely to experience acute health effects. Technological and cultural constraints to effective communication would make smoke effects more pronounced, as averting behavior is limited. However, burn plans written for implementation of the proposed prescribed fires would include modeling to determine the most appropriate conditions under which to burn in order to minimize smoke impacts.

Effects Unique to Each Action Alternative and Differences among Them

Forest Products: Alternative 2 would produce approximately 5.3 Million CCF of forest products over the life of the project. The economic analysis assumes that volume is harvested evenly over a 20-year period. Approximately 262,920 ccf would be harvested annually.

Alternative 3 would produce approximately 3.6 million ccf of forest products over the life of the project. The economic analysis assumes that volume is harvested evenly over a 20 year period. Approximately 178,530 ccf would be harvested annually.

Economic Efficiency: Under Alternatives 2 and 3, the per-acre administrative burden (cost of time and other resources) of planning, implementation, and monitoring forest restoration activities would be lower than for Alternative 1. The Rim Country project benefits from economies of scale – a single environmental compliance document addresses hundreds of thousands of acres across three forests. Alternative 2 would mechanically treat up to 889,334 acres of vegetation and treat up to 953,132 acres with prescribed fire. Alternative 3 would mechanically treat up to 483,158 acres of vegetation and treat up to 529,059 acres with prescribed fire.

The present net cost to taxpayers to conduct restoration treatments equivalent with those proposed under Alternative 2 would be approximately $370 million, and approximately $200 million under Alternative 3, over 20 years. The Rim Country Project would provide a stable supply of forest products to encourage private sector engagement in forest restoration activities, which would reduce the cost to taxpayers. Furthermore, the treatments will reduce the risk and hazard of uncharacteristic wildfire. The costs of a single large fire routinely amount to millions of dollars in direct suppression expenditures alone. The Forest Service, for instance, spent approximately $14.4 million responding to the 2010 Schultz Fire (Combrink et al. 2013). Furthermore, the total cost of the Schultz Fire and subsequent flooding – including decreased property values, loss of life, cleanup, evacuation, and habitat destruction – is estimated to be between $133 million and $147 million (Combrink et al. 2013). For the 2002 Rodeo-Chedeski Fire, estimated suppression costs ranged between $43 and 50 million. Other direct costs, including the loss of homes and property, totaled $122.5 million. Rehabilitation costs were projected over a three year period for a total cost of $139 million (WFLC 2010).

Compared to Alternative 2, Alternative 3 would treat fewer acres more intensively. More concentrated treatments could lower the operating costs associated with treatments. Fixed costs associated with site preparation would be lower, site infrastructure needs (e.g., processing, roads) would be reduced, and costs associated with transporting forest products would be lower than under Alternative 2. Given the relatively low market value of most of the wood products to be removed from the project area, keeping operating costs low is critical to the financial feasibility of forest treatments.

Employment and Labor Income: The direct, indirect, and induced economic effects of forest product removal under Alternative 2 are estimated to support approximately 1,890 jobs and $78 million in labor income on an average annual basis over the life of the Rim Country Project.

Alternative 3 would produce somewhat lower wood product volume than Alternative 2. Therefore, Alternative 3 would support fewer jobs and less labor income than Alternative 2. The direct, indirect, and induced economic effects of forest product removal under Alternative 3 are estimated to support approximately 1,280 jobs and $53 million in labor income on an average annual basis over the life of the Rim Country Project.

Both Alternatives 2 and 3 may temporarily displace other forest users (e.g., recreation visitors) due to treatment activities. Alternative 2 would lead to more displacement of forest visitors than Alternative 3 due to the larger number of acres to be treated under Alternative 2. Displaced recreationists are expected to visit another site on one of the three forests to participate in another activity in the local area. Therefore, recreation visitor expenditures are not expected to change.

Likewise, forest restoration activities may affect ranchers who graze livestock in the project area. The brief duration and advance notice of disturbances due to Rim Country treatments would make it easier for ranchers to adapt to changes. As a result, no reductions in grazing-related employment are expected. However, minor reductions in rancher income are possible if ranchers purchase more expensive private forage or reduce their stocking levels. However, post-treatment soil and forage quality is expected to increase. Therefore, over the long-term, ranchers would benefit from Rim Country activities.

Table 115. Resource indicators and measures alternative comparison

Resource Element	Resource Indicator	Measure	Alternative 2	Alternative 3
Economic feasibility	Forest product volume removal	Forest products (ccf) harvested	Volume from trees < 5” = 278,440 CCF Volume from trees 5” - 12”= 2,303,480 CCF Volume from trees > 12”= 2,676,470 CCF	Volume from trees < 5” = 191,000 CCF Volume from trees 5” - 12”= 1,467,810 CCF Volume from trees > 12” = 1,911,750 CCF
Economic feasibility	Economic efficiency	Project benefits less project costs	$370 million present net cost; Avoided costs from forest restoration and reduced risk of high intensity wildfire	$200 million present net cost; Avoided costs from forest restoration and reduced risk of high intensity wildfire; more concentrated treatments (compared to alternative 2) would lower operating costs
Economic impact	Employment and labor income	Number of jobs and amount of labor income	1,890 jobs and $78 million in labor income	1,280 jobs and $53 million in labor income
Environmental justice	Effects to low-income and minority populations	Qualitative evaluation	Employment and labor income may have a small, but positive, effect on economic opportunities in low-income and minority communities; smoke emissions may have a disproportionate effect on low-income and minority communities	Same as alternative 2

Effects from Rock Pit Use and Expansion

The Rim Country Project would authorize the use and expansion of rock pits to supply material for road construction and improvement. Rock pits on the national forests provide a low cost source of material for road work. In particular, rock pits avoid the need to purchase and haul roadbed material from more distant sites. The 2016 Rock Pits Environmental Assessment for the Coconino and Kaibab National Forests found that haul costs were approximately four times higher for material purchased off-site than for on-forest rock pits. Rock pit use and expansion would increase the financial feasibility of road work needed to support Rim Country project activities.

Effects from Use of In-woods Processing and Storage Sites

The key barrier to the financial feasibility of forest restoration is that the costs of hauling raw material from the harvest site to mill locations may exceed the value of the timber harvested in the project area. To address this challenge, the Rim Country Project would authorize 13 in-woods sites (in addition to the eight sites analyzed in the Cragin Watershed Protection Project) for processing, sorting, storing, and the refinement of raw material. In-woods processing and storage sites would offset haul costs by increasing the value of material either by hauling dried material or secondary products.

In-woods processing and storage site selection criteria – including at least ¼ mile from hiking trails, campgrounds, group recreation sites, and private property – would reduce the potential for effects on forest visitors and nearby residents.

Cumulative Effects

Past management activities, including mechanical vegetation treatments, fuels treatments, and prescribed fire, have affected economic activity in the communities in and around the project area. The socioeconomic consequences of these actions are captured in the baseline data presented in the affected environment section of this report. Therefore, these activities are not included in the cumulative effects analysis.

Restoration activities would continue to occur in the region regardless of the Rim Country decision. Current and foreseeable activities include approximately 470,000 acres of mechanical vegetation treatments and approximately 650,000 acres of fuels treatments. The acreages of mechanical vegetation management and fuels are not all mutually exclusive. There are many acres on which proposed fuels treatments (mechanical and prescribed fire) overlap with proposed mechanical vegetation management treatments. Reasonably foreseeable actions on private, state, and other federally-managed lands include mechanical treatments, fuels treatments, and prescribed fire. These actions will occur regardless of the selected Rim Country alternative.

The effect of past, present, and reasonably foreseeable treatment activities in the project area would improve forest health relative to existing conditions even without the implementation of the Rim Country Project.

Forest Products: Forest products available for harvesting under the Rim Country Project would contribute to an increased supply of forest products available from national forests in the region. When harvest volumes are low, harvesting and processing industries are unlikely to locate in the region. However, the cumulative effects from both Alternative 2 and Alternative 3 would be to improve the financial viability of locating forest product industries - including logging firms, sawmills, and biomass facilities – in the project area.

Economic Efficiency: Observational evidence and fire modeling indicates that large-scale fuel treatments are necessary to meaningfully reduce the risk of high intensity wildfire and produce fire suppression cost savings (Thompson et al. 2017). The proposed Rim Country treatments, in combination with the current and foreseeable mechanical and prescribed fire treatments, would conduct fuel treatments across a large landscape. The cumulative effects of Alternative 2 are most likely to reduce wildfire suppression costs in the project area.

Employment and Labor Income: The increased forest product supply from Rim Country and other current and foreseeable projects would contribute to the development of a local forest products industry. The development of a local industry would have several economic effects, including (1) lower costs of transporting wood products for secondary processing thereby increasing the financial viability of treatments, (2) increase the probability that employment and labor income associated with forest restoration activities would occur in the local area, and (3) contribute to the growth of supporting industries (e.g., construction and retail trade).

As described in the Affected Environment section above, there has been limited growth of jobs and income from 4FRI phase one implementation activities. With more acres treated from the

Rim Country 4FRI project, this will add to the wood utilization employment. Cumulative effects of increasing wood volume could increase the amount of economic contributions that stay in the region if the activity boosts the infrastructure and capacity to process the harvested wood in the region. For example, if the wood produced from both phases of 4FRI implementation creates enough demand (or the funding mechanism is collaboratively resolved) for a company to install a biomass facility, the jobs and income from restoration activities are more likely to stay in the region.

Environmental Justice: Ongoing and reasonably foreseeable prescribed fire treatments will contribute to smoke emissions, which may affect the health and quality of life of individuals who live near or visit the forests. Since the no action alternative would not prescribe additional treatments, it would not cause cumulative effects related to smoke emissions from prescribed fire. However, the risk of uncharacteristic wildfire and associated smoke emissions in the project area would be highest under this alternative.

The proposed treatments under Alternatives 2 and 3, combined with other ongoing and foreseeable treatments, could increase exposure to smoke emissions, which could cause cumulative effects to health and quality of life for individuals who are sensitive to smoke. However, the cumulative effect of these treatments would be to decrease the risk of uncharacteristic wildfire, which would decrease the probability of smoke emissions associated with these events.

Recreation

A summary of the Recreation Report is presented here and the specialist report (Wright 2018) is incorporated by reference. The potential effects of the 4FRI Rim Country Project on recreational opportunities was not raised as a concern by the public.

Affected Environment

Recreation Trends

The Apache-Sitgreaves, Coconino, and Tonto NFs provide diverse outdoor recreation opportunities connecting people with nature in a variety of settings. Forest users can hike, bike, drive motorized vehicles, camp, fish, view wildlife and scenery, and explore historic and prehistoric places. They enjoy opportunities for year-round recreation activities from birding and wild flower observing in the spring, hiking in summer months, fall color viewing and hunting, to cross country skiing in the winter.

Recreation activities provide physical challenge, require development of skills and inspire wonder and curiosity about the natural world. Recreation contributes to the physical, mental, and spiritual health of individuals, families, and friends. Outdoor recreation has become a part of American culture (USDA 2010).

Forest users may occasionally experience short-term or temporary disruptions in their recreation activities as a result of other groups currently occupying a preferred site, forest management activities such as current thinning or prescribed fire projects, fire restrictions or fire closures due to hot, dry weather and extreme fire danger, as well as natural occurrences such as fallen trees blocking a roadway or trail, and so on. When asked how visitors would react to such disruptions in their plans, they reported in the National Visitor Use Monitoring survey (NVUM) using substitution behaviors such as coming back another time, going elsewhere for a different activity, going elsewhere for the same activity, going to work, some other substitution or staying at home (USDA 2016- 2017). The number one response for all three Rim Country forests was by far going elsewhere for the same activity.

Over the last two decades, Arizona has seen a dramatic increase in population. The entire state of Arizona has grown almost 75 percent from 1990 to 2010 (U.S. Census Bureau, 2015), which is more than double the rate of the average population growth in the country. In addition, the last several decades have seen increases in the number of people participating in outdoor activities; between 2000 and 2007, these participants increased by 4.4 percent (Cordell, et al., 2008).

Demographic shifts and lifestyle changes have affected the demand for recreation opportunities on national forests. Today about 80 percent of the population lives in urban settings and may not have the same values as rural residents who live closer to or may depend on natural resources for their livelihood (Forest Service 2010). In the West, growth of retirement communities and other population shifts have created urban settings close to public lands. Both of these trends have created challenges to Forest Service recreation managers to meet demands for an ever increasing number of recreation users as well as a diverse number of desired recreation activities.

Arizona has a high percentage of public land compared to private lands. Private land is notably scarce in Arizona. Residents are more likely to rely on public land for recreation activities due to the lack of private facilities. In addition, public lands provide recreational, environmental and lifestyle amenities. Johnson and Stewart (2007) found that there is overlap between counties that contain national forests and those designated as recreational, high amenity, and retirement destinations. Increase in population density along the forest edge puts pressure on cultural and environmentally sensitive areas, increases the use of recreation facilities and complicates forest management and fire suppression. The researchers also found that counties with more than 10 percent of their land in national forests (almost 39 percent of Coconino County) grew by significantly larger margins than other counties (Headwaters Economics 2012).

Arizona’s population was one of the fastest growing in the United States from 2000 to 2010. The populations of Coconino and Yavapai Counties continue to grow steadily. These counties include attractive cities such as Flagstaff, Sedona and Prescott. As Arizona’s population grows, demand for recreation grows (Arizona State Parks 2008). Rapid development and infill of limited private land also places more pressure on public land agencies to provide open space and recreation opportunities.

An increasing population, along with growing participation in outdoor activities, contributes to increased visitation to the Coconino National Forest according to the most recent NVUM data. However, the Apache-Sitgreaves National Forest shows a dramatic decrease in visits. This could possibly be attributed to staff changes in the implementation of the survey design and/or to the implantation of field interviews. The next NVUM data collection is scheduled for fiscal year 2018, with results available in 2019. At that time, a better understanding of the trends for its national forest visits should be obtainable. National forest visits for the Tonto were similar for 2013 and 2016. Population growth is expected to continue into the future and will increasingly affect national forest management activities, as well as ability to provide satisfying recreation opportunities.

Table 3-** provides local recreation information available for the Apache-Sitgreaves, Coconino and Tonto NFs. All forests have been surveyed several times in the NVUM. NVUM estimates the volume of recreation visitation to national forests and grasslands and produces descriptive information about that visitation, including activity participation, demographics, visit duration, measures of satisfaction, and trip spending connected to the visit.

Table 116. Apache-Sitgreaves, Coconino and Tonto NF Visitation (USDA Forest Service 2017, 2018)

Forest	Site Type					Total
	Day Use Developed	Overnight Developed	Undeveloped Areas	Wilderness	Skiing	National Forest Visits
Apache-Sitgreaves 2007	865,000	660,000	206,000	5,000	0	1,173,000
Apache-Sitgreaves 2014	385,000	148,000	204,000	7000	0	520,000
Coconino 2005	2,308,000	148,000	2,700,000	384,000	138,000	3,275,000
Coconino 2010	2,244,000	128,000	1,842,000	501,000	130,000	2,868,000
Coconino 2015	1,312,000	84,00	3,155,000	506,000	121,000	4,390,000
Tonto 2008	800,000	961,000	3,195,000	152,000	0	4,801,000
Tonto 2013	595,000	305,000	1,724,000	340,000	0	2,514,000
Tonto 2016	1,182,000	366,000	1,327,000	169,000	0	2,580,000

The Apache-Sitgreaves NFs' most drastic changes in site type visits are the decreases in day Use Developed and Overnight Developed (campgrounds) sites. The Coconino NF visits show increases in Undeveloped Areas and decreases in Day Use Developed and Overnight Developed over the last five years. The Tonto National Forest displays major changes with an increase in Day Use Developed and a decrease in Wilderness.

According to NVUM, most visitors to the Apache-Sitgreaves, Coconino and Tonto NF use day use developed sites (such as picnic areas, observation points, and trailheads) and undeveloped areas (the general forest area with no developed facilities. The types of activities that people participate in are displayed in Tables 3-**. 3-**, and 3-** by forest.

Table 117-: Comparison of selected recreation activity participation in 2005, 2010, and 2017 for the Coconino National Forest (USDA Forest Service 2017, 2018)**

Activity	Percent Participation 2005	Percent Participation 2010	Percent Participation 2015
Viewing Natural Features	84.2	73.1	83.1
Hiking/Walking	71.2	70.8	74.0
Viewing Wildlife	63.9	48.7	38.8
Relaxing	60.2	62.3	49.1
Driving for Pleasure	51.3	46.1	33.9
Visit Historic Sites	30.9	29.2	10.6
Nature Study	18.2	17	9.7
Picnicking	14.8	21.4	9.3
Fishing	5.8	4.8	2.6
Bicycling	5.7	6.2	5.6
OHV Use	5.6	9.0	1.9
Motorized Trail Activity	5.4	3.8	1.7
Developed Camping	4.4	5.5	2.0
Downhill Skiing	4.4	5.0	2.9
Primitive Camping	4.2	4.2	3.0
Motorized Water Activities	2.6	1.0	0.3
Hunting	2.1	2.1	1.1
Backpacking	1.7	1.4	0.6
Horseback Riding	0.9	1.2	0.2
Cross-country Skiing	0.2	1.2	0.5

The percent of participation in the activities varies by survey year, but the types of activities have not varied. The Coconino NF data shows increase in the amount of people viewing natural features and hiking/walking. Other notable changes include decrease in all other activities but more important decrease in viewing historic sites, nature study and picnicking.

On the Apache-Sitgreaves NF, changes differed as hiking/walking and picnicking increase in the percent participation by activity type between the two survey years. Large decreases can be seen in relaxing, viewing wildlife, and viewing natural features. There are more variations in smaller positive and negative changes.

The Tonto NF saw important increases in OHV, non-motorized water, some other activity and viewing natural features. Other notable changes are important decrease in hiking/walking, relaxing and driving for pleasure. There are similar smaller positive and negative variations in all other activities such as on the Apache-Sitgreaves NFs.

Table 118. Comparison of recreation activity participation in 2005 and 2015 for the Apache-Sitgreaves National Forest (USDA-Forest Service 2017, 2018)

Activity	% Participation* 2007	% Participation* 2014
Hiking / Walking	35.8	59.0
Relaxing	80.2	58.7
Viewing Wildlife	68.9	48.2
Driving for Pleasure	44.6	42.2
Viewing Natural Features	64.8	38.8
Fishing	38.5	38.0
Picnicking	20.9	33.5
Developed Camping	34.7	31.0
Nature Study	14.6	15.5
Non-motorized Water	4.9	5.1
Motorized Trail Activity	4.3	5.0
Other Non-motorized	3.9	5.0
Bicycling	7.7	4.5
Nature Center Activities	4.9	4.3
OHV Use	6.8	4.0
Some Other Activity	3.1	3.7
Primitive Camping	3.8	3.6
Gathering Forest Products	8.5	3.3
Visiting Historic Sites	9.2	3.2
Resort Use	2.5	1.6
Motorized Water Activities	7.6	1.4
Hunting	1.7	1.2
Cross-country Skiing	0.1	1.0
Other Motorized Activity	0	0.9
Horseback Riding	1.6	0.0
Snowmobiling	0	0.0
Downhill Skiing	0	0.0
No Activity Reported	0.6	0.0
Backpacking	4.0	0.0

Table 119. Comparison of recreation activity participation in 2005 and 2015 for the Tonto National Forest (USDA Forest Service 2017, 2018)

Activity	% Participation* 2008	% Participation* 2013	% Participation* 2016
Hiking / Walking	26.3	50.5	29.3
Relaxing	23.4	33.6	22.6
Fishing	23.3	23.2	17.9
Viewing Wildlife	17.7	22.1	25.1
Driving for Pleasure	15.0	19.4	10.5
Picnicking	14.8	15.1	7.7
Viewing Natural Features	14.5	13.8	22.2
Motorized Water Activities	11.0	13.4	12.5
Developed Camping	10.6	8.2	7.9
Other Non-motorized	10.6	6.7	11.1
Motorized Trail Activity	10.4	5.7	3.5
Some Other Activity	8.3	5.5	14.5
Hunting	5.1	4.9	1.5
Nature Center Activities	4.6	4.4	0.7
Primitive Camping	4.3	4.3	4.1
Non-motorized Water	3.5	3.7	14.9
OHV Use	2.9	3.6	27.5
Visiting Historic Sites	2.8	2.5	2.8
Nature Study	2.5	2.3	5.9
Gathering Forest Products	1.1	2.2	0.7
Horseback Riding	1.0	2.1	0.3
Bicycling	0.9	1.7	1.5
Other Motorized Activity	0.8	0.5	0.1
Resort Use	0.7	0.0	0.3
Snowmobiling	0.7	0.0	0.2
Downhill Skiing	0.6	0.0	0.1
Cross-country Skiing	0.1	0.0	0
No Activity Reported	0.0	0.0	0.4
Backpacking	0.0	0.0	0.4

People who participated in the NVUM came primarily from Coconino County, Yavapai County, and Maricopa County, Arizona. Coconino NF has the most internationals visitors with 21 percent. About one-third of visitors to the Coconino and the Tonto NF came from Maricopa County (including the Phoenix metro area).

Visitation to the Coconino NF has increased concurrently with population growth in Arizona. Data on visitation is collected by national forest every five years and is part of the National Visitor Use Monitoring Program. Data collected in 2015 shows the Coconino National Forest has about 4.7 million visitors per year (USDA Forest Service, 2017). During this time period, the Coconino NF had the most visitors of all the national forests in Arizona followed by the Tonto NF, with about three million visitors each year. Adjacent national forests, like the Kaibab and Prescott, had substantially lower visitors; all under one million visitors.

The NVUM data highlights that the Coconino NF is the most popular national forest in the southwestern region, but the data also shows that the forest serves an interesting niche. The Coconino NF is heavily used by non-local and international visitors; it is estimated that 60 percent of the 4.7 million visitors come a long distance (over 100 miles) to visit the national forest (USDA Forest Service, 2018). While the Apache-Sitgreaves NF serves a higher percentage of visitors coming from more than 100 miles with 70 percent, both forests are visited by about 30 percent of local visitors. The Tonto NF is mostly visited by locals, with 42 percent of visitors coming from within 25 miles and about 74 percent of visits coming from less than 50 miles away. Large numbers of visitors come from areas (primarily the Phoenix metropolitan area) to visit the area largely for the change of scenery, ideal climate, and relief from extreme summer temperatures in nearby major metropolitan areas. The Rim Country project area covers a wide array of recreationists coming from different places within Arizona and from other states and countries. This reflects the desire of many recreationist to participate in the extensive possibilities of recreation activities in the area.

Recreation Activities within the Project Area

There are a number of FS trails and developed recreation facilities within the Rim Country analysis area, including developed campgrounds. Most of the recreation facilities are located on the Apache-Sitgreaves NFs. The Recreation Opportunity Spectrum (ROS) classifications within the analysis area include Semi-Primitive Non-Motorized (SPNM), Semi-Primitive Motorized (SPM), Roaded-Natural (RN), and Rural (R). The recreation facilities within the Rim Country project area are shown on Figure 3-** and are summarized in Table 3-**.

Table 120. Summary of Recreation Facilities in Rim Country Project Area

Type of Site	Apache-Sitgreaves NF	Coconino NF	Tonto NF
Boating site	4	2	0
Campground	14	5	11
Camping area	15	0	1
Day Use Area	13	0	0
Group Campground	3	2	4
Interpretative Site	0	0	0
Info Site/Fee Station	0	0	1
Interpretive Site	0	1	0
Lookout/Cabin	0	1	0
Observation Site	0	0	0
OHV Staging Area	0	0	0

Type of Site	Apache-Sitgreaves NF	Coconino NF	Tonto NF
Picnic Site	2	1	
Trailhead	4	0	0
Wildlife Viewing Site	0	1	0

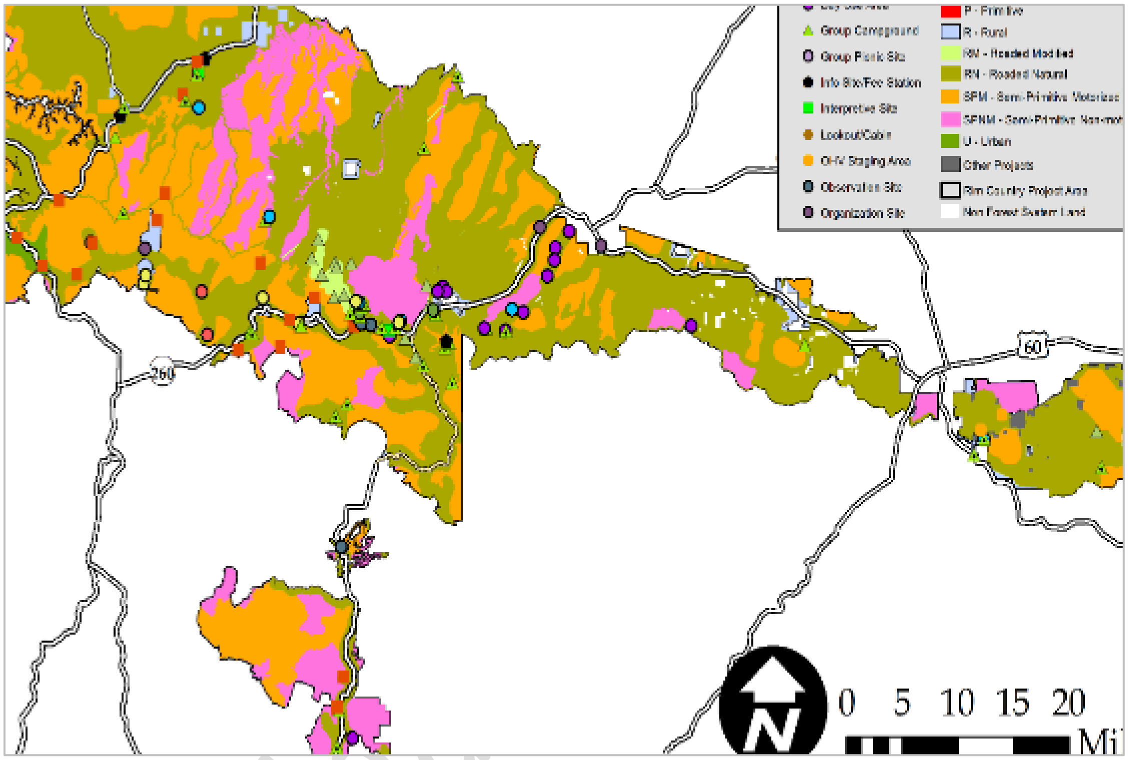


Figure 9. Rim Country Developed Recreation Sites

Developed Campground

There are a total of 30 developed campgrounds in the Rim Country project area. Campgrounds generally operate from May to October depending on weather. These campgrounds see high use on weekends typically from mid-May to mid-September.

Trails

There are portions of several Forest System Trails within the project area. There is a total of 728 miles of trail identified in the project area. Table 3-** shows the number of miles per trail and class per forest. The Forest Service Handbook (FSH 2353, Section 14.2, Exhibit 01) defines trail classes as general categories reflecting trail development scale. The trail class identified for a system trail prescribes its development scale, representing its intended design and management standards. Local deviations from any trail class descriptor may be established based on trail-specific conditions, topography, or other factors, if the deviations do not undermine the general intent of the applicable trail class.

The Apache-Sitgreaves NFs contain the most miles of trail; with more than double that of the Coconino and Tonto NFs. In addition, the Apache-Sitgreaves is the only forest to have snow trails. It has 92 miles of snow trails and 359 miles of terra trails.

Table 121. Mileage of trails by trail class for Rim Country national forests

Trail class	Typical ROS	Apache-Sitgreaves	Coconino	Tonto	Total miles per trail class
1: Minimally developed	Natural, unmodified Primitive to Roaded Natural	0	5	0	5
2: Moderately developed	Natural, essentially unmodified Primitive to Roaded Natural	94	76	5	176
3: Developed	Natural, primarily unmodified Primitive to Roaded Natural	235	43	123	401
4: Highly developed	May be modified Semi-Primitive to Rural	115	0	9	124
5: Fully developed	May be highly modified Commonly associated with visitor centers or high-use recreation sites Roaded Natural to Urban	4	0	0	4
No trail class identified		9	4	7	20
Total		457	128	143	728

Arizona National Scenic Trail

The Arizona National Scenic Trail (Arizona Trail) was designated a National Scenic Trail by Congress in the Omnibus Public Land Management Act of 2009. It extends approximately 800 miles across the State of Arizona from the border with Mexico to the border with Utah. The Arizona Trail is intended to be a primitive, non-motorized, long distance trail that highlights the state's topographic, biologic, historic, and cultural diversity. Administration of the Arizona Trail is the responsibility of the Regional Forester. Figure 3-** shows the trail alignment within the Rim Country project area.

The Arizona Trail is Arizona's only National Scenic Trail and provides local hiking opportunities above and below the rim around the Flagstaff area, as well as a recreational experience to long-distance hikers, mountain bikers, and equestrians. The Arizona Trail corridor represents a connected landscape across the state. As the trail becomes better known, people from the U.S. and internationally are coming to experience a unique cross-section of Arizona that can only be seen by traveling the Arizona Trail.

As envisioned in "Trails for America" report (American Trails 2012), national scenic trails are to be very special trails: "According to the National Trails System Act (1968) national trails "will be extended trails so located as to provide for maximum outdoor recreation potential and for the conservation and enjoyment of nationally significant scenic, historic, natural, and cultural qualities of the area through which such trails may pass." National scenic trails may be located so as to represent desert, marsh, grassland, mountain, canyon, river, forest, and other areas, as well as landforms which exhibit significant characteristics of the physiographic regions of the nation.

The revised Coconino Forest Plan (2018) provides desired conditions for the trail including “the Trail will emphasize a semi-primitive recreation experience in a predominantly natural or natural-appearing landscape. Where infrastructure and facilities affect the scenic integrity along the trail, mitigation is applied appropriately. Recreation does not negatively impact cultural and natural resources, or scenic integrity.” The Arizona Trail traverses the Tonto National Forest but does not go through the Apache-Sitgreaves.

The Arizona Trail traverses 39.7 miles through the project area from South to North on its way from Mexico to Utah. The trail is intended to be a primitive, long distance trail highlighting the state’s topographic, biologic, historic, and cultural diversity. The trail receives use by day hikers and overnight backpackers, as well as by through-hikers attempting to hike or ride all of the more than 800 miles of trail across the state of Arizona. The Arizona Trail Association is an active volunteer organization that maintains the trail and performs a variety of stewardship actions, including advocacy for the trail.

General George Crook National Recreation Trail

The General Crook National Recreation Trail traverses 98.4 miles through the project area. The trail traverses both the Apache-Sitgreaves NFs (58.5mi) and Coconino NF (36.9mi). The General Crook Trail follows the historic route of General George Crook of the U.S. Army from Fort Whipple in Prescott to Fort Apache. The route was established in the 1870s to serve as a supply and patrol road. Modern Forest System Roads have replaced some sections of the trail but the trail still provides for spectacular views over the Mogollon Rim and invites adventurers to explore this historic route. The Apache-Sitgreaves Forest Plan considers both the GCNRT and the Blue Ridge National Recreation Trail a special area that provides specific management directions for National Trails. Arizona State also designated General Crook Trail as a State Historic Trail. Table 1 displays the desired conditions, objectives and guidelines.

Blue Ridge National Recreation Trail

The Blue Ridge National Recreation Trail, located on the Lakeside Ranger District of the Apache-Sitgreaves National Forests is approximately nine miles long. The trail climbs the west side of Blue Ridge Mountain (7,650 feet in elevation) through a mixture of pines, junipers, and many varieties of wildflowers. The mountain itself is a volcanic remnant. There are scenic views from the summit. The entire trail is in the Rim Country Project area.

Highline National Recreation Trail

The 50-mile long Highline National Recreation Trail is on the Payson Ranger District of the Tonto NF. The west terminal of the trail is at 5,360 feet and ends at 6,620 feet in elevation. The Dude Fire of 1990 burned portions of the forest along the Highline Trail. The Highline Trail, established in 1870, was used to travel between homesteads and to attend school in Pine. Zane Grey and Babe Haught used the Highline Trail while hunting. The portion of the Highline Trail from Washington Park Trailhead and Pine Trailhead is part of the Arizona Trail. This trail ties to several other trails, providing opportunities for loop hikes and rides. The Highline Trail runs essentially east to west, below the Mogollon Rim and roughly following it.

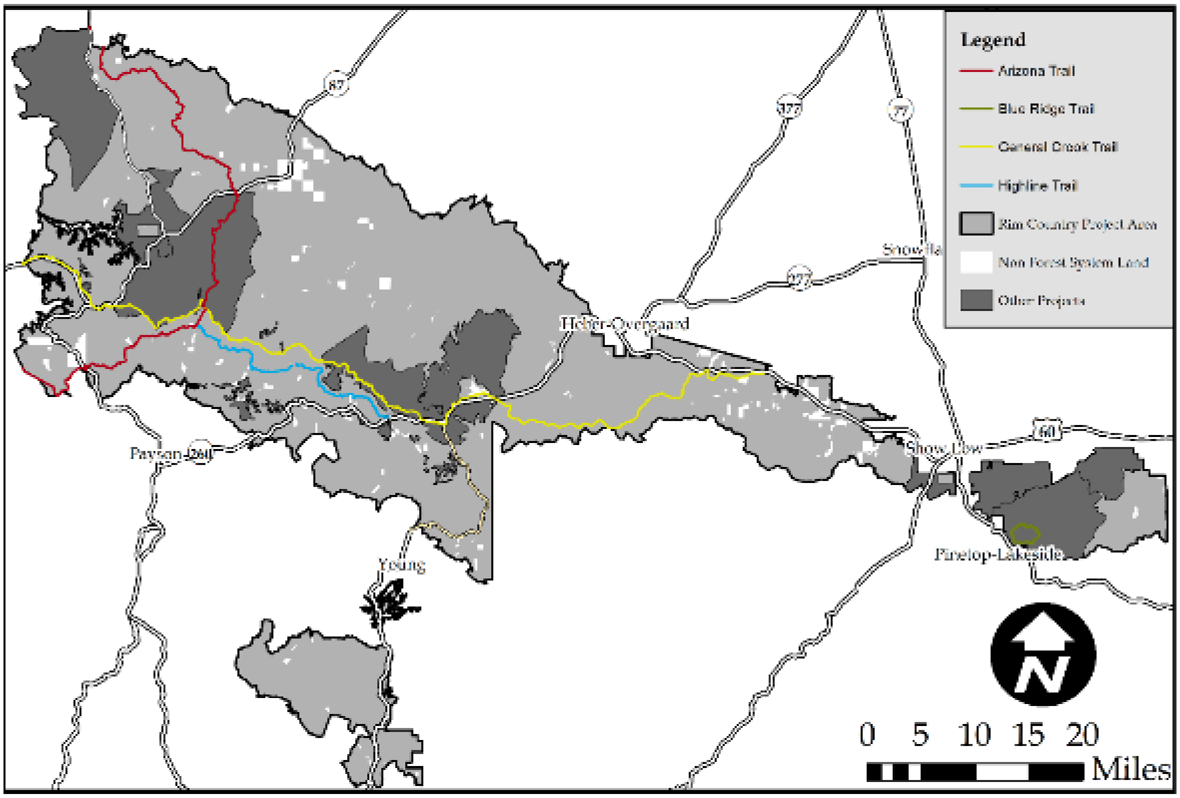


Figure 10. Rim Country National Scenic and Recreation Trails

Wild and Scenic Rivers

There are currently no designated segments of wild and scenic rivers in the Rim Country project area. There are however, currently 9 segments of eligible wild and scenic rivers on the Apache-Sitgreaves and Coconino National Forest in the project area. In addition, as part of its forest plan revision process, the Tonto NF is completing an updated eligibility report for wild and scenic rivers to replace the existing eligibility report from 1993. To ensure compliance with current forest plan direction, this analysis includes both the eligible rivers reported in the 1993 study, as well as those listed in the current draft eligibility report. The figure below illustrates the locations of the eligible wild and scenic rivers on the Apache-Sitgreaves and Coconino National Forest relative to the project area and the rivers from the 1993 eligibility report and the current eligibility study (ongoing) respectively.

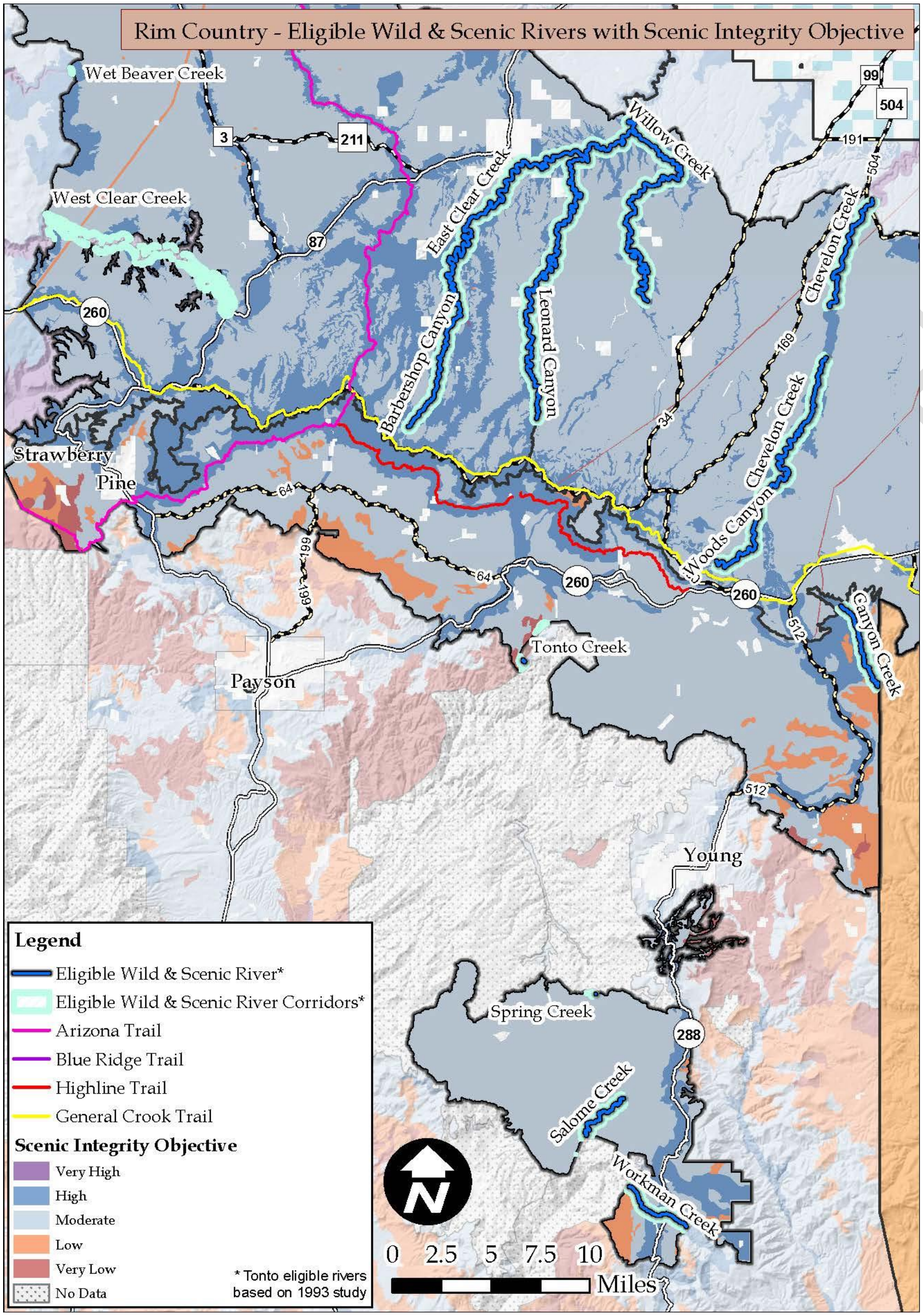


Figure 11. Eligible Wild and Scenic Rivers Segments with 1993 Tonto Eligibility Report

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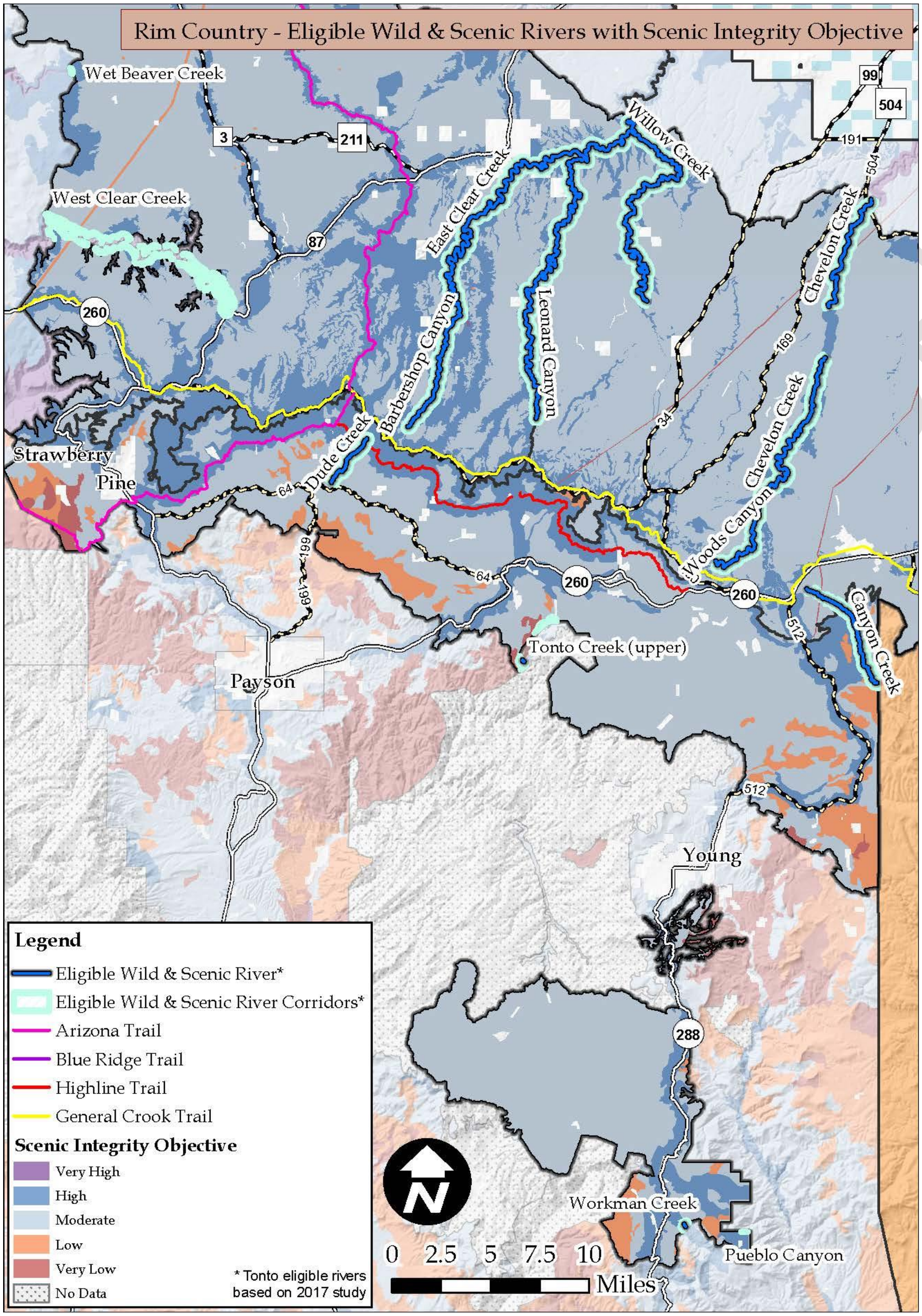


Figure 12. Eligible Wild and Scenic River Segments with Current Tonto Eligibility Study

9989 Dispersed Recreation

9990 The forest plans define dispersed recreation as the type of outdoor recreation that tends to be
9991 spread out over the land and in conjunction with roads, trails, and undeveloped waterways.

Activities are often day-use oriented and include hunting, fishing, gathering of forest products, boating, hiking, off-road vehicle use, cross-country skiing, mountain biking, and rock climbing.

Dispersed Camping

Dispersed recreation includes the full suite of outdoor non-motorized and motorized recreation opportunities available throughout the year. Visitors to the area camp using a variety of shelters, including large recreational vehicles (RVs), live-in toy haulers, and tents. Many campers come from the Phoenix metro area to escape extreme summer temperatures and enjoy the cool weather provided by the high elevation of the project area.

Dispersed camping requires no additional facilities other than road or trail access, though the relatively unconstrained nature of dispersed camping can cause resource impacts such as soil compaction and erosion, loss of vegetation, increased fire risk, displacement of wildlife, and accumulation of trash and human waste. The number of dispersed campers in the analysis area is also difficult to estimate.

Motor Vehicle Use

As Arizona’s population has grown, the state has also seen a dramatic increase in ownership and use of personal off-highway vehicles (OHVs). Arizona Trails 2010 reported a 623 percent increase in sales of off-highway motorcycles and all-terrain vehicles (ATVs) in Arizona between the years 1995 to 2006 (McVay et al. 2010). NVUM indicates a particular great increase of OHV use to recreate from 3.6 percent to 27.5 percent activity participation for the Tonto National Forest. The Coconino and Apache Sitgreaves national forests show a slight decrease in OHV use. The growth in ownership and use of OHVs has greatly influenced how users recreate in the analysis area.

The 2013 Arizona Statewide Comprehensive Outdoor Recreation Plan reports that, based on the Arizona Trails 2010 Plan, OHV users represent almost 22 percent of the Arizona population which includes residents who use motorized vehicles on trails for multiple purposes. Of that, 11 percent of Arizona residents reported that motorized trail use accounted for the majority of their use and are considered “core users.” With Phoenix and surrounding communities being among the fastest growing populations in the state, adjacent forest areas can expect a large increase in visitation.

Visitors are extremely mobile, require large areas for camping to accommodate trailers and toy haulers, and their recreating patterns directly relate to the road system in the project area.

In November 2005, the Forest Service announced new federal regulations called the Travel Management Rule, requiring each national forest to establish a designated system of roads, trails, and areas by vehicle type and time of year. Designated roads, trails, and areas would then be identified on a Motor Vehicle Use Map, made available to the public for free (36 CFR 212.56).

The travel management planning project prohibits cross country travel and restricts public motorized travel on the forests except on designated roads, trails, and areas per the final Travel Management Rule: http://www.fs.fed.us/recreation/programs/ohv/final.pdf. It does allow for emergency activities, and limited administrative motorized use of non-designated forest roads, trails, and areas. Travel management is regulated by each forest’s motorized vehicle use maps. These include information about authorized motorized activities including designated roads, trails and areas, corridors for dispersed camping, and motorized big game retrieval (USDA-Forest Service 2011a). Non-motorized recreation activities are not included in the motorvehicle use maps.

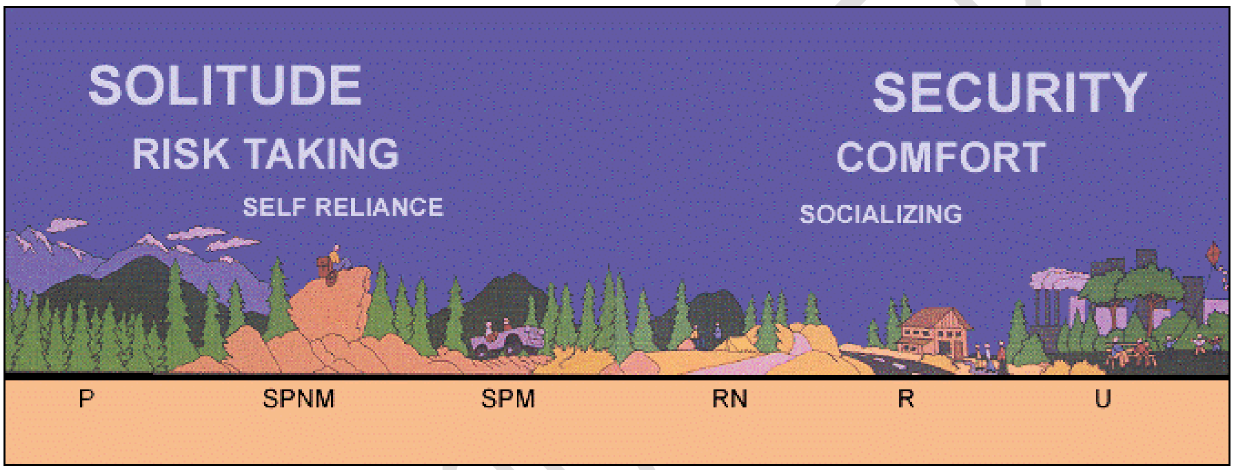
In 2010, the Apache-Sitgreaves NFs proposed a draft EIS for a travel management plan and alternatives were released for public comment. As a result of the Wallow Fire, the changes to the landscape and species status, and the release of the Apache-Sitgreaves NFs Revised Forest Plan in 2015, it was decided to present a modified proposed action to the public for comment in a revised draft EIS, as a continuation of the NEPA analysis process. The Apache-Sitgreaves NFs are developing the revised proposed action. The 4FRI Rim Country Project will adhere to the current Travel Management Rule decisions for the Coconino NF.

Recreation Special Uses

Many authorizations are for re-occurring activities like outfitting and guiding, and some are for facilities. In addition, four areas have been designated for temporary activities like recreation events and non-commercial group use.

Recreation Opportunity Spectrum

Figure 13-: Recreation Opportunity Spectrum, USDA ROS Primer and Field Guide 2011**



The Forest Service uses the Recreation Opportunity Spectrum (ROS) to provide a framework for defining classes of outdoor recreation environments, activities, and experience opportunities (USDA Forest Service, ROS Primer and Field Guide 2011). Figure 3-** depicts the various ROS categories and their characteristics. The ROS is a land classification system that categorizes national forest land into six classes, each class being defined by its setting and by the desired opportunities and characteristics the setting offers. The six ROS classes are: Primitive (P), Semi-Primitive Non-Motorized (SPNM), Semi-Primitive Motorized (SPM), Roaded Natural (RN), Rural (R), and Urban (U). There are no wilderness or recommended designated wilderness areas within the proposed project. Opportunities for experiences along the spectrum represent a range from very high probability of solitude, self-reliance, challenge and risk, to a very social experience where self-reliance, challenge and risk are relatively unimportant.

The purpose of the ROS is to identify desired conditions across the Forest so that different parts of the forest may facilitate different recreational experiences. The ROS represents management objectives, which may not always reflect actual user experiences.

Table 122. ROS settings and characteristics (USDA Forest Service, 1986)

ROS Setting	Evidence of Human Contact and Human Use	Social Encounters
Rural and Roaded Natural	Highest contact with other visitors and highest evidence of use compared to other ROS settings	Social encounters are higher within ½ mile of trailheads, paved roads, and residential areas.
Semiprimitive Motorized and Semiprimitive Non-motorized	Lower contact with other visitors and lower evidence of human use than in Rural and Roaded Natural but higher levels than Primitive or Wilderness ROS settings.	Social encounters are higher within ½ mile of trailheads and at destination features such as water, natural formations, cultural features, vistas.
Primitive	Lower contact with other visitors and lower evidence of human use than in Semiprimitive Motorized and Semiprimitive Non-motorized but higher levels than Wilderness ROS settings.	Social encounters are higher within ½ mile of trailheads and at destination features such as water, natural formations, cultural features, vistas.

The large majority of the Rim Country project area falls into the SPM and RN classes. Approximately 418,680 acres or 35 percent of the project area is SPM. RN makes up 418,675 acres or 50 percent, and SPNM makes up 13 percent of the area. The recent revised forest plans for the Coconino and the Apache-Sitgreaves NFs contain updated ROS maps that represent the desired conditions for ROS classes across the forests. Not all acres on the forests currently meet these desired conditions. The desired conditions are meant to guide project design, alternative development, and assessment of potential project effects. ROS classifications are also used to determine if project activities would help move toward desired conditions for recreation opportunities at the forest level.

Throughout much of the project area, numerous resource management activities have occurred including vegetation management, road maintenance, developed recreation site construction, trail construction and maintenance, prescribed burning, hazard tree removal, and utility corridor clearing. In addition, there have been numerous wildfires in the area. Not all projects have met or currently meet the characterizations and mapped ROS classes at this time.

All three national forests in the project area offer numerous developed recreation opportunities as illustrated in Figure 3-**. The Rim Country Project does not include restoration activities in developed recreation sites, special areas, or designated Wilderness. Outside of these areas, many forest users engage in dispersed recreation including hiking, dispersed camping, driving motorized vehicles, rock climbing, cross country skiing, and snow play. There will be restoration activities in many places where dispersed recreation occurs.

A spectrum of high-quality outdoor recreation settings and opportunities will be made available in the project area. Roaded Natural and Semi-Primitive Motorized ROS areas will provide high scenic and recreational values and Semi-Primitive settings will provide more natural-appearing settings. The National Forest System lands in the project area provide high quality recreation opportunities and settings that compliment and support local communities' tourism industries, and contribute to local residents' quality of life.

Management activities on National Forest System lands are consistent with recreation setting objectives that provide opportunities for the public to engage in a variety of developed and dispersed recreational activities, in concert with other resource management and protection needs.

Table 123. Acres of ROS

ROS class	Acres	Percentage (%)
R- Rural	*18,309*	2
RM- Roaded Modified	8,645	1
RN- Roaded Natural	598,346	50
SPM- Semi-Primitive Motorized	418,675	35
SPNM- Semi-Primitive Non-motorized	153,798	13
U- Urban	4,009	0
Total	1,201,783	100

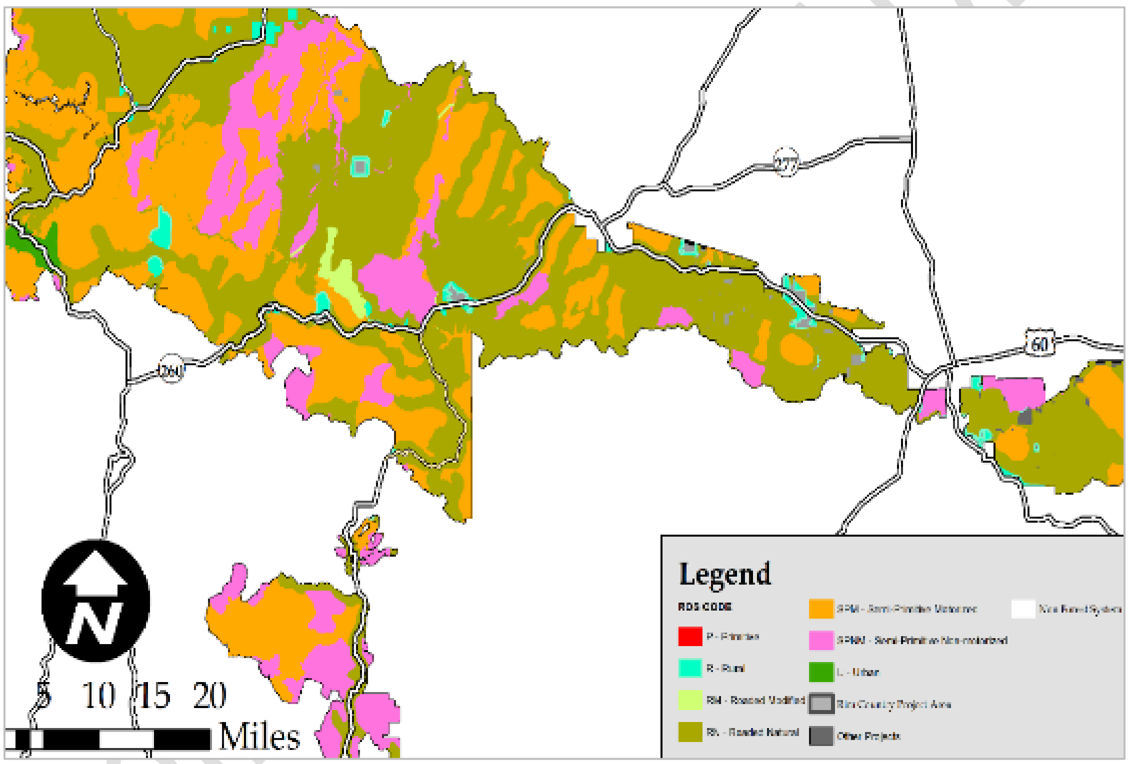


Figure 14. ROS Classes

Approximately 50 percent of the project area is classified as RN. Under this designation:

- Access in the project area can range from full access via road or trail to neither road nor trail being an available opportunity.
- Individuals can experience either full remoteness where they perceive themselves as removed from the sights and sounds of human activity (more than 1½ hour walk) or in other locations where they are not out of sight and sound of other humans.
- Experiences may range from encountering very few other recreationists, to experiencing moderate to frequent contact with other recreationists in developed sites or when on roads and trails.

- Some locations will offer on-site information that is noticeable but is presented in a manner that harmonizes with the natural environment, and other locations may not offer any on-site information.
- Recreationists will find some sites that offer no facilities for user comfort while other sites may offer some facilities that are rustic and built out of native materials. These facilities offer some on-site protection from the natural elements.

As mentioned, 35 percent of the analysis area is designated SPM. Under this designation:

- Access can include non-motorized and motorized trails, and primitive roads.
- Remoteness is more evident than in areas classified as RN.
- Human encounters can range from under 6, up to 15 parties met per day, or less than 3, up to 6 parties seen at a campsite per day.
- Information facilities provided on-site range from very limited to nonexistent.
- On-site protection facilities range from rustic or rudimentary to nonexistent.
- SPM management direction stipulates that limited to no site hardening occurs at / on recreation sites and locations that fall within this designation.
- Visitors' impacts range from unnoticeable with no site hardening to subtle site hardening.

As mentioned, 13 percent of the analysis area is designated SPNM- Semi-Primitive Non-motorized. Under this designation:

- Access include non-motorized trails and existent primitive roads if usually closed to motorized use. Motorized roads are at least 0.5 mile but no further than 3 miles from the designated area.
- Remoteness is evident and the environment offers challenge and risk.
- Human encounters can range from under 6, up to 15 parties met per day, or less than 3, up to 6 parties seen at a campsite per day.
- On-site protection facilities range from rustic or rudimentary to nonexistent.
- SPM management direction stipulates that limited to no site hardening occurs at / on recreation sites and locations that fall within this designation.
- Visitors' impacts range from unnoticeable with no site hardening to subtle site hardening.

Assumptions and Methodology

This assessment includes use of the best available science, based on relevant peer-reviewed literature, published reports from regulatory and land management agencies, existing resource inventories, field visits, and the professional judgment of interdisciplinary and cooperating agency team members.

The Recreation Opportunity Spectrum (ROS) is the guiding system that forest plans direct be considered when planning projects to properly manage and balance recreation opportunities. The ROS provides a framework to assist managers in identifying different outdoor recreation environments, settings, activities, and experiences desired by the public, and deciding how to provide these different recreational opportunities over the landscape within the forest (USDA Forest Service, ROS Book, 1986). ROS classifications are identified to distinguish the desired conditions across the landscape. ROS classifications within the project area were referenced to determine if project activities would affect the potential for meeting or moving toward desired conditions identified in the ROS classifications.

The Special Uses Database System was used to generate a list of all recreation special use authorizations within the project area. This report was sorted by status. The authorizations were considered part of the existing condition if they had statuses of application accepted, pending signature, or issued.

Data and experiences from both the 4FRI 1st EIS and the Cragin Watershed Protection Project were used in this analysis because of proximity to the project area, probability that users would recreate in all these project areas, and the similarity of terrain and vegetation.

The timeframes for direct and indirect effects include the potential for up to 20 years of project implementation. The thinning treatments may take up to 20 years to complete, with each thinning contract generally completed within a three-year timeframe. Implementation will include prescribed burning over a 20-year period of time, with multiple burn intervals of two to 10 years across the project area

Issues/Indicators/Analysis Topics

Analysis topics identified relative to recreation and lands management resources are based on Forest Plan desired conditions, management approaches, guidelines, and standards. There were very few public comments identifying issues or concerns related to recreation, except for potential effects from treatments on the Arizona National Scenic Trail and its users. Consequently, this resource area was determined to require cursory analysis. The primary issue of concern to recreation resources from the proposed activities is to minimize and mitigate impacts to recreation features (e.g., developed campgrounds, signs, trails, and trailheads) and recreation activities (e.g., driving for pleasure, dispersed camping, hiking, mountain biking, equestrian use, hunting, boating, special use events, and developed camping)..

Environmental Consequences

Alternative 1 – No Action

Under this alternative, recreation resources would be managed as they are currently without any effects from vegetation treatments and prescribed burning proposed in the Rim Country project area. Although electing the no action alternative would not result in impacts to these resources from prescribed burning or thinning, this alternative would not reduce the risk of uncharacteristic wildfire that could cause important resource damage, damage to recreation and lands infrastructure, and subsequent flooding. Wildfires ignited by lightening could be managed for resource benefit given conditions allow; however, the use of this strategy to decrease future crown-fire risk is unpredictable and unlikely to affect a majority of the project area. Alternative 1 is the point of reference for assessing action alternatives 2 and 3.

Recreation Sites and Uses

Recreation Resources

The threat of uncharacteristically severe wildfire continues to increase with ongoing, unmanaged growth of vegetation. Uncharacteristic wildfire would severely impact recreation values and experiences in the analysis area. Research has demonstrated the negative effects wildfire can have on recreation activities. Vaux, et al. (1984) found that “intense fires may have detrimental effects on recreation values” (p.1).

Recent wildfires in the Coconino NF (Schultz Fire in 2010 and Slide Fire in 2014) and Apache-Sitgreaves NFs (Rodeo-Chediski Fire in 2002 and Wallow Fire in 2011) demonstrate the significant impacts of uncharacteristic wildfire on recreation. In all cases, recreation facilities had to be closed to the public, with many remaining closed for months or even years. After the Slide Fire, Slide Rock State Park in Oak Creek Canyon was closed for several months during the period of highest visitation, and eventually opened after a very expensive early warning system for potential flash floods was installed.

During NVUM, visitors were asked what they would do if they were unable to visit this national forest due, for example, to closures related to wildfire damage and rehabilitation. The majority of visitors responded that they would have gone elsewhere for the same activity. This suggests that if the Rim Country project area was closed due to wildfire or related effects, visitors would seek alternative locations to enjoy the same recreation activities. This could lead to overcrowding in nearby areas, resulting in resource damage and undesirable recreational experiences.

Developed Recreation Facilities

Developed recreation facilities, such as campgrounds and group event sites, could be negatively affected if there is no action to reduce the risk of uncharacteristic wildfire. The changes to landscape character and visual quality following a severe fire would considerably diminish the quality of recreation experiences and activities in affected areas. Effects from severe wildfire on other recreation-related infrastructure such as restrooms, kiosks, bulletin boards, and trail signs would be substantial and would result in high costs to repair or replace damaged facilities. Historic sites such as lookout towers and guard stations could not be replaced if destroyed.

Trails

While the Schultz Fire on the Coconino NF severely damaged several trails, subsequent flooding was more destructive and caused more substantial damage than the fire itself. Large debris flows caused by rainfall on the denuded slopes destroyed major sections of the Little Bear Trail. In other areas, trails sections were rendered unpassable and invisible due to large boulders and tree trunks transported by the floodwaters and debris flows. Much of this flood damage occurred on trails that cross steep slopes or drainages. The economic cost and effort to reopen these trails was immense. Little Bear Trail was closed from the fire in 2010 until October 2016. The Deer Hill Trail was also closed and only reopened at the end of November 2017.

The Rim Country project area contains parts of four national trails: the Arizona National Scenic Trail (70 miles in the project area), the entire Blue Ridge National Recreation Trail (9.4 miles), the General Crook National Recreation Trail (95 miles in the project area), and the Highline National Recreation Trail (44 miles in the project area). Figure 3-** illustrates the locations of the national trails in the project area. The Rim Country project area contains 728 miles of trail, ranging from most primitive to fully developed. Some trails in the Rim Country project analysis area share characteristics with the trails that were damaged in the Schultz Fire. Wildfire or flood damage to segments of trails within the project area would require closures of affected sections until they could be properly repaired and determined safe for use. In the interim, potentially lengthy re-routes would have to be established for visitors wishing to hike any affected trails, especially for the state-wide Arizona National Scenic Trail.

Several research papers and lessons from the Schultz Fire reveal that the no action alternative, which has no vegetation management actions to reduce the risk of wildfire, could have negative and unpredictable effects on trails and trail users if an uncharacteristically severe wildfire occurred in the Rim Country project area.

Overall, trail users respond negatively and show decreased short-term return rates to areas that have experienced uncharacteristic wildfire, such as the Schultz Fire and Slide Fire ((Hesseln, Loomis, Gonzalez-Caban, & Alexander, 2003) (Starbuck, Berrens, & McKee, 2006) (Bawa, 2017). In New Mexico, Hesseln, et al. (2003) found that visitation to areas recovering from crown fires, by both hikers and mountain bikers, decreased through time. Similarly, Starbuck et al. (2006) showed that unrestored areas in the five national forests of New Mexico that experienced uncharacteristic fire were unappealing to bikers and hikers. According to the study's model, decreases in post-fire recreational visitation by hikers and bikers resulted in estimated losses of over $51 million in output, over $23 million in earnings, and a loss of 1,240 jobs.

While short-term effects of uncharacteristic wildfires on recreation are almost uniformly negative, longer-term effects may differentially impact certain user groups. Fire-damaged trees can take many years to fall, and it is likely that any affected trail system would experience increased numbers of downed trees across trails for many years, despite routine maintenance. Crossing downed logs on trails is more burdensome for mountain bikers, who must stop, dismount, and lift their bikes over fallen trees, than it is for hikers, who may be able to simply step over these obstacles. Hesseln, et al. (2003) found that the value of net benefits for hikers increased during the 40 years following crown fire, whereas the net benefits for mountain bikers declined over the same period. This demonstrates that different intensity fires may impact groups engaged in different recreation activities in different ways.

Overall trail users respond negatively and have a decreased return to forested areas that have experienced uncharacteristic wildfire. "The lack of mature trees and the large numbers of downed trees make the area unattractive to hikers and mountain bikers" (Starbuck et al. 2006, p. 63). So the no action alternative which has no vegetation management activities or prescribed burning treatments to reduce the risk of wildfire could have negative effects on trails and trail users if an uncharacteristic wildfire was to occur in the Rim Country project area.

Wild and Scenic River

There would be no effect on the eligible Wild and Scenic Rivers as they would continue their management per the direction in the respective Forest Plans.

Dispersed Recreation

Following the Rodeo-Chediski Fire in 2002, dispersed camping in the burned area was prohibited for nearly seven years. The major reasons for this restriction was to protect visitors and property from damage due to falling trees and flooding, and to reduce recreation effects to fragile fire-damaged soils. The time it takes a fire-damaged tree to fall is unpredictable and depends on several factors including weather, topography, burn severity, and flooding. Trees that have been killed or damaged by fire may be unstable and parts or all of such trees can easily become dislodged and can fall onto forest visitors, vehicles, or camping equipment.

Dispersed camping is popular in the Rim Country project area and an uncharacteristic wildfire could result in closing a fire area to camping and other activities. This would impact thousands of visitors every summer that visit the project area to camp in the desirable summer temperatures. Even after the initial threat of and hazards of fire-damaged trees has passed, visitors may avoid the area because it would be less appealing because of the loss of trees, shade, and desirable dispersed camping locations. Shelby et al. (Shelby, Thompson, Brunson, & Johnson, 2004) found that camping in areas affected by wildfire received universally lower quality levels than those same areas for hiking after the same period. Hence, the no action alternative could have adverse effects on dispersed camping. Should a wildfire result in large, long-term closures for safety or resource protection purposes, activities such as camping, hunting, and other recreational uses would be lost or severely degraded during both short-term (one to five years) and long-term (five years or more) timeframes.

Recreation Special Uses

Although the no action alternative would not produce any effects from vegetation management or prescribed burning on recreation special use activities, the risk of uncharacteristic wildfire would not be reduced. Uncharacteristic wildfire could impact recreation special uses because sites (recreation events) would likely be unsafe and less appealing for recreation special use activities after such a fire and would likely result in closures (short-term and long-term) depending on severity.

Motor Vehicle Use

Motorized Travel Management implementation in combination with the no action alternative is expected to have no effects on recreation settings. Present and future activities may result in degradation along heavily used camping corridors, but these would be small and localized.

Recreation Opportunity Spectrum

ROS would remain within forest plan guidelines unless stand-replacement wildfire affects a large portion of the analysis area. Locations and results of unplanned fire ignitions are impossible to predict; however, it is fairly likely that an uncharacteristic wildfire would move conditions away from desired conditions for semi-primitive areas where the evidence of humans is meant to be limited (semi-primitive areas). Uncharacteristic wildfire would likely include a number of alterations to the forest environment such as cutting of dead roadside hazard trees, increased signage to warn of post-fire dangers, re-constructed roads, or recently constructed dozer or hand-built fire line. All of these would result in short and some long-term effects that would move conditions away from desired conditions identified for semi-primitive areas.

Effects Common to Both Action Alternatives

Developed Sites

Mechanical and prescribed fire treatments could negatively affect developed recreation sites by short closures of the sites during the operations. However, developed recreation sites would not be modified by any alternatives as design features have been developed to protect the sites from possible negative effects from proposed treatments in Alternatives 2 and 3.

Recreation Special Use

None of the alternatives would have any effects from vegetation management or prescribed burning on Recreation Special Use activities. There would be no effects on recreation residences at Diamond Point and Elison Creek, or organization camps including Camp Shadow Pines, Tall Timbers County Park, Arizona Cactus-Pine Girl Scout Camp, and Grand Canyon Council Boy Scout Camp. All permittees can execute their business as intended by their authorized special use permits.

Effects Unique to Each Action Alternative and Differences among Them

The no action alternative does not include any thinning or prescribed burning treatments in the project area, increasing the likelihood of uncharacteristic wildfire that may have lasting effects on recreation areas throughout the Rim Country project area.

Alternatively, the Modified Proposed Action and the Focused Alternative, which include different amounts of thinning and prescribed burning, would reduce the risk of extensive crown fire and uncharacteristic wildfire. These alternatives would protect the developed campgrounds, lands infrastructure, trails, and dispersed recreation areas within the project area, maintaining open recreation areas and activities for users during and in the years following the project implementation. Shorter term impacts would occur to uses during implementation, including the potential impacts from larger processing sites near residences, highways, and dispersed recreation areas.

In the long term, the Modified Proposed Action would support the health and safety of recreationalists and surrounding communities, as well as reduce potential effects on water supplies, utilities, and other infrastructure within and adjacent to the project area.

Trails

Overall, trail users respond negatively and have a decreased return to forested areas that have experienced uncharacteristic wildfire. Trail users would be minimally affected by the proposed treatments in both Alternatives 2 and 3 since design features are developed to mitigate any issues related to trails. Effects like visitor displacement and possible overcrowding of some areas where visitors choose to go instead of areas closed or disturbed by proposed treatments are difficult to estimate. However, all three alternatives present different possibilities of risks of uncharacteristic wildfires. The no action alternative presents the highest risk because of the lack of concentrated treatments on a large landscape scale. Consequently, Alternative 2 has the lowest risk because of its sizeable amount of acres treated. Alternative 3 would have lower risk than the no action alternative and higher risks than the Modified Proposed Action. The greatest effects on trails would result from uncharacteristic wildfires. This risk can be reduced with proposed treatments. Alternative 1 poses the greatest threat to the trail systems, followed by Alternative 3. The Modified Proposed Action (Alternative 2) offers the best possible outcome for the current and future use of the trail systems, treating the most acres of forest.

Dispersed Recreation and Motor Vehicle Use

Dispersed recreation and motor vehicle use display the same effects from Alternatives 2 and 3, while Alternative 1 would have no effects unless there is an uncharacteristic wildfire. Alternatives 2 and 3 might result in some reduction of recreation opportunities during active forest thinning and prescribed burning, and potentially longer slash treatment duration. Areas may be closed to the public due to hazardous conditions which would result in forest user displacement and user dissatisfaction. There could also be an increase in crowding in nearby open forest areas.

Alternatives 2 and 3 propose to decommission 230 miles of existing system and unauthorized roads on the Coconino and Apache-Sitgreaves NFs and 20 miles on the Tonto NF. The Rim Country Project will adhere to the travel management decisions for the Coconino, Tonto, and Apache-Sitgreaves NFs. Design features would address any issues related to the construction of temporary roads for haul access, insuring decommissioning of all temporary roads after treatments are completed. Hence, both alternatives would reduce access or ease of access to recreate in certain areas on the forests. However, decommissioning unauthorized roads could positively affect recreation resources by protecting resources and removing access to motorized recreation where unlawful.

Alternatives 2 and 3 would have similar effects, but would vary proportionally with treatment area size. Minor effects would be mitigated through design features.

Recreation Opportunity Spectrum

The no action alternative would allow ROS to remain within forest plan guidelines unless stand-replacement wildfire affects a large proportion of the project area. Locations and results of unplanned fire ignitions are impossible to predict; however, it is fairly likely that an uncharacteristic wildfire would move conditions away from desired conditions for semi-primitive areas where the evidence of humans is meant to be limited (semi-primitive areas). Uncharacteristic wildfire would likely include a number of alterations to the forest environment such as cutting of dead roadside hazard trees, increased signage to warn of post-fire dangers, re-constructed roads, or recently constructed dozer or hand-built fire line. All of these would result in short and some long-term effects that would move conditions away from desired conditions identified for semi-primitive areas.

Alternatives 2 and 3 might cause temporary effects on recreation users at particular areas during implementation activities, mainly thinning operations and hauling. There would be longer term potential effects of increased traffic and noise near processing site locations. However, since most of the project area is located within Roaded Natural, Semi-Primitive Motorized, and to a lesser amount Semi-Primitive Non-Motorized ROS settings, these effects would be consistent with recreation opportunity objective settings for the majority of the project area.

Alternative 2 – Modified Proposed Action

Recreation Sites and Uses

Developed Sites

Any vegetation treatments or prescribed burning in developed recreation sites would generally occur in fall, winter, or spring, which are low-use recreational periods. All treatments in recreation sites would be designed to protect and enhance existing vegetative structure, while maintaining the character of the site. Proposed mechanical treatments and prescribed fire adjacent to developed recreation sites must be reviewed and approved by the district ranger. The district recreation staff will help determine boundaries or no treatment zones around constructed features that need to be protected in campgrounds. Treatments around the perimeter of campgrounds are encouraged. The timing of treatments must be worked out with districts. Treatments would generally avoid summer. Activity slash must be piled in agreed upon locations, and treated as soon as possible. If campgrounds remain open into fall and winter, provide information about upcoming closures and management activities on-site, at FS offices, and on FS websites (see recreation design features in Appendix C).

Facilities at developed sites and campgrounds in the project area would be protected from adverse effects from management activities, and such treatments would protect the developed sites from any short or long-term risk of uncharacteristic wildfire.

Trails

Trail use level is not expected to change. The Modified Proposed Action includes prescribed burning and thinning activities adjacent to the Arizona National Scenic Trail, Highline Recreation Trail, and General Crook National Recreation Trail. Trails within the project area may be temporarily closed during prescribed burning activities but, throughout project implementation, trails and trail infrastructure would be considered and protected, and effects on scenic qualities minimized to the extent practicable. Damage to trails or necessary trail maintenance resulting from prescribed burning or mechanical treatments in the area would be rehabilitated as soon as possible.

In the Modified Proposed Action, mechanical thinning activities would avoid national and forest system trails if possible. Coordination with district recreation planners, trails specialists, and local trail stewards would occur during prescription or burn plan development, layout, marking, thinning, and burning where any treatment would occur on, adjacent to, or near national and system trails. This is to ensure that trails and trail infrastructure are considered and protected and effects on scenic qualities are minimized to the extent practicable. If trails are temporarily closed due to thinning, trails would be returned to pre-treatment conditions (see recreation design features in Appendix C).

Skidding of felled trees would avoid national and forest system trails, if possible, except where motorized use is already authorized (trails located on open system and administrative roads). If it is determined necessary that a trail must be used as a skid trail crossing, perpendicular trail crossings would be used. Trail crossing locations, including those on the Arizona National Scenic Trail and the General Crook and Highline National Recreation Trails would be designated and flagged with input from district trails specialists, recreation planners, or archaeologists. Trails would be restored to USFS standards (pre-project condition) following treatment.

There would be no use of motorized equipment on national scenic and recreation trails, or other forest system trails. If these are used for control lines, the district recreation staff would help coordinate the implementation. Where new temporary roads intersect existing roads or trails, native materials such as logs, slash, and/or boulders would be placed along the temporary road to line-of-sight or first 300 feet, whichever is greater.

Road closures, one-way traffic, and area closure restrictions would be implemented as deemed necessary by forest officials for health and safety concerns during any operation. Signs would be placed at major intersections on hauling routes during periods of active hauling. If it is necessary to close forest roads or areas of the forest, notices and signs would be posted at key locations adjacent to and within the project area, such as along major FS roads accessing the area or on kiosks at trailheads, bulletin boards, electronic sign boards. Closures due to operations would also be posted online and on social media as well as being publicized via news releases. Coordination is required with district recreation planners or trails specialists to ensure well marked and publicized detour routes for the Arizona Trail, General Crook Trail, Highline Trail, and system trails during operational closures.

Dispersed Recreation

Vegetation treatments, prescribed burning, and fuel treatments, occurring over time and space, would have little effect on the recreating public. Alternative 2 would support the re-integration of low-intensity fire as a regulatory process on the landscape. Several cases show low-intensity wildland fires yielding virtually no effects on recreational value and in some instances imparting positive social impacts. Both Sanchez et al. (Sanchez, 2016) and Starbuck et al. (2006) show visitations in California and New Mexico increasing under low-intensity fire scenarios. The only anticipated effect that the Modified Proposed Action would have on dispersed recreation is when prescribed burning coincides with hunting seasons, especially in the fall of the year, or during brief closures of campsites, roads, or trails.

There may also be temporary area closures while prescribed burns are being implemented and, less often, closures for managed fire activities. Spring burning would affect fewer people using dispersed campsites. In total, the action alternatives are not expected to considerably affect dispersed recreation within the project area. Treatments would be planned to be staggered throughout the project area in both time and space, so that even during temporary closures from active treatments, there would be many other places to hunt, camp and recreate. Efforts would be taken to limit forest treatment activities within the project area during high-use weekends and holidays, such as Memorial Day, Independence Day, and Labor Day, especially in locations where concentrated use is expected to occur.

Temporary closures from treatments would result in the temporary loss of recreational access or opportunities and could result in decreased satisfaction of nearby recreational sites where there is overcrowding. This is most likely to occur during high-traffic weekends from Memorial Day through Labor Day, which often includes heavy use of dispersed camping sites within the project area. It can also occur during hunting season.

The transportation system proposed for use under Alternative 2 utilizes a combination of existing Forest Service system roads, improved existing non-system roads, and new temporary roads. No new permanent roads are proposed. Road use during the project for hauling and prescribed burning would affect dispersed recreational uses such as OHV riding where project activities occur on MVUM open roads. Dispersed camping areas along open roads that are being used for implementation may be affected by noise and dust.

There may be temporary road closures enacted during thinning operations or prescribed burning, but these closures would be short term for burning and mainly on FS administrative use roads. The effects from disturbance and closure would be a minor effect on dispersed recreational uses, because they would be of limited duration and there would be many other open areas to camp and recreate during this period.

Spring restoration and improvements would improve the resilience of these areas and make them more attractive to dispersed recreationists. Water in the Southwest is a rare feature, and people are attracted to it for recreation activities including hiking, picnicking, camping, scenery, wildlife and wildflower viewing.

Recreation Special Uses

The Modified Proposed Action would reduce the risk of uncharacteristic wildfire in areas with recreation special uses activities. Coordinated efforts would be made with sponsors of recreational special-use events such as running or mountain biking races, to minimize the effects of such proceedings during Rim Country project implementation. Appropriate signage would be used to inform the public of thinning or prescribed burning activities. The Modified Proposed Action would allow for continued recreation special use activities at current levels throughout the project area during and beyond the timeframe of project implementation.

Wild and Scenic River

Proposed treatments would have no effect in either alternative 1 or 2 on the eligible Wild and Scenic Rivers. All possible effects would be addressed as per the design features, best management practices and mitigations per Appendix C (Design Features). Qualifying characteristics for Wild and Scenic River eligibility (outstanding remarkable values, free flow and water quality) are protected.

Motor Vehicle Use

There would be log truck and other activity-related traffic on the designated road system, although not all roads would be used as haul routes. Hauling would not occur on all roads at the same time. Recreationists could expect increased noise, dust, and traffic on some haul routes.

Approximately 150 miles of existing non-system roads would be reconstructed or improved as part of project implementation. Road improvement activities are defined as activities that result in an increase of an existing road’s traffic service level, expansion of its capacity, or a change in its original design function. Activities included in road improvement include, but are not limited to, widening corners to improve turn radiuses, straightening of road segments to improve haul safety, installing turnouts to improve haul safety, and changing alignments at road intersections to improve site distance and haul safety. These activities may result in limited removal of vegetation. Road relocation may include relocating roads out of drainages, construction of rock rip-rap, the installation of new culverts, and the construction of low water crossings.

There would be short-term disturbance and temporary changes in ROS classes and roadside recreation settings during road improvement activities. Recreation visitors may be inconvenienced and have to wait during some activities, or roads may be temporarily closed causing displacement. Road relocation would result in a safer road to travel on. It would also result in short-term disturbances such as increased bare ground and decreased roadside visual quality in scattered locations. Long-term effects would be improved water quality at stream crossings, and safer and better maintained roads for forest user enjoyment.

Road decommissioning would occur on approximately 230 miles of existing system and unauthorized roads on the Coconino and Apache-Sitgreaves NFs and approximately 20 miles of unauthorized roads on the Tonto NF. Decommissioning includes applying various treatments, including one or more of the following:

1. Reestablishing former drainage patterns, stabilizing slopes, and restoring vegetation;
2. Blocking the entrance to a road or installing water bars;
3. Removing culverts, reestablishing drainages, removing unstable fills, pulling back road shoulders, and scattering slash on the roadbed;
4. Completely eliminating the roadbed by restoring natural contours and slopes; and
5. Other methods designed to meet the specific conditions associated with the unneeded road.

Short-term effects of road decommissioning would include ground disturbance and sedimentation and noise disturbance to recreationists. Short-term effects would last from three to 10 years as the project activities rotate across the landscape. There would be a long-term improvement of recreation settings as vegetation is established, soil erosion is minimized, and there is decreased disturbance from motorized vehicles. Once recovered, these former routes are often not apparent to the casual user. Decommissioning 860 miles of roads would improve recreation settings over time and would improve ROS classes, especially in the semi-primitive non-motorized ROS class where all 85 miles of haul routes would be decommissioned.

About 350 miles of temporary roads for haul access would be constructed to support restoration activities. Construction may include tree removal, ground disturbance, and installation of drainage structures, road blading, and other disturbances. Following implementation, the temporary roads would be obliterated using techniques noted for road decommissioning. Temporary road construction would result in short-term disturbance. When possible, there would be relocation and reconstruction of existing open roads adversely affecting water quality and natural resources, or of concern to human safety. This would have long term-positive effects on water quality, natural resources, and human safety.

There may be some increase in illegal motorized vehicle use of these roads until they are decommissioned. Once these roads have been decommissioned, they are usually not apparent to the casual user. Mitigation measures would be used to close off entrance and exit locations of these roads, as well as the use of Best Management Practices (BMPs) (see Appendix C).

Recreation Opportunity Spectrum

There may be temporary effects on recreation users at particular areas during implementation activities, mainly harvesting operations and hauling. There would be longer term potential effects from increased traffic and noise near processing site locations. However, since most of the project area is located within Roaded Natural and a small amount of Rural ROS settings, these effects would be consistent with recreation opportunity objective settings for the majority of the project area.

Construction of all new temporary roads would be similar to a primitive, native surface road that would be cleared and opened for short-term use during thinning and hauling operations. The construction and use would be consistent with the RN or SPM designations and, after use, the temporary road would be completely rehabilitated and would become naturalized within several years after use. The very slight encumbrance of the SPNM area would likely not result in long-term effects to the ability of the area to meet SPNM characteristics over the long term.

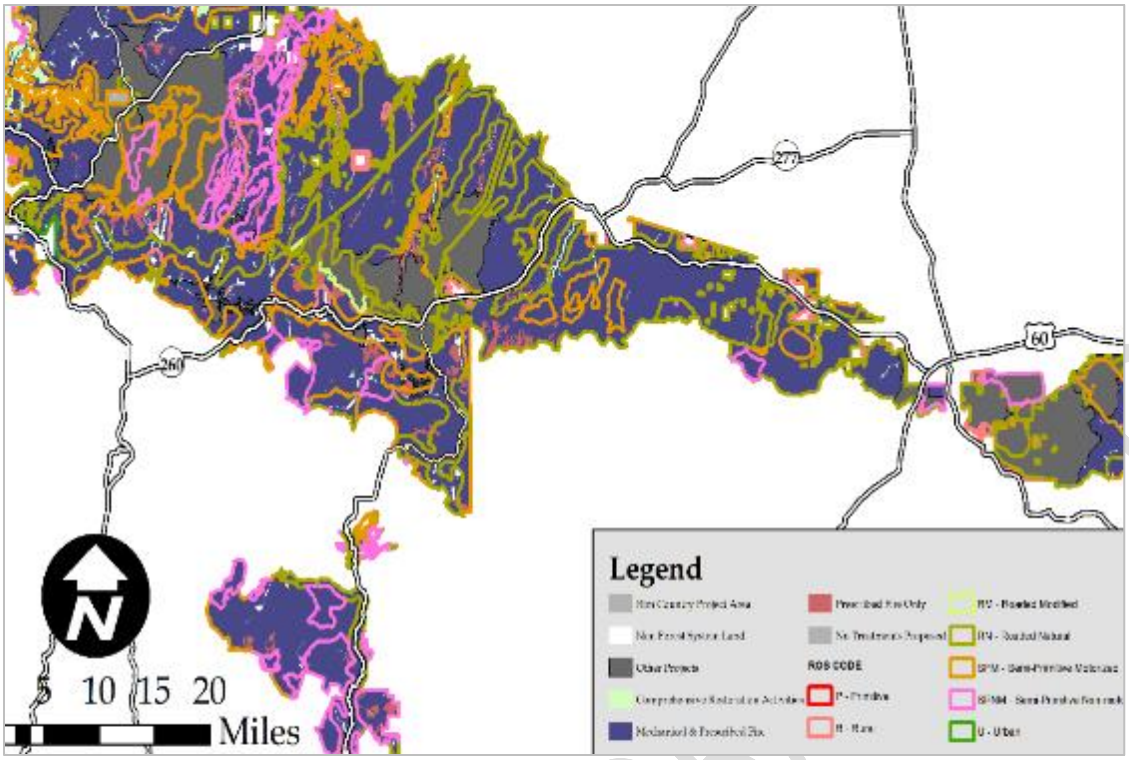


Figure 15. Treatments and ROS Designations

Mechanical treatments would primarily occur in RN (50 percent) and SPM (35 percent) areas, with a lesser amount occurring in SPNM (13 percent) in the project area (Figure 3-**). Mechanical treatments would be expected to result in short-term effects (one to two years after treatment) where the sights and sounds of humans are more noticeable on the landscape. However, after a short period of time and subsequent treatments such as prescribed fire, the evidence of treatments would fade and is not expected to affect ROS designations. As a result none of the mechanical treatments would prevent an area from meeting or moving toward ROS classifications over the long term (greater than one year).

Spring restoration and improvements would improve the resilience of these areas and make them more attractive to dispersed recreationists. The proposed improvements may cause short-term changes in the recreation settings, but would result in improvements in the setting characteristics and ROS classes over time. In both action alternatives, up to 184 springs would be improved. Mitigations to use native materials or natural-appearing materials appropriate to the ROS setting would result in natural-appearing improvements. The spring improvements would improve and meet ROS classes.

The 777 miles of channel restoration proposed would improve recreation settings over time. Mitigations to use native materials or natural-appearing materials appropriate to the ROS setting and consultation with a landscape architect regarding project design would result in natural-appearing improvements. The channel improvements would improve the settings and meet ROS classes.

Aspen treatments would take longer for recreation settings to be natural-appearing in roaded natural and semi-primitive settings due to the need to fence or create barriers to ungulate grazing. Aspen groves are popular recreation settings for many users throughout the year, but especially for fall color viewing. The restoration activities would assure that aspen continue as a vital component within the ponderosa pine forest. There would be short to moderate term changes in ROS settings where aspen are treated. Aspen restoration requires that ungulates be kept out of sprouting trees until they are large enough to withstand the browsing pressure. Fencing and jackstraw piling are both proposed methods for keeping the ungulates out.

Up to 200 miles of protective barriers around springs, aspen, native willows, and big-tooth maples, as needed for restoration, would be constructed. This would cause temporary changes in the ROS class setting characteristics since the natural-appearing environment would be somewhat altered. More developed settings would appear altered for a shorter time period since human alterations may be visible in these settings. Since the barriers must stay in place for many years, the primitive ROS settings would be altered for at least 20 years or until the trees can survive browsing. When the protective barriers are removed or begin to break up and decompose, treatment areas would meet ROS classes.

Alternative 3 – Focused Alternative

Recreation Sites and Uses

The effects from Alternative 3 would be the same as those described for Alternative 2 with the exception of the number of acres restored. The same design features would be applied for both Alternative 2 and Alternative 3. Alternative 3 would treat 47 percent fewer acres than Alternative 2. Approximately 39 percent fewer acres would receive mechanical and prescribed fire restoration treatments, about 26 percent fewer prescribed fire-only. Additionally, the Severe Disturbance Area Treatments would be 78 percent less in Alternative 3. Alternative 3 would have less potential to reduce the risk of large-scale, high-severity fires in the project area. It would have less of a positive effect than Alternative 2 on protecting and maintaining high quality recreation settings over time.

Developed Sites

Any vegetation treatments or prescribed burning in developed recreation sites would follow the same design features as in Alternative 2. Consequently, the effects from management activities on developed sites would protect the developed sites from any short or long-term risk of uncharacteristic wildfire similarly to Alternative 2. However, facilities at developed sites and campgrounds in the project area would be less protected from adverse short and long term effects from the risk of uncharacteristic wildfire because of the fewer area treated.

Trails, Dispersed Recreation, Recreation Special Uses, and Motor Vehicle Use

The effects explained in Alternative 2 would be the same for the following areas: dispersed recreation, recreation special use, and motor vehicle use.

Recreation Opportunity Spectrum

Alternative provides for the long-term protection of recreational settings and facilities on 474,930 acres where mechanical thinning and burning would occur, by improving stand conditions and reducing fuel loading, and would lower the risk of high-severity fire somewhat on 316,580 acres of treatments. Maintaining healthy, green forests and reducing the risk of large-scale, high-severity fires in the project area would have a positive effect on protecting and maintaining high quality recreation settings into the future. Effects from Alternative 3 would be similar to those from Alternative 2 although on an area almost half the size.

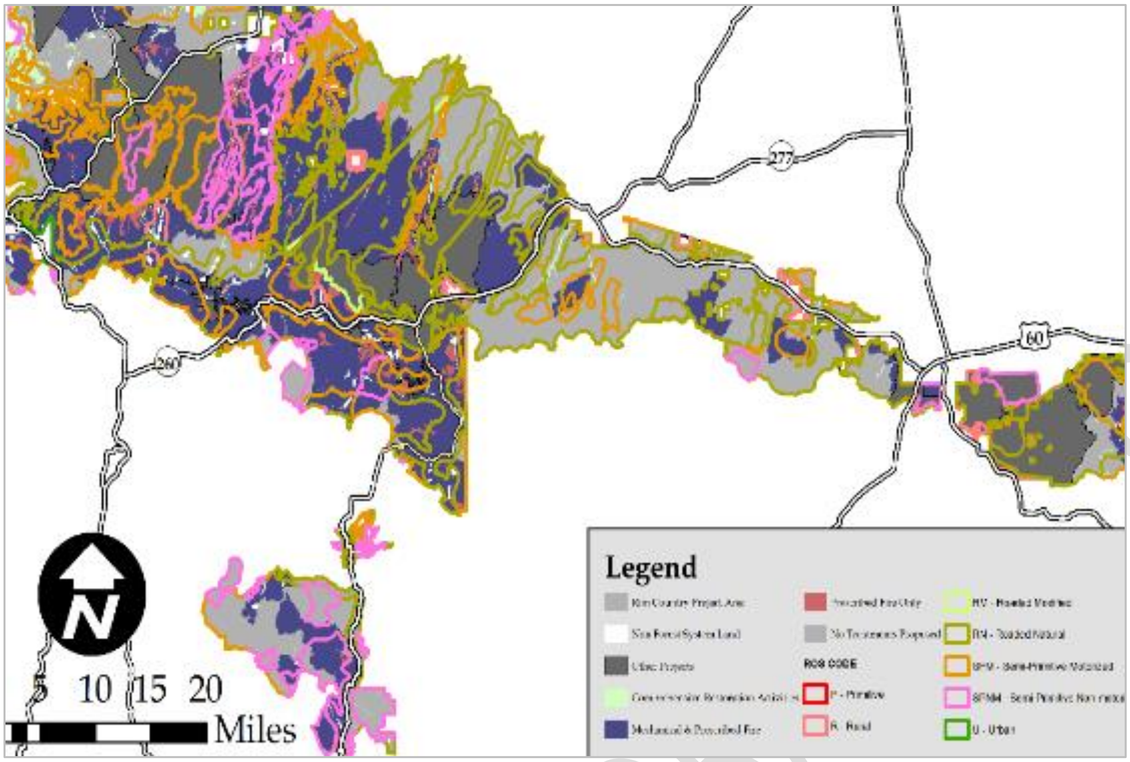


Figure 16. Treatments in the project area and ROS designations

Mechanical treatments would primarily occur in RN (50 percent) and SPM (35 percent) areas, with a lesser amount occurring in SPNM (13 percent) (Figure 3-**). Mechanical treatments are expected to result in short-term effects (one to two years after treatment) where the sights and sounds of humans are more noticeable on the landscape. However, after a short period of time and subsequent treatments such as prescribed fire, the evidence of treatments would fade and would not be expected to affect ROS designations. As a result, none of the mechanical treatments would prevent an area from meeting or moving toward ROS classifications over the long term (more than one year).

Effects from Rock Pit Use and Expansion

Effects Common to All Alternatives

All alternatives would increase the level of noise, dust, and traffic in the project area. All alternatives would cause a temporary loss of access to desired recreation areas when rock pits are being used to mine and process roadbed material. There would also be potential safety issues when recreationists are using roads that are haul routes for roadbed material.

There would be no direct or indirect effects on recreation special use permittees as they could continue their normal operations as directed in their permit. Motor vehicle use should not be affected as these rock pits would not add any access restrictions or modifications affecting recreationists.

Figure 3-** displays the ROS in the areas where the pits are located in relation to major travelways and forest boundaries. Most rock pits are located in ROS in forested areas making them difficult to view. Under both action alternatives, design features would help mitigate the impact to recreation from rock pits.

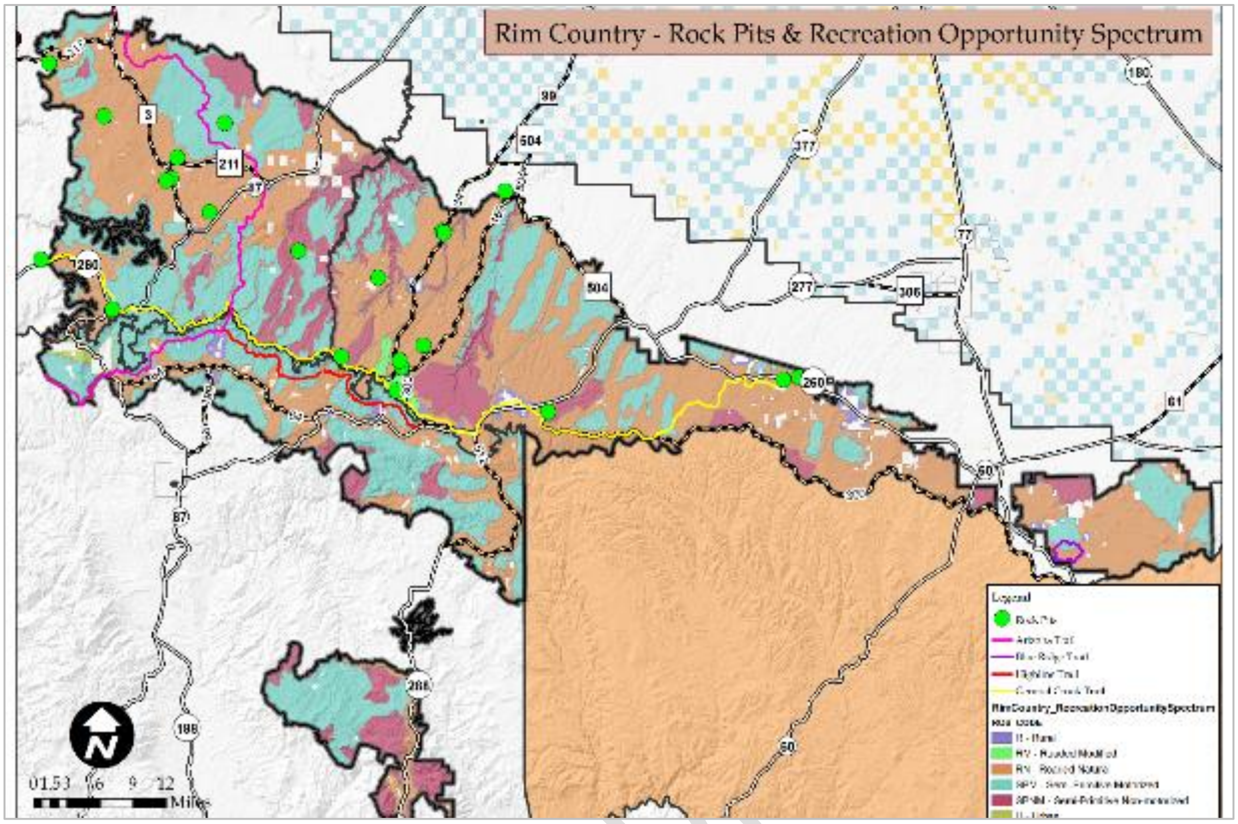


Figure 17. Rim Country Rock Pits and ROS

Alternative 1- No Action

General Effects to Dispersed Recreation, Recreation Special Uses, Developed Recreation Sites, Trails and Motor Vehicle Use

If Alternative 1 were to be implemented, there would be rock mining, processing, and hauling activities at the existing and currently operational rock pits.

Alternative 1 could cause a short-term disruption of recreation uses and displacement of recreation users at and near the existing and operational pits during times when aggregate materials are being hauled. This would have the effect of concentrating operations and hauling to a relatively small number of locations, and as a result this alternative would concentrate rock mining, processing, and hauling at currently operating pits or on main hauling routes (when aggregate material is purchased from private sources and hauled onto the forests), increasing the amount of time spent in each location since fewer pits would be used.

Alternative 1 would include dust and noise impacts to nearby trails and recreation areas. Portions of the trails and recreation areas in proximity to these rock pits would likely experience increased dust, noise, and perceptions of human activity when the pits are operational. These effects would be temporary and short term.

Recreational Opportunity Spectrum

Rock pits are located in Roaded Natural, Roaded Modified, and Semi-Motorized ROS setting. The pits developed in these settings would be in compliance with the setting characteristics.

Since the pits are located away from or not in the viewshed of primary (sensitive) travel corridors, these would be in compliance with the setting characteristics.

Effects Common to Both Action Alternatives

General Effects to Dispersed Recreation, Recreation Special Uses, Developed Recreation Sites, Trails and Motor Vehicle Use

Effects from Alternative 2 would include dust and noise effects on these resources. Portions of the trails and recreation areas that are in proximity to these trails would likely experience increased dust, noise, and perceptions of human activity. However, the maximum values of estimated noise levels for most of the heavy equipment associated with pit development would be in the 40-50 dB range for locations 0.5 miles away, or comparable to a running computer or refrigerator.

Effects from Alternative 2 would include disruption of recreation use at and near pits where roadbed materials are being mined and processed, and along haul routes that provide recreational access. Access to desired recreation resources could be altered, requiring recreationists to use another route, or go to another recreation resource where access is not disrupted by hauling activities.

There could also be safety impacts if recreationists are using the same roads as those used for hauling. Potential safety impacts to recreationists would be reduced by placing signs at major intersections on hauling routes during periods of active hauling. The effects at, and in proximity to, active pits would be temporary and short term. With the application of recreation design features, effects on trails and recreation areas would be temporary, short-term, and therefore less than significant.

Recreational Opportunity Spectrum

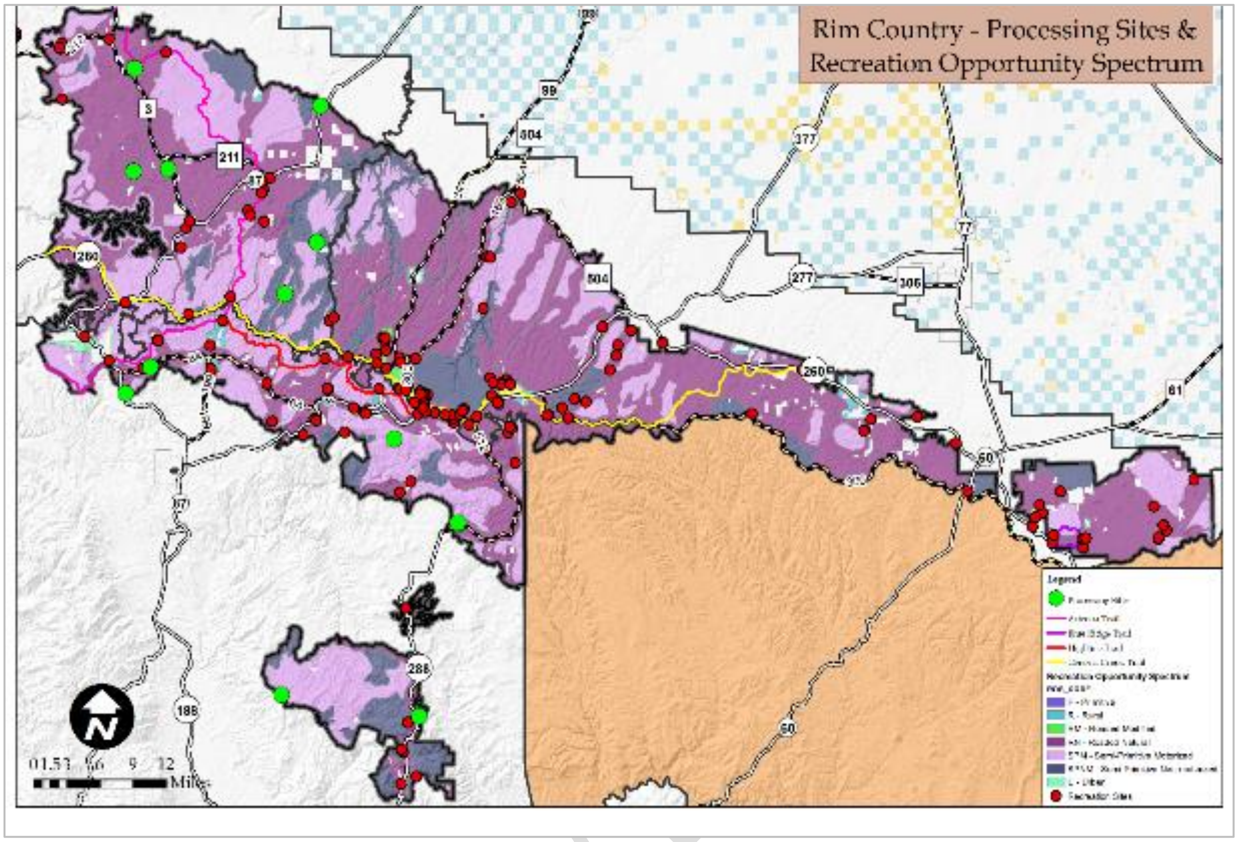
Most of the rock pits are located in Roaded Natural settings. One rock pit is located in the Roaded Modified and two rock pits are located in Semi-Motorized ROS setting. The pits developed in Roaded Natural, Roaded Modified, and Semi-Motorized settings would be in compliance with the setting characteristics. Since the pits are located away from or not in the viewshed of primary (sensitive) travel corridors, these would be in compliance with the setting characteristics.

The pits are similar to a very small mechanical treatment area, which would generally be consistent with natural vegetation patterns. For example, rock pit development would occur at the scale of non-ponderosa pine inclusions such as aspen and meadows that naturally occur in northern Arizona forests. The development would meet the intent of the management direction in the Apache-Sitgreaves Forest Plan.

Effects from Use of In-woods Processing and Storage Sites

Figure 3-** displays the ROS and the areas where the proposed processing sites are located in relation to developed recreation sites. Most processing sites are located in forested areas making them difficult to view even from 300 feet to 0.5 miles.

Figure 18-: Potential In-woods Processing Sites, ROS, and Developed Recreation Sites**



Alternative 1 - No Action

Alternative 1 does not propose in-woods processing sites and storage sites and would not initiate human-caused changes to the recreation resources within the project area. Alternative 1 would meet the ROS in both the Coconino and Tonto NFs.

Alternative 2 – Modified Proposed Action

The processing sites may be used as part of 4FRI Rim Country Project implementation. Following completion of use of processing sites and removal of all equipment and materials, site rehabilitation would have to be accomplished, including but not necessarily limited to removal of aggregate, restoration of pre-disturbance site grades, de-compaction of soil for seedbed preparation, and seeding and mulching of the site with native grasses and forbs. To hasten recovery and help eliminate unauthorized motorized and non-motorized use of skid trails and temporary roads, physical measures would be used such as re-contouring, pulling slash and rocks across the line, placing cull logs perpendicular to the route, and disguising entrances.

Of the proposed 12 processing sites, nine are in Roaded Naturel ROS, three are in Semi-Primitive Motorized and one overlaps Semi-Primitive Motorized and Semi-Primitive Non-Motorized. Development and operation of the processing sites would not conflict with desired conditions for SPM and RN designations where there are occasional or regular sights and sounds of human influence. The processing sites could have a broader effect on ROS experience in the immediate area where operations can be heard and seen (0.14 to 2.4 miles around a site), but these would not be inconsistent with the RN, SPM, or SPNM settings. During use of a processing site, the appearance of the forest would change because most of any existing trees would be cleared on the site. The locations of the processing sites have been selected to limit the need for tree removal and would be designed so that there is visual screening from the main roads, thereby moderating the visual effects of the sites. Also, during use there would be increased traffic and interaction between log trucks, chip vans, or other vehicles and equipment in use at the site and public use of the forest. The time period of effects to ROS from the processing sites would be variable: smaller processing sites would be used over a shorter time period (5 to 10 years) than the larger sites which could be in use from 10 to20 years. After use, the areas would be completely rehabilitated and trees and vegetation would slowly be reestablished.

All of the sites are located 100 to 300 feet from forest system roads to provide for visual screening. Effects on dispersed recreational use from the processing sites includes noise disturbance from equipment and increased truck traffic entering and leaving the site. These effects would range from temporary, over a few months when the mechanical operation are active, to several years for the large sites (10 to 15 acres) that would service as focal points for in-woods processing of logs, etc.

There could be longer term use of some processing site locations under the larger 4FRI implementation effort. Therefore, the authorization of these sites may combine with the effects from other projects occurring within or adjacent to the Rim Country project area, or in the 4FRI footprint, resulting in longer term effects from their use. Those effects would be related to noise and traffic in the vicinity of some processing sites.

Alternative 3 – Focused Alternative

Effects on recreation resources would be of the same type as described for Alternative 2, as all proposed in-woods processing sites could potentially be utilized.

Cumulative Effects

Alternative 1 – No Action

This alternative would mainly result in indirect effects of increasing risk of loss or degradation of recreational and lands infrastructure and opportunities. Uncharacteristic wildfire could impact recreation because sites (recreation events) would likely be unsafe and less appealing for recreation special use activities after such a fire and would likely result in closures (short term and long term) depending on severity. Such a fire would also have severe effects on permitted lands and could destroy infrastructure, limit access to private lands, and degrade water quality in the reservoir and other waters such as the eligible Wild and Scenic Rivers.

This alternative would cumulatively contribute to these same risks identified as indirect effects. The increased risk of uncharacteristic wildfire resulting from this alternative would contribute to the issue of limited recreational access and opportunities on the national forests. Over the last several years, there have been a number of large high-intensity wildfires such as the Slide Fire, Wallow Fire, Schultz Fire, General Fire, which have resulted in area closures and loss of temporary access and recreational use. Given an increasing likelihood of wildfire and a greater likelihood of high-intensity wildfire throughout the southwest under predicted climate change scenarios, the increased risk of wildfire, this alternative would result in a cumulative increase of these effects of risk to permitted infrastructure, limited recreational access, and loss of recreational opportunities and access in project area and surrounding areas. This alternative would also cumulatively combine with the increasing risk of high intensity fire from climate change and result in an elevated risk to lands and events managed under short-term or long-term special use permits.

Increasing population growth is also expected to drive increasing recreational demand, which would further result in decreasing recreational access and opportunity. By 2020, the Coconino NF is expected to experience an addition 338,000 national forest visits per year compared to current use (English and others 2014). Closures resulting from wildfires within or near the project area would combine to further reduce the available supply of recreation opportunities and access compared to demand, and would result in fewer visits to the national forests in some cases, increased crowding, and degradation of user experiences in surrounding areas that forest users travel to as a substitute recreational experience.

Alternative 2– Proposed Action

The cumulative effects of Alternative 2 and past, present, and future projects would have short-term and local negative cumulative effects on the provision of recreation opportunities and the associated recreation settings on the forests. Forest users seeking ponderosa pine recreation settings could be displaced or restricted, and the quality of recreation sites temporarily decrease during implementation of management activities for Rim Country and other current or future projects. Long distance hikers could have trips disrupted or be rerouted to different areas in the short term.

Alternative 2 would restore the ponderosa pine forest health and sustainability on 899,340 acres; this combined with other restoration activities would decrease the risk of high-severity wildfire or large insect outbreaks. Increasing numbers of recreation users and demand for ponderosa pine recreation settings would continue to strain the agency’s capacity and, in some areas of concentrated use, the resource capacity. With increasing demand for ponderosa pine forest settings, the large scale improvements to forest health and sustainability of this project, as well as similar vegetation and burning projects such as Upper Beaver Creek Forest Restoration, Hart Prairie Forest Restoration, Marshall Forest Restoration, and Rim Lakes Forest Restoration, would be expected to result in cumulative retention of or improvement in the quality of recreation settings and an increase in the ability of the Apache-Sitgreaves, Coconino, and Tonto NFs to meet recreation demands over the long term.

Past vegetation management activities resulted in an even-aged forest structure that is generally undesirable for recreation settings. It contributed to the scarcity of large, mature trees, and has not resulted in a forest with a more open structure, two setting characteristics (Ryan 2005) that have been identified as desirable to forest users. Past fire suppression activities have contributed to overstocked forest conditions, increased quantities of fuels, and decreased understory vegetation.

The current and planned vegetation management treatments and burning projects on all three forests, as well as opportunities for managed wildfire, would cumulatively result in improvements in forest health and sustainability in the ponderosa pine that are large and widespread. In the event of a wildfire or insect infestation, the restored forest would likely experience more typical low-severity fire and smaller scale insect infestation. The cumulative effects on desired recreation settings and ROS class characteristics forest users seek would be to maintain and improve them.

Alternative 2 is expected to have mostly positive effects on recreation settings due to the decommissioning of user-created routes and some existing forest roads. The quality of some recreation settings in ROS classes were declining due to unconfined motorized use. Present and future activities may result in additional degradation along camping corridors, but these would be short term and localized. There would be positive cumulative effects and an overall improvement in ROS classes as a result of these activities.

No new road construction is proposed now or in the future in cumulative effects projects. Motorized trails projects include new construction, road to trail conversion, and route decommissioning in appropriate ROS classes. This would have positive cumulative effects in more primitive ROS classes when decommissioned routes naturalize, and expected characteristics are re-established.

Desired recreation setting characteristics such as large, mature trees, healthy understory, and diversity of tree age classes, sizes, and species are also at high risk from the effects of climate change. While drought cycles are common in the Southwest, increasing temperatures and decreases in precipitation, in combination with overstocked forest conditions and high fuel loads, are predicted to result in an increase in high-severity wildfires (Westerling 2006) (Marlon 2012)(CLIMAS. 2011). Unmanaged forests have shown increases in tree stress and mortality as a result of global warming, and old, mature trees are especially vulnerable(Ritchie and others 2008.; Van Mantgem 2009.; Williams 2010). Alternative 2 and other restoration projects will cumulatively result in improved forest structure, composition and diversity, more resilient forest conditions, decreased tree stress, and the potential for decreased mortality.

Over time, effects would lessen and the crown fire risk predicted for the project area as a result of climate change would decrease. Recreation structures and environment would be made more resilient to wildfire effects by mechanical thinning and prescribed fire treatments. Since direct or indirect effects resulting from project activities would be mitigated by project design features, there would be no cumulative effects on trails, recreation sites, other structures related to recreation, and recreationists' experience.

Ongoing or planned projects of a similar nature to Rim Country within the project boundary include the Cragin Watershed Protection Project (64,430 acres), Upper Beaver (49,210 acres), Timber Mesa Vernon (41, 162 acres), Upper Rocky Arroyo (33,436acres), Larson (30,041 acres), Rim Lakes (33,770 acres) and Clint Wells (17,741 acres). These thinning and burning projects would have similar effects on recreation as Rim Country and resource impacts would be mitigated similarly. The Rim Country Project, in combination with ongoing and future projects, would not result in any detrimental cumulative effects to recreation.

Alternative 3– Focused Alternative

The focused alternative would have similar minor, short-term, and temporary negative direct and indirect effects on recreation sites and uses as Alternative 2. As noted, less area inside the project boundary would be affected by treatments. Consequently, the predicted crown fire risk as a result of climate change would menace more area in the project area than in Alternative 2. This would heighten the danger of disastrous consequence to recreation structures, sites, and recreation settings.

Rock Pit Use and Expansion

Alternative 1 – No Action

This analysis includes the potential cumulative effects to recreation during the 20-year implementation of this project. There are numerous other projects that would require the use of the same roads that are used to access recreational resources on the three national forests. Other restoration projects would still result in a cumulative increase in hauling by heavy machinery on main forest travel corridors and concentrated hauling for periods of several weeks in project areas.

The cumulative effects would be an increase in potential safety hazards such as dust and truck traffic to motorized recreation users, especially during duplicate hauling periods (which includes hauling associated with road maintenance and hauling associated with tree and slash removal). However, this cumulative effect is considered less than significant because of the long time frame and large area for implementation of the future foreseeable actions. If any activity from a particular project in combination with actions associated with existing rock pit activity were to affect recreational access, recreationists could find other areas on the three national forests with similar recreation opportunities.

The largest cumulative effect from this alternative would be the cumulative effect of hauling, causing traffic, noise, and dust in areas near recreation sites or on the main road system being used to access recreation opportunities. Under tis no action alternative, there would still be cumulative effects on the recreational experience for several thousand forest visitors over the next two decades.

Effects Common to Both Action Alternatives

The cumulative effects from both action alternatives (Alternatives 2 and 3) would be similar to those under Alternative 1, which include the effects of hauling, and causing traffic, noise, and dust in areas near recreation sites or on the main road system being used to access recreation opportunities. However, since more rock pits would be available for use, this would spread the effects to more areas while lessening the effects in areas where rock pits would be more intensively used without the addition of the new rock pits. The cumulative effects would be less for Alternative 3 since the treatment area is half the size of Alternative 2.

Scenery

A summary of the scenery report is presented here. The specialist report (Fargo 2018) is incorporated by reference. This analysis for the Rim Country Project is consistent with scenery-related Apache-Sitgreaves, Coconino, and Tonto Forest Plan direction, USFS policies, and applicable elements of FS Scenery Management Systems.

Affected Environment

The 4FRI Rim Country Project area is important to many people for its unique scenic qualities. These scenic qualities are admired from the panoramic views of the Mogollon Rim and from the four national trails, developed recreation sites, and scenic roads that wind through the project area. Due to the high concentration of visitors to the project area, the scenic resources of this area are critical to their experiences and perceptions. The President's Commission on Americans Outdoors identified natural beauty as the most cited reason for choosing an outdoor recreation site (Rosenberger and Smith 1998).

Project-level Scenic Inventory

The Apache-Sitgreaves, Coconino, and Tonto National Forests' natural, cultural, and historic resources provide diverse outdoor recreation opportunities that connect people with nature in a variety of settings. Forest users can hike, bike, drive motorized vehicles, camp, fish, view wildlife and scenery, and explore historic and prehistoric places. They enjoy opportunities for year-round recreation activities from birding and wild flower observing in the spring to hiking in summer months, fall color viewing and hunting, and cross country skiing in the winter. See the Recreation Report for more detail on developed recreation sites, the Recreation Opportunity Spectrum classifications, and other recreation information specific to the Rim Country project area.

In all three forests in the project area, the existing condition of scenic resources is a result of implementing the forest plans. The management of multiple resources has, to varying degrees, altered the natural landscape character. The most obvious effects on scenic resources within the project area are from vegetation and landform alterations. Resource management activities which have altered scenic resources include vegetation management, mineral extraction, utility corridors, roads and trails, development of recreation sites such as campgrounds and picnic grounds, improvements associated with special use permitted sites, livestock grazing, and fire management (suppression and prescribed burning).

Sense of Place

Landscape character gives a geographic area it's visual and cultural image, and consists of the combination of physical, biological, and cultural attributes that make each landscape identifiable or unique. Existing landscape character may range from predominantly natural landscapes to those that are heavily culturally influenced.

The three Rim Country forests have developed a recreation niche setting to provide general context for the importance of inherent scenic qualities that contribute to the landscape character. These qualities include aesthetic, social, and biophysical features. Valued scenic assets and recreational opportunities in the project area include the Mogollon Rim, eligible Wild and Scenic Rivers, lakes, National Recreation Trails (Arizona, General Crook, Highline), the visitor center and campgrounds on the Mogollon Rim and other developed campgrounds, trailheads, trails, and dispersed recreation opportunities. Dispersed recreation opportunities include hunting, fishing, wildlife and bird watching, camping, and many other activities. The importance of scenic assets for recreation is described in the following descriptions and displayed in Figures 3-**, 3-**, and 3-**. "The variety of landforms creates a changing viewscape seen from communities, trails, and roads. The quality of life for local communities is enhanced by the scenery, clean water, and clean air." (NEED CITATION)

Niche information was developed for the Apache-Sitgreaves and Coconino NFs. Four settings were identified: High Use, Scenic Corridor, Moderate Use/Dispersed, and Secluded/Low Use/Primitive Area. Wilderness is excluded from treatment and is represented in Low Use as well as in portions of Moderate and High Use areas.

High Use/Developed - This setting includes activities such as interpretation and education, developed camping, scenic viewing and hiking. Visitors to the forest commonly experience a seamless shift from community trails and roads onto the forest, without recognizing the change. Developed recreation sites include campgrounds, picnic areas, interpretation sites, and trailheads.

Scenic Corridor – Visitors drive through the changing landscapes and view the spectacular scenery. By stopping at observation points they gain an understanding and appreciation for environmental ethics. Activities include interpretation and education, developed camping, and viewing scenery. Developed recreation opportunities include campgrounds, picnic and day use areas, and trailheads.

Moderate Use/Dispersed – This less structured setting includes a lot of the vast open space of the forest. From sparse vegetation to dense forest, canyons to plateaus and mountains, this area typifies the forest's contrasting landscapes. Activities in this area include OHV riding, hiking, and dispersed and developed camping. Developed recreation opportunities include boating, campgrounds, cabins, and trailheads.

Secluded/Low Use/Primitive Area – Remote areas offer solitude and unconfined recreation. The area's primeval character dominates and no permanent improvements exist. The forest has wilderness areas, not all of which are in this setting. Activities in low-use areas include hiking and backpacking and site types with trailheads and information boards.

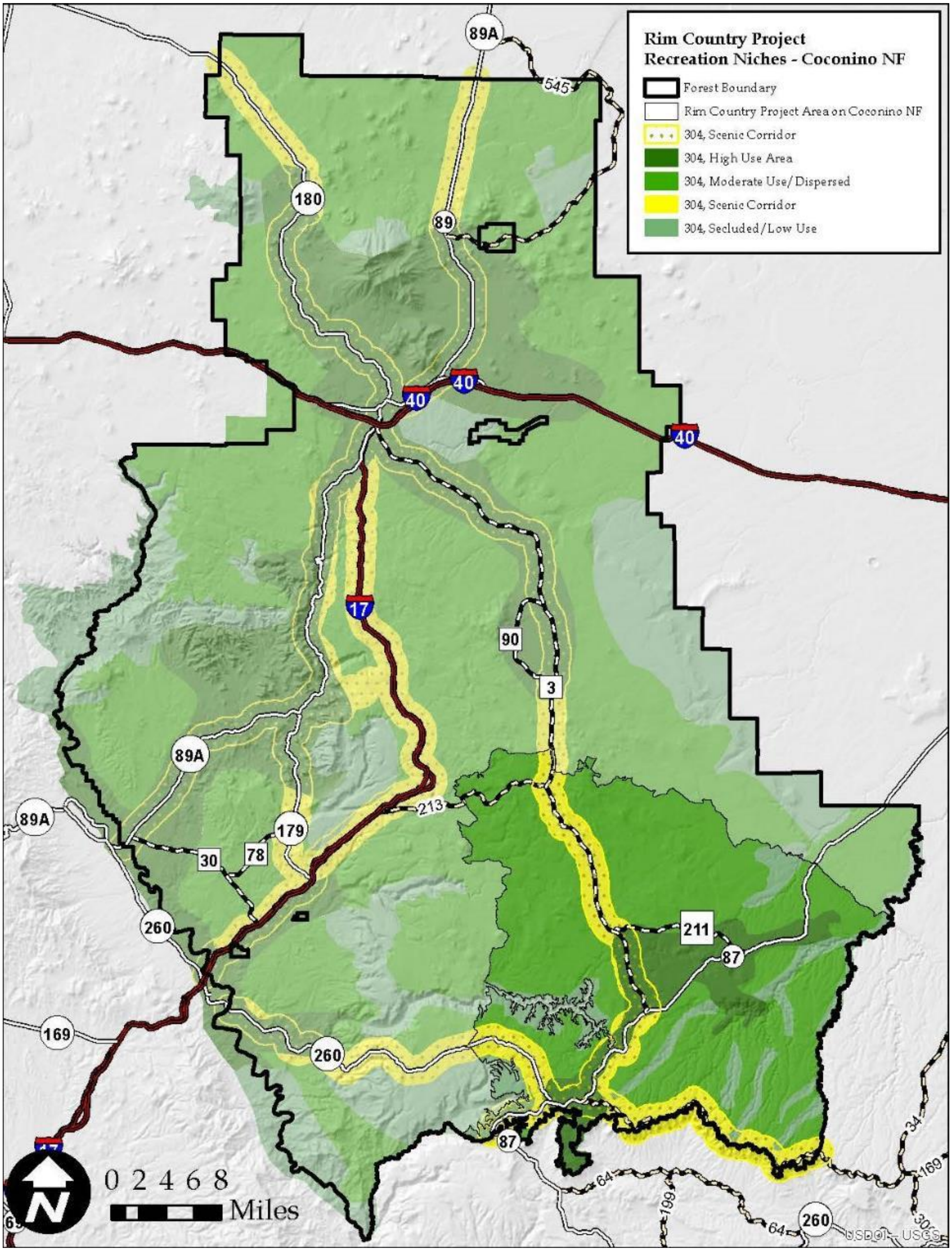


Figure 19. Coconino NF Recreation Niche Setting

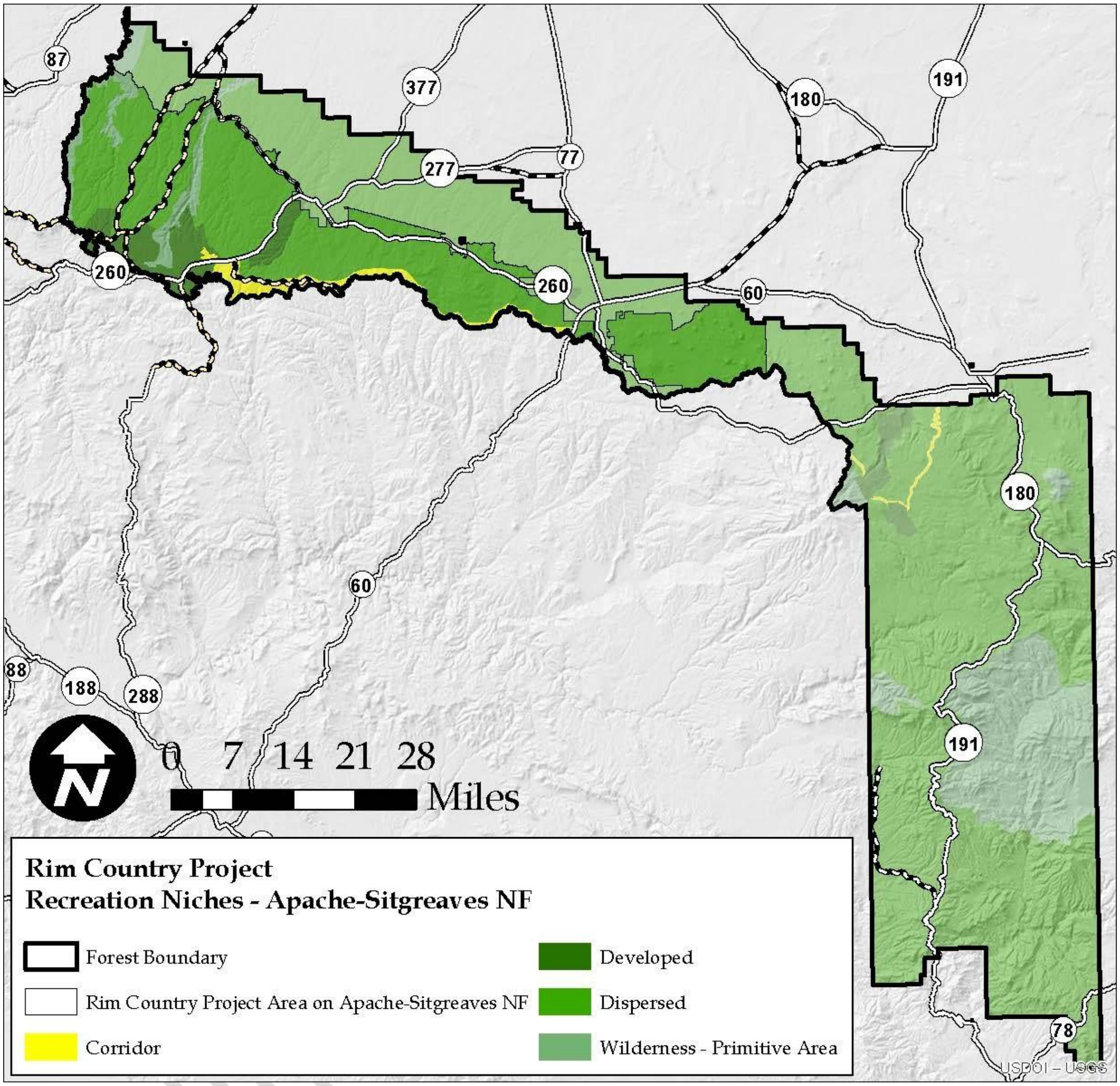


Figure 20. Apache-Sitgreaves NF Recreation Niche Setting

Niche information was also developed for the Tonto NF. Of the six settings identified, only three are represented in the Rim Country project area (Figure 3-**). Backcountry, High Country, and Linear Adventures (e.g., hiking, biking).

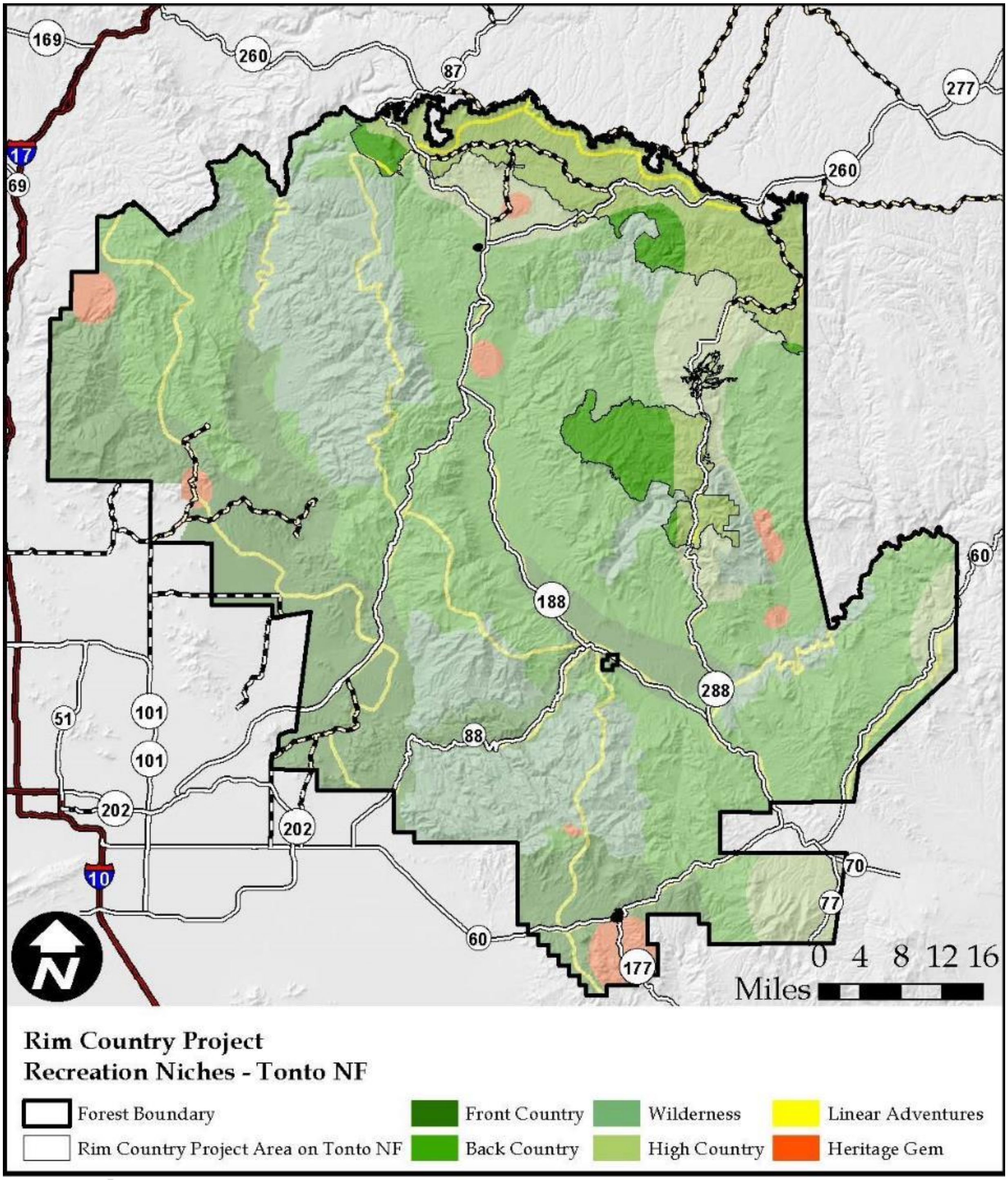


Figure 21. Tonto NF Recreation Niche Setting

Scenic Character Description

The 4FRI Rim Country project area includes land on the Mogollon Rim and Red Rock Ranger Districts of the Coconino NF, the Black Mesa and Lakeside Districts of the Apache-Sitgreaves NF, and the Payson and Pleasant Valley Districts of the Tonto NF, and includes portions of Coconino, Yavapai, Gila, and Navajo Counties. Major access routes include US Highways 87 and 260, State Route 288, Roads 213, 3, 512 as well as the From the Desert to the Tall Pines

National Scenic Byway. These communities and routes receive high use and users have high concern for scenery.

The project area is viewed at foreground, middleground, and background distances from sensitive roadways, trails, and recreation sites located inside and around the project boundary. Figure 3-** displays the definitions of landscape distance zones (Forest Service 2000).

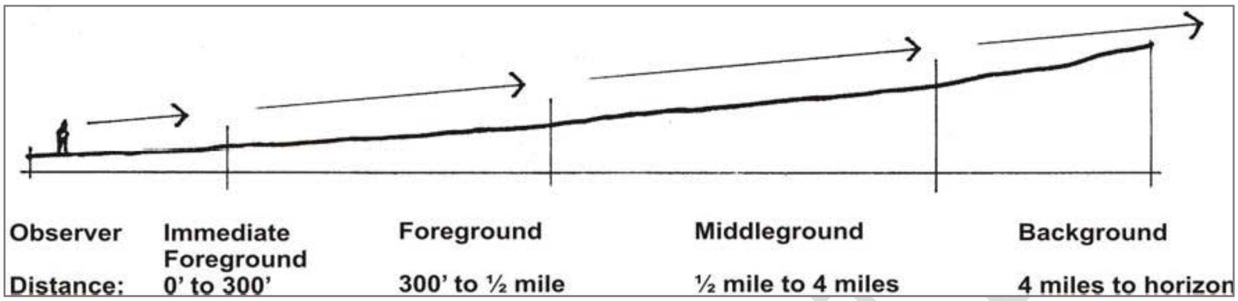


Figure 22. Landscape distance zones

The forested landscapes in the Rim Country project area are highly departed from desired conditions, lacking desired species composition, spatial arrangement, and structure, and are very dense as measured by basal area, trees per acre, and stand density index. Some of these areas are at high risk for disturbance from undesirable fire behavior, insects and disease, and climate change.

The project area's dominant scenic identity is the continuous ponderosa pine, ponderosa pine-Gambel oak, and ponderosa pine-evergreen oak forests interspersed with less dominant cover types.

The exclusion of fire has resulted in high canopy cover and high tree density which limits the amount of sunlight and precipitation reaching the ground. Consequently, understory vegetation is less diverse, sparse, and provides poorer quality food and cover for wildlife than under more open canopies.

The project area is valued for its open stands of ponderosa pine. Old-growth "yellow pines" are an important component of the ponderosa pine forest. Forest aesthetic research has found that large mature trees and an open forest are important parts of scenic beauty and should be retained in the forest (Ryan 2005). The ponderosa pine and mixed conifer cover types vary from dense stands of smaller diameter trees to open stands of large, stately ponderosa. The mixed conifer stands provide scenic variety.

Figure 23. Ponderosa Pine-Character Zone as seen from Mogollon Rim

The 4FRI project includes about 28,000 acres of the pinyon-juniper cover type. Most of the pinyon-juniper vegetation communities are currently younger and denser than they were historically, because of changes in wildfire occurrence. Greater tree density has increased competition for water and nutrients. This, in turn, has caused a reduction in understory plant cover and diversity, a loss of ground cover, and subsequent increases in soil erosion (USDA-Forest Service 2012e).

Understory species include aspen, oak, and other species of shrubs, grasses, and forbs. Understory tree species are moderately scaled; most have pine trees that have encroached into groves or groups and now overtop many of the deciduous trees. Aspen stands are currently in decline throughout most of the southwest as a result of fire absence, unmanaged forest succession, drought, and ungulate over-browsing (Forest Service 2012). Gambel oak is another important scenic species with characteristics of color, shape, texture, and form that contrast with the dominant conifer species. The oaks are not as showy as aspen, but sport fall color changes, and large, mature trees can be striking. Gambel oak is stressed by absence of fire, unmanaged forest succession, drought, and other extreme weather events.

In the meadows and grasslands of the Rim Country project area, covering approximately 21,000 acres, conifers and junipers have encroached into these once open grassland habitats, decreasing the size and function of landscapes that were historically grasslands. As tree canopy increases, understory productivity decreases.

Figure 24. Vegetation cover and understory in the Rim Country Project Area

The diversity of vegetation-related scenic attributes supports a positive viewing experience for people traveling through or recreating in the project area, and supports the quality of life for local residents and visitors (Ryan 2005). The diversity of vegetation also contributes to abundant wildlife, another important part of scenery viewing.

To the common visitor, the landscape is perceived as a predominantly natural-appearing landscape with some evidence of human modification and disturbance. There are recreation developments such as campgrounds, trailheads, interpretation areas, visitor centers, and historic Forest Service structures. Roads and trails built to accommodate harvesting operations, grazing, and recreation use, are evident across the landscape. Natural disturbances have had an influence on the vegetation patterns. These disturbances include fire, storms, insect and disease events, and recovery processes from these events.

There are 728 miles of trails identified in the project area including four national trails (see Figure 3-**). These trails offer unique recreational opportunities and an opportunity to experience the scenic quality of the project area. The following national trails are located within the project area:

The General Crook National Recreation Trail is a 138-mile-long historic route that was originally over 200 miles in length and connected Fort Whipple to Fort Apache. Portions of the trail are located on the Coconino and Apache-Sitgreaves NFs. The trail follows the Mogollon Rim, one of the more striking geologic features in Arizona, offering spectacular views of the state's central mountains and desert. Approximately 95 miles of this trail are located in the project area.

The Arizona National Scenic Trail is a continuous, more than 800-mile diverse and scenic trail across Arizona from Mexico to Utah that crosses through the Coconino and Tonto NFs. It links deserts, mountains, canyons, communities, and people. Approximately 70 miles of this trail are located in the project area. Approximately 30 miles of its segments overlap with other trails in the project area.

The Blue Ridge National Recreation Trail is a 9.4-mile loop trail located on the Apache-Sitgreaves NF that follows Billy Creek and winds its way through ponderosa pine forest to the top of Blue Ridge Mountain. The entire trail is within the project area.

The Highline National Recreation Trail offers beautiful vistas of rim canyons, brushy hills, distant mountains, unique rock formations, and wonderful stands of ponderosa pine. The Highline Trail runs essentially east to west below the Mogollon Rim and roughly following it. Approximately 44 miles of this trail are located in the project area.

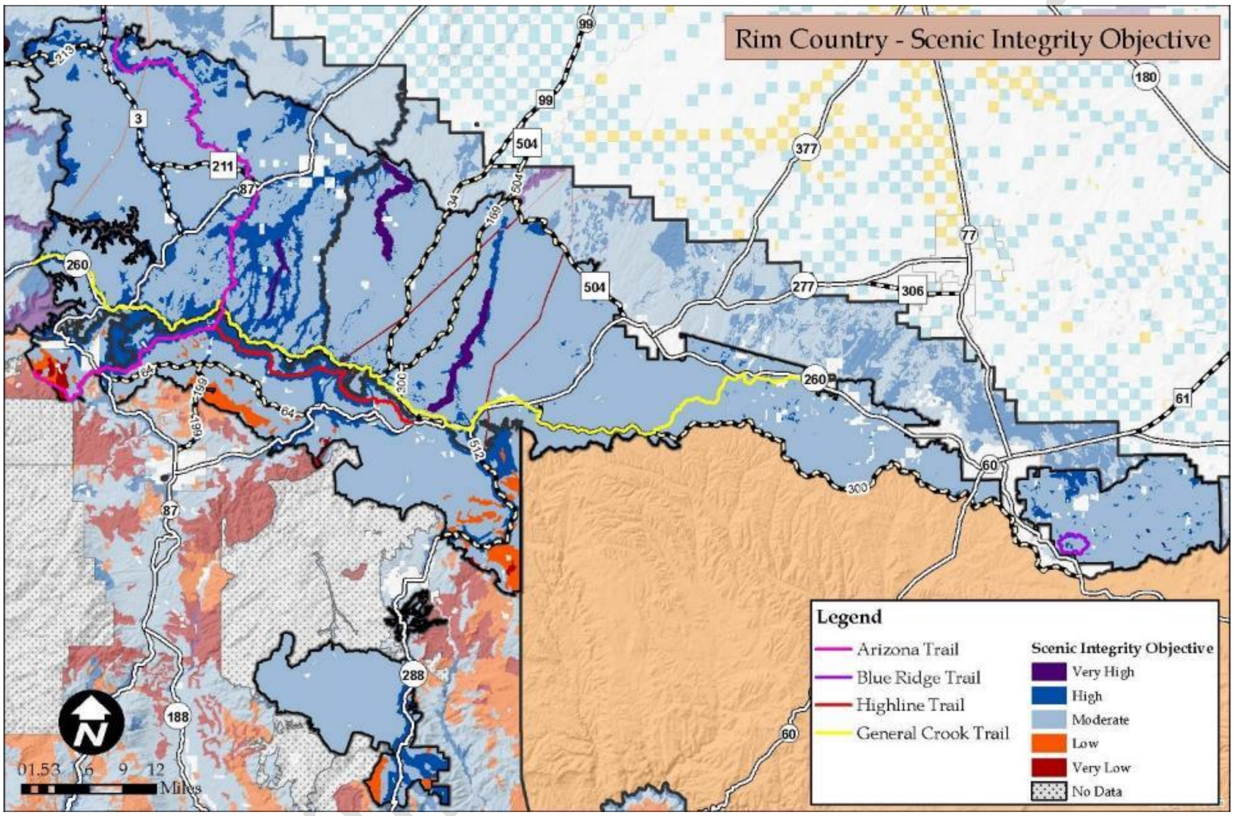


Figure 25. National Trails in the Rim Country Project Area

There are currently no designated segments of wild and scenic rivers in the Rim Country project area. There are however, nine segments of eligible wild and scenic rivers on the Apache-Sitgreaves and Coconino NFs that contribute to the scenic quality of the project area. Each system has a buffer of one-quarter mile where a High scenic integrity objective must be maintained per the forest plans. In addition, as part of its forest plan revision process, the Tonto NF is completing an updated eligibility report for wild and scenic rivers which will replace the existing eligibility report from 1993. To ensure compliance with current forest plan direction, this analysis includes both the eligible rivers reported in the 1993 study, as well as those listed in the current draft eligibility report. Figures 3-** and 3-** display the locations of the eligible wild and scenic rivers on the Apache-Sitgreaves and Coconino NFs relative to the project area, as well as the rivers from the 1993 eligibility report and the current eligibility study (ongoing) for the Tonto NF.

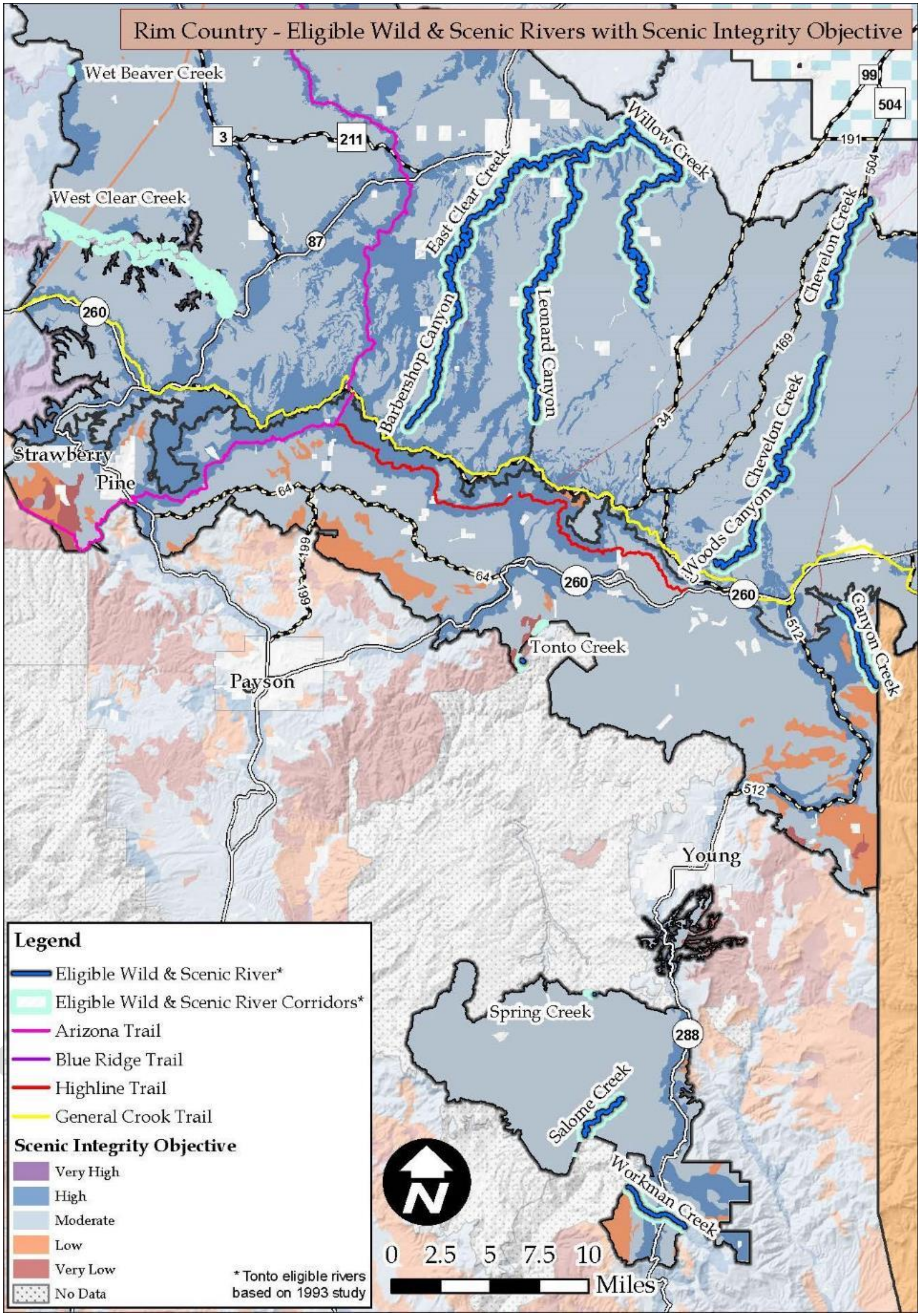
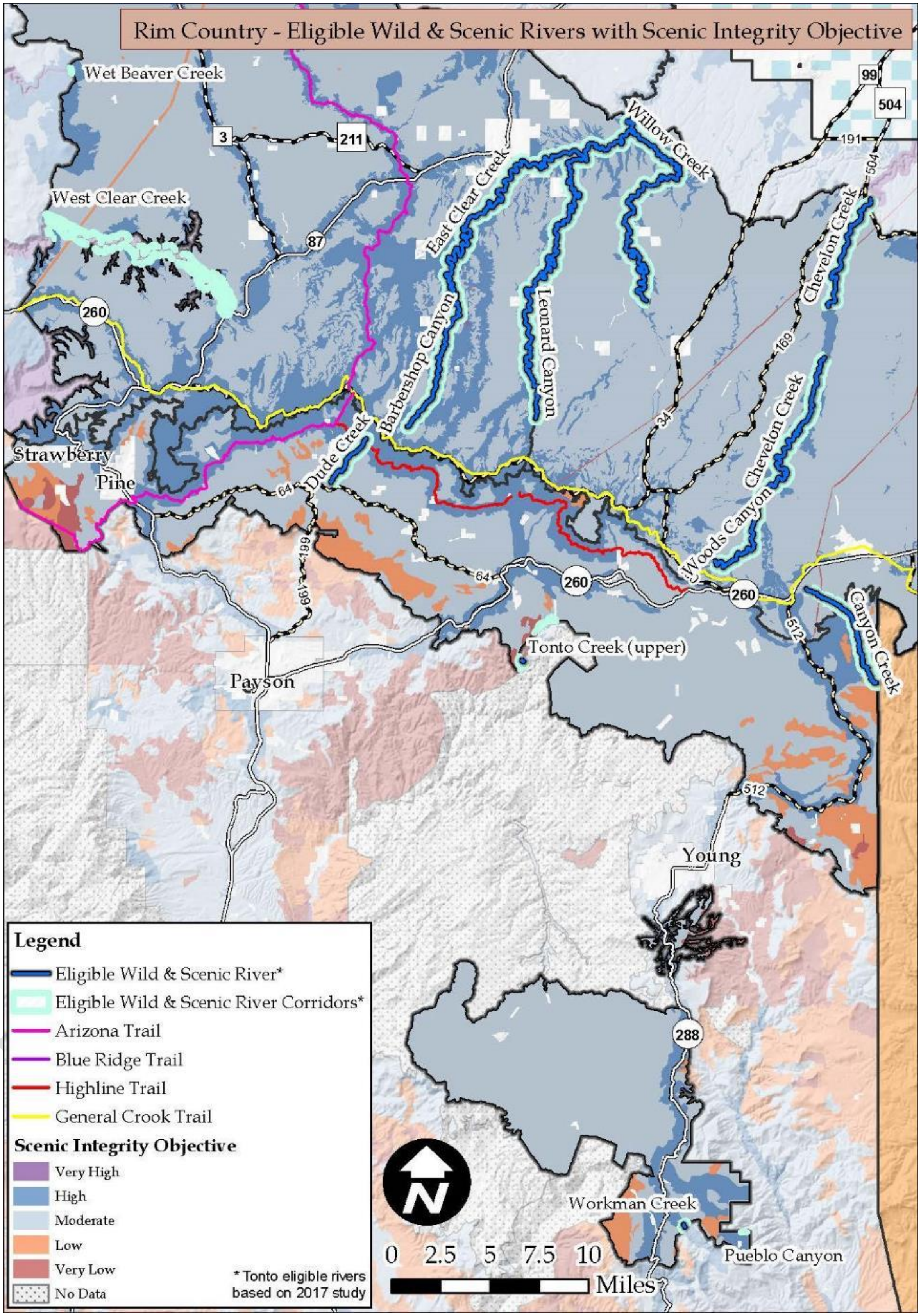


Figure 26. Eligible Wild and Scenic Rivers and Scenic Integrity Objectives (w/ 1993 Tonto NF)



Rim Country - Eligible Wild & Scenic Rivers with Scenic Integrity Objective
Wet Beaver Creek
West Clear Creek
East Clear Creek
Willow Creek
Leonard Canyon
Barbershop Canyon
Chevelon Creek
Dude Creek
Woods Canyon
Canyon Creek
Tonto Creek (upper)
Strawberry
Pine
Payson
Young
Workman Creek
Pueblo Canyon
Legend
Eligible Wild & Scenic River*
Eligible Wild & Scenic River Corridors*
Arizona Trail
Blue Ridge Trail
Highline Trail
General Crook Trail
Scenic Integrity Objective
Very High
High
Moderate
Low
Very Low
No Data
* Tonto eligible rivers based on 2017 study
0 2.5 5 7.5 10
Miles

11077

Figure 27. Eligible Wild and Scenic Rivers and Scenic Integrity Objectives (w/ Current Tonto NF)

Landscape visibility describes the portions of landscapes visible from travelways and use areas important to constituents for their scenic quality, aesthetic values, and landscape merits. Travelways and use areas have identified sensitivity levels for viewing scenery. Concern Level 1, the highest concern for scenery, is given to travelways or use areas that often lead to distinctive scenic features such as residential areas, resorts, and recreation areas, and attract a higher percentage of users having high concern for scenic quality, thus increasing the importance of those travelways for viewing natural-appearing scenery (Forest Service 2000). These areas most often have a High scenic integrity objective allocated to the foreground distance zone. Highway 87, Roads 3 and 512, and the From the Desert to Tall Pines Scenic Byway (288) are Concern Level 1 roads. The national trails are all examples of Concern Level 1 trails. Concern Level 2 is assigned to routes and places that are locally important, where people have a moderate to high concern for scenic quality. Forest Road 64 would be considered a Concern Level 2 route. The existing scenic integrity level ranges from Moderate to High along Concern Level 1 and 2 routes. All routes with a High scenic integrity objective adjacent to them would be considered Concern Level 1 routes.

Ecosystem Context

The vegetation is the dominant scenic attribute in the Rim Country project area. There are substantial opportunities for improvement of the ecological function and for scenery attributes. The existing vegetation density and lack of high frequency, low-severity fires are inconsistent with the desired scenic character and its sustainability.

Currently, the dense conifer vegetation often obscures views of existing scenic attributes within the forest canopy and understory, and greatly restricts viewing access to potential scenic attributes. Among the potential attributes are large mature trees; diverse species including aspen, evergreen oak, Gambel oak, and grasslands; as well as other understory shrubs, grasses, and forbs.

Inter-tree spaces (interspaces) and openings have been filled with small and medium sized trees, where if these were opened up, sunlight would reach the forest floor, adding to the scenic quality as well as helping provide for greater understory vegetation composition and abundance.

Fire has been suppressed for many years and this, in combination with overly dense forests, departs significantly from reference conditions. Currently there is a risk of large-scale, high-severity fire that could result in elimination of the vegetation scenic attributes that are desired. High frequency, low-severity fire helps to recycle nutrients, keep tree densities lower, and keep fuel accumulations lower.

Seeps, springs, and ephemeral drainages have had conifers encroach and overtop other species, reducing their function over time. When these features are functioning properly, they provide high scenic quality and auditory, tactile, and visual features not found without the presence of water.

Throughout the forests, unauthorized routes and redundant roads have been created. These detract from the scenic quality of the area by forming unnatural linear features that are uncharacteristic of the landscape. Decommissioning these roads would restore characteristic forest landscape features.

Assumptions and Methodology

Assumptions

Scenery Management System terminology will be used in the tables, maps, and environmental consequences section of this report to more uniformly describe effects.

Treatment location, in relation to terrain and elevation and other vegetative screening, can affect the visibility of management activities. Vegetation treatments on steep slopes, when other landforms do not block the view, can dominate the landscape.

The duration of view or speed of travel through an area (i.e., walking or riding in a vehicle) determine how long a viewer has to study and pick out objects, forms, lines, colors, and patterns in the landscape.

How well treatments transition from treated to untreated areas can also affect how evident a treatment is in all distance zones.

Proposed activities, although they may have some short-term negative effects on scenery, also may begin to move the landscape toward the desired landscape character. Effects that would move the vegetation toward the desired landscape character are beneficial to scenic resources in the long term. These beneficial effects are often realized over a long period of time but lead to the lasting sustainability of valued scenery attributes. For example, tree thinning may have short-term effects of ground disturbance, stumps, and slash, but in the long term, if properly mitigated for scenery, may provide visual access into the forest and promote large tree growth and a smooth herbaceous ground cover. In the long-term, the removal of some trees, dependent upon scale and intensity of treatment, may be a beneficial effect for scenery.

Desired landscape character often includes and is linked to preferred visual settings. Gobster (1994) summarizes visually-preferred settings as having four common attributes: large trees, smooth herbaceous ground cover, an open midstory canopy with high visual penetration, and vistas with distant views and high topographic relief.

Visual access, or how far one can see into a forest, is also a preferred scenic setting (Ryan 2005). The degree of visual access varies throughout the project area, depending on the amount of understory vegetation present in the forest. Younger ponderosa pine forests may have dense vegetation, which allows very little visual access into the forest. In the long term, scenic resources will have higher scenic quality if visual access is achieved or enhanced.

Methodology

This analysis applies current National Forest Scenery Management methodology in conjunction with existing Apache-Sitgreaves, Coconino, and Tonto National Forest Plan direction. ArcMap and GIS data layers were used to analyze the proposed activities in regards to recreation use, sensitive travel corridor locations, areas potentially seen from sensitive travel corridors and use areas, and visual quality objectives and scenic integrity objectives assigned to the area. The potential effects on scenic resources from this project were determined based on a site visit to the project area with members of the interdisciplinary team, review of photos of the project area, use and interpretation of GIS data and aerial imagery, and review of research and analysis of similar projects including the 1st 4FRI project analysis and scenic resource report. Direct, indirect, and cumulative effects were considered in this analysis.

Visual Management System (VMS)

The Tonto NF currently manages scenic resources through the application of the VMS. The VMS was adopted by the Forest Service in 1974. The culmination of the VMS were Visual Quality Objectives (VQOs) prescribed in the Forest Plan for all lands within the forest. VQOs provide the degree of acceptable alteration of the characteristic landscape and are also a measure of the degree to which a landscape is visually perceived to be complete. As shown in Table 3-**, the VQO classifications include Preservation, Retention, Partial Retention, Modification, and Maximum Modification.

Table 124. Scenic Integriy as described by VQO levels

Visual Quality Objectives/VQOs)	Scenic Integrity (as people perceive it)
Preservation	Unaltered, complete
Retention	Unnoticeably altered
Partial retention	Slightly altered
Modification	Moderately altered
Maximum modification	Heavily altered
Unacceptable modification	Unacceptably altered

During analysis, it was recognized that the Tonto NF had data gaps on a small percentage of VQO GIS polygons in the project area. An analysis using site visit information, photos, GIS, and Google Earth was conducted to supply the missing VQO data.

The Tonto NF will be transitioning in the future to the Scenery Management System. For this project, the current Visual Management System is used to ensure Tonto NF plan consistency and compliance. However, the Scenery Management System terminology will be used in tables, maps, and the environmental consequences section to more clearly describe effects, as well as be consistent with Apache-Sitgreaves and Coconino NF terminology.

Scenery Management System (SMS)

The SMS began with the same basic premises of the Visual Management System, but has been revised to better accommodate ecosystem management and the timeframes and disturbance patterns of natural systems. This system places greater importance on identifying which scenic elements forest constituency most values, and developing management strategies to maintain or improve those elements. The Apache-Sitgreaves and Coconino Forest Plans currently use SMS. For forests not currently revising their forest plans or requiring extensive time for revision, application of SMS will occur at the project level. This is the case for the Tonto NF, which will be transitioning from VMS to SMS at a later date. For consistency in this analysis, the SMS terminology will be used in tables, maps, and the environmental consequences section.

The eleven fundamental principles to the Scenery Management System are:

- Biological, physical, and social factors create and influence scenery and interact to determine landscape character.
- Landscape character varies greatly with the interaction of environmental factors.

- People have the ability to perceive landscape character and develop expected images.
- Through various activities, people have the ability to modify landscape character and scenic conditions and have often done so.
- Such changes in landscape character and scenic condition often modify, suppress, or replace the original landscape character.
- People value most highly the more scenic landscapes.
- Generally, natural-appearing landscapes are the most valued.
- Resource managers can design their activities to reduce adverse effects on landscape character and scenic integrity.
- People have the ability to establish goals to maintain or create desired landscape character.
- People have the ability to apply ecological, technical, and design knowledge to meet scenery management goals and objectives.
- In some situations, resource managers perpetuate or create desired scenic environments to provide an improved quality of life.

The Scenic Integrity Objectives (SIOs) are used in the Scenery Management System in much the same way as VQOs are used in the Visual Management System. The scenic integrity or "intactness" of national forest lands is the means by which proposed alterations to the land are evaluated. Scenic integrity is produced from the combined inventory of scenic attractiveness, viewing distance from the observer, and concern level of forest visitors. Scenic integrity objectives are established for the forest and can be applied at the forest, management area, or project area level (USDA Forest Service 2000). They range from Very High, meaning the landscape character is unaltered, to Very Low, meaning the landscape character is highly altered. Intermediate levels include High (landscape character appears unaltered), Moderate (landscape character is slightly altered), and Low (landscape character is moderately altered). Scenic integrity objectives can be applied in two ways: (1) to describe a degree of existing scenic integrity or disturbance, or (2) to describe a minimum objective for future integrity. Another basic premise of the Scenery Management System is landscape character, which gives a geographic area its visual and cultural image. It consists of a combination of physical, biological, and cultural attributes that make each landscape identifiable and unique. Landscape character embodies distinct landscape attributes that exist throughout an area (USDA-Forest Service 2000). Figure 3-** identifies the scenic integrity objectives for the Apache-Sitgreaves and Coconino NFs and the visual quality objectives for the Tonto NF.

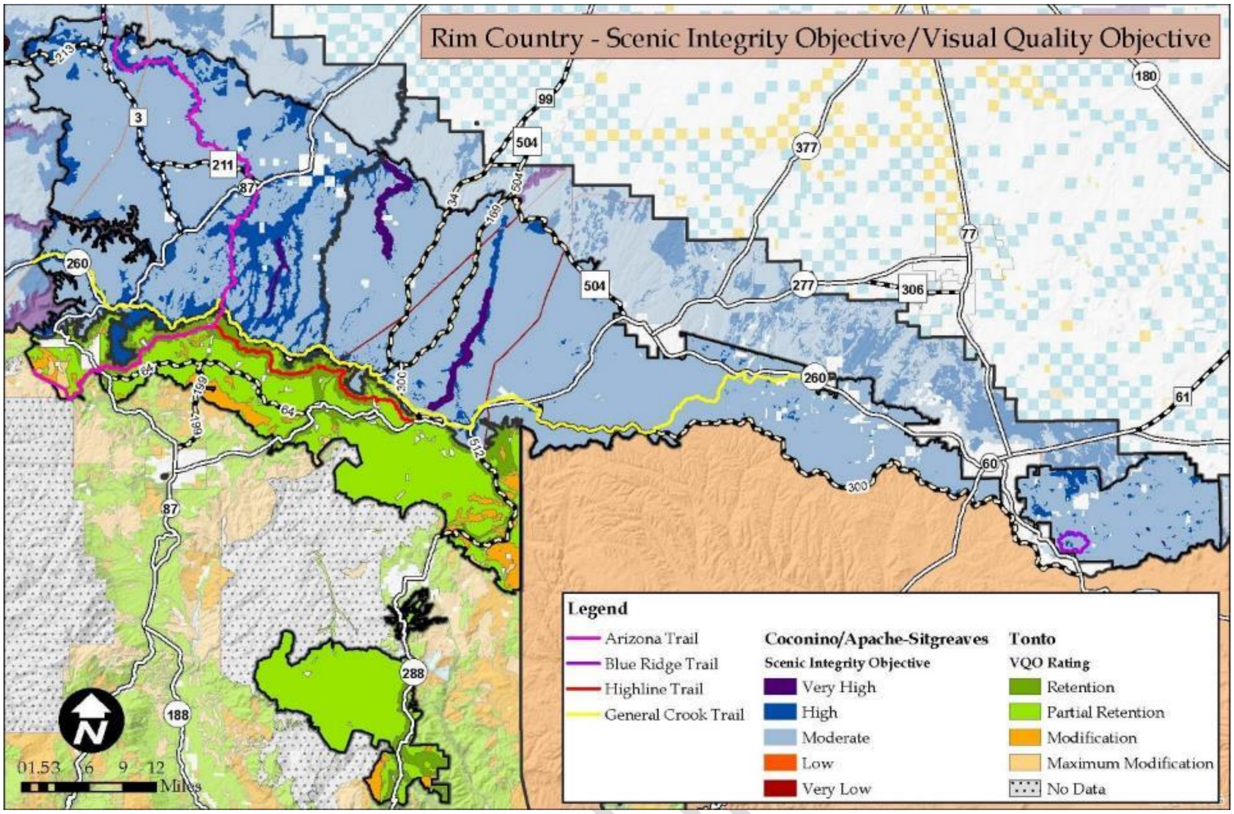


Figure 28. Scenic Integrity and Visual Quality Objectives

Figure 3-** displays the scenic integrity objectives for the project area (the visual quality objectives for the Tonto NF have been converted). For the 4FRI Rim Country Project, these scenic integrity objectives represent the long term goals for the restoration activities proposed. The majority of the project area is mapped as Moderate where the landscape character “appears slightly altered.” The areas designated as High or Very High are generally located along sensitive scenic areas such as scenic roadways or highly traveled routes, or along eligible Wild and Scenic Rivers. There is also a small amount of Low on the Tonto NF. Figure 3-** illustrates the percentages of scenic integrity objectives in the project area.

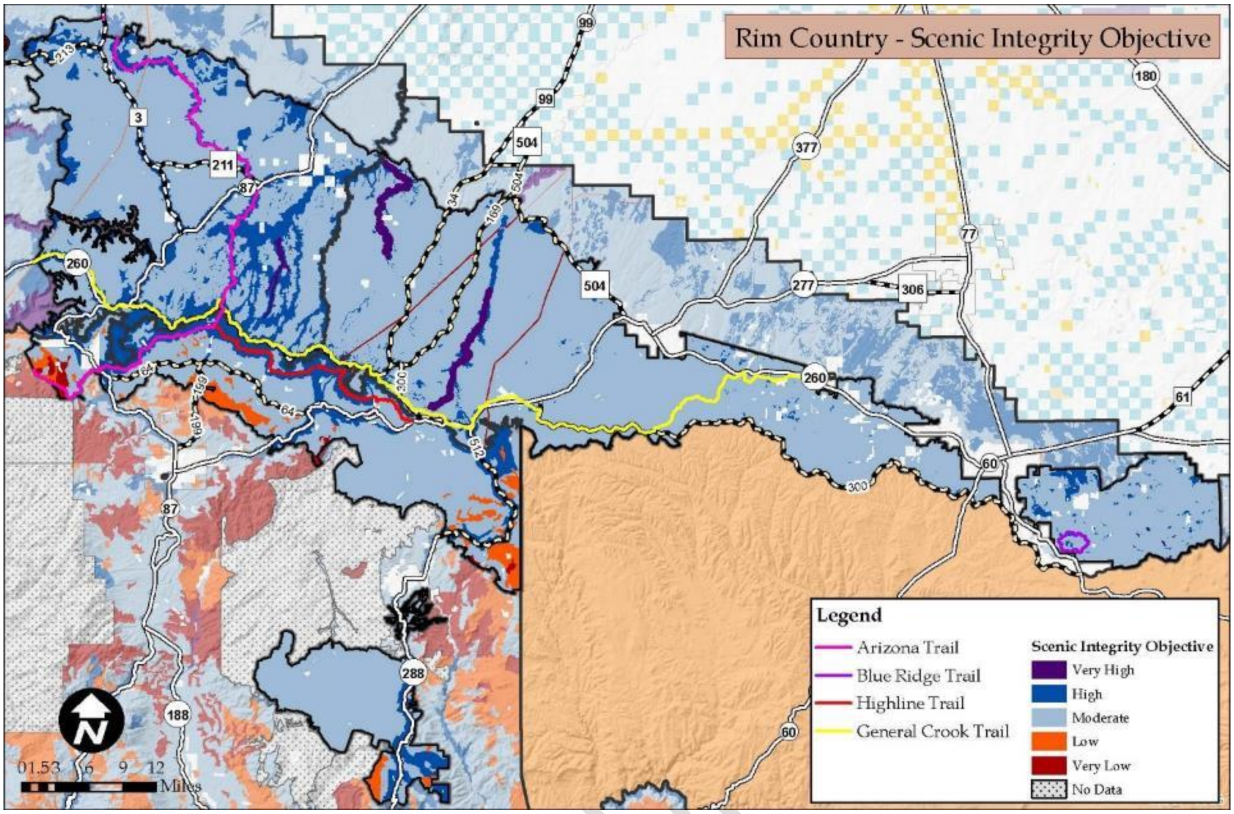


Figure 29. Scenic Integrity Objectives for the Entire Project Area

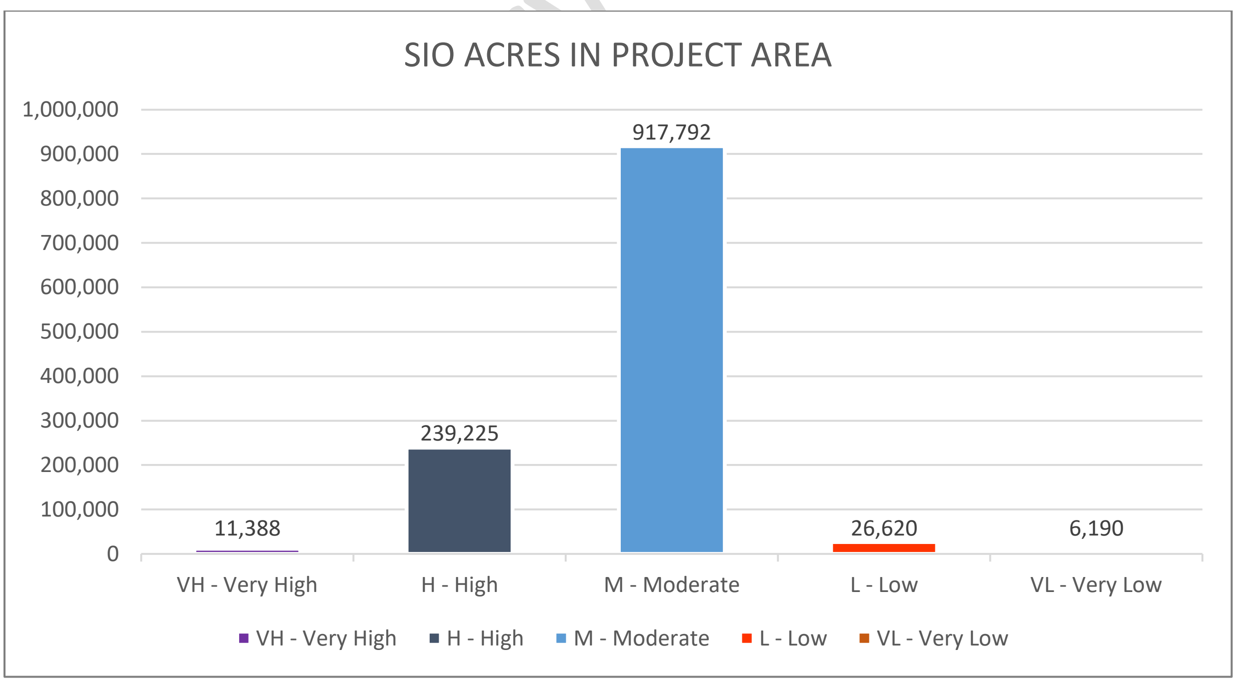


Figure 30. Acres of Scenic Integrity Objective

Spatial and Temporal Context for Effects Analysis

The spatial boundaries for analyzing the direct and indirect effects on scenery are National Forest System lands within the project area boundary since the proposed activities would only occur on National Forest System lands.

Short-term scenic effects from vegetation management are often the most noticeable until the growth of grasses, shrubs, and remaining trees begin to soften the effects of thinning operations. Short-term for this analysis refers to a three to five-year period after all vegetation treatments in an area are complete. Short-term effects are especially noticeable when the viewer has an up-close view of the treatment site, usually in the foreground viewing distance.

Long-term effects, which for this analysis is considered beyond five years, vary by the treatment and the method used.

Past harvest of forested slopes is generally noticeable for 15 to 30 years, depending upon the treatment prescription, soil type, aspect, and vegetative species composition. At the end of this time period, the regrowth of vegetation begins to develop closed canopy characteristics and the area no longer appears altered. The cumulative effects analysis area consists of all lands, including other ownerships inside the 4FRI Rim Country project boundary.

Environmental Consequences

Alternative 1 – No Action

Alternative 1 proposes no additional management activities in the project area and initiates no human caused changes to the scenic resources or visual quality objectives within the project area. In the short term, the scenic integrity would remain unchanged and the project area would continue to be mostly natural-appearing for several years. In the long term, important scenic attributes such as scattered groups of trees of all ages with grassy openings, evidence of frequent low-severity fire, large mature tree character, diverse understory, prominent Gambel oak and grasslands, functioning riparian systems and ephemeral channels that historically contributed to the attractiveness of the area would continue to decline along with scenic integrity.

There is the potential, if dense stands foster beetle outbreaks, mistletoe infestation, or other forest health concerns, that tree vitality would decline and there would be a reduction of scenic integrity. If stand-replacing wildfire were to occur, this would also result in the loss of valued scenic character and would continue to be of concern to the Coconino, Apache-Sitgreaves, and Tonto NFs and residents of the surrounding communities. If a large fire or series of fires occur, views of a fire-altered landscape may begin to dominate. Effects on scenic quality include charred bark on standing trees and down logs, a blackened appearance to the ground plane, and burned understory plants. The visual effects would be reduced within two years, with the regeneration of ground cover plants and the deposition of forest litter over the burned sites. Charred bark, limbs, and other features may be visible for many years. The burned areas would likely regenerate in dense stands of shrubs and seedlings, particularly in moist sites at the bottom of drainages and where root stock and seed sources exist.

These changes would be visible throughout the project area in the foreground of forest roads and trails, and as middle ground and background views from communities within the project area, and developed recreation sites. If a wildfire were to occur near a recreation site, those who use the sites may choose to go elsewhere, if they are sensitive to the appearance of a fire-altered landscape.

Under this alternative there would be no opportunities to enhance and improve scenic resources or achieve the desired conditions, since there would be no thinning, prescribed fire, or other treatments related to restoration. The forests would continue to implement small-scale thinning and prescribed burning, but nothing on the scale of this project. As a result, very little progress would be made toward desired conditions.

The No Action Alternative would not meet forest plan desired conditions or forest plan direction. It would not meet long-term scenic integrity objectives since these are dependent upon improving the condition of scenic attributes so that they are more resilient to ecological stressors. In addition, the No Action Alternative would continue the current condition outside of the natural range of variability.

The comparison of effects from the No Action alternative indicates that the only positive effect or trend would be the cumulative effect of Motorized Travel Management. All other ongoing or reasonably foreseen actions would result in a decline in the vegetation, water, and land form that create the landscape character of the area; decreased long-term scenic attractiveness as the unique natural and cultural elements that combine to form the scenic beauty of the area decline; and a downward trend in the scenic integrity objectives as deviations from the valued landscape character become more pronounced.

Effects Common to Both Action Alternatives

The effects on scenery from Alternative 2 would be the same as those from Alternative 3 with the exception of the difference in treatment acres where the effects would occur. Alternative 3 would treat 47 percent less area than Alternative 2, so the following effects can be expected to affect scenic resources in less of the project area with Alternative 3.

Aspen, Native Willows, Big-Tooth Maple, Seep/Spring Protective Barriers

Aspen, native willows, big-tooth maple, ephemeral drainage treatments and spring/seep areas require protective barriers to protect the areas from browsing. Both action alternatives require up to 200 miles of protective barriers. Barrier materials proposed include wire, wood and jackstrawing of trees. All would introduce unnatural linear features into the landscape that would not be natural appearing. Since these are isolated areas scattered around the over 1,000,000 acre project area, introduction of linear features would have minor effects.

Wood fencing materials would have the least effect since they would be in scale, and have texture and color that would look most natural in the seep/spring and aspen settings. Many times wooden fencing is viewed as an attractive cultural feature. If the fences are maintained, wood fencing would have very low effects and would meet the SIO. If they fall into disrepair, this would detract from their appearance, but they would still meet the SIO.

Wire fencing materials would be more noticeable than wooden fences. Wire and metal posts can be shiny and their color can contrast with the natural surroundings. Design features will be used to introduce the fewest contrasting elements where wire fencing is used and effort would be made to locate the fencing where it is least noticeable. Wire fencing would have low effects and would meet the SIO.

Jackstrawing has been used to a limited extent on the Coconino NF in order to protect aspen restoration projects from ungulate browsing. It involves cutting and stacking high numbers of cut trees in an irregular manner to form a wide, tall barrier surrounding the aspen stand. While natural materials would be used to create the jackstraw, the shape and form created at this scale would not normally be found in the characteristic landscape. It would not be completely unnatural however, as it would be similar to large scale blow down events that may be caused by weather related events. Placement of jackstraw treatment would not meet the requirements for foregrounds of Concern Level 1 roads or the National Trails in high SIO areas. Even if foreground sites were allowed to drop one SIO level, they would still not meet the basic definition of moderate SIO that “noticeable deviations must remain visually subordinate to the landscape character being viewed” (Forest Service 2000). Beyond the foreground, jack-straw piling may be suitable, and would be mitigated by carefully locating these barriers. As noted, the short term effects timeline for jackstrawing around aspen would be longer than for conifers, up to 20 years. Design criteria will be implemented to avoid placement of jackstraw within the foreground of high concern level roads or National Trails. As jack-straw barrier begins to deteriorate, trees lose their brown needles, branches break off, and logs lose their bark and grey out, the jack-straw piles compress and become less noticeable. It is anticipated that the aspen would also be large enough to withstand ungulate browsing when the jack-stray piles deteriorate or are burned in follow up prescribed burning activities. These areas will improve over time to the mapped SIO.

Landings and In-woods Processing and Storage Sites

Landing sites, where logs are processed for removal, are a primary short term visual effect. These sites are cleared, and scraped and leveled. Slash, log decks, and equipment dominate the immediate foreground view, and will be evident from a foreground view. Ground disturbance occurs from trucks, loaders and skidders moving over the site. After harvest is complete and slash has been removed, the site disturbance will be evident for approximately five years following use of the site. Sometimes landing sites require additional tree clearing.

Trails

People are often more sensitive to changes in the landscape along trails, than along roads and recreation developments. This is because they travel at a slower pace, and are immersed in the environment, and tend to have an expectation for a natural appearing setting. Smaller details, such as stumps and slash, are more likely to be noticed.

As a result, a decrease in the sense of solitude and diminished scenic quality will likely occur while traveling the trails within the project area. Most viewers will perceive diminished scenic quality along area trails until slash is reduced, and the remaining trees have matured. Temporary roads and skid trails will potentially cross the trails. There will be a reduction in the natural appearance of the forest as viewed from the trail. There will be increased encounters with people and machinery until the project is completed. Many of the trails provide access to unmanaged areas; this negatively affects visitor’s experience when they anticipated a more natural, unmanaged environment. This will be reduced over time, and should be a minimal effect over 10 -15 years, once ground cover and understory are reestablished and the slash has been reduced.

The Scenic Integrity will likely be reduced in the foreground and middleground, because viewers will more likely be aware of details as treatments. A decrease in the sense of solitude could lead to displacement of trail users in the short term (1 to 5 years.) They may opt to visit other areas where they will have the experience of a landscape that appears unmanaged.

National Trails, specifically the Arizona, Highline and General Crook Trail will have similar short term effects on scenery as described above. However, additional design criteria specific to National Trails will help protect the scenic integrity, especially in the foreground of the trail, during project implementation. Ultimately, in the long term, the vegetation activities will move the vegetation adjacent to trails towards desired conditions outlined in the Forest Plan.

Developed Recreation Sites

Mechanical and prescribed fire treatments could negatively affect developed recreation sites. However, developed recreation sites will not be modified by any alternatives as design features have been developed to protect the sites from possible negative effects from proposed treatments in alternatives 2 and 3.

For campsites, it is desirable to provide and retain privacy and screening, screen other constructed features such as restrooms, provide shade, retain unique character trees and so on. Per the design criteria for recreation campgrounds, these areas will be treated, but require coordination with the District Recreation Staff in order to determine places where no treatment will occur in order to protect constructed features. In addition prioritizing treatments, treatment timing and slash pile locations will be agreed upon. Immediate adjacent to the campgrounds (outside of fenced or otherwise delineated campground boundaries), prescribed burning or mechanical treatments and burning would be appropriate.

For other developed recreation sites, it is appropriate to include burning or mechanical treatments and burning outside of an established boundary that will protect the constructed features at these sites. Per the mitigations for recreation, these boundaries will be established in conjunction with the District Recreation Staff prior to treatment.

Effects of treatments in developed recreation sites would be similar to those analyzed for mechanical treatments and prescribed burning discussed in this report under Alternatives 2 and 3. There would be short term reductions in scenic quality as a result of treatments. In the long term, the treatments would help to reduce risks to scenic stability and would improve the overall scenic integrity.

Eligible Wild and Scenic Rivers

The overall objectives for management within the project area are to bring the landscape closer to the desired conditions outlined in the Forest Plan. Wild and scenic rivers are managed to protect the outstandingly remarkable values for which they were designated in the National Wild and Scenic River Preservation System and to protect their free-flowing nature. Rivers determined to be eligible for the System are also managed to protect the outstandingly remarkable values for which they are eligible. There are currently 9 eligible wild and scenic rivers on the Apache-Sitgreaves and Coconino National Forest and additional segments on the Tonto National Forest from the 1993 eligibility study and the current eligibility study. A map illustrating the locations of the segments are in the Scenic Character Description portion of this report. The tables below show the classifications of each eligible wild and scenic river segment (including the Tonto 1993 and current eligibility study) as well as the treatment type and acres affected for each alternative.

Table 125. Eligible Wild and Scenic Rivers on the Apache-Sitgreaves and Coconino National Forests

River Name and Class	Mechanical & Prescribed Fire	Prescribed Fire Only	Total Acres
Barbershop Canyon	**2,601**	**1,140**	**3,741**
Wild	2,601	1,140	3,741
Chevelon Creek	**2,228**	**5,053**	**7,281**
Recreational	617	0	617
Scenic	1,611	0	1,611
Wild	0	5,053	5,053
East Clear Creek	**3,406**	**2,063**	**5,469**
Scenic	3,406	2,063	5,469
Leonard Canyon	**3,542**	**2,372**	**5,914**
Recreational	3,542	2,372	5,914
West Clear Creek	**1,194**	**551**	**1,745**
Wild	1,194	551	1,745
Wet Beaver Creek	**8**	**11**	**19**
Wild	8	11	19
Willow Creek	**0**	**4,806**	**4,806**
Wild	0	4,806	4,806
Grand Total	**12,979**	**15,996**	**28,976**

Table 126. Eligible Wild and Scenic Rivers on the Tonto National Forest Identified in the 1993 Eligibility Study

River Name and Class	Mechanical & Prescribed Fire	Prescribed Fire Only	Total Acres
Canyon Creek	**1,150**	**364**	**1,514**
Recreational	1,150	364	1,514
Salome Creek	**1,112**	**0**	**1,112**
Wild	1,112	0	1,112
Spring Creek	**34**	**0**	**34**
Recreational	34	0	34
Tonto Creek	**150**	**0**	**150**
Wild	150	0	150
Workman Creek	**1,159**	**0**	**1,159**
Recreational	1,159	0	1,159
Grand Total	**3,605**	**364**	**3,969**

Table 127. Eligible Wild and Scenic Rivers on the Tonto National Forest Identified in the Current Study

River Name and Class	Mechanical & Prescribed Fire	Prescribed Fire Only	Total Acres
Canyon Creek	**1,548**	**364**	**1,913**
Recreational	1,548	364	1,913
Dude Creek	**1,045**	**0**	**1,045**
Recreational	1,045	0	1,045
Pueblo Canyon	**0**	**9**	**9**
Wild	0	9	9
Tonto Creek (upper)	**211**	**0**	**211**
Scenic	211	0	211
Workman Creek	**82**	**0**	**82**
Recreational	82	0	82
Grand Total	**2,886**	**373**	**3,259**

Wild	0	3,504	3,504
Grand Total	**9,844**	**12,200**	**22,044**

As noted in the Interagency Wild & Scenic Rivers Coordinating Council Technical Paper (IWSR Coordinating Council 2014) "Timber management activities on federal lands within WSR corridors must be designed to help achieve land-management objectives consistent with the protection and enhancement of the values that caused the river to be added to the National System. Management direction needed to protect and enhance the rivers values is developed through the river planning process. WSR designation is not likely to significantly affect timber management activities beyond existing measures to protect riparian zones, wetlands, and other resource values as guided by other federal requirements." In addition, "Timber management activities on federal lands outside the corridor are managed to protect and enhance the values that caused the river to be designated. Measures needed to protect and enhance the rivers values are developed through the river planning process and include management direction as necessary for lands adjacent to the corridor."

The treatment areas that overlap the proposed WSR boundary have specific design criteria for scenery, recreation and other resource protection. The design features have been included in Appendix C specifically for the purpose of adjusting proposed treatments in the future as eligibility and suitability are determined. Any management activities proposed in eligible wild and scenic river corridors in the Rim Country project area would have the purposes of restoring natural geomorphic and ecological processes and the specific outstandingly remarkable values (ORVs) of the river. These activities are proposed to move the vegetation within the corridor towards desired conditions outlined in the Forest Plan and according to the standards and guidelines for the river corridors. In addition, the proposed activities would help to protect potential scenic values of the eligible wild and scenic river from the effects of wild fire. For both Alternatives, there would be short term effects associated with mechanical treatment and prescribed fire within the eligible wild and scenic river corridors, but in the long term, the proposed vegetation treatments would increase diversity for scenery. Overall, the scenery outstandingly remarkable value would be maintained and enhanced.

Wilderness

There are no treatments proposed in wilderness therefore there will be no effects on wilderness areas. However, at the viewpoint toward or from the Wilderness, there will be a change in the texture between the forested area that will be treated outside the Wilderness, and the untreated forest within the wilderness. There will be increased areas of ground seen between the remaining trees, giving a more coarse appearance to the landscape and slopes. In the case where the Wilderness boundary crosses on a slope, it is possible that this boundary may be evident to observers because of the change in the forest texture. Because of the increased dominance, the scenic integrity will likely be reduced in the short term.

Large Mature Trees

The proposed actions would meet forest plan requirements for large mature trees across the landscape. Some allocated acres will not meet all old growth characteristics, but will move conditions toward requirements for large trees, downed woody debris, and snags. The more open, groupy character of the conifer forest will help make the trees more visible and as a result, more prominent. Use of the old tree strategy will help recruit and retain large trees. The treated areas will have more of the desired landscape characteristics and will make progress toward meeting SIO.

Proposed Activities for Mexican Spotted Owls

As a result of the treatments proposed under this alternative, stands throughout most of the project area would appear more to have the desired conditions of open, groups of trees of all ages and sizes. In some areas, treatments are modified for Mexican spotted owls. These changes are designed to meet other laws, regulations and policies.

MSO treatments proposed incorporate the need for "Improving habitat structure in addition to managing for fire risk abatement is consistent with the USFWS draft MSO recovery plan that focuses on desired conditions and provides for treating PACs to meet restoration and fuels reduction objectives. A key draft recovery objective is to maintain habitat conditions necessary to provide roosting and nesting habitat (pp. 84-85) (USDI 2012)". This treatment would result in stands appearing slightly more open and more diverse over time when compared to the existing condition, although the difference may not be noticeable to the casual forest visitor, particularly when driving along the roads. The treatments proposed for MSO will move the habitat toward desired conditions, but scenic attributes in these areas will continue to be at risk from ecological stressors.

Alternative 2 – Modified Proposed Action

Mechanical Treatment and Burning

Approximately 899,340 acres would be mechanically thinned or burned under this alternative. Mechanical treatments include but are not limited to the use of chainsaws or feller-bunchers to cut trees and lop slash, skidders to move material to landings, bulldozers to pile slash, and specialized equipment such as feller-bunchers or track-type hot saws, and tree shears to cut, chop, break, and lop fuel material.

Hand thinning usually has little or no short-term effects on scenery. Trees are cut down, then cut into segments that can be treated. Effects may include slash from limbing and topping trees. Project mitigations require slash to be treated.

Conventional mechanical treatments typically have moderate short-term effects on scenery. During implementation, in most cases whole trees are cut and moved to a "landing" near a haul road. At the landing, the limbs and tops are removed, and the clean logs are decked to be loaded and hauled away. After vegetation has been thinned, the slash is piled using bulldozers. Effects typically include trampling of vegetation where equipment is operating, creation of linear skid trails where vegetation is trampled or completely removed exposing bare soil, creation of linear log landings where vegetation has been removed and bare soil is exposed, and piles of cull logs not suitable for commercial uses. After logs or useable material is removed, slash would be treated as per mitigation measures. This may include bulldozers push slash into large piles (10-20 foot wide piles, often 10 feet tall) which can trample vegetation and cause bare soil to be exposed, and hand piling. Design criteria would prioritize treatment of slash along high concern level roads (those in High SIO), require trails to be returned to pre-treatment conditions, and cull logs be removed from landings and potentially used to help close off entrances to decommissioned roads.

There would be a low to moderate effect on scenic quality during and immediately following mechanical treatments. Stumps are typically left no more than six inches high and are often cut flush with the ground unless prevented by rocks or other natural features. The presence of skid trails, landings, and piled or scattered slash would also result in a moderate reduction of the scenic quality until harvesting activities are completed and design features are implemented. The effects in these areas would be short term (lasting one to five years after treatment) since skid trails would be rehabilitated and activity-generated slash would be treated or mostly removed to be utilized. The ground disturbance resulting from using machines to pile slash would be noticeable for one to three years after project completion, depending on how quickly the areas revegetate. Scraped trees would heal or scars would become less noticeable over time.

Prescribed burning would likely result in short-term, moderate reduction in scenic quality, but with ground vegetation recovery, can enhance scenic beauty within five years. Where prescribed fire is limited to slash reduction, isolated areas of burned piles would be evident. Once these piles have been scattered there may be some short-term evidence of darkened litter and soil that would be reduced within five years and generally only be noticeable within the immediate foreground. Greater visual effects would occur in areas where prescribed fire is used as a tool to regenerate aspen or reintroduce fire. This includes charred bark of standing trees and down logs, and a blackened appearance to the ground plane and burned understory plants. The visual effects would be reduced within two years, with the regeneration of ground cover plants and the deposition of forest litter over the burned sites. Charred bark, limbs, and other features could be visible for many years.

Smoke from prescribed burning would be heaviest during the initial burns, and would reduce visibility of the scenic landscape in the short term. Some residual smoke could be expected to continue in small localized areas where stumps or roots smolder for up to a few weeks. The residual smoke would have little if any effect on visibility of scenic attributes.

The restoration treatment areas should be recovered and moving toward reference conditions after the first thinning and prescribed burning activities. These would be further improved after follow-up prescribed fire treatments. The restoration treatments would meet the purpose and need of the project and would help move the forest structure, pattern and composition toward reference conditions.

Road Reconstruction and Decommissioning

Approximately 150 miles of existing roads will be reconstructed with Alternative 2. There would be few to no effects from road improvements. Improvements may include, but are not limited to, drainage improvements, tree removal, slight realignments, and addition of surfacing materials.

Potential effects include exposure of bare soil, tree stumps, and contrasting color and texture of surfacing materials. These effects are usually short term (one to five years) and become less noticeable as natural vegetation is re- established and the surfacing material begins to be incorporated into the soil horizon. Road relocation would have more noticeable effects on scenery. Effects of the newly constructed road bed would include newly exposed bare ground, damaged vegetation, tree stumps, root wads, and contrasting color and texture of surfacing. There would also be effects associated with the old road bed. It would appear newly disturbed as well if associated drainage features such as culverts are pulled, new drainage ditches established, the surface roughened to promote vegetation establishment, and slash, brush, boulders or other devices are used to close off the entrance. There would be a strong contrast between the existing forest floor and the new and old road beds that would detract from scenic quality. Design features, best management practices, and mitigation measures would be used during road reconstruction. The old roads would naturalize over time and become less noticeable to the casual observer.

Approximately 330 miles of temporary roads would be constructed for haul access. These would be decommissioned when treatments are finished. The new temporary roads would add new, unnatural linear features to the landscape on a temporary basis. Trees would be removed, soil exposed, and roadbeds constructed including minimal drainage features. This would have moderate effects on the mapped scenic integrity objectives. In High scenic integrity objective, the new temporary road construction would drop these areas one level to Moderate until the roads are decommissioned and begin to naturalize, about five years later. Design features and best management practices would be used to rehabilitate decommissioned roads and this would hasten their recovery.

Under this alternative up to 200 miles of system road on the Coconino and Apache-Sitgreaves NFs could be decommissioned. The Tonto NF Travel Management EIS has identified approximately 290 miles of road within the Rim Country project area for decommissioning. In addition to system road decommissioning, up to 800 miles of unauthorized roads on all three forests could be decommissioned under this alternative. Following decommissioning, all roads would be allowed to naturalize. There would be short-term effects (up to five years) as the roads have drainage established, the surface area roughens, is seeded and mulched with pine needles and slash, and boulders and other devices are used to close off entrances to the roads. Design criteria and best management practices would be used to rehabilitate these roads. The existing closed roads would naturalize over time and become unnoticeable to the casual observer.

Alternative 3 – Focused Alternative

Mechanical Treatment and Burning

Alternative 3 treats 47 percent less area than Alternative 2. Approximately 39 percent fewer acres would receive mechanical and prescribed fire restoration treatments, about 26 percent less prescribed fire only. Additionally, the Severe Disturbance Area Treatment area is 78 percent less in Alternative 3 than in Alternative 2. Approximately 474,930 acres would be mechanically thinned or burned with prescribed fire under Alternative 3. Figure 3-** provides the approximate locations of treatments for Alternative 3 and the Recreation Opportunity Spectrum classifications. For Alternative 3, there would be less prescribed burning activity that would likely result in less short-term, moderate reductions in scenic quality relative to Alternative 2. As a result, there would be fewer visual effects in the project area where prescribed fire is used as a tool to regenerate aspen or reintroduce fire, resulting in fewer areas of reduced visibility of the scenic landscape in the short term. However, Alternative 3 would treat significantly fewer acres of grasslands, savannah, and open canopy cover, resulting in fewer acres of improved understory species abundance and composition. Ultimately, this alternative would have less potential to reduce the risk of large-scale, high-severity fires in the project area. Since high-severity fire is a risk factor for most scenery attributes, the fewer proposed mechanical and prescribed fire treatments in Alternative 3 would result in fewer improvements to scenic quality in the long term.

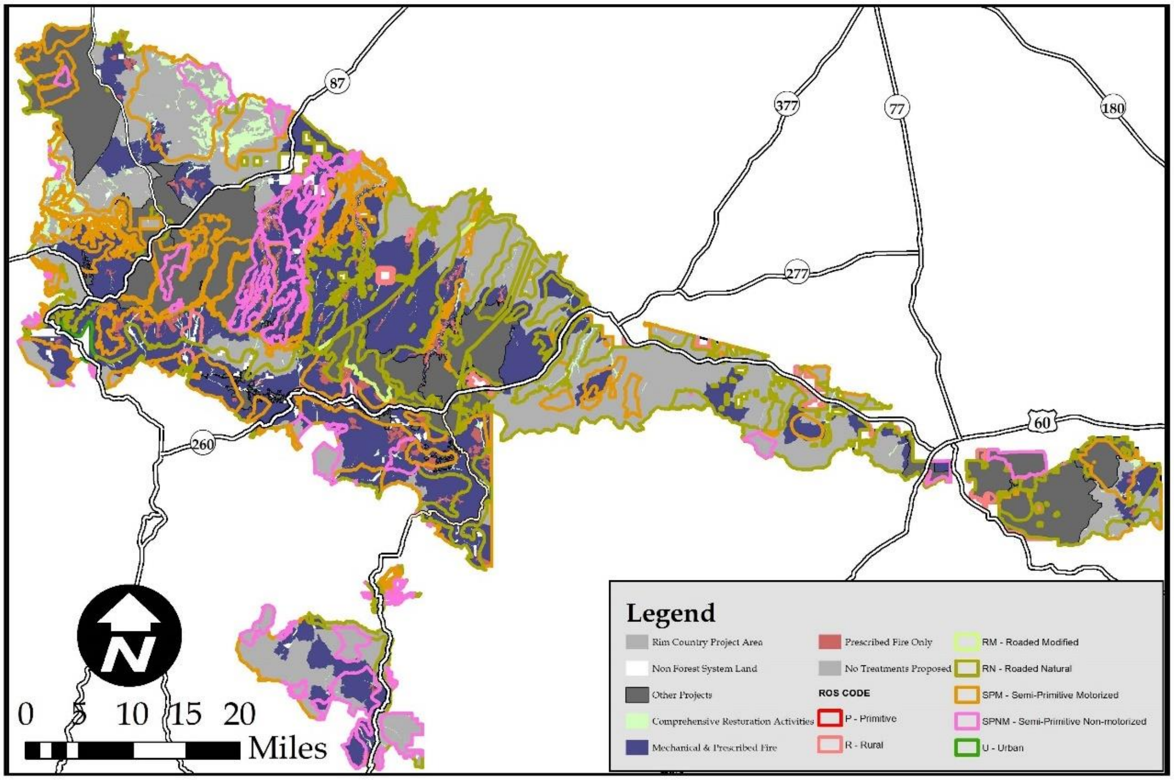


Figure 31. Alternative 3 Treatments and Recreation Opportunity Spectrum

Road Reconstruction and Decommissioning

Approximately 150 miles of existing roads would be reconstructed with Alternative 3. There would be little to no effects from road improvements. Improvements may include, but are not limited to, drainage improvements, tree removal, slight realignments and addition of surfacing materials. Potential effects would be the same as described under Alternative 2.

Approximately 170 miles of temporary roads would be constructed for haul access. These would be decommissioned when treatments are finished. Although the effects of temporary roads would be the same as in Alternative 2, this alternative proposes nearly 50 percent fewer temporary roads, resulting in fewer unnatural linear features in the landscape on a temporary basis. Similar to Alternative 2, this action would have moderate effects on the mapped scenic integrity objective. In High scenic integrity objective, the new temporary road construction would drop these areas one level to Moderate until the roads are decommissioned and begin to naturalize about five years later. Design criteria and best management practices would be used to rehabilitate decommissioned roads and this would hasten their recovery.

Under this alternative up to 200 miles of system road on the Coconino and Apache-Sitgreaves NFs could be decommissioned. The Tonto NF Travel Management EIS has identified approximately 290 miles of road within the Rim Country project area for decommissioning. In addition to system road decommissioning, up to 800 miles of unauthorized roads on all three forests may be decommissioned under this alternative. Following decommissioning, all roads would be allowed to naturalize. Effects would be as described for Alternative 2. Design features and best management practices would be used to rehabilitate these roads. The existing closed roads would naturalize over time and become unnoticeable to the casual observer.

Cumulative Effects

The cumulative effects analysis area is the ponderosa pine forest on the Coconino, Apache-Sitgreaves and Tonto NFs within the Rim Country project area. The timeline for analysis is 20 to 30 years because most long-term effects of the alternatives are assessed out to a 20-30 year timeframe (with the exception of large-scale high-severity wildfire which is more difficult to project). The following is a list of actions relating to scenic attributes, landscape character, and scenic integrity considered in the cumulative effects analysis for this project:

- Past activities that created the current conditions include grazing, the evolving forest management practices related to timber harvest and fire suppression, drought, disease and insect infestations, and dispersed recreational use.
- Present and future activities such as vegetation management, fire and fuels management, utility corridor clearing and new utility corridors, and other management activities (e.g., noxious weeds treatments). These activities could occur on private lands as well.

The cumulative effects of past management activities are visible as the existing conditions. Vegetation management practices, fire suppression, and over grazing have resulted in the current overly dense forests, even-aged forest structure, and sparse understory trees, shrubs, grasses, and forbs.

Alternative 1 – No Action

The short-term cumulative effects (1 to 5 years) from the No Action Alternative, combined with similar current and future restoration treatments and prescribed burning projects, are expected to be negligible unless additional large-scale, high-severity wildfires occur in the ponderosa pine type in the project area. If wildfires burn large areas, the scenic quality would be decreased and there would be long-term negative changes in scenic character. The scenic attributes that contribute to high scenic integrity, such as an open forest with tree groups of varying ages, sizes and shapes; large, mature trees; and healthy, diverse understory would decline or not be present. The scenic effect of a high-severity wildfire would combine with scenic effects from adjacent land development, utility development and/or maintenance, and effects from dispersed recreation use to result in a cumulative effect so that scenic integrity is greatly diminished in areas burned for up to a decade or more. In some places there would be a chance that climate change could contribute to type changes in parts of the ponderosa pine forest so that these characteristics would be replaced with difference landscape characteristics, which would also cumulatively effect scenic attributes.

In the absence of large, high-severity wildfires, long-term cumulative effects of the No Action Alternative and present and future vegetation management activities (Table 10) would be relatively small and localized. In the absence of large-scale treatment, the scale of treatments that are currently accomplished would not result in improvement to scenic integrity. The desired landscape character of an open forest with tree groups of varying sizes, shapes and ages; presence of large, mature trees; and healthy, diverse understory would not be met.

Alternative 2 – Modified Proposed Action

Vegetation management projects would alter the appearance of the landscape where ground-disturbing activities are conducted. Similar to the action alternatives, activities that are very close (300 feet or less) to scenic highways, major travelways, and recreation resources, would have temporary adverse effects on visually sensitive areas. This would increase the chance that people would be exposed to evidence of fire and mechanical thinning activities. Once slash and/or the evidence of fire are reduced, the forest would have a more managed appearance until understory shrubs and trees have provided a more varied appearance, which could be 30 to 40 years.

Individuals who are sensitive to the visual changes of vegetation management and fire-altered landscapes would likely perceive diminished scenic quality. There would be an increased visual presence of roads. When roads are obliterated, the prism would remain for many years. However, once vegetation grows in the road prism, especially trees, it would be less noticeable, and probably only noticed by people walking across or near the road bed. The length of time for recovery ranges from two or three years, to over 50 years, depending on the effectiveness of the decommission at deterring travel by off-highway vehicles.

Cumulative effects on scenery resources in the Rim Country project area are expected to meet the visual quality objectives of the forest plans in the short term. In High scenic integrity objective areas, it is expected that any human activities would not be visually evident. In Moderate scenic integrity objective areas, any deviations present would be expected to be subordinate to the characteristic landscape. In Low scenic integrity objective areas any deviations present may dominate the characteristic landscape but would utilize naturally established form, line, color, and texture, and appear natural or compatible to the natural surroundings.

Alternative 2, along with the other past, ongoing, and reasonably foreseeable projects and activities, may have cumulative effects on scenery resources. However, these cumulative effects are expected to meet the visual quality objectives of the forest plans in the short term; no long-term effects are anticipated if the scenery project design features are applied.

Alternative 3 – Focused Alternative

The cumulative effects from Alternative 3 would be similar to those from Alternative 2. There would be slightly fewer negative short-term cumulative effects in localized areas (areas with landings, temporary roads, ground-disturbing activities), since this alternative would mechanically treat and burn fewer acres and require fewer temporary roads. However, there would also be slightly fewer positive long-term cumulative effects in terms of, counteracting drought and insect damage likely to occur as a result of climate change, improved stand structure, and understory improvement, since there would be less mechanical treatment and burning to facilitate greater forest resiliency.

Effects from Rock Pit Use and Expansion

A total of 21 rock pits were identified for use and potential expansion up to 30 percent of their existing footprint. The material from the rock pits may be used for a variety of road maintenance activities, from general maintenance of primary roads to construction or rehabilitation of temporary roads. The proposed use and expansion of rock pits would include hauling of equipment and aggregate materials to and from the pits for use in road maintenance, road construction, and erosion control to aid in implementation of the 4FRI Rim Country project and other projects in the 4FRI footprint.

Effects Common to All Alternatives

Effects common to all alternatives include views of exposed soil at active rock pits locations, and removed vegetation. Active pits would also have processing and mining equipment, and trucks for hauling roadbed material to desired locations. In addition to space for processing equipment, pits requiring processing will also need space to store stockpiles of processed and partially processed materials. The space needed for processing equipment, stockpiling of materials, and loading is included in the footprint of each rock pit site.

Most rock pits are located in Moderate scenic integrity objective in forested areas making them difficult to view even from a foreground distance (300 feet to 0.5 miles). Under both action alternatives, design features would help mitigate the effect on scenery from rock pits.

Alternative 1 - No Action

Under Alternative 1, for implementation of other projects and activities, rock pit activities would continue to mine and process roadbed materials from active existing pits either for maintenance of Forest Service roads, temporary road construction, or through permitted use. Direct effects on visually sensitive areas would be views of exposed soil, removed vegetation, and of trucks and other equipment used to mine and process roadbed material. The magnitude of these direct effects would vary depending on the duration of activities at each existing pit, the number of viewers that are able to see the exposed soil, removed vegetation, and equipment, and the distance from which viewers can observe these project-related activities.

Indirect effects would include long–term views of the pits following mining activity and before re-vegetation efforts have been completed.

Mining and processing activities that occur at any of the pits within 0.5 miles of scenic routes or major travelways, or within 0.5 miles of recreation resource areas, could cause adverse, temporary effects. The importance of these effects can be evaluated in terms of their consistency with scenic integrity objectives. Actively mined pits are consistent with the scenic integrity objective of Moderate since the landscape may appear slightly altered and the pits are visually subordinate when viewed from distances of greater than 0.5 mile, which is the breakpoint between the foreground and middle-ground distances (USDA FS 1996).

Alternative 2 - Modified Proposed Action

Due to the relatively small footprint and locations of the proposed rock pits on the landscape, most direct and indirect visual effects would be very limited to where the pit can be seen from forest roads. Out of the proposed 21 pits, there are 8 pits that are located within 0.5 miles of major travelways or trails. Most of the pits that are located next to a major roadway, recreation site, or trail were initially used to provide material to construct these same roadways, recreation site, or trail. Often the rock pit was built very near the road or trail but in an area not visible to provide for a convenient material source without affecting the viewshed.

Mining and processing activities that occur at any of the pits within 0.5 miles of scenic routes or major travelways, or within 0.5 miles of recreation resource areas, could cause adverse, temporary effects. The importance of these effects can be evaluated in terms of their consistency with scenic integrity objectives. Actively mined pits are consistent with the a Moderate scenic integrity objective since the landscape may appear slightly altered and the pits are visually subordinate when viewed from distances of greater than 0.5 mile, which is the breakpoint between the foreground and middleground distances (USDA FS 1996). In situations where a proposal does not meet scenic integrity objectives or visual quality objectives, the Forest Plan allows for “one classification movement downward…“(USDA FS 1987, p. 60).

Alternative 3 – Focused Alternative

Effects on visually sensitive areas and consistency with scenic integrity objectives would be of the same type as described for Alternatives 1 and 2. As discussed for Alternative 2, these proposed activities would result in some adverse effects on scenic integrity objectives.

Effects from Use of In-woods Processing and Storage Sites

A total of 12 in-woods processing sites are proposed for consideration in this project. Tasks that would be carried out at processing sites include drying, debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, producing wood cants, scaling and weighing logs, and creating poles from suitably sized logs. Equipment types commonly used at processing sites include circular or band saws, various sizes and types of front-end loaders, log loaders, and chippers of several types, and may include processors, planers and mechanized cut to length systems, and associated conveyers and log sorting bunks for accumulation and storage of logs. Electric motors and gas or diesel generators are also used to provide power.

Eight processing sites were proposed and analyzed for environmental effects in the Cragin Watershed Protection Project. These sites are carried forward for potential use in implementing the Rim Country Project. An additional 12 processing sites are being analyzed that range in size from four to 21 acres. Most processing sites are located in forested areas making them difficult to view even from a foreground distance (300 feet to 0.5 miles).

Potential sites were screened so as to be located outside of meadows, where some of the most productive forest soils are found, and in relatively flat areas. Other sites are located in existing clearings and flat areas. The siting of processing sites in relatively flat areas would minimize the need for extensive site grading. Processing sites were located to provide for a buffer of 100 to 300 feet from forest roads and state highways to provide for visual screening from Concern Level 1 and 2 travelways. Site boundaries are approximate and may be further modified during implementation and layout.

The processing sites may be used as part of the 4FRI Rim Country Project throughout implementation. Following completion of use of processing sites and removal of all equipment and materials, site rehabilitation would have to be accomplished, including removal of aggregate, restoration of pre-disturbance site grades, de-compaction of soil for seedbed preparation, and seeding and mulching of the site with native grasses and forbs.

Alternative 1 - No Action

Alternative 1 proposes no in-woods processing and storage sites and initiates no human-caused changes to the scenic quality within the project area. Alternative 1 would meet the adopted High, Moderate, and Low scenic integrity objectives throughout the project area as it does not create any unnaturally-appearing elements of form, line, color, or texture.

Alternative 2 - Modified Proposed Action

The scenic integrity objectives, adjacent scenic resources, and the visibility of the proposed processing sites were considered from foreground, middleground, and background perspectives. The highest level of detail would likely be perceived from the foreground perspective. However, due to the size and scale of the sites, particularly those of larger acreage, there is the potential for the proposed openings and associated infrastructure to be seen from a distance from sensitive viewing platforms. Thinning around the edges of the processing site boundaries will promote a more naturally-appearing landscape when these sites are seen from a distance.

Low interim scenic integrity objectives would be assigned to these locations during implementation. During implementation, the proposed processing sites would likely be noticeable to the casual observer and, depending on the perspective of the viewer, may dominate the view. Visitors would notice the lack of vegetation and the aggregate surface. Built structures such as fencing, sanitation facilities, office trailers, fuel storage containers, or other temporary structures would likely be noticeable to the casual observer. Heavy equipment, such as circular or band saws, various sizes and types of front-end loaders, log loaders and chippers, processors, planers and mechanized cut to length systems, and associated conveyers and log sorting bunks for accumulation and storage of logs may be highly visible from sensitive viewing platforms. For safety, most of the equipment would likely be a yellow color to ensure visibility for the workers, which would create a notable contrast for visitors. The concentration of wood and slash for sorting and drying would be evident to visitors to the near vicinity. Design features would ensure that scenic integrity objectives are met post implementation and effects on scenery are minimized during implementation to the extent practicable. Due to the potential for the soils to be heavily compacted form the operations at these sites, recovery post-implementation may take up to 10 years, depending on the duration and extent of usage of the processing site. The scenic integrity objectives would be met after the sites have been reclaimed and restored to a naturally-appearing landscape character, likely 10 years post treatment.

Alternative 3 - Focused Alternative

Effects on visually sensitive areas and consistency with scenic integrity objectives for Alternative 3 would be similar to those for Alternative 2, as all proposed in-woods processing sites could potentially be utilized. As discussed for Alternative 2, proposed activities would result in some adverse effects on scenic integrity objectives.

Repeat burning would result in fewer effects than described above since fuel loadings would be reduced by initial prescribed burns. Effects are expected to be noticeable for a shorter duration, and within 2 to 3 years, the areas will be natural appearing. Smoke from repeat burning would not be as heavy as initial burns, and would be expected to be shorter in duration.

Lands and Minerals

Affected Environment

Lands

The acquisition and disposal of National Forest System lands are designed to consolidate interest and management of the federal estate to enhance public benefit, and to consolidate the management and ownership of federal, state, and private lands within the proclaimed forest boundary. The establishment of rights-of-way throughout the forest is needed to create easy accessibility to both public and private lands within the proclaimed boundary of the national forest.

Land subdivision and development is increasing the need for accurate and reliable surveys. Numerous conflicts between past surveys have occurred, leading to an unknown number of unauthorized occupancies and use violations on national forest lands. Identification of property boundaries is an increasing expense to resource programs, especially fuel treatments. Increasingly, additional expenditures would be necessary in order to fully utilize national forest resources and to prevent claims against the federal government. Although land acquisition eliminates the need for land line location in some areas, many miles of property boundary still need to be surveyed and posted.

Property boundary location involves all activities necessary to identify the boundaries of National Forest System lands, including the search for survey corners, surveying and marking of land lines, and maintenance of the same. Marking and posting boundaries identifies or locates National Forest System lands for public use and enjoyment and prevents and controls trespass upon the forests.

There are many private land inholdings within the Rim Country project area. To ensure any treatment is done on private land and to meet Forest Service policy, the boundary lines between FS and private lands should be marked by a professionally-licensed land surveyor prior to implementation. This will also ensure the lines are adequately marked so the FS can meet objectives stated in the Apache-Sitgreaves Forest Plan for Community-Forest Intermix and Wildland-Urban Interface, as well as similar direction in the other forests (Coconino and Tonto NFs) within the Rim Country project area. Boundaries are considered marked to standard if they have been surveyed and posts set at approximately 250-foot intervals along the boundary line and have been set with boundary signs attached. Some historic boundary lines can be maintained, which entails ensuring posts and signs are in good condition and replacing any that are not. This can be accomplished with surveys that have been recently completed. Any posting older than 15 years may be questionable because of age. The current status of boundary lines in the project area is shown in Table 3-**.

Table 128. Miles of boundary lines within the project area

Forest	Total Miles	Marked	Unmarked	Marked over 15 years ago
Apache-Sitgreaves	374	231	143	182
Coconino	110	55	55	42
Tonto	132.5	125	7.5	75

Overall, it is important to provide ample time to existing land surveying staff to analyze implementation areas and access needs, and provide feedback on necessary time and funding to complete work.

In addition to marking and posting boundary lines before resource work is completed, there are also numerous pieces of direction in the forest plans on how land within the Wildland Urban Interface (WUI) and Community-Forest Intermix should be treated. This direction calls for lower basal areas, treatment of slash, and retention of fire-resistant tree species. There is very little restriction on what kind of treatments are used, but forest plans do convey the message of minimized smoke effects, reduction of fuel load, and working with communities on defensible space.

The existing access routes through the project area may travel across both FS and private lands. It is important for the FS to ensure rights-of-way are properly obtained in order to protect existing or new roads crossing private property by describing type and duration of use. If a permanent easement for standard use can be obtained in an area that was not historically documented, this would be beneficial to both parties to guarantee the road’s protection in the future.

Lands Special Uses

Lands special use authorizations include permits, term permits, leases, and easements that authorize occupancy and use of National Forest System lands. Authorized activities include uses such as utility corridors, roadways, communications sites, research projects, and many other uses. The terms of these authorizations vary based upon the type of use.

As of August 29, 2017, there were 261 active lands special use permits within the project area (Table 3-**). Of these, 219 (85 percent) are communication sites, water storage or conveyance, powerlines, roads/easements, or water or waste treatment facilities. These uses have direct effects on human populations and therefore carry greater risks from fire danger than other uses.

Table 129. Lands Special Use Authorizations within the Project Area

Permit Type	Total
Fish Hatchery	2
Fence	2
Cemetery/Church/Monument	3
Waste Disposal Site (solid/liquid)	2
Sewage Line	3
Weather Station	9
Observatory	1
Research/Non-Disturbing Use	8
Warehouse/Storage Yard	4
Processing Plant	1
Powerline	10
Easement	85
Road	21
Communication Site	42
Irrigation/Water Transmission/Conveyance	35
Dam/Reservoir/Well/Storage Tank	20
Wildlife Water Supply	10
Stream Gauge	2
Water Treatment Plant	1
TOTAL	**261**

Permit records are maintained in the Special Use Database System (SUDS),

Recent years show an increasing demand for lands special uses. As communities in and around the forests increase in development, their need to utilize public lands in support of their infrastructure also increases. Proposals for power lines, rights-of-way, communication sites, water transmission lines, and roadways have increased steadily and will continue to do so in future years. Increased interest in renewable energy sources, such as wind and solar, has also contributed to the increased demand.

Solar energy potential is high and future development will be related to demand. There may be a need for additional energy corridors or developments (e.g., electric transmission lines, pipelines, wind turbines) because of the expected demand for electricity to serve the growing populations of Arizona and the Southwest and to provide reliable and consistent services. As communities expand and as non-FS lands surrounded by FS lands are developed, there may be increased demand for energy development on FS lands.

Minerals

Minerals of economic interest are classified as leasable, locatable, or salable. Coal, oil shale, oil and gas, phosphate, potash, sodium, geothermal resources, and all other minerals that may be acquired under the Mineral Leasing Act of 1920, as amended, are referred to as leasable minerals. Common varieties of sand, stone, gravel, pumice, and clay that may be acquired under the Materials Act of 1947 are considered salable minerals. Any minerals that are not salable or leasable, such as gold, silver, copper, tungsten, and uranium, are referred to as locatable minerals. These mineral deposits include most metallic mineral deposits and certain nonmetallic and industrial minerals. Locatable minerals are subject to the Mining Act of 1872.

Apache-Sitgreaves

Mineral resource activity on the Apache-Sitgreaves NFs has historically been low. Mineral activity is presently concentrated in a few scattered areas. Commodity use and production have shown declines from the past. However, these forest uses contribute to sustaining the lifestyles and traditions of local communities. The potential for locatable minerals on Apache-Sitgreaves NFs lands may be much greater at depth than surface geology would otherwise suggest. The potential for leasable minerals on the Apache-Sitgreaves NFs is low because of the existing geology. There are no known leases on the forests for the following leasable mineral resources: oil and gas, oil shale, coal or geothermal (BLM 2009/2013). Should valid leasable mineral proposals be submitted, the Forest Service would respond as a cooperating agency when requested by the BLM, which acts as the lead agency for subsurface mineral extraction. There are no current leases for oil and gas, geothermal, or coal on the Apache-Sitgreaves NFs.

Coconino

The Coconino National Forest has very few locatable mineral resources, and no oil and gas leases or developments, but has potential geothermal resources (no current leases, no developments) associated with the San Francisco Volcanic Field. Locatable minerals with past or current production have included manganese, gypsum, flagstone and pumice. The forest has a small amount of common variety mineral materials production including cinders, crushed and pit run aggregate, rock and fill dirt, and landscape rock/decorative stone. Most of the use of mineral materials on the forest is by the Forest Service or authorized contractors or permittees for projects and by Coconino County under permits or other agreements. Aggregate production and salable minerals are anticipated to increase with future forest restoration activities. Some areas are withdrawn from locatable mineral entry.

Tonto

No leasable mineral authorizations or applications are currently located on the Tonto NF. The potential for development of leasable minerals in the planning area is low; the geologic depositional environment of the planning area is not conducive to hydrocarbon generation. The Tonto National Forest has a long history of mining across the national forest.

Although numerous prospects on the Payson Ranger District were identified from the Arizona Department of Mines and Mineral Resources database, most of the gold and silver deposits were found within veins found fairly close to the surface with visible mineralization. Most of the metals could be extracted with minimal milling effort, usually with a stamp mill. Most if not all of the mineralization occurred within “quartz stringers” of a granodiorite intrusion (Botsford 1933). Once these narrow dikes (bands) are mined out, only the “non-visible” or disseminated mineralization is left behind, which requires a much greater milling process and larger scale operation to be profitable.

Arizona is well known for its large porphyry copper deposits, which are low-grade disseminated type deposits that require mining by large-scale, low-per-ton cost methods. The copper minerals are distributed uniformly through large sections or blocks of the deposit, that must be mined by bulk methods, rather than selective or vein mining methods. These bulk mining methods consist of either open-pit or block caving mining methods. Gold and silver occur as secondary metals that are associated with porphyry-type deposits. Based on historic activity of this district, further exploration efforts may have merit. As a result, the favorability for mineral potential within the Green Valley Mining District and two other districts, the Polk and the Rye Creek, is determined to be moderate (USDI 1993). Although no exploration activity is currently taking place on the Payson Ranger District, the potential for such activities remains.

Asbestos was mined from several large and numerous small workings of the Sierra Anchas Mining District of the Pleasant Valley Ranger District. Asbestos has not been mined in the United States since 2002 (USGS 2014). Although asbestos is still a legal commodity, its use has declined considerably. Combined with the health and environmental concerns

associated with asbestos use, as well as the decline in demand, the future potential of asbestos prospecting and development of the Sierra Anchas district is considered low (BOM 1993).

Uranium was also developed within the Sierra Anchas region. Although during the years of 1953-1960 over 122,000 lbs. of uranium oxide concentrate was produced from the Dripping Springs Quartzite in Gila County, the ore grade and extent were often disappointing. Uranium mining in Arizona today is concentrated within the Arizona Strip area of northern Arizona. There are currently no proposed exploration or development activities occurring within the district with regard to uranium production. Therefore, development potential for uranium mineral development within the Sierra Anchas district of Pleasant Valley Ranger District is determined to be low.

Assumptions and Methodology

Assumptions

The following assumptions were made for this analysis:

- Forest Plan direction will be followed when planning or implementing site-specific projects and activities resulting from this decision.
- Applicable laws, regulations, and policies will be followed when planning or implementing site-specific projects and activities resulting from this decision.
- With population growth in the communities within and surrounding the forest, as well as throughout the State of Arizona, there will be increased demand for uses such as alternative energy development, utility corridors, and transportation systems.
- Community and public needs for use of federal land for services and infrastructure, including roads and energy corridors, will continue.
- Proposals for lands special uses, mineral exploration, and energy development on the national forests will increase in the foreseeable future.

The primary assumption for the analysis of effects on lands, lands special uses, and minerals is that the number of acres treated under each alternative corresponds directly to a reduced risk of uncharacteristic wildfire behavior within the project area. This in turn corresponds to a reduced risk of damage to structures and facilities within the project area. Therefore, the greater the number of acres treated, the greater the reduction in uncharacteristic fire behavior, and therefore the greater positive effect to these resources. This correlation holds true regardless of the mix of treatment methods used (i.e., mechanical thinning, prescribed burning).

Methodology

The Special Uses Database System (SUDS) was used to generate a list of all special use authorizations within the project area. This report was sorted by use type; recreation special uses were then removed from the analysis. The remaining lands special use authorizations were then sorted by status. They were considered as part of the existing condition if they had statuses of application accepted, pending signature, or issued.

Some inaccuracies are commonly known to exist in the SUDS. Permits are sometimes shown as "issued" even after they have expired, or sometimes are shown as expired when in fact they have been reissued and the activity continues. Where it was known or suspected that these permits were still in place and in the process of reissuance, they were considered in the analysis.

Mineral resources were identified using the specialist reports and supporting materials for the Forest Land and Resource Management Plan Revisions for each forest in the project area.

Issues/Indicators/Analysis Topics

None of the significant issues for Rim Country relate to the potential effects on lands, lands special uses, or minerals, and therefore they do not serve as indicators for analyzing the effects of the project on these resources. However, the project would have an indirect effect in the form of reduced risk of uncharacteristic fire behavior. Uncharacteristic fire behavior presents a threat to the facilities authorized by special use permits and to any structures that may lie on non-forest lands within the project area. Therefore, the indicator used for this analysis is the reduced risk of uncharacteristic fire behavior, as represented by the number of acres treated under each alternative.

Environmental Consequences

Alternative 1 – No Action

Under this alternative, no large-scale restoration activities would occur. Stand and vegetation structures would be improved only in accordance with each forest plan. With the data available at the time of this report, this would be occur on only 140,324 acres. This would make the landscape in the project area less resilient to disturbance and would provide increased fuels for wildland fires and uncharacteristic fire behavior. Increased fire danger would impact lands special uses by threatening the structures they authorize in both the short term (10 years) and long term (20 years and more). Any structures associated with active minerals sites and those located on non-NFS lands would be similarly threatened. Long-term effects could be the destruction of these facilities by fire, and possibly the closure of fire-damaged areas for rehabilitation. There may be short-term, temporary effects in the form of restricted access to sites during fire suppression activities or post-fire rehabilitation (see the Fire Ecology and Air Quality Report for detailed information on existing and foreseeable fire risk).

Many of these authorized land uses serve and support local communities. If infrastructure is damaged by wildfire, there could be a delay in providing utilities such as power, phone, and water. Emergency service providers could be delayed in providing for health and safety if communication equipment is damaged. Private property has the potential to be impacted as a result of wildfires in the area as fires may burn at a higher intensity and severity and would be more difficult to control. Existing land uses would continue to be managed under the current forest plan direction and under the terms of their authorizations and other laws, policies, and regulations such as power line clearance requirements and vegetation management along highway corridors for safety purposes and utility reliability.

Effects Common to All Action Alternatives

All action alternatives would improve forest health by restoring forest ecosystems toward their natural, pre-fire-suppression states. While they vary in specific approaches, the overall effect on lands, lands special uses, and minerals would be the same. Increased forest health would lower the risk of undesirable fire behavior, which would reduce the threat to the structures authorized for lands special uses and mineral projects and to those on private lands.

Effects Unique to Each Action Alternative and Differences among Them

For the purposes of this analysis, the only difference between action alternatives is the number of acres treated (Table 3-**).

Table 130. Comparison of Alternatives by Number of Total Acres Treated

Alternative	Acres Treated Under This Project	Total Acres Treated
1	0	140,324
2	899,330	1,039,654
3	474,930	615,254

Effects from Rock Pit Use and Expansion

Rock pit use and expansion would be the same under both action alternatives. There would be no effects on lands or lands special uses. The effect on minerals would be that, once used, these resources would no longer available for other future projects. The consumption of mineral resources for road surfacing needs for the Rim Country Project must be weighed against the cost of purchasing these materials from a commercial source in the future. As budgets continue to shrink, this would be an important consideration. The Coconino and Tonto NFs receive very high levels of use, and road surfacing will continue to be an ongoing need.

One potential way to mitigate this effect would be to salvage the material used on temporary roads built for this project, so that it could be stored and used in the future. The best method of doing this would need to be determined by forest engineers and the cost of doing this analyzed. During this process it would be important to recognize that, with so much of the state’s land base being national forest or other public lands, private commercial sources of mineral materials could be limited in the long run.

Effects from Use of In-woods Processing and Storage Sites

For both projects, processing site location and siting considerations include: flat uplands less than five percent slope; more than 200 feet from perennial, intermittent, and ephemeral stream channels; more than 300 feet from meadows, springs, and karst features; more than ¼ mile from MSO PACs and outside of NOGO PFAs; more than ¼ mile from system hiking trails, campgrounds, and group event recreation sites; more than ¼ mile from private lands, residences, or offices; and adjacent to roads that are open year-round for product removal. Processing sites were located to provide a buffer of 100 to 300 feet from forest roads and state highways to provide for visual screening from Concern Level 1 and 2 travelways.

Processing sites may be authorized under timber contract or under special use authorizations. Special use authorizations for processing sites would comply with appropriate policies related to cost recovery and land use fees and other special use regulations (36 CFR 251). A performance bond would be used to insure that all obligations are fulfilled by the contractor or permittee and would be used if needed to cleanup and rehabilitate the processing sites.

Processing site locations and use are the same under both action alternatives. There would be no effects on minerals. There would, however, be potential effects on lands or lands special uses.

Residents living within the project area boundaries could be impacted by the increased noise, traffic, and emissions produced by active operations at processing sites. These effects would be greater the closer processing sites are to any private lands or special use facilities with residents. These effects can be mitigated by advance communications with any residents and notifying them of potential active operation timeframes.

Cumulative Effects

The cumulative effects analysis area for lands, lands special uses, and minerals is the Rim Country project area.

Alternative 1 – No Action

Alternative 2

Under this alternative, approximately 953,130 acres would receive vegetation treatments and restoration activities. This is a 60 percent increase over the no action alternative. Alternative 2 would treat the greatest number of acres and therefore contribute the most toward the reduction of fire risk to lands, lands special uses, and mineral site structures.

Alternative 3

Under Alternative 3, approximately 529,060 acres would receive vegetation treatments and restoration activities. This represents 44 percent fewer acres than Alternative 2, but a **percent increase over alternative 1. Beneficial effects on lands, lands special uses, and mineral site structures would be greater than under Alternative 1 but less than under Alternative 2.

Tribal Relations

Affected Environment

All of the lands in the 4FRI Rim Country project area are the ancestral homelands of American Indian tribes. The archaeological resources in the project area demonstrate a high level of traditional uses which continue today (see the Cultural Resources section for more details concerning archaeological resources). In lands occupied by their ancestors, tribal members continue traditions of hunting, collecting medicinal plants, and conducting traditional ceremonies. This includes American Indian traditional use areas and places known as Traditional Cultural Properties (TCPs). TCPs are places traditionally used by cultural groups over generations. These TCPs hold a central and important place in American Indian culture. Through years of tribal consultation the forests have learned that many natural springs, prominent bodies of water, mountains, subsistence areas, prayer areas, shrines, clan origin locations, holy places, trails and shelters (ie. Sweat lodges and brush shelters) are considered TCPs by numerous tribes.

Tribal members make pilgrimages to the Rim Country forests for ceremonial activities throughout the year. Springs in the project area and throughout the forest are valued as TCPs and sacred sites. Many plants gathered for ceremonial use are collected on or near TCPs.

Tribal Consultation

The Forest Service and Tribes have legislative authority to partner under law, including but not limited to the Indian Financing Act of 1974, the Cooperative Funds and Deposits Act of 1975, the Forest and Rangeland Renewable Resources Research Act of 1978, the Federal Technology Transfer Act of 1986, the Department of Interior, Environment and Related Agencies Appropriations Act of 1992, the Tribal Forest Protection Act of 2004 (TFPA), the Culture and Heritage Cooperative Authority of 2008 (CHCA), and the Wyden Amendment (Public Law 109-54, Section 434). These authorities provide opportunities to exchange technical expertise, funding, goods, and services to the mutual benefit of both parties. An effective government-to-government relationship will provide for the identification of common goals and partnership opportunities. For additional guidance, see FSM 1563 (2015 draft).

Assumptions and Methodology

Assumptions made are as follows: no activities will adversely affect archaeological sites or traditional cultural properties; the removal of excess fuels is a benefit to cultural resources, traditional cultural properties, traditional use forest products, and adjacent tribal lands; low heat prescription wildfires can result in the regeneration of medicinal plants; mechanical thinning of specific species can protect other plant species of cultural importance (such as Emory oak groves); restoration activities will benefit natural springs which are of universal importance to Indian tribes; Indian tribes will be consulted at critical points before project activities.

Issues/Indicators/Analysis Topics

Traditional Collecting Areas - Dense tree growth and heavy ground fuels can have a negative effect on certain plant species; thinning the forest may provide a better habitat for these plants to thrive. Fire can also enhance certain plant species such as wild tobacco. Restoration activities could positively affect the sustainability and availability of traditionally important plant species and natural springs.

Smoke Impacts - Increases in prescribed fire in all alternatives (no action, Alternative 2, and Alternative 3) create the potential for increased smoke impacts. Most of the smoke from prescribed fires on the Coconino and Tonto NFs would carry from the southwest to the northeast, potentially affecting the Havasupai Reservation and western portions of the Navajo Nation Reservation. Many people living in these areas are seniors with health conditions and are sensitive to smoke. The effects of limited communications (they cannot get on a website to check out where we’re burning, etc.), language barriers, and cultural differences make it difficult to get information to them and receive information in return about smoke impacts. There is a general lack of smoke monitoring data on the reservations. Therefore, those living on these reservations may be disproportionately affected by smoke from burning by the various agencies (especially from multiple fires on multiple jurisdictions). Coconino County has a significantly higher poverty rate than the other counties and the states of Arizona and Utah. The incidence of poverty in Coconino County is not evenly distributed among racial and ethnic groups. Approximately 50 percent of American Indian residents in Coconino County live in poverty. The high proportion of American Indian residents in the county therefore increases the poverty rate relative to other study area counties and the state (Eichman and Jaworski 2011).

Environmental Consequences

Alternative 1 – No Action

Direct effects as a result of the no action alternative would result in the loss of native plant species, an increase in springs drying up, and a greater threat of devastating wild fires. Also, with continued drying trends across the southwest, the forests would issue forest closures and fire restrictions thus effecting traditional uses and ceremonies.

TCPs are at risk to catastrophic fire because it can destroy the setting of the TCP. Springs and plant collection areas are at risk to catastrophic fire because of excessive runoff from monsoon rain washing in ash and debris in a fire-devastated landscape. Overstocked stands are reducing the sunlight available for cultural and medicinal plants and catastrophic fire could destroy seed and habitat for native plants. A lack of low-intensity fire is reducing regeneration of plants collected by native people.

Soil erosion due to uncharacteristic wildfires could have both direct and indirect effects on traditional collecting areas. Rain and snow melt could cause channels to form, or mud slides from nearby slopes could deposit soil and debris over traditional areas, leading to the loss of biological communities for both plant and animal species used by the tribes.

The no action alternative may result in the possible reduction over time of pre-settlement adapted native plants, some of which have been collected since historical times by American Indians for food and medicine. Additionally, springs and seeps are important locations to American Indians and other members of the public; increasingly overstocked forests might affect those historic water sources.

Effects Common to Both Action Alternatives

The ground-disturbing activities associated with these two alternatives (2 and 3) are not significant enough to analyze separately.

Alternatives 2 and 3 would increase the amount of ground-disturbing activities, including mechanical treatments, prescribed burning, temporary road construction, skidding, stream restoration, and fence construction. When considered together with the past, present, and reasonably foreseeable future actions, these activities have the potential to affect cultural resources such as traditional collecting, gathering, ceremonial use areas, and TCPs. All undertakings that have the potential to affect cultural resources would go through tribal consultation. In addition, protection measures such as the possibility of tribal monitors during mechanical activities, keeping ground-disturbing activities out of sensitive areas by flagging and avoiding the sensitive areas, and post-prescribed burn monitoring to assess the effects of the low-intensity burns, would help to minimize the effects. The potential cumulative effects on cultural resources and TCPs such as springs from increased ground-disturbing activities and prescribed burning in these alternatives are therefore not considered to be adverse.

Cumulative Effects to Both Action alternatives

The cumulative effects on TCPs, and gathering and ceremonial areas resulting from any potential increase in erosion would also be minimal. Reducing fuel loads and implementing low to moderate-intensity prescribed fires do not cause soil sterilization or hydrophobic soils as high intensity wildfires do. Low-intensity prescribed fires leave some vegetation in place and re-vegetation occurs soon afterwards if soils are not sterilized. However, as implementation occurs, monitors would check for erosion concerns by examining culturally sensitive locations like TCPs and ceremonial sites in the implementation areas, including focusing on slopes, drainages, and other areas with a high probability of cultural resources. The cumulative effects on cultural resources caused by an increase in erosion are not considered to be adverse. An increase in these types of activities would not result in an adverse effect on cultural resources as long as tribal consultation is conducted prior to project implementation, protection measures are imposed, and post-project implementation monitoring is conducted when appropriate.

Range

A summary of the range specialist report is presented here and the complete report is incorporated by reference (Hughes 2018). Refer to the Range Report for additional information on methodology, the grazing history of the project area, and supporting information. This analysis incorporates questions designed to evaluate movement toward desired conditions and concerns brought up by the public during scoping: (1) How would project activities affect livestock grazing management in the project area? (2) How would project activities affect livestock forage in the project area? (3) Would livestock grazing affect the restoration of understory species? (4) How would livestock grazing affect the ability to return fire as a natural process to the project area? and (5) How would climate change affect the range resource and how would the project affect climate change (relative to range)?

Affected Environment

The affected environment for the range analysis is the Rim Country project area, approximately 1,240,000 acres. Only allotments within the project area are considered. Within the project area, approximately 1,129,490 acres are within grazing allotments and 109,170 acres are not grazed by livestock. The majority of the understory vegetation within the grazing area is dominated by Arizona fescue, mountain muhly, pine dropseed, blue grama, and squirreltail grasses.

Within the project area there are 70 livestock grazing allotments, with 69 active allotments and one vacant. Of these 70 allotments, 68 permit cattle grazing and two permit sheep grazing (one being a sheep driveway). The amount of each allotment lying within the project area varies from less than 1 percent to 100 percent.

Grazing Effects from the 1860s to the Present

There is a long livestock grazing history within the project area. The first pioneers settled in this area in the 1860s with their livestock. As more settlers moved in, they brought with them more and more livestock. Initially, livestock numbers were low but they increased quickly throughout the entire project area. The major factor contributing to the increase in cattle was when the Atlantic and Pacific Railroad connected Flagstaff to Albuquerque and the eastern U.S. markets in 1882.

Livestock numbers on the A-S, Coconino, and Tonto National Forests have generally declined since the 1890's. One exception to this general trend was during WWII when numbers were temporary increased. In the early years, livestock reductions were generally made when allotments changed hands. Some of the reductions were made for range protection without a permit changing hands.

On the A-S National Forests, livestock numbers have declined for more than 20 years, as the forests have balanced permitted numbers with the capacity of the land. In the 1980s, about 236,000 AUMs were permitted on an annual basis, compared to 130,000 AUMs permitted in 2011.

Livestock grazing began on the area now known as the Tonto NF in the late 1800s. Heavy grazing was occurring in the 1880s and livestock numbers reached their peak in about 1900, with an estimated 1.5 to two million head grazing the area now known as the Tonto NF. Mostly cattle grazed on the Tonto, although some sheep, goats, and hogs have utilized the rangelands as well as native ungulates.

From the 1920s until the early 1930s, individual allotments were fenced. After the allotments were fenced, the pastures started to be divided and water sources developed. By 1940, most dual use between cattle and sheep ended in this region as most of the permittees switched to cattle. All of these changes improved grazing management and reduced the effects from grazing on understory vegetation within the project area.

In summary, historic livestock effects on understory vegetation follow the history of livestock management within the project area. Range trends within the project area follow this grazing history. Unregulated grazing from the 1860s to the 1920s led to declines in grass, forb, and shrubs and an increase in trees. Since then, grazing management practices have evolved through time to limit overgrazing by livestock and to match conservative livestock utilization with forage production. With the improvement in grazing management, trends in understory vegetation have generally improved in areas where tree density does not limit recovery. Tree density limits the amount of understory vegetation since as tree densities increase, the understory vegetation declines. The direct relationship between tree basal area and understory production has been widely studied (Moore et al 2004, Arnold 1950, Cooper 1960, Pearson and Jameson 1967). In these studies, the direct relationship between tree density and understory vegetation was observed regardless of whether the study area was grazed by livestock, or whether the study area was excluded from livestock grazing.

Assumptions and Methodology

Annual planning occurs prior to the livestock grazing season. During this planning the livestock numbers and the grazing season are developed based on several factors including the previous year's management plans and outcomes, current year's predictions, and current resource conditions. During the grazing season, changes may be needed to the rotation or numbers, due to unexpected changes in conditions, such as those caused by drought or fire. This is a piece of the adaptive management cycle. Annual monitoring typically includes an assessment of current conditions, a measure of livestock usage and actual use. Long-term monitoring usually consists of condition and trend monitoring every five to 15 years measuring plant canopy cover, plant frequency, species composition, and/or ground cover.

Design features, best management practices, mitigation and conservation measures have been developed to be used during implementation to protect range resources as well as other resources from grazing effects (see Appendix C).

Environmental Consequences

Direct and Indirect Effects from Livestock Grazing

Livestock grazing can affect vegetation by reducing plant height, plant canopy cover, and ground cover, and can compact soils. Current grazing management systems on allotments within the project area are designed to mitigate these effects by rotating grazing so individual forage plants are not grazed at the same time each year. They are also designed so forage species can reach maturity and seed most years. Current allotment management plans generally have utilization guidelines of 25-40 percent by ungulates, which leaves 60-75 percent for ground cover, soils, fire spread, hiding cover, and forage for other animals and insects. Adaptive management for all allotment grazing management systems in the project area is also mitigation to grazing. It is primarily used to match livestock numbers with annual available forage.

In some areas managed livestock grazing can affect the spread of natural fire by the removal of fine herbaceous fuel until the plants regrow. Historic unregulated livestock management from the 1860's to the 1920's removed a significant the amount of forage plants and did not allow for much regrowth. As range management practices were improved through the years, more forage plants became available to carry a fire. A likely factor in the increase in the amount of forest acres burned in recent history is a result of this improvement in range management practices.

Current grazing management systems effects on fire within the project area is short lived and limited in area. The effect is normally limited to one pasture in an allotment, until that pasture can regrow, for typically between two to six weeks depending on climate conditions. It is also limited in scope because of conservative 25 to 40 percent utilization levels used in these grazing management systems in the project area, leaving 60 to 75 percent of the plants available for fire spread or mulch. The exceptions are generally always corrected the following year by resting the pasture, deferring use, reducing grazed periods, and/or reducing livestock numbers. Many fuels reduction and restoration projects have occurred within the project area and have been successful with livestock grazing.

Grazing effects appear less important than abiotic and biotic factors in explaining the observed spatial variation in vegetation (Laughlin and Abella 2007). The model results imply that ungulate (cattle, sheep, deer, and elk) grazing might directly influence plant community composition. Heavy grazing can shift the community toward greater abundance of unpalatable species (Westoby et al., 1989; O'Connor, 1991). A few unpalatable species, including broom snakeweed (*Gutierrezia sarothrae* (Pursh, Britt. & Rusby) and spreading fleabane (Erigeron divergens Torr. & Gray), were most abundant in the heavily grazed plots (Abella and Covington, 2006). It is likely that the unregulated grazing in the 1860s to 1920s in the project area likely led to temporary changes in vegetation. As heavy grazing was eliminated over time the plant composition responded.

Livestock grazing can affect riparian and aspen areas similarly to upland areas. However, livestock can be more attracted to riparian and aspen areas because of the increased water and/or forage. Riparian plants and aspen can be reduced by grazing these species. Special livestock management techniques have been employed within the project area to reduce effects including livestock exclosures, deferred grazing, herding, and alternative water sources with adjustments in Allotment Management Plans over the years. These practices have limited the amount of livestock grazing on riparian vegetation and aspen. Additional adjustments in management may be necessary to reduce effects on these areas, especially if riparian and aspen regeneration areas would be expanded with new management practices.

Domestic cattle grazing has the potential to affect soil and hydrologic functions that are important in the maintenance of long-term productivity and favorable conditions of water flow. Specifically, changes in the soil's surface structure and its ability to accept, hold, and release water may be affected by compaction caused by trampling. The nutrient cycling function of the soil may be interrupted by removal of vegetation that affects above ground nutrient inputs into the system. Finally, the soil's resistance to erosion is affected by changes in plant density, composition, and protective vegetative ground cover that are part of the organic components in the soil.

The effects of livestock grazing on soil and hydrologic function is limited within the project area because of the current management in place that limits utilization, maintains forage plants, and limits compaction with deferred and rest rotational grazing systems.

Alternative 1

Direct and Indirect Effects

In Alternative 1, there would be no management activities occurring within the project area as a result of the Rim Country Project. Because no activities would occur, tree densities and canopy cover would remain high and understory plant cover would stay the same. Over time, tree densities and canopy cover would continue to increase, under which understory vegetative cover and production would decline. Understory species would also be reduced because of the buildup of pine needles and the lack of nutrient cycling.

The reduction in understory vegetation over time would reduce the amount of forage available to livestock. Over time, livestock numbers may need to be reduced. This reduction in forage and decrease in livestock numbers has been recorded throughout the project area. There is no reason to believe that this trend would not continue under Alternative 1.

Under Alternative 1, additional prescribed fire would not occur in the project area. Without these acres of prescribed burning, no pasture rest periods would be necessary after burning.

Since no treatments are planned in Alternative 1, grazing management would continue as has generally been planned and actually carried out in the past. However, this alternative would not adequately reduce the increased risk of uncharacteristic wildfire.

Uncharacteristic wildfires can burn with high severity and burn through multiple pastures, burning fences and other structural range improvements. Uncharacteristic wildfire would have an adverse effect on livestock grazing management and forage until the area recovers and structural improvements are replaced. See the Fire Ecology and Air Quality Report for additional information (Haas 2018).

Effects Common to Both Action Alternatives

The environmental consequences for Alternatives 2 and 3 are based upon the application of design features and other resource protection measures, and are based upon the environmental consequences in the Silviculture, Fire and Air Quality, and Wildlife Reports. See the range section in Appendix C, the Range section, of this FEIS for the complete list of resource protection measures.

Tree thinning and prescribed burning would increase understory vegetation. Understory species and composition would change primarily by increasing shade-intolerant understory species and decreasing shade-tolerant species. Understory species would also be increased because of the reduction of pine needles and the increase in nutrient cycling provided by burning. All these factors would improve forage production for livestock within the areas treated.

Both Alternatives 2 and 3 would directly decrease tree density by mechanical tree thinning and prescribed burning. Overall stand tree basal area may not measurably change in areas treated, but an increase in the groupy/clumpy arrangement would substantially increase herbaceous species production by creating openings between these groups. The indirect effect of cutting trees in a groupy/clumpy arrangement would increase herbaceous vegetation because of the overall increase in sunlight reaching the soil. The increase in forage would have short-term (within three years) and long-term 10-year beneficial effects on livestock grazing. In research near the project area, herbaceous production dropped from greater than 650 pounds per acre to 100 pounds per acre when basal area increased above 50 square feet/acre (Pearson and Jameson 1967). In another study, grasses increased by more than 470 percent cover in high-intensity harvest units compared to a 53 percent increase in pre-treatment control units (Stoddard et al. 2011). Griffis et al. (2001) also found that the abundance of native grasses increased significantly along with treatment intensity throughout thinned and burned stands.

The increase in forage within treatment areas would improve allotment conditions and allow for more flexibility in grazing management systems. Livestock distribution would improve because forage is more available in uplands than in more typical grazing areas like meadows. The increase in forage would either drop utilization rates within a pasture or increase pasture graze periods. An increase in pasture graze periods would allow for additional pasture rest or deferment in other pastures within an individual allotment.

Prescribed burning would have an adverse effect on livestock grazing by removing forage available to livestock. This effect would be short term until the forage plants regrow, typically within one year. This effect would be offset by the long-term increase in forage after burning. The prescribed burning would be phased throughout the project area to minimize effects on individual allotments. Pastures would be rested prior to prescribed burning, in coordination with the range specialist, but it would not be a requirement to reach burning objectives. The allotments in the project area have the ability to rest a main pasture for one year after a burn with little effect on overall allotment grazing management. However, livestock numbers or season of use might have to be reduced in some allotments because of the combined effects from prescribed burns and other factors like wildfire and drought. If the burned areas do not recover within a year, then livestock would likely continue to run in the same pastures, reducing the amount of rotational grazing on an allotment. This might also lead to a temporary reduction in livestock numbers or a reduction in length of grazing season to maintain the health of the grazed pastures until the treatment area recovers and rotational grazing is restored. Adaptive management would continue to be used to adjust livestock numbers to meet annual forage production, with or without the burns.

Restrictions in grazing of livestock after prescribed fires are a mitigation to reduce effects on forage species. These mitigations have shown to maintain static understory conditions in grazed areas. An estimate of this restriction is not available because each pasture’s response to ground-disturbing treatments (including mechanical thinning and prescribed fire) is unique. Climatic conditions, soils, vegetation, the severity of fire effects, burn amount, intensity of vegetation treatments, and pasture management may vary greatly from year to year or from pasture to pasture.

The removal of trees during mechanical thinning operations would have little effect on livestock grazing. Mitigations would be implemented to maintain structural range improvements and keep livestock within designated pastures during these operations. Pastures may be deferred during operations to minimize equipment and livestock conflicts, but it is not mandatory. Mechanical thinning has been conducted throughout the project area for many years with few effects on livestock grazing operations, although post-treatment inspections may result in changes to annual pasture rotations (such as deferment).

Mechanical and fire treatments (Intermediate Thin, Stand Improvement, and Uneven-aged) would leave tree groups with differing sizes of interspaces between the tree groups. Treatments in the 40 to 55 percent and the 55 to 70 percent interspace ranges would result in an increase in herbaceous cover and production, and the treatments in 10 to 25 percent, 10 to 40 percent, and 25 to 40 percent interspace ranges would still result in an increase in herbaceous cover and production, but less of an increase than the higher interspace treatments..

Single-tree selection treatments leave fewer tree groups and more randomly spaced trees. They are designed to increase or maintain age class diversity and reduce understory brush and shrub response, creating small openings less than or equal to 1/4 acre in size. This type of treatment would result in an increase in herbaceous cover and production in the openings created. Aspen restoration treatments, mechanical and prescribed fire facilitative operations, and savanna, grassland, and meadow restoration treatments would result in an increase in herbaceous cover and production. Severe disturbance area treatments, due to their objective of restoring forest cover, would reduce herbaceous cover and production slowly over time.

Spring exclosure areas would not be available for livestock grazing and would have an adverse effect on available forage within a pasture. However, these exclosures would not be large enough and would not amass in any particular pasture to reduce pasture stocking rates. In addition, by the time these exclosures would be completed, it is anticipated the increase in pasture forage by the tree thinning and burning would help to offset the forage lost within the exclosures. Spring projects would not have a measureable impact on the capacity of allotment or grazing management.

Stream and riparian area restoration would have a long-term benefit to livestock grazing management by increasing forage, by improving bank stability, and by decreasing the amount of sediment to downstream stock tanks. Excluding livestock from these restoration areas would be short term.

Aspen exclosure areas would not be available for livestock grazing and would have an adverse impact on available forage within a pasture. However, the majority of these exclosures would not be large enough or amassed in any particular pasture to reduce pasture stocking rates. Aspen projects would not have a measureable impact on the capacity of allotment or grazing management.

Road decommissioning would have a beneficial effect on livestock grazing by growing additional forage in the old road bed. Constructing temporary roads would have a temporary adverse effect to livestock grazing when the forage on the road was disturbed. No road project would have a measureable impact on the capacity of allotments or grazing management.

Effects from Use of In-woods Processing and Storage Sites

The development and use of the proposed processing areas would make any potential forage unavailable to livestock grazing for approximately 20 years from their initial development. These processing sites would reduce the amount of forage available in these areas which could last up to 20 years. This effect would be small compared to the size of the allotment, and would likely have no noticeable effect on livestock management.

Alternative 2

Under Alternative 2, the Black Canyon, Clay Springs, Heber, Railroad, Town Tank, and the Willow Wash Allotments on the Apache-Sitgreaves NF, and the Cross V, Green Valley, Sheep Driveway, Indian Gardens, O.W., Payson, and the Tonto Basin Allotments on the Tonto would receive the largest portions of the acres severe disturbance treatments. These areas are generally within previously burned areas, such as the Rodeo-Chediski Fire area.

Alternative 3

Under Alternative 3, the Black Canyon, Clay Springs, Heber, Railroad, Town Tank, and the Willow Wash Allotments on the Apache-Sitgreaves NFs, and the Cross V, Green Valley, Indian Gardens, and Tonto Basin Allotments on the Tonto would receive some of the severe disturbance treatments, but much less than in Alternative 2. The O.W., Payson, and Sheep Driveway Allotments would receive similar amounts of these treatments as in Alternative 2.

Cumulative Effects

The area considered for cumulative effects analysis includes 100 percent of the acres within allotments that occur within the project area. This is a logical boundary because changes to grazing management in one pasture of an allotment affect the management in the entire allotment.

The time frame for these combined effects is 10 years, 10 years in the future because changes in condition and trend in the vegetation depend on the presence of favorable growing conditions after cattle leave the pasture. If growing conditions are favorable, plant height and canopy cover would completely recover from the effects of the proposed forest management activities within one year. If growing conditions are not favorable, plant recovery would occur more slowly (up to two to three years). Vegetation recovery from the other activities and natural events may take this long depending on annual weather conditions particularly annual precipitation.

Continuation of current management, absent the proposed treatments in the Rim Country project area, would result in further reductions in forage production over time with the increase in tree density. Past restoration projects within and close to the project area have increased forage and understory vegetation. Forest Service policy and forest plan direction is to manage for uneven-aged stands and allow fire to return to its nature role in ecosystems. Current grazing management uses adaptive management to meet objectives established in existing allotment management plans. Past vegetation and prescribed fire projects have resulted in the current resource conditions.

The cumulative effects on livestock grazing management and livestock forage from Alternative 1 would be no change in the short term, but would result in a long-term decrease in forage with the increase in tree density. The 4FRI Rim Country project area would not be treated with the additional activities proposed. When other current and foreseeable projects are considered, 282,291 acres would be treated (168,416 acres of mechanical thinning and 113,875 acres of burning). Livestock grazing management would be affected by these treatments; pastures would be rested and deferred as these treatments are completed. With fewer treatment acres, there would be fewer effects on pasture rotations.

The treatments proposed in Alternatives 2 and 3 would overlap with the other current and reasonably foreseeable projects in the project area. Any overlap would produce a short term effect, with a typical duration of one year after burning. In the long term, forage would increase on the acres treated throughout the cumulative effects analysis area (allotments throughout the project area). In terms of grazing management, even though forage would be reduced for a period of one year, design features applied in implementation of all projects would mitigate any effects on grazing management. Coordination between fire, silviculture, and range specialists as part of an implementation interdisciplinary team would result in minor adjustments to grazing management.

Transportation

A summary of the transportation report is presented here. The specialist report (Rich 2018) is incorporated by reference.

Affected Environment

Forest system roads within the analysis area are managed in accordance with current management objectives that are based on a variety of needs for access and use of forest resources. The system of roads ranges from primitive, unsurfaced roads (maintained for resource protection and not user comfort), aggregate surfaced roads (maintained for varying degrees of user comfort), and double-lane asphalt-surfaced state highways. These roads form a transportation system that provides access to the area for a variety of uses, including vegetation treatments, fuel treatments, fire suppression, and recreation. The majority of these system roads were planned and constructed during past commercial timber harvest activities and are not accessible year-round by all types of vehicles. These roads were designed for primary use by a standard log truck. In addition to passenger vehicles and high clearance vehicles, many of these roads are used by off-highway vehicles, hikers, mountain bikers, and horseback riders.

Some roads within the project area are poorly located. They may be overly steep and difficult to drain, located in drainages, too close to streams, or a number of other situations. Many of these roads are difficult to maintain and are causing soil and water resource damage.

The number of miles of county, state, and federal highways within the project area and that provide access to the project area and link it with potential wood processing facilities is not estimated. Since the location of potential future processing facilities is unknown it is not possible to designate all public roads which may or may not be used for accessing the area.

Current National Forest System Roads within Rim Country

Currently there are approximately 5,682 miles of FS roads within the project area on FS lands. Table 3-** displays the miles of road by operational maintenance level.

Table 131. Summary of existing road mileage

Maintenance Level	A-S	Coconino	Tonto	Total
1- Basic Custodial Care (closed)	1,747	189	140	2,076
2 - High Clearance	856	1,417	591	2,864
3 - Suitable for Passenger Vehicles	347	240	82	669
4 - Moderate Degree of User Comfort	22	11	38	71
5 - High Degree of User Comfort	0	0	2	2
Total System Roads	2,972	1,857	853	5,682

Assumptions and Methodology

The Rim Country project area consists of 1.24 million acres on the Apache-Sitgreaves, Coconino, and Tonto NFs. Within this area, several other environmental analyses have been conducted in recent years. These previous analyses affect the type of transportation analysis conducted in this document.

Two environmental assessments, totaling 61,101 acres, were recently analyzed for transportation needs for mechanical thinning and also for road decommissioning. No additional transportation analysis was conducted in these areas within the Rim Country EIS project area. These projects are:

- Larson- 29,921 acres- Apache-Sitgreaves NFs
- Upper Rocky Arroyo- 31,180 acres- Apache-Sitgreaves NFs

Six other environmental assessments totaling 192,187 acres, analyzed only for transportation needs for timber harvesting and did not analyze for any road decommissioning. These projects are:

- Upper Beaver Creek- 48,245 acres- Coconino NF
- Clints Well- 16,825acres- Coconino NF
- CC Cragin- 63,867 acres- Coconino NF
- Rim Lakes- 33,746 acres- Apache-Sitgreaves NFs
- Show Low South- 4,624 acres- Apache-Sitgreaves NFs
- Timber Mesa-Vernon- 24,880 acres- Apache-Sitgreaves NFs

On the Coconino NF, 212,720 acres are identified for mechanical treatment as part of the Rim Country EIS. On the Apache-Sitgreaves NFs, 243,995 acres are identified for mechanical treatments. On these two forests, all mechanical treatments are assumed to require adequate road access to facilitate the removal of forest product resulting from forest restoration work.

On the Tonto NF, 210,251 acres have been identified for mechanical treatment as part of Rim Country; however, many of these acres are dominated by chaparral, juniper, or other vegetation with less ponderosa pine present. While these areas may be mechanically treated, it is unlikely that mechanical thinning would be carried out on all of these acres due to the small amount of merchantable material present.

Areas not proposed for mechanical treatments with wood products removal would not need the same level of access as those areas where forest products would be utilized. A minimum of 100 square feet of basal area per acre of ponderosa pine was used to determine which acres would likely need adequate road access to remove forest products. Based on this analysis, 80,561 acres on the Tonto were analyzed for temporary road construction needs. The remaining 129,690 acres on the Tonto were not analyzed for temporary road construction needs, as removal of forest products is considered to be unlikely.

As a result of the previous analyses in the 4FRI footprint, and the basal area threshold of 100 square feet per acre on the Tonto NF, temporary road needs are only analyzed for 243,995 acres of the Apache-Sitgreaves NF, 212,720 acres of the Coconino NF, and 80,561 acres of the Tonto NF, for a total of 537,276 acres within the Rim Country project area.

Road decommissioning is analyzed for 1,080,341 acres within the Rim Country EIS project area. This represents the entire project area outside of the Larson and Upper Rocky Arroyo analysis areas, which have already been analyzed for road decommissioning.

Issues/Indicators/Analysis Topics

The following significant issue was identified for the Rim Country Project:

The miles of temporary roads in the proposed action may negatively affect watershed and stream conditions, and wildlife habitat and connectivity. Commenters asked that the Forest Service limit road networks to those roads needed for access and management. Commenters requested an alternative that dramatically reduces temporary road mileage.

Indicators/Measures:

Indicators will include the range of temporary roads that may be needed in each of the alternatives, measured by the approximate number of miles of temporary roads proposed in each alternative.

Environmental Consequences

Alternative 1 – No Action

Use of Existing Roads

Under Alternative 1, no new restoration activities would take place and no additional use of existing roads would occur. Current rates of public and administrative use would continue.

Road Maintenance

Under Alternative 1, maintenance to provide public and administrative access would continue, contingent upon funding. No increase in road maintenance to accommodate restoration activities would occur.

Road Decommissioning

Under Alternative 1, no road decommissioning would occur within the project area unless it is analyzed under separate NEPA analysis.

Temporary Roads

Under Alternative 1, no new temporary roads would be constructed, unless constructed under separate NEPA analysis

Rock Pit Use and Expansion

Under Alternative 1, there would be no expansion of existing pits. Current use of existing and new pits analyzed under separate NEPA would continue.

Use of In-woods Processing and Storage Sites

Under Alternative 1, no in-woods processing and storage sites would be created or used; therefore there would be no effects resulting from them.

Effects Common to Both Action Alternatives

An adequate transportation system to provide access for restoration work and for removal of forest products generated from restoration activities is critical for accessing stands identified for mechanical treatment. Listed in the following paragraphs are practices that are common to all action alternatives.

Use of Existing System Roads

It is assumed that nearly all of the existing roads within the Rim Country analysis area may be used to provide access for a variety of restoration activities, including hauling of forest products resulting from mechanical treatments. Nearly all of the forest system roads within the project area are ML 1, 2, or 3 roads. This analysis addresses temporarily opening existing closed roads (ML 1) to utilize them for the time period they are needed to provide access for restoration work. These roads would be closed upon completion of work in the area they access and returned to a closed status (ML 1).

The preferred alternative in the Tonto Travel Management EIS proposes that 354 miles of ML 2 roads be converted to motorized trails. These roads have received minimal maintenance over the years and their current condition is not anticipated to improve (narrowing, roughening up, or otherwise modifying the road as it’s redefined to a motorized trail). Full size vehicles would be authorized to use these routes under Tonto Travel Management and they would be managed as motorized trails. It’s anticipated that pre-haul maintenance is all that would be needed in the future to prepare the motorized trails for use to access mechanical treatment areas.

Roads used for hauling of forest products under this analysis would be maintained or improved in order to meet road management standards under National Best Management Practices for Water Quality Management on National Forest System lands.

Road Maintenance

Road maintenance is defined as, “The upkeep of the entire transportation facility including surface and shoulders, parking and side areas, structures, and such traffic-control devices as are necessary for its safe and efficient utilization. This work includes brushing of roadside vegetation, falling danger trees, road blading, cleaning ditches, cleaning culvert inlets and outlets, etc.” (36 CFR 212.1)

Road maintenance on roads that receive substantial use by the public are maintained by the FS on a regular basis as funding allows. When there is a substantial increase in use of a road by a FS contractor for uses such as hauling, this contractor is usually required to perform maintenance both during and after their use of the road commensurate with their use. This maintenance is often blading and reshaping of the road surface. Road maintenance on roads that are closed to the public would be performed by the logging contractor.

Roads used for hauling of forest products under Rim Country would generally be maintained by contactors. This maintenance would likely be done while the road is being used and at the completion of hauling. All maintenance performed by contractors would be in accordance with FS maintenance standards.

Road Decommissioning

Road decommissioning is defined as: "Activities that result in the stabilization and restoration of unneeded roads to a more natural state." (36 CFR 212.1, FSM 7705 – Transportation System) The Forest Service Manual (7712.11- Exhibit 01) identifies five levels of treatments for road decommissioning which can achieve the intent of the definition. These include:

- Block entrance
- Revegetation and water barring
- Remove fills and culverts
- Establish drainage ways and remove unstable road shoulders
- Full decommissioning, recontouring and restoring natural slopes

These five treatments provide a wide range of options to stabilize and restore unneeded roads. In some cases restoration may be achieved by blocking the entrance. In other situations, more extensive actions may be called for.

This analysis does not identify specific road segments for decommissioning. Rather it would provide the NEPA decision to decommission roads and road segments at the time that task orders or other projects are implemented. Roads would be evaluated for decommissioning at that time.

Roads may be decommissioned for a variety of reasons, including but not limited to roads that are:

- No longer needed for future management
- To protect cultural resources

- Causing soil or water resource damage
- Not useable without significant investment beyond current and future funding levels
- An ongoing road maintenance challenge
- An unauthorized road (an unauthorized roads is defined as road that is not a forest road or a temporary road and that is not included in a forest transportation atlas).
- Other unique situations

Under this alternative both National Forest Systems roads and unauthorized roads could be decommissioned. When a system road is decommissioned it is also removed from the National Forest Road System.

Transportation Analysis Process (TAP) reports for the Coconino, Apache-Sitgreaves, and Tonto NFs and site-specific on-the-ground evaluations would be considered in selecting roads for decommissioning.

On the Tonto NF, decommissioning of system roads is being analyzed as part of the Tonto Travel Management EIS and roads for decommissioning are identified. Roads identified for decommissioning under the Tonto Travel Management EIS could be physically decommissioned as part of restoration work undertaken to implement the Rim Country EIS. Additional roads on the Tonto could also be identified for decommissioning as needed in the project area.

Unless already identified for decommissioning under the Tonto Travel Management, roads on all three Rim Country forests that are needed to provide reasonable skidding distances for future harvesting would not be decommissioned. Also, roads that are needed to provide access to leases and other special uses on National Forest System lands would not be decommissioned unless other suitable access is provided. If these roads are needed for future management, but are a problem for soil and water resources, they would instead be relocated.

Unauthorized roads within the project area on all forests could be decommissioned under this decision. Roads currently designated as open on a forest’s Motor Vehicle Use Map would not be decommissioned or closed under this alternative.

Road Relocation

Road relocation is defined as moving an existing road from its current location and re-locating it to a new location. Unfortunately many roads within the project area are poorly located and were never properly designed. As a result these roads are in need of relocation. Roads that could be considered for relocation include those that are:

- Too steep, resulting in significant erosion
- Below the level of the surrounding land and are difficult to drain.
- Are too close to a seasonal or perennial waterbody and contributing sediment to the waterbody
- Other unique situations
- Any combination of the reasons listed above

When roads are relocated, their former location would be decommissioned. This would result in little if any net gain or loss in road mileage in most cases. Road relocation of a system road is not considered construction of a new permanent road. It is considered a relocation of an existing road.

This analysis does not identify specific road segments for relocation. Rather it provides the basis to relocate roads and road segments at the time that task orders or other projects are implemented. Roads would be evaluated for relocation at that time.

Temporary Roads

The Collaborative Forest Landscape Restoration Act (CFLRA), does not allow for the construction of new permanent roads in CFLR projects. Any new road constructed under CFLRA must be a temporary road and cannot be added to the national forest road system. All new road construction in this project will be considered temporary.

A temporary road is defined as: "A road or trail necessary for emergency operations or authorized by contract, permit, lease, or other written authorization that is not a forest road, or trail and that is not included in the transportation atlas." (36 CFR 212.1)

In order to provide adequate access to the project area for timber removal, temporary roads would need to be constructed in some locations. Temporary roads for this project are intended to provide short-term access to a specific area for wood products removal and/or follow up treatments, such as prescribed burning. Temporary roads are often used to provide economically feasible skidding distances in harvest operations. Following completion of work in the area they serve, temporary roads would be decommissioned and made impassable to vehicles. Decommissioning would be accomplished with one or more of the five levels of treatments described above.

Temporary roads might be either new construction or utilize existing road prisms of unauthorized roads.

Rock Pit Use and Expansion

Rock pit use and expansion could require a limited amount of temporary road. This mileage is included in the estimated temporary road mileage under each action alternative.

Use of In-woods Processing and Storage Sites

In-woods processing and storage sites could require a limited amount of temporary road. This mileage is included in the estimated temporary road mileage under each action alternative.

Effects Unique to Each Action Alternative and Differences among Them

Alternative 2 – Modified Proposed Action

Use of Existing Roads

It is assumed that nearly all, if not all, system roads within the project area could be utilized at some point in time to carry out restoration activities.

Road Maintenance

Roads that would be utilized for restoration work and hauling of forest products would likely see pre-haul maintenance if needed to make the roads passable to truck traffic, as well as maintenance during hauling and post haul maintenance. This maintenance would be in addition to a forest's regular schedule of maintenance.

Road Decommissioning

Under this alternative, up to 200 miles of system road on the Coconino and Apache-Sitgreaves NFs could be decommissioned. The Tonto NF Travel Management EIS has identified approximately 290 miles of road within the Rim Country project area for decommissioning. In addition to system road decommissioning, up to 800 miles of unauthorized roads on all three forests may be decommissioned under this alternative.

Road Relocation

Roads might be relocated as needed under this alternative in order to reduce adverse resource effects, to facilitate use for restoration activities, and improve public safety.

Temporary Roads

Under this alternative up to 330 miles of temporary road could be utilized to facilitate mechanical treatments. These temporary roads might be new construction or utilize existing unauthorized roads. Temporary roads would be decommissioned when thinning and related restoration work is completed in the areas that they access.

Alternative 3 – Focused Restoration

Use of Existing Roads

It is assumed that nearly all, if not all roads within the project area could be utilized at some point in time to carry out restoration activities.

Road Maintenance

Roads that would be utilized for restoration work and hauling of forest products would likely see pre-haul maintenance if needed to make the roads passable to truck traffic, as well as maintenance during hauling and post haul maintenance. This maintenance would be in addition to a forest’s regular schedule of maintenance.

Road Decommissioning

Under this alternative up to 200 miles of system road on the Coconino and Apache-Sitgreaves NFs could be decommissioned. The Tonto NF Travel Management EIS has identified approximately 290 miles of road within the Rim Country project area for decommissioning. In addition to system road decommissioning, up to 800 miles of unauthorized roads on all three forests could be decommissioned under this alternative.

Road Relocation

Roads might be relocated as needed under this alternative in order to reduce adverse resource effects, to facilitate use for restoration activities, and improve public safety.

Temporary Roads

Under this alternative up to 170 miles of temporary road could be created and utilized to facilitate mechanical treatments. These temporary roads might be new construction or utilize existing road prisms of non-systems roads already present. Temporary roads would be decommissioned when thinning and related restoration work is completed in the areas that they access.

Cumulative Effects

Alternative 1 – No Action

Under Alternative 1, there are no proposed activities so there would be no additional cumulative effects in the project area from; use of existing roads, road maintenance, road decommissioning, temporary roads, rock pit use and expansion, and use of in-woods processing and storage sites.

Alternative 2 – Modified Proposed Action

Use of Existing Roads

Use of existing roads under this alternative would be in addition to current use by both the public and contractors and permittees for other authorized projects on national forest lands.

Road Maintenance

Road maintenance performed under this alternative would be in addition to road maintenance performed currently under a forest regular program of road maintenance

Road Decommissioning

Road decommissioning performed under this alternative would be in addition to decommissioning of national forest system roads and unauthorized roads that has been performed in the past.

Road Relocation

Any roads relocated under this alternative would be in addition to roads relocated on other projects within the Rim Country project area.

Temporary Roads

Temporary roads that are constructed and then decommissioned would be in addition to temporary roads that have been constructed and utilized for vegetation and fuels reduction projects in the past.

Alternative 3 – Focused Alternative

Use of Existing Roads

Use of existing roads under this alternative would be in addition to current use by both the public and contractors and permittees of other authorized projects on national forest lands.

Road Maintenance

Road maintenance performed under this analysis would be in addition to road maintenance performed currently under a forest regular program of road maintenance.

Road Decommissioning

Road decommissioning performed under this alternative would be in addition decommissioning of national forest system roads and unauthorized roads that has been performed in the past.

Road Relocation

Any roads relocated under this alternative would be in addition to roads relocated on other projects within the Rim Country project area.

Temporary Roads

Temporary roads that are constructed and then decommissioned would be in addition to temporary roads that have been constructed and utilized for harvesting and fuels reduction projects in the past.

Unavoidable Adverse Effects

Though both action alternatives (Alternatives 2 and 3) were designed to move resources toward desired conditions, implementation of either one would result in some unavoidable, short-term, adverse effects. At the same time, implementation of Alternative 1, the no action alternative, would also result in some unavoidable, short-term, adverse effects from forest management activities that are part of other projects and from wildfires that may occur within or near the Rim Country project area.

Adverse effects from implementation of either of the action alternatives would be limited in extent and duration by ensuring that management activities are consistent with standards and guidelines from the forest plans and proposed amendments. Project design features, found in Appendix C, along with mitigations and protocols in Appendix J of the Programmatic Agreement between the Southwestern Region of the Forest Service, the Arizona, New Mexico, Texas and Oklahoma State Historic Preservation Offices and the Advisory Council on Historic Preservation, would apply to both action alternatives and would provide additional means and mitigations to avoid or minimize adverse effects while still meeting the purpose and need of the project.

Implementation of activities in both action alternatives could result in some of the following unavoidable, short-term, adverse effects (further details can be found in the respective resource sections of this chapter):

1. Individuals of some threatened and endangered species, as well as some sensitive species, may be harmed. Habitat for certain species may be temporarily adversely affected.
2. Short-term disturbances to grasses, forbs, shrubs, and small trees may occur.
3. Air quality may temporarily decrease.
4. Erosion and soil compaction may temporarily increase.
5. Water quality may be temporarily affected.
6. Cultural artifacts, features, and sites may be disturbed or damaged.
7. Tribal access to Traditional Cultural Properties and forest products may be temporarily hindered during implementation of treatments.
8. Temporary decreases in access to recreation opportunities and deviations from scenic integrity objectives may occur.
9. Forage availability may decrease temporarily.
10. Noxious weed infestation may increase.

None of the alternatives has expected energy requirements or conservation potential (40 CFR 1502.16(e)).

Natural or depletable resource requirements and conservation potential of various alternatives and mitigation measures, as well as means to mitigate adverse environmental effects are discussed in the resource sections of this chapter and in Appendix C (40 CFR 1502.16(f)).

None of the alternatives would affect the design of the built environment. The effects of implementing the alternatives on urban quality and historic and cultural resources (40 CFR 1502.16(g)) are displayed in the Fire Ecology and Air Quality, Tribal Relations, and Heritage Resources Reports and the corresponding sections of this chapter.

Short-term Uses and Long-term Productivity

NEPA requires consideration of “the relationship between short-term uses of man’s environment and the maintenance and enhancement of long-term productivity” (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101). Consistent with the Multiple-Use Sustained-Yield Act of 1960 (16 U.S.C. 528-531), the Forest Service manages each national forest to sustain the multiple use of its renewable resources in perpetuity while maintaining the long-term health and productivity of the land. Land management plans (forest plans) guide sustainable, integrated management of the resources within the plan area in the context of the broader landscape, giving due consideration to the relative values of the various resources in particular areas (36 CFR 219.1(b)). By ensuring that proposed treatment activities and design features in both action alternatives move resources towards desired conditions in a manner consistent with forest plan direction, the long-term productivity of the land would not be impaired by short-term uses associated with implementation of either action alternative. All potential short-term disturbances would be evaluated and mitigated at a site-specific level prior to implementation. This disclosure focuses on soils, water, and vegetation resources. More detailed discussions related to short-term uses and long-term productivity can be found in the effects analysis sections for the individual resources earlier in this chapter and in individual resource specialist reports.

Soils and Water

Implementation of Alternative 1, the no action alternative, would not directly affect soil and water productivity and quality, though it would result in continued loss of soil productivity on, and erosion from, roads that would be decommissioned by implementation of either of the action alternatives. It would do nothing to avoid or decrease undesirable effects on soils and water quality from future wildfires.

Restoration treatments and associated activities, including prescribed fire, in Alternatives 2 and 3 would result in some ground disturbance and would produce short-term, localized effects to soil productivity and water quality. Long-term benefits of treatments in both alternatives would include avoiding or decreasing undesirable effects on soils and water quality from future wildfires and improving overall soil retention and water quality in degraded watersheds. Because of the larger area over which mechanical thinning and prescribed fire treatments would be implemented in Alternative 2, both the short-term effects and long-term benefits to productivity would be greater than those from activities in Alternative 3. Both action alternatives would decommission equal mileages of forest system and unauthorized roads, leading to positive long-term benefits on soil productivity and water quality in the areas around those roads under either alternative.

Vegetation

Alternative 1 would not directly result in short-term effects on the productivity of vegetation. At the same time, it would not address the problems of stagnant tree growth and mortality, or susceptibility to fire and insect or disease outbreaks. Thus it would be expected to lead to declining productivity, if not outright losses of over- and understory species from stand-replacing wildfires and insect or disease outbreaks over the long term.

Implementation of either action alternative would lead to short-term effects on and mortality of vegetation from disturbances associated with implementing restoration treatments. However, restoration treatments would reduce inter-tree competition, improve growth and vigor of residual trees, and increase understory productivity and diversity, including of shade-intolerant species. These treatments would also improve resistance and resilience to wildfires, climate change, and insect and disease outbreaks, thus maintaining or enhancing the long-term productivity of restored ecosystems.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be undone, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time, but are reversible, such as the temporary loss of canopy cover in forested areas that are kept clear for use as a power line right-of-way or road. See discussions of environmental consequences for individual resources earlier in this chapter for more detail.

A likely outcome of Alternative 1 would be one or more high-intensity, stand-replacing wildfires in the project area. Post-fire effects on resources that require decades or longer to recover would constitute irretrievable commitments of those resources in the short term and potentially the long term. For example, topsoil, which is critical to healthy surface vegetation, would take centuries to fully recover. Likewise, the loss of old and large trees would be irretrievable and would require many decades, if not centuries, to recover. Given uncertainties of the effects of climate change and the possibility of post-fire vegetation type conversions from forest to non-forest, the loss of entire stands to wildfires could represent an irreversible commitment of those resources. Cultural resources are non-renewable, and direct damage from high-intensity wildfires, such as spalling of rock art or cracking of artifacts, would represent an irreversible commitment of those resources. In addition, indirect effects of high-intensity wildfires on cultural resources, such as damage from bulldozers used during suppression operations, or exposure following post-fire erosion, can lead to irreversible degradation or losses of cultural resources.

Alternative 1 would not result in additional road decommissioning within the project area beyond what may occur as part of other projects or management activities. Relative to the action alternatives, both of which would include decommissioning of up to 490 miles of existing system roads and 800 miles of unauthorized roads, the lost soil and vegetation productivity associated with continued use of these roads in Alternative 1 would represent an irretrievable commitment of these resources.

Alternatives 2 and 3 include mechanical thinning and prescribed burning on approximately 953,130 and 529,060 acres, respectively. Potential cultural resource damage from thinning, burning, and related activities would represent an irreversible commitment of these resources. Design features and established mitigation measures and protocols would help avoid and minimize potential negative effects on cultural resources.

Alternatives 2 and 3 include the construction of up to 330 and 170 miles of temporary roads, respectively. Decreases in soil and vegetation productivity while these roads are used would represent irretrievable commitments of resources. Inadvertent damage to cultural resources from construction and use of temporary roads would be an irreversible commitment of these resources. Design features, along with established mitigation measures and protocols to protect cultural resources, would help avoid and minimize potential negative effects of construction and use of temporary roads. Temporary roads would be decommissioned when restoration work is completed in the areas to which they provide access.

Alternatives 2 and 3 include the proposed expansion of 11 existing rock pits to provide adequate sources of road surfacing material for project-related activities. The expansion of these pits would represent an irretrievable commitment of resources due to the removal of developed soils needed for vegetative growth on approximately 27 acres. The differences in soil productivity within the pit and in the surrounding area would be distinct and unavoidable, though effects on other resources would be mitigated by using design features. The loss of productive topsoil from rock pit expansion would be offset by decreases in soil erosion on and along roads from the proper maintenance of road surfaces to manage runoff.

Alternatives 2 and 3 include the potential for creation of up to 12 in-woods processing and storage sites to facilitate more utilization of forest resources, increase transportation efficiencies, and reduce implementation costs. The surface area for all 12 processing sites would be 127 acres, with individual sites ranging in size from four to 21 acres. Sites were chosen to minimize potential effects on soils and water quality, and design features were developed to further mitigate potential effects on these and other resources. Nonetheless, the clearing and preparation for use of any of these sites would result in irretrievable commitments of vegetation and soil productivity resources, since vegetation would be cleared and topsoil displaced and compacted if any of these sites are used.

Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs "To the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with… other environmental review laws and executive orders."

1. Implementation of restoration activities, temporary road construction, and road decommissioning may require Section 404 permits from the U.S. Army Corps of Engineers and/or Section 401 permits from the Arizona Department of Environmental Quality (ADEQ) or tribes, as required by the Clean Water Act, if they involve dredging or discharging fill into waters of the U.S., or if they may result in discharges to state or tribal waters.

2. In-woods processing and storage sites would likely be regulated as industrial sites subject to permitting under ADEQ's Multi-Sector General Permit program. This permit program requires that certain industrial facilities implement control measures and develop site-specific stormwater pollution prevention plans to comply with Arizona Pollutant Discharge Elimination System (AZPDES) requirements.

3. All operators at rock pit sites must have or obtain coverage under an AZPDES permit and establish and implement a stormwater pollution prevention plan, if required, to comply with state water requirements based on the magnitude of the specific rock pit operation.

4. Permits for installation of aboveground storage tanks at in-woods processing sites, and for temporary fuel storage tanks used to implement restoration treatments would have to be obtained through the Arizona State Fire Marshall's Office.

5. Petroleum storage in aboveground containers with a total aggregate capacity of 1,320 gallons or more, would be subject to the Spill Prevention, Countermeasures, and Contingency (SPCC) Rule and an SPCC plan would be required (40 CFR Part 112).

6. Best management practices would be implemented and monitored for all activities with the potential to impair water quality in accordance with the intergovernmental agreement between ADEQ and the Forest Service Southwestern Regional Office to control and manage nonpoint source pollution.

7. All prescribed burning would be coordinated daily with ADEQ to comply with state and federal regulatory requirements and to ensure ADEQ is aware of potential smoke impacts to receptors. Burning would not take place without prior approval from ADEQ.

8. The U.S. Fish and Wildlife Service, in accordance with the Endangered Species Act regulations for projects with threatened or endangered species, provided informal project design input as the alternatives were developed. Formal consultation will begin after the official DEIS comment period.
9. Current denning/rendezvous site locations of Mexican gray wolves and any necessary changes to planned restoration activities due to proximity to those sites would be determined through coordination with the Mexican Wolf Interagency Field Team.
10. If cultural sites are found during pre-implementation surveys or during activity implementation, the Forest Service will follow guidance found at 36 CFR 800.12 and in the Programmatic Agreement between the Southwestern Region of the Forest Service, the Arizona, New Mexico, Texas and Oklahoma State Historic Preservation Offices and the Advisory Council on Historic Preservation. Implementation of this guidance is done in consultation with the AZ State Historic Preservation Office and tribes, if appropriate, and an effort is made to minimize effects to the discovery.
11. In accordance with the National Historic Preservation Act (NHPA), Executive Order 13175, the Programmatic Agreement, and other regulations and policies, the Tonto Tribal Liaison has begun government-to-government consultation for the Rim Country project. Consultation with Native American tribes on the Rim Country project was initiated on August 16, 2016 and will continue throughout the project’s 10- to 20-year life span.
12. Appendix J of the Programmatic Agreement is a protocol for large-scale fuels reduction, vegetation treatment, and habitat improvement projects developed in consultation with and signed by the Regional Forester, all four State Historic Preservation Offices, and the Advisory Council. Appendix J describes the methods to be used to achieve a No Adverse Effect determination for the Rim County analysis as a whole, while providing a strategy for a phased NHPA Section 106 evaluation for individual task orders.
13. Individual task orders, or undertakings, will be inventoried when each specific project area is identified. A NHPA Section 106 report will be produced for each proposed individual undertaking, and all consultation with the AZ State Historic Preservation Office and appropriate tribes will be completed prior to implementing the task order.

See the Law, Regulation, and Policy section earlier in this chapter for more information on applicable laws, regulations, and policies.

Chapter 4. List of Preparers and Consultants

The following personnel were involved in preparation of the draft environmental impact statement (DEIS).

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Cary Thompson	Wildlife Biologist, Flagstaff Ranger District, Coconino NF	Wildlife	B.S., Biology (fish and wildlife emphasis), Northern Arizona University, 1995. Years of Experience: 22
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John Souther	4FRI NEPA Specialist	NEPA	M.S., Geography, University of Wisconsin - Madison, 2014; B.S., Geology, West Virginia University, 2003. Years of Experience: 3
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Matthew O'Neill	Forest Fisheries Biologist, Coconino NF	Aquatics	Ph.D., Biology, Northern Arizona University, 2012; M.S., Biology, Northern Arizona University, 2005; B.S., Biology, Florida Institute of Technology, 1999. Years of Experience: 8
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Name	Title	DEIS Contribution	Education and Experience
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William Dudley	North Zone Fuels Specialist, Tonto National Forest	Fire Ecology and Air Quality	Fire Ecology and Management Certificate, Northern Arizona University, 2018. Years of Experience: 4

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Chapter 5. Distribution List (This section needs updating)

Introduction

This chapter lists all tribes, agencies, organizations, and persons to whom the draft environmental impact statement (DEIS) was provided. Distribution methods include paper copies, DVDs, and electronic documents posted on the 4FRI Web site: http://www.fs.usda.gov/4FRI.

Tribes and Tribal Chapters

As part of this project, the Forest Service consulted with following tribes and tribal chapters who have historic ties and interests in the Apache-Sitgreaves, Coconino, and Tonto National Forests: Fort McDowell Yavapai Nation, Gila River Indian Community, Havasupai Tribe, Hopi Tribe, Hualapai Tribe, Kaibab Band of Paiute Indians, Navajo Nation, Mescalero Apache Tribe, Salt River Pima–Maricopa Indian Community, San Carlos Apache Tribe, San Juan Southern Paiute Tribe, Tonto Apache Tribe, White Mountain Apache Tribe, Yavapai–Apache Nation, Yavapai–Prescott Indian Tribe, Pueblo of Acoma, and Pueblo of Zuni. Eight Navajo Chapters in proximity to the project area – the Alamo, Bodaway/Gap, Cameron, Coalmine Canyon, Dilkon, Lechee, Leupp, Ramah, Tolani Lake, and To'Nanees'Dizi Chapters – and the Dine Medicine Man's Association are also included.

Federal, State, and Local Agencies and Representatives

Federal

Advisory Council on Historic Preservation, Washington, DC

National Oceanic and Atmospheric Administration, Southwest Region Fisheries Habitat Conservation Division, Long Beach, CA

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USDA National Agricultural Library, Beltsville, MD

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U.S. Department of the Interior, Office of Environmental Policy & Compliance, Washington, DC

U.S. Environmental Protection Agency, Region 9, San Francisco, CA

U.S. EPA, Region 8, Denver, CO

USDI Fish and Wildlife Service, Flagstaff, AZ

U.S. Federal Aviation Administration, Western-Pacific Region, Lawndale, CA

U.S. Federal Highway Administration, Arizona Division, Phoenix, AZ

USDI National Park Service, Flagstaff, AZ

U.S. Navy, Energy and Environmental Readiness Division, Washington, DC

State

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Arizona State Fire

Arizona State Forestry Division, Flagstaff, AZ Arizona State Historic Preservation Office Arizona State Junior Senator Jeff Flake

Arizona State Senior Senator John McCain

Congresswoman Anne Kirkpatrick, Congressional District 1 Congressman Raul Grivalva, Congressional District 7 Western Area Power Administration

Local

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City of Flagstaff, Flagstaff, AZ

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Gila County, Silver City, NM Graham County, Safford, AZ Greenlee County, Clifton, AZ

Mountainaire Community Council, Flagstaff, AZ Navajo County, Holbrook, AZ

Sedona City Council, Sedona, AZ Tusayan City Council, Tusayan, AZ Williams City Council, Williams, AZ Yavapai County, Districts 1 to 3

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