Four Forest Restoration Initiative

Rim Country EIS

Terrestrial Wildlife Specialist Report

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Rim Country EIS

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Introduction

This report documents existing and desired ecological conditions, proposed alternatives to address the difference between existing and desired conditions, and analyses of the effects of those alternatives on species of status. Status species include: threatened, endangered and proposed species and their critical habitats listed under the Endangered Species Act (ESA) of 1973, as amended; Region 3 Sensitive Species (updated in 2013); Management Indicator Species (MIS; MIS for the Apache-Sitgreaves National Forest [NF] were replaced by Focal Species in 2015 and for the Coconino NF in 2017); and Migratory Birds and their habitats for the Rim Country project area, Coconino, Tonto and Apache-Sitgreaves NFs. Regulatory requirements for effects analyses and determinations were met using the best available science, collective expertise of local professionals, reviews and evaluations of habitat conditions as reported in the methodology section, and professional judgment. Status of and effects on wildlife are described in this report by species and species assemblages.

The desired condition from implementation of Rim Country is to reestablish and restore forest structure and pattern, forest health, and vegetation composition and diversity. There is a need to increase forest resiliency and sustainability, protect soil productivity, and improve soil and watershed function. Resiliency increases the ability of the ponderosa pine forest to survive natural disturbances such as fire, insect and disease, and climate change (FSM 2020.5). The objective of these analyses is to identify how well the proposed alternatives would accomplish this and thereby change forest resiliency and function. Resiliency increases the ability of the ponderosa pine forest to survive natural disturbances such as insects, disease, fire, and climate change. This project should put treated forests on a trajectory toward comprehensive, landscape-scale restoration with benefits that include improvements in vegetation communities, soil productivity, watershed function, biodiversity, and so improve wildlife habitat.

Detailed descriptions of the alternatives are in Chapter 2 of the Rim Country Environmental Impact Statement (EIS). Detailed analyses of the proposed restoration activities are described in the Silviculture, Fire Ecology and Air Quality Reports. This report incorporates these reports by reference.

Relevant Law, Regulation, and Policy

The Forest Service is legally required to comply with a number of federal laws, regulations, and policy, including: the Endangered Species Act (ESA) of 1973, as amended, the Bald and Golden Eagle Protection Act of 1940, as amended, Forest Service Manual (FSM) 2600, the Migratory Bird Treaty Act of 1918 (as amended), Executive Order 13186 (migratory birds), National Environmental Policy Act, 1969, National Forest Management Act, 1976 (as amended), and the Land and Resource Management Plans (as amended or revised) for the Apache-Sitgreaves (2015), Coconino (2018), and Tonto (1985) National Forests.

Endangered Species Act (ESA)

The ESA directs all Federal agencies to use their authorities to carry out programs for the conservation of listed species. It prohibits Federal agencies from carrying out actions likely to jeopardize the continued existence of species listed under the Endangered Species Act. It further requires Federal agencies to consult with the FWS on actions authorized, funded, or carried out by such agencies that may affect listed species and/or their designated critical habitat. The ESA requires consultation with the Secretary of the Interior whenever an action is likely to jeopardize the continued existence of any species proposed for listing as threatened or endangered, or whenever an action might result in destruction or adverse modification of critical habitat proposed for listing.

The Endangered Species Act (ESA, PL 93-205), Forest Service Manuals (FSM) 2670.11, 2670.21, and 2670.31, and forest plan standards and guidelines all require that National Forest land be managed for both conservation and recovery of endangered, threatened, and proposed species. Section 7 of the ESA requires a Biological Assessment be done by Federal agencies for review by the Secretary of Interior to ensure that agency actions are not likely to jeopardize the continued existence of federally listed species and includes actions that further the conservation of endangered species and threatened species listed pursuant the ESA. FSM 2670 directs the Forest Service to manage habitats to assist in the recovery of threatened, endangered and proposed species, and to avoid actions "which may cause a species to become threatened or endangered."

Forest Service Manual (FSM) Direction

The Wildlife specialist report was prepared in accordance with FSM direction 2672.42 and meets legal requirements set forth under Section 7 of the ESA and implementing regulations [19 U.S.C. 1536 (c), 50 CFR 402.12 (f) and 402.14 (c)] to ensure that Forest Service actions do not contribute to loss of viability of any native or desired non-native plant or animal species, or contribute to trends toward Federal listing of any species; and, to provide a process and standard by which to ensure that threatened, endangered, proposed, and sensitive species receive full consideration in the decision-making process.

Forest Service Sensitive Species

The 2012 Planning Rule introduced Species of Conservation Concern. Directives for identification of SCC are found in FSH 1909.12 Chapters 10 and 20. Regional Forest Sensitive Species RFSS are based on FSM2670. Forests use the RFSS list until they complete plan revision and develop the SCC list. The forests of Rim County do not have completed lists of SCC so RFSS will be used for this report. 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). A primary objective of Forest Service policy is to develop and implement management practices to ensure that species do not become threatened or endangered due to Forest Service actions (FSM 2670.22). Project-level guidance described in FSM 2672.4 was followed:

1. All listed, proposed, and sensitive species known or expected to be in the project area or that the project could potentially affect were identified. Presence was determined by direct observation, ranger district files, and use of the Forest Attributes and Wildlife Needs (FAAWN) database (Patton 2011, see Methodology). The USUSFWS was contacted at the start of the planning process and was involved in project design before project boundaries were even delineated.

2. Occupied and suitable (i.e., potentially occupied) habitat was identified and appropriate vegetation classes defined in the vegetation database. Habitat was summarized by acres for individual sensitive species (see Affected Environment).

3. An analysis of the effects from the proposed action on species and their habitat was conducted for individual sensitive species (see Environmental Consequences).

4. A discussion of cumulative effects resulting from the planned project in relationship to existing conditions and other related projects (see Description of Alternatives and Environmental Consequences).

5. Determinations of no effect, may affect, not likely to adversely affect, or may adversely affectand rationale for the determination was completed for individual sensitive species (see Environmental Consequences).

6. Design features for removing, avoiding, or reducing adverse effects are presented in the Description of Alternatives, Appendix 5, and within the anlysis for individual species.

7. Many sources of information were used in the development of this biological evaluation. Data sources are identified in Methodology, literature references are identified in the Literature Cited, and consultation with the USFWS is in progress.

The National Forest Management Act of 1976

The National Forest Management Act of 1976 required the Secretary of Agriculture to develop guidelines for land management planning with the individual forest being the planning unit or area. The Act states that "Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area" (36 CFR § 219.19). A viable population is defined as "[a population] which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area" (§ 219.19). Therefore, management of viable populations is intended to be accomplished at the individual national forest level (planning area).

National Environmental Policy Act of 1969 (NEPA)

NEPA established procedures for decision making, disclosure of effects, and public involvement on all major federal actions. Forest Service Manual 1950.2 requires a consideration of the impacts of Forest Service proposed actions on the physical, biological, social, and economic aspects of the human environment (40 CFR § 1508.14).

Management Indicator Species (MIS)

Management indicators are: "Plant and animal species, communities, or special habitats selected for emphasis in planning, and which are monitored during forest plan implementation in order to assess the effects from management activities on their populations and the populations of other species with similar habitat needs which they may represent" (FSM 2620.5). Forestwide assessments summarize current knowledge of population and habitat trends for management indicator species on the Coconino (USDA FS 2017), Tonto (2016) and Apache-Sitgreaves (2014) NFs. Additional site specific (Game Management Unit) population information was provided by Arizona Game and Fish Department (AZGFD).

Migratory Bird Treaty Act (MBTA)

The MBTA (as amended 1998) implements conventions between the United States and four other countries (Canada, Mexico, Japan, and Russia) for the protection of migratory birds (16 U.S.C. 703). Executive Order (EO) 13186, signed January 10, 2001, imposes procedural requirements on evaluating project level effects on migratory birds with emphasis on state designated priority species. Under this combined direction the FS must identify where unintentional take reasonably attributable to agency action is having, or is likely to have, a measurable negative effect on migratory bird populations. Removal or destruction of vegetation is not considered "take" under the MBTA. Project evaluations should include effects on Important Bird Areas where applicable and be aware of opportunities to restore or enhance migratory bird habitat or mitigate negative project effects.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (Eagle Act), originally passed in 1940, prohibits the take, possession, sale, purchase, barter, offer to sell, purchase, or barter, transport, export, or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit (16U.S.C 668(a) -668(d); 50CFR 22). "Take" is defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb" a bald or golden eagle. The term "disturb" under the Eagle Act was recently defined via a final rule published in the Federal Register on June 5, 2007 (72 FR 31332). "Disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.

All golden and bald eagles are protected under the Eagle Act. Project analysis must determine if take is likely to occur with implementation of Alternatives 2 and 3. The USFWS issued a report titled "Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance" (Pagel et al. 2010) to protect golden eagles.

E.O. 13443 – Facilitation of Hunting Heritage and Wildlife Conservation

The purpose of this order is to direct Federal agencies that have programs and activities that have a measurable effect on public land management, outdoor recreation, and wildlife management, including the Department of the Interior and the Department of Agriculture, to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat.

Forest Plan Direction

The Coconino, Apache-Sitgreaves and Tonto National Forest Plans provide management direction for the Wildlife resource as follows:

The Coconino NF Revised Land and Resource Management Plan (USDA FS 2017hereafter called Coconino Forest Plan) determined standards and guidelines for snags and downed logs, wildlife cover, raptor nest buffers, old growth, turkey nesting and roosting habitat, and pronghorn habitat. It also provides wildlife direction for other programs, including forest management, range management, recreation, and etc. The plan follows habitat management objectives and species protection measures from approved recovery plans that should be applied to activities occurring within federally listed species habitat to promote recovery of the species.
The Apache-Sitgreaves NF Revised Land and Resource Management Plan (USDA FS 2015; hereafter called A-S Forest Plan) provides directions for the range of snags and down materials along with desired conditions of the vegetation types across the forest. The guidelines in the Threatened, Endangered and Sensitive species section follow the habitat management objectives and species protection measures from approved recovery plans that should be applied to activities occurring within federally listed species habitat to promote recovery of the species.
The Tonto NF Revised Land and Resource Management Plan (USDA FS 1985; hereafter called Tonto Forest Plan) provides directions for the range of snags and down materials along with desired conditions of the vegetation types across the forest. The Tonto NF is in a draft stage of forest plan revision as of December 2018 (USDA FS 2018).

There are three project level amendments proposed as part of Rim Country for the Tonto NF Land and Resource Management Plan. These amendments are for Mexican spotted owl, northern goshawk and slope restrictions. The following amendments are needed:

- The Mexican spotted owl (MSO) amendment would update the Tonto Forest Plan so it is consistent with the 2012 MSO recovery plan; which the Apache-Sitgreaves and Coconino

Forest Plans already incorporate. This plan amendment updated definitions, language, and treatments within MSO habitat.

- The goshawk amendment would update guidance and direction in the Tonto Forest Plan so it is consistent with the Apache-Sitgreaves and Coconino NFs revised forest plan management direction.
- The slope restrictions amendment would remove language from the Tonto Forest Plan restricting mechanical equipment to slopes less than 40 percent as well as removing language that identifies those slopes as inoperable. Rim Country proposed the use of specialized mechanical equipment to restore steep slopes. .

Consistency with Forest Plan Biological Opinions: Based on a review of the Land and Resource Management Plan Biological Opinions for the Coconino (USDI USFWS 2017), Tonto (USDI USFWS 1985) and Apache-Sitgreaves (USDI USFWS 2015) NFs, and the information discussed in the effects analysis, implementation of any of the action alternatives would be consistent with the forest-wide programmatic Land and Resource Management Plan Biological Opinions for the Coconino, Tonto and Apache-Sitgreaves NFs.

Affected Environment

Vegetation Cover Types Within the Project Area

The Rim Country project area is approximately 1,240,000 acres and includes state, private, and federal lands. Also within the project area are recent and ongoing vegetation management projects excluded from Rim Country planning. The Rim Country Project acres analyzed for treatment equal about 940,000 acres of predominantly ponderosa pine, pine-oak, and mixed dry conifer forest. Mixed wet conifer, aspen, juniper, pinyon-juniper, oak-shrub, Madrean pinyon-oak, cottonwood, and non-forested (including grasslands) cover types are included in the Rim Country project area (Table 1). Other lands managed by the FS within the project area include designated wilderness, and other current and recent projects planned by the individual ranger districts.

Table 1. Vegetation Cover Type Acres.

Cover Type	Coconino	Sitgreaves	Tonto	Grand Total
Aspen	635	805		1,440
Grassland/Meadow	12,292	6,526	25	18,843
Madrean Woodland			24,996	24,996
Mixed Conifer with Aspen	1,809	1,311		3,120
Mixed Conifer/Frequent Fire	16,648	21,207	11,444	49,299
Pinyon-Juniper Woodland	29,074	80,027	25,961	135,062
Ponderosa Pine	196,976	281,548	77,779	556,304
Ponderosa Pine/Evergreen Oak	1,824	9,052	137,193	148,069
Riparian	2,716	5,402	6,440	14,558
Grand Total	261,974	405,878	283,839	951,691

The cover types above possess key habitat features outside of the natural range of variation (NRV). Forests within the Rim Country project area 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. Most springs within the project area are either rheocrene- meaning they flow directly from the ground resulting in a small stream, helocrene- they emerge from low gradient wetlands, or hillslope – they emerge from confined or unconfined aquifers on a hillslope (typically 30 to 60 degrees); often with indistinct or multiple sources.

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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 five Regional Forester sensitive species (see the Aquatics 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 (NRV). 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.

Climate Change Common to All Alternatives

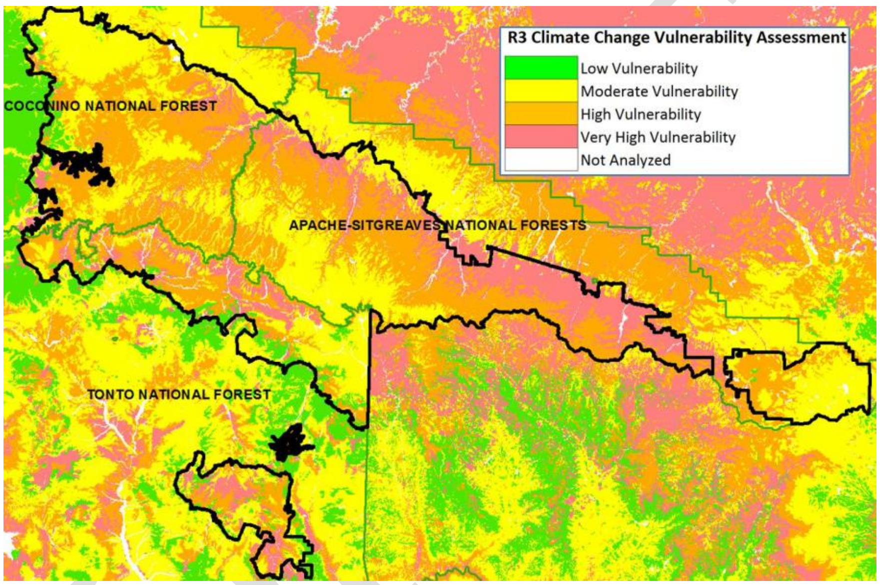
From: USDA Forest Service. 2017. Climate change vulnerability assessment – Coconino National Forest and Rim Country project area. Unpublished technical report, on file. Regional Office, Albuquerque NM.

The Climate Change Vulnerability Assessment project (CCVA) was developed as an ecosystem-based evaluation of the potential vulnerability of Southwest ecosystems to the projected climate of late 21st-century. This report provides tabular summaries for major upland Ecological Response Units (ERUs) of the Rim Country project area. Ecological Response Units (ERUs) are map unit constructs, technical groupings of finer vegetation classes. The suite of vegetation classes that make up any given ERU share similar disturbance dynamics, plant species dominants, and theoretical succession sequence (potential vegetation). A total of 10 major ERUs were identified for Rim Country. Minor ERUs, including wetland

and riparian, collectively represent about two percent of the Forest. Ponderosa Pine Forest makes up the largest portion of the Rim Country reporting areas at about 60 percent.

In broad terms it may be helpful to think of future climate simply as a potential stressor of significant change (i.e., on structure, composition, function), with the vulnerability rating on par with risk or probability of stress, either low, moderate, high, or very high. In more specific terms, vulnerability can be considered the ‘relative probability of type conversion’.

Figure 1. Patterns of vulnerability to climate change within the Rim Country project area on the Apache-Sitgreaves, Coconino, and Tonto NFs and surrounding lands of central Arizona. The National Forests are represented by extents within the dark green borders.



The Assessment 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.

Issues/Indicators/Analysis Topics

Two issues were raised from commenters during the scoping process regarding terrestrial wildlife:

1) The Proposed Action may have negative effects on Mexican spotted owl (MSO) by cutting trees up to 17.9 inches in diameter in MSO protected activity centers (PACs). The Forest Service should act conservatively to protect MSO habitat and consider all cautions identified in the revised Recovery Plan for MSO (USDI, 2012). There is a concern about how MSO will respond to the removal of trees up to 17.9 inches in diameter, given a lack of monitoring data.

This issue is addressed in the effects analysis for all alternatives, and via design features and conservation measures as outlined in the revised Recovery Plan. The wildlife analysis would reference all available monitoring information from the 1st 4FRI EIS and from other sources across the Region.

Indicators include changes in amount and quality of MSO nest/roost habitat within PACs in the project area. Specific measures include:

a) Acres treated and improved by habitat/vegetation type by alternative within MSO habitat Type (mixed conifer, pine oak, canyon) and management type (Protected, and recovery habitats).
b) Changes in BA by tree size-classes to show uneven aged management by alternative within MSO Habitats to protect large tree density and encouragement of more large trees in protected and nest/roost recovery habitat.
c) Changes in Quadratic Mean Diameter in inches, Trees per Acre, Stand Density Index, Canopy Cover, and Basal Area Average by alternative in MSO Habitats.
d) Change in numbers per acre of snags, with a diameter of 12 inches and greater by alternative in MSO Habitats.

Measures to assess the effects of wildfires in MSO habitat include:

a) Changes in Fuel Loading in tons per acre by alternative
b) Changes in potential fire behavior (Fire Hazard Index) by alternative in MSO habitats.
c) Changes in risk of crown fire by alternative and MSO habitats.

MSO prey habitat measures include:

a) Number per acre of snagsand coarse woody debris (tons per acre) in MSO habitats.

b) Changes in percent shrub and herbaceous biomass in tons per acre (to maintain fruits, seeds, and regeneration to provide needs of MSO prey species) in MSO habitats.

2) Treatments in Goshawk Habitat: There is a potential for adverse effects on Northern Goshawk from proposed treatments. Specifically, there is a concern that treatments would result in a reduced mix of densities and cover types, including later seral stages in pure ponderosa pine.

This issue would be addressed in the effects analysis for all alternatives, and via design features and conservation measures as outlined in the most current management recommendations for northern goshawk. Forest plan standards and guidelines for northern goshawk would be applied.

Indicators will include changes in amount and/or quality of goshawk nesting and PFA habitat. Specific measures would include:

a. Acres treated/improved by habitat/vegetation type by alternative in PFAs and ponderosa pine areas outside of PFAs.
b. Changes in tree size-classes by alternative in PFAs and ponderosa pine areas outside of PFAs.
c. Changes in Quadratic Mean Diameter in inches, Trees per Acre, and Stand Density Index by alternative in PFAs and ponderosa pine areas outside of PFAs.
d. Number per acre of snags, and coarse woody debris (CWD) tons per acre in PFAs and ponderosa pine areas outside of PFAs.
e. Changes in percent shrub/herbaceous biomass (to maintain fruits, seeds, and regeneration to provide needs of goshawk prey species) in PFAs and ponderosa pine areas outside of PFAs.
f. Changes in fuel loading in tons per acre by alternative in PFAs and ponderosa pine areas outside of PFAs.
g. Changes in potential fire behavior (Fire Hazard Index) by alternative in PFAs.
h. Changes in risk of crown fire by alternative in PFAs.

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 growth, 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.

Fire Hazard Index

Five datasets were used to identify areas of high probability for severe fire effects and/or extreme behavior. These datasets are crown fire potential, fireline intensity, heat per unit area, slope, and soils with high erosion potential. As a general rule, the amount and size of plants top-killed by fire increases with an increase in either the rate of heat energy released (fire intensity) or total amount of heat energy released (heat/unit/area). Estimates of the rate and amount of this heat release are thus important descriptors of fire behavior (Wade 2013).

Table 2 Fire Hazard Index scores used to identify the need for treatment for target vegetation types.

Rating	Comments
1 – low need for treatment	Conditions are such that expected fire behavior would have minimal negative impacts to resources and where needed suppression efforts are expected to effective
2 – average need for treatment	From a fire perspective, areas where crown fire is expected would not pose a threat to soil stability. Areas of high erosion potential are not expected to burn with active crown fires or high intensity conditions. Use of ground resources for suppression efforts becomes increasingly difficult.
3 – Moderate need for treatment	Either extreme fire behavior resulting in difficult to control fires, or moderate soil severity. Presence of steep highly erodible soils may coincide with crown fire and higher intensity fires. Control of wildfire by suppression efforts would be difficult.
4 – High need for treatment	This is the level at which it is possible to have the highest levels of all the fire behavior metrics. Control of wildfire by suppression efforts would be difficult.
5 – Highest Complexity for treatment	This is the level at which it is possible to have the highest levels of all the fire behavior metrics, as well as steep slopes and highly erodible soils, making them prone to adverse second order effects such as debris flows. Control of wildfire by suppression efforts would be difficult.

Crown Fire

This is when a fire burns the canopy of trees.
Active Crown Fire: Causes 100 percent mortality in most conifers in the Rim Country project area. The two exceptions are Alligator Juniper (*Juniper depeanna*) and Chihuahua Pine (*Pinus leiophylla*), both of which may sprout if top-killed or damaged by fire. Additionally, active crown fire is difficult to control since direct attack is not possible, and spotting is common.
Passive Crown Fire: Passive crown fire at some levels is a normal part of the fire ecology in ponderosa pine and related systems. Nonetheless, when it occurs in proximity to active crown fire, or if there are large areas that have potential for passive crown fire, small shifts in wind may cause it to become active, or result in spotting. As such, it was given a value of 1 in the rating process below.
Surface Fire: This was not given any points because, in general, it is not a threat for control andwouldn't be expected to produce undesirable fire effects.

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. All specialist reports are available on the 4FRI website and in the Rim Country project record.

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 NFs) 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.

Roads for Hauling Forest Materials in Wildlife Habitat

The Transportation Report assumes that nearly all of the existing roads in the Rim Country project area may at some point in time be used to provide access for a variety of restoration activities, including hauling of forest products resulting from mechanical treatments. Mileage of existing system roads by maintenance level (ML) is shown in Table 1 of the Transportation Report. Nearly all Forest System roads within the project area are ML1, 2 or 3 roads. This analysis addresses temporarily opening existing closed roads (ML 1) to utilize them for the time period that they are needed to provide access for restoration work. These roads shall be closed upon completion of work in the area they access and returned to a closed status (ML1).

It is proposed in the Tonto Travel Management DEIS that 354 miles of ML2 roads be converted to motorized trails. These 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 will be managed as motorized trails. A motorized trail is defined as "a route 50 inches or less in width or a route over 50 inches wide that is identified and managed as a trail." It is anticipated that pre-haul maintenance is all that would be needed in the future to prepare the motorized trails for use to access areas to be treated.

The Flexible Toolbox Approach for Mechanical Treatments

Appendix 2 contains the complete Flexible Toolbox Approach for Mechanical Treatments. The proposed approach builds on the methods used in the 1st 4FRI EIS, but expands upon it to give the desired flexibility in mechanical treatments in areas with or without other management constraints (such as Mexican spotted owl (MSO) and goshawk (NOGO) habitat, or sensitive soils).

Stands with a Preponderance of Large Young Trees (SPLYT)

The iterative spatial analysis and field validation effort undertaken by the Forest Service and stakeholders yielded an initial filter for SPLYT located outside of MSO PACs, MSO recovery habitat, and wildland urban interface (WUI). For ponderosa pine SPLYT, criteria are that: a) the Quadratic Mean Diameter (QMD) of the top 20 percent of trees is >15" diameter at breast height (DBH), and b) there is >50 square feet/acre of basal area (BA) in trees >16" DBH. All stands would be field-verified prior to mechanical thinning. Stands (or portions thereof) meeting SPLYT criteria, including those not captured by the data filter, would be treated at the lowest range of intensity within the identified silvicultural prescription. For example, a stand identified by the decision matrices to receive an uneven-aged treatment leaving 10 to 25 percent interspace (UEA 10-25), would be treated to 10 percent interspace and to the upper end of its natural range of variation (NRV) for trees per acre (TPA) and BA in order to maintain large tree dominance and conditions favorable to canopy-dependent species. Stands (or portions thereof) that are identified by the SPLYT criteria data filter but, upon field verification, are determined not to meet the SPLYT criteria, would be treated within the range of intensities applied to other non-SPLYT stands.

The Flexible Toolbox Approach for Aquatic and Watershed Restoration Activities

Appendix 3 contains the complete Flexible Toolbox Approach for Aquatic and Watershed Restoration Activities.

This flexible toolbox approach applies to all action alternatives as well. Before carrying out aquatics and watershed restoration treatments, project leaders, specialists, and partners would look at a specific area to be treated and select the appropriate restoration tool(s). Some of the factors to be considered when designing these projects are: the extent and cause of the degraded resources, water quality issues, threatened and endangered species habitat, scenic sensitivity levels, and effects on non-forest lands. Design criteria, best management practices, and mitigation and conservation measures developed for the Rim Country Project (Appendix C of the DEIS) apply to the flexible toolbox.

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:

- a range of tree sizes and ages with a preponderance of trees greater than 12 inches d.b.h.,
- BA and density of pine and Gambel oak,
- canopy cover and structure,
- tree sizes suggestive of uneven-aged management, and
- 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:

- high volume of fallen trees (mid-point diameter of 12 inches or greater) and other woody debris
- plant species richness, including woody species
- residual plant cover to maintain fruits, seeds, and regeneration to provide needs of MSO prey species, and
- other improvements to prey habitat

PCEs Related to Canyon Habitat (one or more of the following):

- Presence of water (often providing cooler air temperature and often higher humidity than surrounding areas.
- Clumps or stringers of mixed conifer, pine-oak, pinyon-juniper, and/or riparian vegetation:
- Canyon walls containing crevices, ledges, or caves: and.
- 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 to analyze the effects of the proposed activities according to FVS modeling over a thirty year period from Existing Condition 2019, 2029, and 2039.

1. Acres treated and improved by habitat/vegetation type by alternative within MSO Habitat Type (Protected, recovery (2 categories: nest-roost and foraging.dispersal), and critical habitats).
2. Changes in BA by tree size-classes to show uneven aged management by alternative within MSO Habitats.

3Changes in Quadratic Mean Diameter in inches, trees per acre, Stand Density Index, Canopy Cover and Basal Area Average by alternative in MSO habitats.

To analyse the effects of Alternatives to dead standing trees (Snags) with a diameter of 12 inches or greater, the following habitat 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.

To analyse the effects of Alternatives to provide for MSO prey habitat measures in MSO Habitats the following variables were modeled and reviewed:

1. Downed logs greater than 12 inches (tons per acre), and coarse woody debris (CWD) surface fuel 3" or greater in tons per acre in MSO habitats.
2. Changes in tons per acre shrub and herbaceous biomass (to maintain fruits, seeds, and regeneration to provide needs of MSO prey species) in MSO Habitats.

To analyse the effects of fire by Alternatives in MSO Habitats the following variables were modeled and reviewed:
1. Changes in tons per acre by alternative of total suface 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 CWD. 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 d.b.h., 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 d.b.h. In addition, prescribed burns conducted along Highway 87 and Forest Highway 3 (2005-2006) appear to have had loss of canopy cover and BA. 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 4FRI 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 term 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.

Design Features, Best Management Practices, and Mitigation

Applicable forest plan desired conditions, standards and guidelines, best management practices (BMPs), Forest Service Manual and Handbook direction, and an adaptive management component would be incorporated in project design and implementation. Additional vegetation design features result from the Rim Country being an ecologically based project with partial funding from the Collaborative Forest Landscape Restoration Program (Pub. L. 111-11 Title IV March 30, 2009). This program is a science-based ecosystem restoration effort for treatments on National Forest System lands. As such, the intent of the Mexican Spotted Owl Recovery Plan would be met through pro-active design rather than after the fact mitigation. See Appendix 5 of this report for a complete list of design features and associated BMPs.

When evaluating wildlife species effects determinations, treatments were analyzed as if all acres would be treated (thinned and/or burned). . This represents a maximum potential effects scenario with the understanding that logistical concerns would limit or curtail treatments in some of the areas analyzed.

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 USFWS.

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 Rim Country counties. 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 4).

There are 15 species of special status addressed by this analysis (Table 3). Several species are analyzed more than once if more than one status applies. For example, northern goshawks are addressed as both sensitive species and MIS. This report excludes fish, aquatic invertebrates, mussels, snails, aquatic snakes, and plants, as these are addressed in the Aquatics and Botany Reports for this project.

Table 3. Threatened, Endangered and Forest Service Sensitive (TES) Species Evaluated in this Analysis.

Common Name	Scientific Name	Status[1]
Amphibians		
Chiricahua leopardfFrog	*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
Golden Eagle	*Aquila chrysaetos*	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
Reptiles		
Narrow-headed gartersnake[2]	*Thamnophis rufipunctatus*	T
Northern Mexican gartersnake[2]	*Thamnophis eques megalops*	T

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.
2. Included in the Aquatics Specialist Report.

Table 4. 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
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 qoccurs in the project area	S

Commented [SJ-1]: Need to add analysis for this species between draft and final

Common Name	Scientific Name	Rationale for Dropping	Status[1]
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 Fisheries Report

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

Chiricahua Leopard Frog and Critical Habitat

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.

Recovery Unit 5: Mogollon Rim – Verde River
Description from the Final Recovery Plan, 2007.
RU 5 lies both above and below the western and central portions of the Mogollon Rim of Arizona. On the west, it is bordered by the Verde River southeast of Camp Verde, to the north the boundary is roughly along the interface between the forested mountains and the grasslands and pinyon-juniper woodlands of the Colorado Plateau. On the east, RU 5 terminates at the border of RU 6, where elevations rise into the White Mountains. The boundary on the south is based roughly on where elevations drop below about 4,000 feet, which corresponds to the presumed lower limit of the frog's distribution in this RU. Above the Mogollon Rim, most drainages flow north or northeast into East Clear Creek, Chevelon Creek, and other tributaries of the Little Colorado River. Below the Mogollon Rim, Fossil Creek, East Verde River, West Clear Creek, and others drain into the Verde River. The vegetation communities of RU 5 are primarily ponderosa and mixed conifer forest, and pinyon-juniper at the lower elevations. Land management is primarily by the San Carlos and White Mountain Apache Tribes, and portions of the Tonto, Coconino, and Apache-Sitgreaves National Forests.

Historically, there are records of Chiricahua leopard frogs scattered across the western and southern portions of the RU. The relative lack of localities compared to RUs 6-8 may in part reflect a lack of historical survey data, but is also probably a reflection of the relatively dry nature of much of RU 5. Today, the species is extirpated in three of five Management Areas (MA) in RU5; West Mogollon, East Clear and Alder Creek-West Chevelon Canyon. On the Tonto there are two Management Areas (MA) with occupied habitat. One is in the Ellison and Lewis Creek critical habitat unit Northeast of Payson, AZ (Figure 2), and the the Crouch, Gentry and Cherry Creeks, and Parallel Canyon management area near Young, AZ (Figure3).

Recovery Unit 6: Mogollon Rim-Upper Gila

RU 6 contains the highest elevation and most mesic environments within the range of the Chiricahua leopard frog. Included are the White Mountains, the highest peak of which is the 11,403-foot Baldy Peak on the White Mountain Apache Reservation. The White Mountains contain headwaters of the Little Colorado, White, Black, Blue, and San Francisco rivers. In Arizona, RU 6 also extends northwest through the Show Low area to capture Silver Creek in the Little Colorado River drainage. In New Mexico, RU 6 includes the San Francisco and Tularosa rivers, the Gila National Forest, including the Gila Wilderness in the headwaters of the Gila River, southeast to the continental divide in the Black Mountains, and south to near Silver City (Figure B6). Elevations in New Mexico are frequently above 7,000 feet, and include many peaks above 9,000 feet, including the 10,895-foot Whitewater Baldy Peak in the Mogollon Mountains of the Gila Wilderness, which is the highest peak in the New Mexico portion of RU 6. Lands in the very northwestern portion of the RU in New Mexico drain into the Little Colorado River. Most of the remainder of the RU in New Mexico drains into the Gila River. The high country of RU 6 is characterized by forested landscapes with many meadows, lakes, streams, and rivers.

Figure 2. CLF CH Unit for Ellison and Lewis Creeks Unit.

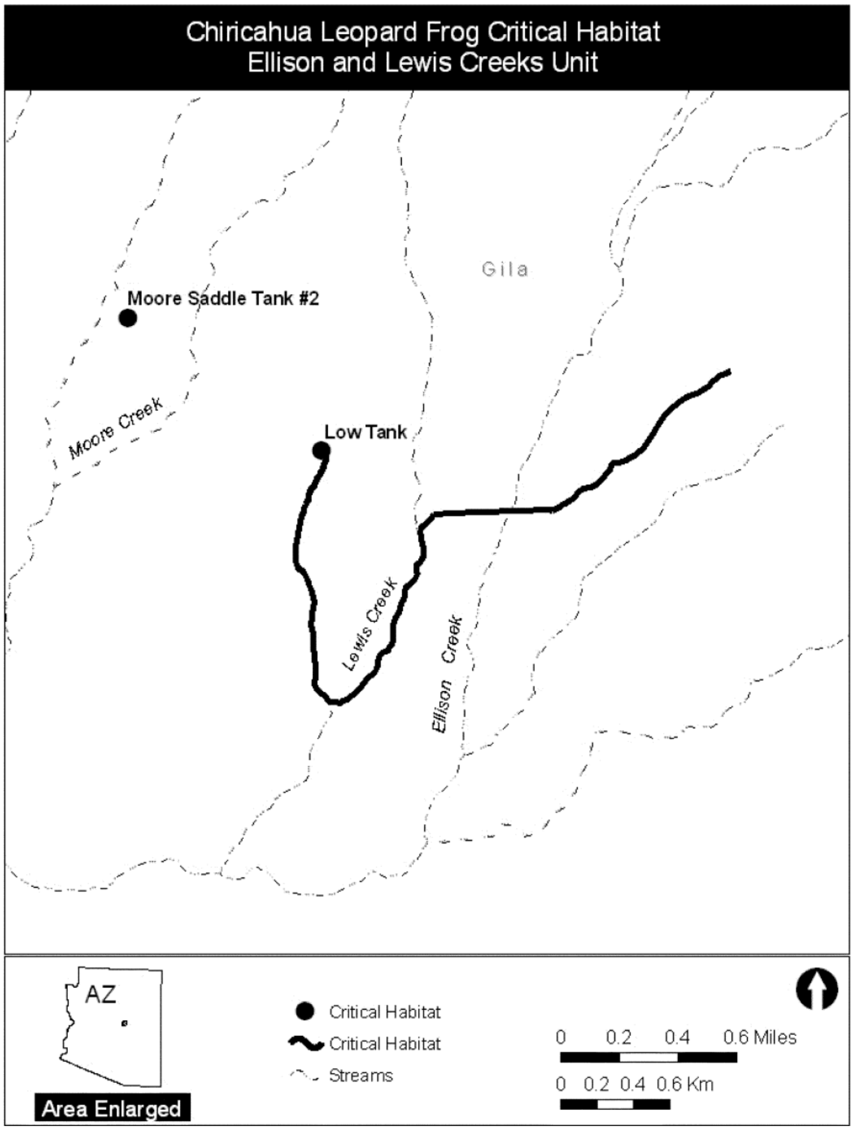
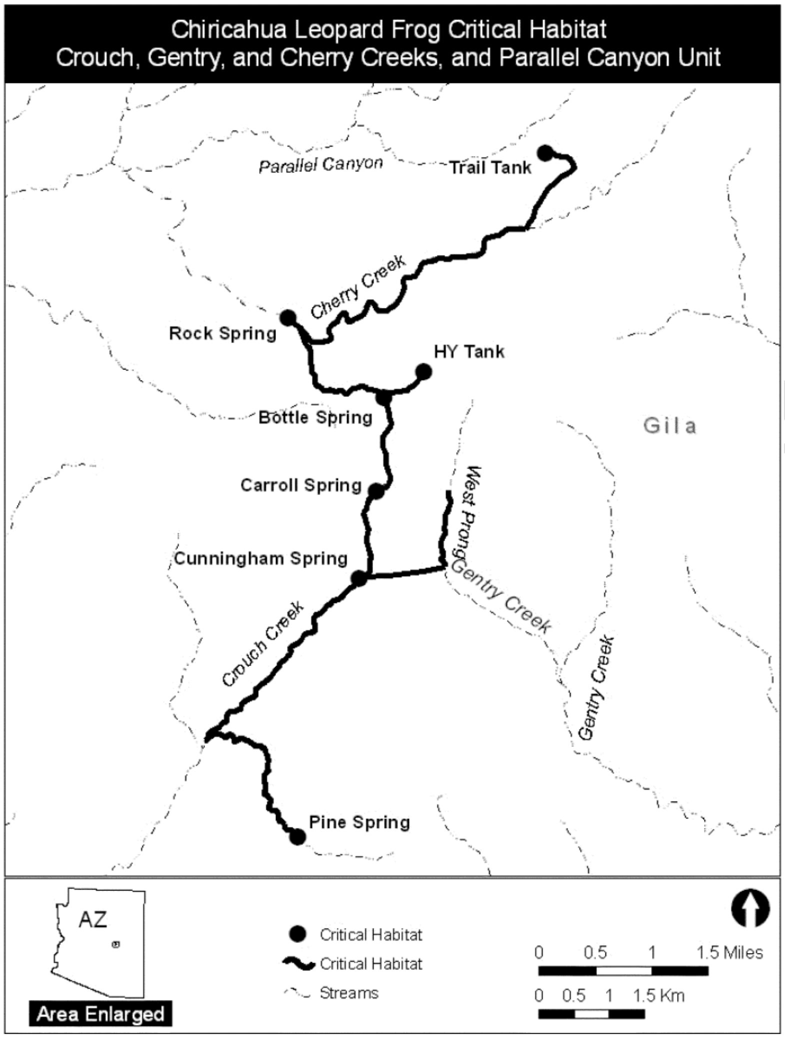


Figure 3. CLF CH Unit for Crouch, Gentry, and Cherry Creeks, and Parallel Canyon Unit.



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

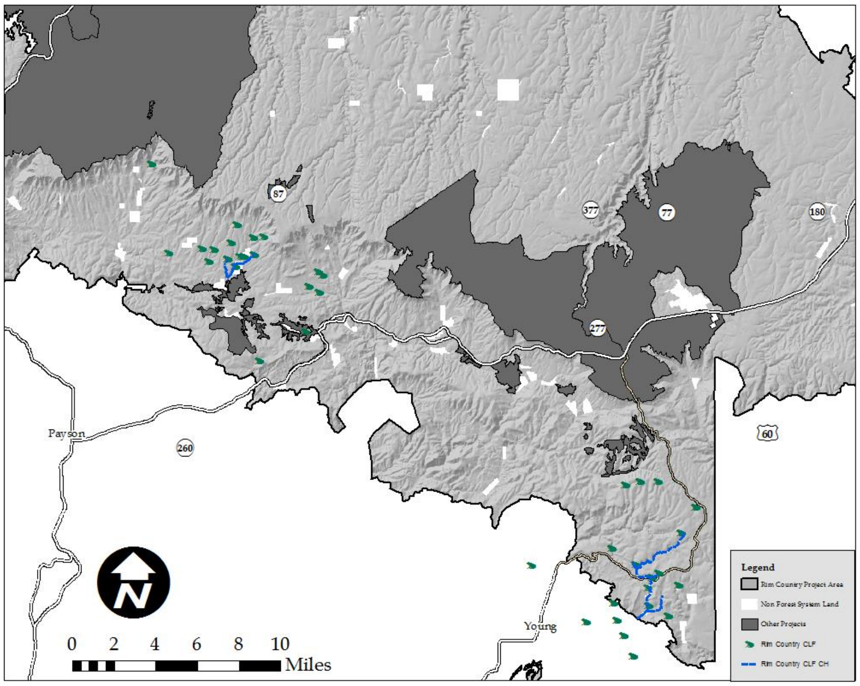
2,710 meters), including rivers, permanent streams and permanent pools in intermittent streams, beaver ponds, cienegas (i.e., wetlands), springs, and earthen livestock tanks. They are occasionally found in livestock drinkers, irrigation sloughs or acequias, wells, abandoned swimming pools, ornamental 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 varous 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 4. Rim Country 4 FRI Occupied CLF Habitat Wthin 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).

The Gentry Creek Management Area for CLF in the UVMA falls within the Rim Country 4 FRI project area. Chiricahua leopard frog (CLF) populations include both lentic and lotic sites and range from streams, earthen livestock tanks and springs (Figure 4). 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); sites in the action and project area make up the Naegelin-Cherry Creek metapopulation. Monitoring data described below is housed in the Arizona Game and Fish Department's (AZGFD) Ranid Frog's Project Riparian Herpetofuana Database.

Information presented below represents data from CLF protocol surveys up to July 30th, 2016 by permitted biologists from Payson Ranger District, AZGFD, and Phoenix Zoo; this data is housed in AZGFD's Ranid Frog Projects *Riparian Herpetofauna Access Database*. Since 1995, for a project on 5 grazing allotments within a part of the project area, CLFs have been observed one time or another at 19 sites in this MA, however, frogs were observed at only 10 sites in 2015 and 2 sites in 2016. Lack of surface water availability in occupied stock tanks and disease may be the cause for this recent local decline in addition to the presence of nonnatives like bullfrogs, barred tiger salamanders, and crayfish.

The AZGFD and USFWS have partnered with USFS, USFW, and Phoenix Zoo (PZ) to implement captive rearing/head-starting recovery actions throughout the species range, including sites within the proposed action area. Since 2009, AZGFD has released over 2,197 tadpoles, 2,374 juvenile, and 56 adult CLFs to 14 sites on the Tonto National Forest. There have been more releases to the Pleasant Valley Ranger District within the 4FRI footprint. These recovery actions include, 1) releasing headstarted frogs to unoccupied sites, 2) augmenting known CLF sites with headstarted frogs to increase genetic variability, and 3) translocating wild egg masses to new or existing sites. The Section below illustrates the number and life stage of animals released where and when.

Pieper Hatchery Spring and Borrow Pit Tank

Pieper Hatchery Spring and Borrow Pit Tank are two CLF populations within the project area resulting from headstarting activities by the AZGFD and Phoenix Zoo from 2010 to 2014. Pieper Hatchery Spring is a small but stable site where breeding is reliably documented most years. Conversely, Borrow Pit Tank (known by AZGFD as "Bonita Tank") received 130 juvenile frogs on July 7th, 2014 and frogs have only been reported in extremely low numbers during 2015 survey and despite surveys in 2016, no observations were reported.

Ellison Creek and Surrounding Drainages

Since 1995, a total of 18 CLF populations have been known to inhabit stock tanks and drainages within this areat In the mid 1990's, Ellison Creek was considered the last occupied CLF site in the Upper Verde Management Area and frogs were thought to be locally extirpated by 1999. In 2006, low numbers of CLFs were re-discovered in Ellison Creek and a tributary to Ellison Creek known as "Trib 4" however, frogs were not observed in Ellison Creek after 2006. Starting in 2009 through 2014 the AZGFD headstarted and released 1,588 tadpoles, 1,839 juveniles, and 6 adult CLFs across five drainages and five stock tanks. A total of six sites were occupied in 2015 and two in 2016.

Upper Tank – TON-0187

In 1982, frogs were first discovered at this earthen stock tank. Despite presence of nonnative American bullfrogs, surveys in 1993 and 1998 resulted in observations of both juveniles and adults. Surveys in the early 2000s showed no sign of CLFs and in 2007 and 2011, the TNF, AZGFD, and US Fish and Wildlife Service (USFWS) implemented a bullfrog removal effort at Upper Tank and several nearby waters. Once the site was cleared of bullfrogs in 2013, the AZGFD, FS and US Fish and Wildlife Service (USFWS) conducted the first release of CLFs; augmentations followed in 2014 and 2016. After the augmentation in 2016, surveyors detected over 50 juveniles. The site was not surveyed in 2017. This site is considered currently occupied.

Unnamed Tank (=SW of Upper Tank) – TON-0188

Frogs were first discovered at this earthen stock tank in 1982 and seen again in 1991 and 1993. After 1993, only bullfrogs were detected. Similar to worked completed at Upper Tank, bullfrogs were removed and in 2013, CLFs were released to the tank. Augmentations continued in 2014. Despite consecutive releases, frogs have not been detected at the site as of 2016. The site was not monitored in 2017. On April, 24, 2018, AZGFD reported one frog at this site, the first observation since the 2014 release. This site is considered currently occupied.

Crouch Creek – Private – TON-0273

Frogs were first documented in lower Crouch Creek in 2009 by TNF and AZGFD. The site has not been monitored since 2009. In more recent years, frogs have been seen in upstream of this location (see

TON-0334 below). The lack of surveys at this site is likely due to the site appearing to be located on private property where broadcast burning will not take place. Since surveys are limited, the site is considered occupied.

Unnamed Spring – TON-0332

In 2011, AZGFD released frogs to an unnamed spring in a tributary leading to Crouch Creek. Surveys post release documented low numbers of CLFs in 2012-2015. One bullfrog was detected and removed in 2016. The site was not monitored in 2017. This site is considered currently occupied.

Crouch Creek – TON-0334

Similar to the unnamed spring described above, frogs were released to Crouch Creek in 2011, however, this site was augmented in 2012 and 2014. Since the release, CLFs have been detected each year with breeding documented in 2013 and 2014. Bullfrogs have never been seen at this site. The site was not monitored in 2017. This site is considered currently occupied.

Carroll Spring – AGF-0004

Carroll Spring is located on land owned by the Arizona Game and Fish Department and is a stable and reliable source site for wild to wild egg mass translocations or headstarting at Phoenix Zoo. Frogs were first discovered at Carroll Spring in 1999 and have been routinely detected each year through 2017 with the exception of negative survey observations in 2010 and 2011. Nonnative bullfrogs have never been documented at the site, however, Carroll Spring has tested positive for chytrid fungus in 2008. Habitat renovations to create suitable habitat for frogs occurred in 2006. In 2018, the Arizona Game and Fish Department plans to renovate Carroll Spring by creating additional wetland habitat. This site is considered currently occupied.

Crouch Creek – TON-0247

Similar to Carroll Spring, Crouch Creek is a stable and reliable source site for wild to wild egg mass translocations or headstarting at Phoenix Zoo. Frogs were first discovered in 1996 and have been routinely detected each year through 2017 with the exception of negative survey observations in 2008 and 2017. Nonnative bullfrogs have never been documented at the site. This reach of Crouch Creek has not been sampled for chytrid fungus. This site is considered currently occupied.

Unmarked Tank – TON-0326

In 2007, Tonto National Forest timber crew members incidentally observed Chiricahua leopard frogs at this stock tank while marking timber. Since this observation, the site has only been re-surveyed once in 2017 because the 2007 record was only recently discovered by the current district wildlife biologist. This site is considered currently occupied.

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):

- Permanent or nearly permanent water that is free or relatively free from non-native predators;
- Within-site habitat diversity, including:
    - Shallow water with emergent and perimeter vegetation that provide egg deposition, tadpole and adult thermoregulation sites, and foraging sites;
    - Deeper water, root masses, undercut banks that provide refuge from predators and potential hibernacula during the winter;
    - Substrate that includes some mud that allows for the growth of alga and diatoms (food for tadpoles) and to allow for hibernacula;
- Relatively clean water not overly polluted by livestock excrement or chemical pollutants.
- 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 USFWS 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. the two are in the project area. Ellison and Lewis Creek Unit encompasses a small portion of the westernmost portion of the Apache-Sitgreaves 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

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 USFWS recommends recovery actions concentrate on recovery units with the highest owl populations (USDI FWS 2012). The Upper Gila Mountains Ecological Management Unit (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. Therefore this Ecosystem Management Unit is important to the overall range-wide stability of MSOs. The USFWS 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 habitat.

Modeling 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 generally 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 USFWS 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 USFWS, 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 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 for the Tonto, Coconino and Apache-Sitgreaves 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 recovery habitat was met for 39,461 acres and 188,533 acres was designated as Foraging/Non/breeding recovery habitat as defined in the Recovery Plan (Table 5). All of the mixed conifer in the project area is recovery habitat.

Table 5 Acres of Mexican Spotted Owl (MSO) Habitat within the Project Area.

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 USFWS. 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.

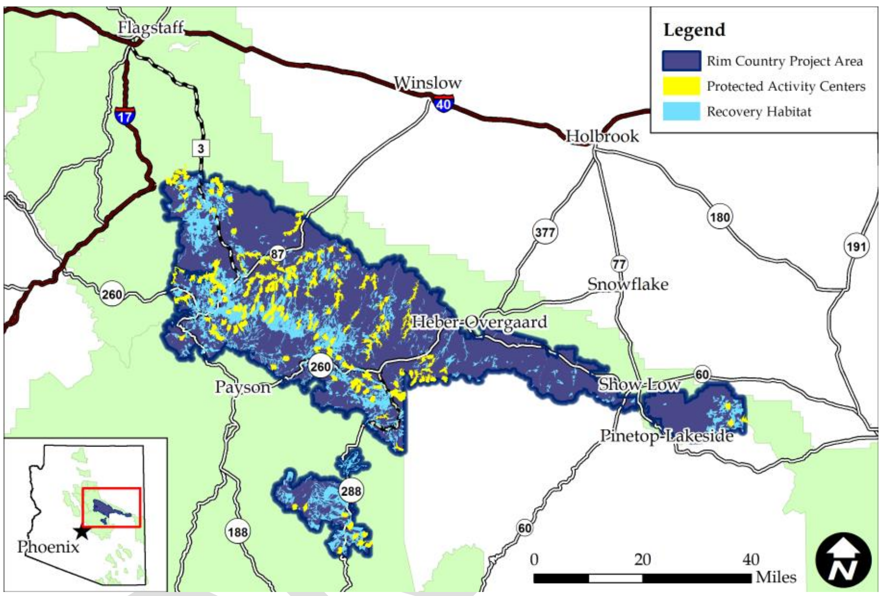
Once the status of the PAC was determined, potential mechanical treatments were considered in terms of whether they could:

- Decrease the amount of time required for growing/increasing tree height and diameter;
- Decrease overall tree density while maintaining the density of large trees, and

- 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.

Mechanical treatments are possible in 22,306 acres in 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. Prescribed fire only was recommended for 49,930 acres in PACs, including using prescribed fire in core areas.

Figure 5. Mexican Spotted Owl Habitat in the Rim Country Project Area.

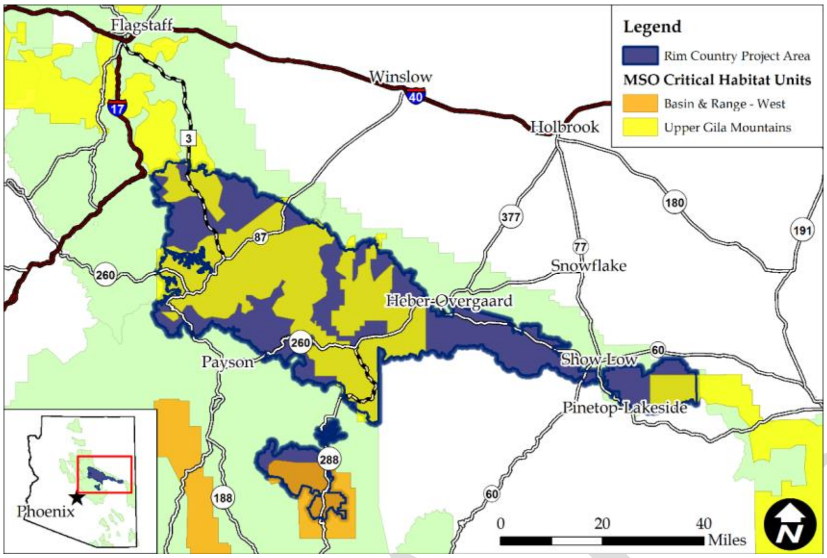


Critical Habitat and Primary Constituent Elements in the Project Area

MSO critical habitat was designated by the USFWS 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.

Twocritical habitat units occur partially or completely within the Rim Country project area (Figure 6). 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 CHUs in the Rim Country project area. In addition, non-MSO habitat occurs within CHUs and designated MSO habitat ocurs outside of CHUs (72,735 acres).

Figure 6. MSO Critical Habit Units in the Rim Country Project Area.



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, 2014 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).

From the Catalina Firescape Biological Opinion for the Coronado NF in the southern part of Arizona approximately 100 miles south of the Rim Country project area: We describe both the Rangewide and Southwestern breeding habitat below:

Rangewide breeding habitat

Rangewide breeding habitat (including in the Southwest) is generally, but not exclusively, comprised of mixed willow and cottonwood riparian woodlands with an overstory and understory vegetation component in contiguous or nearly contiguous patches. Rangewide breeding habitat is usually within floodplains or in upland areas or terraces adjacent to watercourses often greater than 325 ft (100 m) in width and 200 ac (81 ha) or more in extent (USFWS 2014a). The width of some patches may be less, depending on location and habitat conditions. The slope of the water courses within or adjacent to habitat patches is generally less than 3 percent but may be greater in some instances. The habitat patches are usually dominated by willow or cottonwood, but are sometimes dominated by other riparian species of similar structure (for example boxelder). Habitat patches contain one or more nesting groves that have above average canopy closure (greater than 70 percent), and have a cooler, more humid environment than the surrounding riparian and otherwise arid upland habitats (Laymon and Halterman 1989, Hughes 1999). These features provide sites for breeding, nesting, sheltering, and foraging. Riparian breeding habitat in the Southwest ranges from the dense habitat described above to narrower and more sparsely vegetated habitat (described below).

Southwestern breeding habitat

Southwestern breeding habitat is located in the Southwestern United States (particularly in Arizona) and is comprised of riparian woodlands, mesquite woodlands, or Madrean evergreen woodlands with a variable overstory canopy and understory component within drainages at least 200 ac (81 ha) in size. In addition to cottonwood, willow, and mesquite, occupied riparian habitat in Arizona may also contain a greater proportion of xero-riparian species than in the rest of the Distinct Population Segment (DPS). Oak, hackberry, sycamore, walnut, ash, acacia, tamarisk, and juniper are among the most common xero-riparian species in Southwestern breeding habitat (Corman and Magill 2000, Corman and Wise-Gervais 2005, USFWS unpubl. data). Tamarisk may be a component of breeding habitat, but there is usually a native riparian tree component within the occupied habitat (Gaines and Laymon 1984, Johnson et al. 2008, McNeil et al. 2013, Sechrist et al. 2013, Carstensen et al. 2015). Habitat patches in the arid Southwest contain a greater proportion of xero-riparian and nonriparian tree species than elsewhere in the DPS. Habitat patches are often interspersed with large openings and include narrow stands of trees, small groves of trees, or sparsely scattered trees. As such, the canopy closure is variable, and where trees are sparsely scattered, canopy closure may be dense only at the nest tree. Southwestern breeding habitat types are as follows:

- Riparian woodland is more water-limited, contains a greater proportion of xero-riparian species, and is often narrower, patchier, and sparser than where water is more abundant. This more arid riparian woodland occurs in perennial and intermittent drainages and floodplains throughout the Southwest.
- Mesquite-dominated woodland habitat occurs in floodplains, adjacent terraces, and adjacent uplands in perennial, intermittent, and ephemeral drainages throughout the Southwest.
- Madrean evergreen woodland (usually oak-dominated) habitat occurs in intermittent and ephemeral drainages and adjacent hillsides in the foothills and mountains of

southeastern Arizona, up to 7000 ft in elevation. The amount of oak varies and may be interspersed with mesquite and other species in Madrean evergreen woodland.

Nest Site

A large majority of nests are placed in willow trees, but cottonwood, mesquite, walnut, box elder, sycamore, hackberry, oak, alder, soapberry (*Sapindus saponaria*), seepwillow (*Baccharis glutinosa*), acacia, pecan (*Carya* sp.), prune (*Prunus domestica*), almond (*Prunus dulcis*) and tamarisk are also used (Laymon 1980, pp. 7–8; Kingsley 1982, p. 142; Groschupf 1987; Laymon 1998, p. 7; Hughes 1999, p. 13; Corman and Magill 2000, p. 16; Launer et al. 1990, p. 22; Halterman 2001, p. 11; Halterman 2002, p. 12; Halterman 2003, p. 11; Halterman 2004, p. 13; Corman and Wise-Gervais 2005, p. 202; Halterman 2005, p. 10; Halterman, 2006; Halterman 2007, p. 5; Holmes et al. 2008, p. 21; McNeil et al. 2013, pp. I-1 – I-3; Tucson Audubon 2015, p. 44; Groschupf 2015, *in litt*.; MacFarland and Horst 2015, pp. 9–12)). Cuckoos may also nest at more than one location in a year (USFWS 2014a,b). On the upper San Pedro River, many cuckoos renested following both successful and unsuccessful nesting attempts (Halterman 2009). These subsequent nests are sometimes hundreds of meters away from previous nests. Yellow-billed cuckoos at this site appear to be regularly double-brooded, and occasionally triple brooded, based on behavior and timing of nests. On the upper San Pedro River, cuckoos were not regularly detected on surveys until late June, and breeding in some years did not begin until late July (Halterman 2006). The breeding season for cuckoos in southeastern Arizona appears to be prolonged, however, and in most years, conditions are apparently right for producing multiple broods.

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 possible 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-thornforest 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 featuresthat 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 7. 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.)

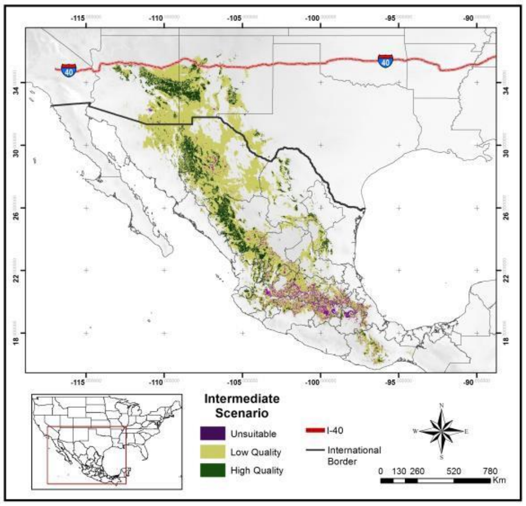


Figure 7 above shows areas of potential wolf habitat and includes parts of the Rim Country planning area classified as high quality. Radio-collared wolves on the Black Mesa District of the Apache-Sitgreaves NF have recently been located within the Rim Country boundary (USFS 2017), before returning to 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/Overguard 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.

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 impacts to species whose viability has been identified as a concern; (4) if impacts 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 impacts, 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 USFWS 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 (CWD) 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.

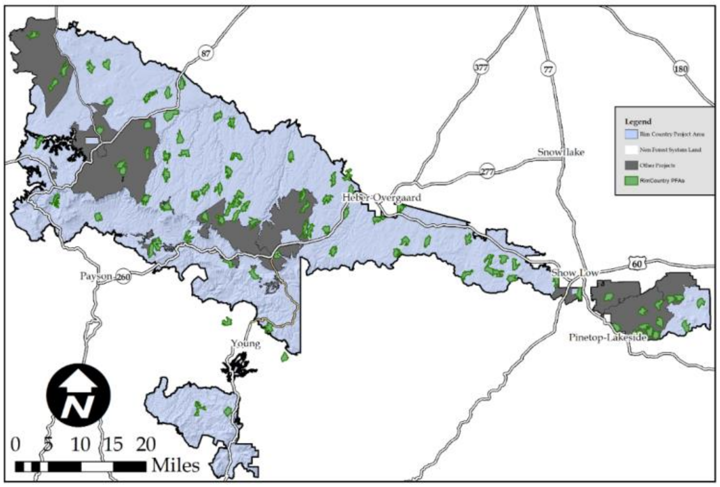
Habitat Strata and Scales of Analysis

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 Apache-Sitgreaves 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 Apache-Sitgreaves National Forests, totaling 60,180 acres in the Rim Country project area. Of these acres, 22,320 are within other project areas (Figure 8).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 8 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 would promote habitat variables needed by this species.

Figure 8. Goshawk PFAs within the Rim Country 4 FRI Project Area.



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 that include 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.

The northern leopard frog range includes the northern tier U.S. states, western states and the southern Canadian provinces. A petition to list the western population of the northern leopard frog seeks to protect frogs in 19 western states (Arizona, California, Colorado, Idaho, Iowa, Minnesota, Missouri, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Texas, Utah, Washington, Wisconsin, and Wyoming). The northern leopard frog is now considered uncommon in a large portion of its range in the western United States, and declines of the species have been documented in most western states. The range of the western population extends into the Canadian provinces of British Columbia, Alberta, Manitoba, southern Northwest Territories, Saskatchewan and western Ontario.

Northern leopard frog habitat consists of springs, slow streams, marshes, bogs, ponds, canals, flood plains, reservoirs, and lakes; usually permanent water with rooted aquatic vegetation. In summer, commonly inhabits wet meadows and fields. Takes cover underwater, in damp niches, or in caves when inactive. Over winters usually underwater. Eggs are laid and larvae develop in shallow, still, permanent water (typically), generally in areas well exposed to sunlight. Generally eggs are attached to vegetation just below the surface of the water.

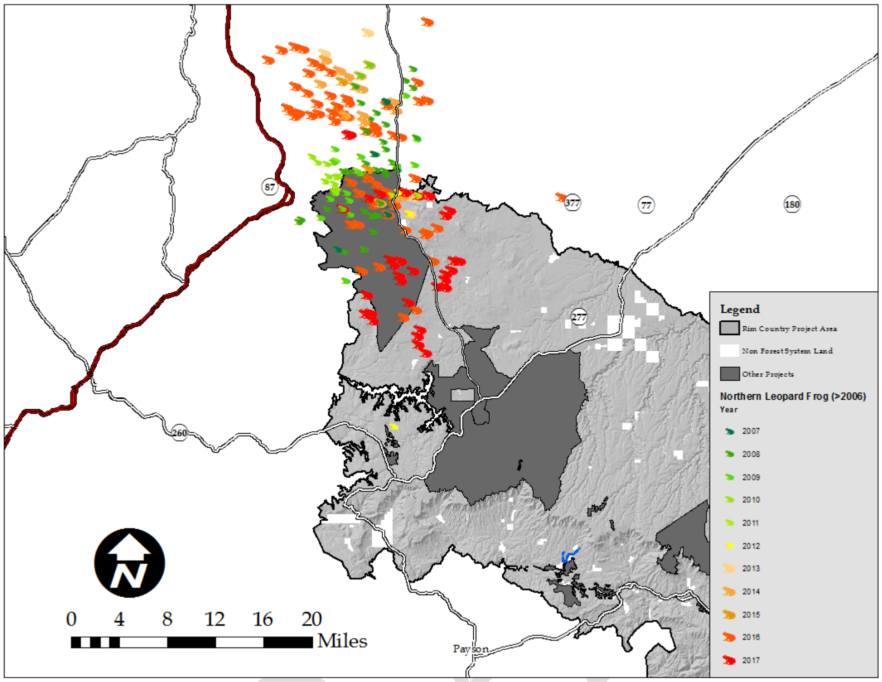
The northern leopard frog is experiencing threats from habitat loss, disease, non-native species, pollution and climate change that individually and cumulatively have resulted in population declines, local extinctions and disappearance from vast areas of its historical range in the western U.S. and Canada.

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 approximately 5-10 miles south of Heber, AZ. In 2004 a NLF was observed in Black Canyon. 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 9.).

Figure 9. Occupied Northern leopard frog habitat near or within the 4 FRI Rim Country Project Area.



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 effects from stray livestock . 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).

Lowland Leopard Frog

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

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. 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.

Bald Eagle

The USFWS 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 USFWS 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.

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 6).

Table 6 Bald Eagle Nests in the Project Area.

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. Nest failed in 2018.
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 and 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 forest plan direction for prairie dogs concerning controls but not for the Burrowing owl. 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. This species was identified in eBird in Pine Creek Canyon near Payson in 2017 and 2018. 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 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 NFs as well. Recent (2018) NaBAT data has confirmed red bat recordings on the Tonto inside the project area.

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).

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 31,293 acres of grassland. Roosting habitat may occur along the 777 miles of riparian habitat.
Design Features to reduce effects on Caves and Bat Roosts include:

- Biologists will be consulted during pre-planning for all treatments that will occur in springs, streams, and riparian areas, as well as fens or bogs where histic soils are present, to determine presence of federally listed or sensitives species (plants or animals), as well as mitigations needed for rare or sensitive species in/near the work areas.
    - A 300-foot buffer for mechanical treatment with heavy equipment should be designated around known bat colonies (use AZGFD HDMS database). For treatments around cave entrances, sink hole rims and other karst features that are to occur during the maternity season (April 15-August 31) or during monsoon season, coordination should occur with a wildlife biologist regardless of whether HDMS data indicates the occurrence of bat colonies or not.

    - A buffer with a radius of 300 feet should be used to restrict activities that can negatively alter the resources, functions, and associated features of caves or karst features unless site-specific adjustments are made in coordination with the appropriate specialist(s), based on the characteristics and importance of the cave or karst features and the expected effects of the proposed activity. If felled trees must be removed from within the buffer, avoid yarding over or through karst features.

    - Thinning or other vegetation treatments with chainsaws or other light equipment, as needed to implement mechanical treatments or prescribed fire, may be used up to cave openings or edges of the sinkholes/pits if specialists determine that there is some risk to the cave/karst environment if nothing is done. Directional felling should be used to fell trees away from karst features. Slash piles should be located at least 50 feet from any karst features.

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.

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).

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 recordings from the 1990s outside of the project area and recordings using NABAT in 2018 as well. Pale Townsend's 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 Townsends 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 2018 Coconino Revised Forest Plan identifies three wildlife species as management indicator species (MIS) to monitor ecosystem health. The current Tonto NF Plan identifies 28 wildlife MIS, with 18 species known or assumed to occur within the Rim Country project area.The revised draft for the Tonto Forest Plan does not include MIS species.

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 NFs encompasses part or all of the project area are included in the terrestrial effects analysis (Table 8). The analysis is also based on forest plan direction and projected changes in quality habitat under the alternatives.

Table 7 Terrestrial Management indicator species (MIS) analyzed for the Rim Country Project

Management Indicator Species	Forest(s)	Key MIS Habitat Component Indicator	Habitat within analysis (project) area
Pronghorn antelope (*Antilocapra americana*)	Coconino	Great Basin grassland, montane-subalpine grassland	Montane–subalpine grassland
Mexican spotted owl (*Strix occidentalis lucida)*	Coconino	Late-seral pine-oak, dry/wet mixed conifer and spruce-fir	Ponderosa pine–oak, dry mixed conifer
Northern goshawk (*Accipiter gentilis*)	Tonto	Late-seral ponderosa pine	Ponderosa pine
Pygmy nuthatch (*Sitta pygmaea*)	Coconino; Tonto	Late-seral ponderosa p**ine**	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 (*Baeolophus ridgwayi*)	Tonto	Pinyon-juniper woodland	Pinyon-juniper
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 of for the The 1985 Tonto NF Forestwide MIS report (USDA FS 1985a) is also incorporated by reference.

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 (BCR), formerly RMBO, a non-government organization and a leader in avian population sampling and analysis, took over the sampling effort and associated data analysis in 2007. Data, monitoring reports, and information about the BCR and their western states monitoring program can be found at: https://birdconservancy.org/what-we-do/science/monitoring/.

Habitat recommendations for wildlife, including game species, were provided by the AZGFD for the Rim Country design features.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 Coconino NF

Late-seral Ponderosa Pine Species Indicator

The pygmy nuthatch is an indicator for late-seral ponderosa pine cover type. Pygmy nuthatches were recorded in the analysis area during forestwide surveys for all four of the 4 FRI forests.

Coconino NF Late-seral Ponderosa Pine Habitat Trend: The forestwide habitat trend for late-seral ponderosa pine is slightly upward since 1996 due to the shift in forest emphasis for the retention of groups of large trees and increasing the amount of old growth that is retained and developed . The age class distribution of ponderosa pine has remained essentially the same, dominated by mid-seral stage, with some increases of old-growth and older trees, and some increases in early-seral stage habitat created by wildfire (USDA FS 2013). There are about 253,407 acres of late-seral ponderosa pine available forestwide (USDA FS 2013).

Pygmy Nuthatch

Pygmy nuthatches use snags or trees with dead portions suitable for excavation for nesting. They are primarily insectivorous. During the breeding season their diet consists of 60 to 85 percent insects. They seem to prefer heterogeneous stands of well-spaced, old pines and vigorous trees of intermediate age. Little information is available on populations of pygmy nuthatches prior to fire suppression policies, but evidence from Arizona and New Mexico suggests that the species was abundant. Management strategies that move ponderosa pine forest closer to the historic range of variation should positively affect the species (USDA FS 2010b).

Coconino NF Pygmy Nuthatch Population Trend: The forestwide trend is stable to slightly declining. Monitoring conducted by the RMBO from 2009-2011 suggests pygmy nuthatches are declining. Results from a long-term bird research project on the Mogollon Rim Ranger District showed an increase in the number of pygmy nuthatch nests on the study sites between 1991 and 1996, then a crash in 1997 from which there has been a slight recovery in recent years. The crash was apparently related to an interactive effect on the habitat as a result of declining snowfall and heavy winter elk herbivory on the study site (Martin and Moran 2012). NatureServe data suggests that Arizona populations are secure (USDA FS 2013).

Ponderosa Pine-Oak, Mixed Conifer (dry), Mixed Conifer (wet) and Spruce-Fir Species Indicator

The Mexican spotted owl (MSO) is an indicator for late-seral ponderosa pine and mixed conifer cover types. MSO have been recorded in the analysis area during forestwide surveys for each of the Rim Country forests.

Coconino NF Ponderosa Pine Habitat Trend: The forestwide habitat trend for ponderosa pine is slightly upward since 1996 due to the shift in forest emphasis for the retention of groups of large trees and increasing the amount of old growth that is retained and developed . The age class distribution of ponderosa pine has remained essentially the same, dominated by mid-seral stage, with some increases of old-growth and older trees, and some increases in early-seral stage habitat created by wildfire (USDA FS 2013). There are about 253,407 acres of late-seral ponderosa pine available forestwide (USDA FS 2013).

Coconino NF Mixed Conifer Habitat Trend: The forestwide habitat trend for mixed conifer is slightly upward since 1996 due to the shift in forest emphasis for the retention of groups of large trees and increasing the amount of old growth that is retained and developed . The age class distribution of ponderosa pine has remained essentially the same, dominated by mid-seral stage, with some increases of old-growth and older trees, and some increases in early-seral stage habitat created by wildfire (USDA FS 2013). There are about 253,407 acres of mixed conifer available forestwide (USDA FS 2013).

Mexican spotted owl

Mexican spotted owls use snags or trees with dead portions suitable for excavation for nesting. They are primarily insectivorous. During the breeding season their diet consists of 60 to 85 percent insects. They seem to prefer heterogeneous stands of well-spaced, old pines and vigorous trees of intermediate age. Little information is available on populations of pygmy nuthatches prior to fire suppression policies, but evidence from Arizona and New Mexico suggests that the species was abundant. Management strategies that move ponderosa pine forest closer to the historic range of variation should positively affect the species (USDA FS 2010b).

Coconino NF Mexican Spotted Owl Population Trend: The forestwide trend is stable to slightly declining. Monitoring conducted by the RMBO from 2009-2011 suggests MSO are declining. Results from a long-term bird research project on the Mogollon Rim Ranger District showed an increase in the number of pygmy nuthatch nests on the study sites between 1991 and 1996, then a crash in 1997 from which there has been a slight recovery in recent years. The crash was apparently related to an interactive effect on the habitat as a result of declining snowfall and heavy winter elk herbivory on the study site (Martin and Moran 2012). NatureServe data suggests that Arizona populations are secure (USDA FS 2013).

Species Indicator for Early- and Late-seral Grasslands

Pronghorn

Pronghorn were selected as an indicator species for early- and late-seral grassland (USDA FS 2013). Pronghorn have been seen in the analysis area. Pronghorn populations in Arizona have declined substantially from historic times for a combination of reasons. Forestwide and local populations are also affected through State permitted hunt structure (appendix 10).

Pronghorn are associated with grasslands, meadows, and savannas on the Coconino NF and are typically found in flat or rolling areas, along foothills, in mountain valleys, and on plateaus. Pronghorn prefer ecosystems with a mixture of grasses, forbs, and shrubs to provide for forage requirements and fawning areas. They evolved to avoid predation through sight and flight; habitats with low-growing vegetation and/or sparse tree densities are important for pronghorn. Pronghorn typically avoid areas with high tree density and cover. Several local studies have recognized the importance of grass, forb, and shrub diversity for sustaining pronghorn nutritional needs throughout the year as well as providing hiding cover for fawns. These studies recommend removal of encroaching woody tree species from grasslands and savannas as well as prescribed fire to reinvigorate production and diversity of understory forbs which have the highest nutritional value during fawning. Since pronghorn are a relatively wide-ranging species, they are likely to respond to changes in forest management at small and large spatial scales.

Pronghorn avoid areas of high tree and/or tall shrub density, preferring areas with less than 30 percent tree/shrub cover and where vegetation height is less than two feet tall. Woody plant invasion into grasslands and meadows has been identified as one of the leading factors reducing habitat quality for pronghorn, sometimes leading to isolation of populations when combined with other sources of habitat fragmentation such as fences and roads.

Coconino NF Pronghorn Habitat and Population Trends: The trend in habitat is stable to declining. Although the total amount of grassland habitat has generally remained stable, habitat quality is stable to declining due to shrub and tree encroachment, lack of fire, long-term climatic changes, short-term drought, and ungulate grazing (USDA FS 2013). There are approximately 206,025 acres of grassland habitat on the Coconino. There are about 22,672 acres of grassland within the analysis area (9 percent of total grassland acres) proposed for treatment under alternatives 2 and 3.

The forestwide population trend for pronghorn appears relatively stable with fawn:doe ratios increasing somewhat during the last 10 years (USDA FS 2013). Pronghorn population indicators have fluctuated since the late 1980s, with fawn:doe ratios showing greater fluctuation than number of pronghorn observed per hour. This is supported by AGFD data that used number of fawns per 100 does observed during annual surveys. The relevant GMUs are 5A, 5B, 6A, 6B, and 7 for the Coconino NF. Population models for these GMUs (with the exception of Unit 6A where information is unavailable) also indicate a stable trend over the last decade.

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 Tonto Forest Land Management Plan (FLMP) elk were selected as a Management Indicator Species for the ponderosa pine and mixed conifer vegetation types (Appendix G, Tonto FLMP) and were considered to be an indicator of general forest conditions.
The Tonto National Forest relies on survey data collected by the Arizona Department of Game & Fish (AZGFD) for population numbers and trend analysis of all game species (CFR 219.19(6)). The FLMP specifically states (page 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. The AZGFD uses this data to set harvest regulations and population goals for the species under their jurisdiction.

Tonto National Forest Population Trend

On the Tonto National Forest, 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.

From the TNF MIS Report, (2005) Resident elk numbers in Units 22-23 appear to be **stable** at this time. Last fall, 900 and 494 elk were surveyed, respectively, showing a bull to cow ratio of 60:100. The calf crop was 37 calves per 100 cows. Poor calf recruitment over the last several years appears to be a response to the prolonged drought conditions in these Unit's. Portions of Unit 23 in the Canyon Creek area were burned in the Rodeo-Chediski Fire and will have an impact on elk populations there. Other fires have improved winter range and foraging parameters but have reduced thermal, hiding and escape cover. This is reflected in the large increase in the grass/forb/shrub component for the ponderosa pine/mixed conifer habitat type forestwide.

Merriam's turkey

In the Tonto Forest Land Management Plan (FLMP) Merriam's Turkey was selected as a Management Indicator Species for the ponderosa pine and mixed conifer vegetation types (Appendix G, Tonto FLMP) 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 National Forest Population Trends

Merriam turkey populations increased after 1985, but have decreased overall since their peak due to drought. Based on the Breeding Bird Survey (BBS), AZGFD harvest data, Audubon data and habitat trends in the ponderosa pine/mixed conifer vegetation type, Merriam's turkey population trend appear to be stable on the Tonto National Forest. 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 Land Management Plan (FLMP) Abert's squirrel was selected as a Management Indicator Species of successional stages within ponderosa pine vegetation type (Appendix G, Tonto FLMP). 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 containing a combination of tree age-classes whose size, density, and grouping provide all the necessary seasonal foods, cover and nesting sites needed.

Tonto National Forest Population Trends: Population trend for Abert squirrel on the TNF based on AZGFD surveys indicates increases in some parts of the forest and decreases in others. On TNF there are three Game 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 squirrel can be found throughout the pine covered portion of Game Unit 22, 23, and to a limited extent, 24A (AZGF 2004).

In addition, the data compiled from AZGFD surveys for Arizona show a stable to increasing trend from 1988-1999 (below). 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 TNF 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 a Management Indicator Species for general riparian condition of High Elevation (>3,000 feet) Riparian (USDA Forest Service 1985).

Tonto National Forest Population Trends: Gray squirrels can be found on TNF in Game Units 22, 23, and 24A where they are limited to pines, mixed hardwoods, and high-elevation riparian habitats. Population trend for the gray squirrel on the TNF 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 a Management Indicator Species for streamside conditions for cottonwood-willow vegetation type in Low Elevation Riparian areas (<1,200 m elev.) and cottonwood-willow and mixed broadleaf vegetation types in High Elevation Riparian areas (>1,100 m elev.), Appendix G, Tonto (USDA Forest Service 1985). On the Tonto National Forest, 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 National Forest Population Trend: In a Conservation Assessment prepared for the Tonto National Forest, Boal and Mannan (1996) determined that the species 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/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 FLMP (Appendix G) designated the ash-throated flycatcher as a Management Indicator Species for ground cover in the piñon-juniper woodland vegetation type (USDA Forest Service 1985). In 2000, the Tonto National Forest 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 National Forest Population Trend: Two current BBS transects on the TNF indicate that this species is commonly counted during survey efforts. In addition, 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 to 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 s that this species is stable on the TNF.

Gray vireo

The gray vireo was selected as a Management Indicator Species (Appendix G, Tonto FLMP) for tree density in the pinyon-juniper woodland type.

Tonto National Forest Trend: Two current BBS routes suggest that this species is uncommon in established survey routes. Statewide CBC 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 dates (Plank 2005). However, based on regional data population trends, it appears that this species' population is declining due to drought-related effects on habitat.

Bell's Vireo

The Bell's vireo was selected as a Management Indicator Species for the low elevation (1,500 to 3,500 ft) riparian vegetation type with a well-developed understory (USDA Forest Service 1985).

Tonto National Forest Population Trend: Statewide CBC suggests low detection of this species with peaks in the late 1990's. During the breeding season this species has been documented on the Bartlett reservoir BBS route on a regular basis. On the Tonto Basin Ranger District in 2003, this species was detected 23 times on 11 different dates on 10 different transect points (Plank 2005). Low elevation riparian habitat has improved in some areas but has declined in others due to grazing, drought and wildfire. Based on this data the population on TNF appears to be declining.

Hairy woodpecker

The hairy woodpecker was selected as a Management Indicator Species for snags and cavities in ponderosa pine/mixed conifer and high elevation riparian habitats.

Tonto National Forest 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 BBS Route is the only transect on the forest that is located in hairy woodpecker habitat and documentation is inconsistent, but low. Statewide CBC 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 dates (Plank 2005). Populations are considered stable on TNF.

Juniper titmouse

The juniper titmouse was selected as a Management Indicator Species (Appendix G, Tonto FLMP) 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 PJ, but old growth PJ appears to be the primary nesting habitat utilized (Towry 1984).

Tonto National Forest Population Trend: Two BBS routes indicate that this species is documented at very low densities on the forest. Statewide the species is documented regularly in CBC surveys from 1997-present. In 2003 on the Tonto Basin 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 TNF are considered stable.

Northern goshawk

The northern goshawk was selected as a Management Indicator Species of vertical diversity within ponderosa pine/mixed conifer vegetation type (Appendix G, Tonto FLMP). 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 National Forest Population Trend: Forest Service biologists, technicians, contract biologists, and Arizona Game and Fish 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/mixed conifer habitat type is likely contributing to declining habitat and population trends for this species.

Northern flicker

The Northern flicker was selected as a Management Indicator Species (Appendix G, Tonto FLMP) for snag conditions in the pinyon-juniper woodland type.

Tonto National Forest Population Trend: There are three BBS routes on the Tonto National Forest: 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 Forest Plan. Drought conditions the last several years have increased the number of dead standing trees that are used for cavity nests and would likely improve nesting success and the snag component. Based on this information, populations on the TNF are considered stable.

Pygmy Nuthatch

The Pygmy nuthatch was selected as a Management Indicator Species for the ponderosa pine and mixed conifer vegetation types (Appendix G, Tonto FLMP), 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 National Forest Population Trend: The Tonto Village BBS route is the only route that includes habitat for the Pygmy nuthatch. CBC 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/mixed conifer habitat type, populations on the TNF are considered to be declining.

Townsend's solitaire

The Townsend's solitaire was selected as a Management Indicator Species for the pinyon-juniper woodland vegetation type, as an indicator of juniper berry production (see Appendix G, Tonto FLMP). 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 National Forest Population Trend: No BBS routes detected this species during survey efforts on TNF. Statewide CBC indicates that this species is abundant throughout the state from 1985-present. In addition statewide BBS results that exclude routes on the TNF 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 TNF.

Violet-green swallow

The violet-green swallow was selected as an MIS species for cavity- nesting habitat in the ponderosa pine/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 National Forest Population Trend: Only the Tonto Village BBS route has documented this species on the Forest. Statewide CBC 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/mixed conifer habitat type and have likely improved nesting habitat parameters. Based primarily on regional data, this species appears to be stable on TNF.

Western bluebird

The western bluebird was selected as an MIS species for forest openings in the ponderosa pine/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 National Forest Population Trend: The Tonto Village BBS transect is the only location where this species is detected during survey efforts. Data suggest this species is encountered at low densities. Statewide CBC suggests that this species is commonly documented during winter months. Based on this information, this species is considered stable on TNF.

Western wood peewee

The western wood pewee was selected as a Management Indicator Species for the High Elevation (>3,000 ft) Riparian Vegetation Type (Appendix G, Tonto FLMP) and was considered to be an indicator for medium riparian overstory. In 2000, the Tonto National Forest and the Arizona Game and Fish Department cooperatively conducted a review of the Forest's MIS species. In that process, it was noted that this species is also common in pine stands adjacent to riparian corridors (Pollock, Tonto National Forest unpubl.). "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 National Forest Population Trend: BBS 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 CBC suggests 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 dates on 4 survey routes (Plank 2005). Precipitous declines in this species may be related to declines in high elevation riparian habitat that are used for breeding habitat. Based on this information, populations for this species appear to be declining on TNF.

Migratory Birds and Important Bird Areas

Affected Environment

For the 4-FRI 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 PIF, USFWS, and USFWS 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 analysis area only occurs within BCR 34.

Table 8. Priority Bird Species Analyzed Under the Migratory Bird Treaty Act.

APIF High Priority Species USFS and FWS Birds of Conservation Concern[1] 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.

APIF High Priority Species USFS and FWS Birds of Conservation Concern[1] by Habitat	Important Habitat Features and Life History Considerations
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.
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.
Common Nighthawk	Primary Habitat: Ponderosa Pine (including P-O), Pinyon Juniper Woodland, Great Basin Grassland. Common Nighthawks nest in both rural and urban habitats including coastal sand dunes and beaches, logged forest, recently burned forest, woodland clearings, prairies, plains, sagebrush, grasslands, open forests, and rock outcrops. Lay eggs directly on the ground, which may consist of gravel, sand, bare rock, wood chips, leaves, needles, slag, tar paper, cinders, or living vegetation, such as moss, dandelion rosettes, and lichens.
Mexican Whip-poor-will	Primary Habitat: Ponderosa Pine-Gambel Oak, and Mixed Conifer. Prefers pine–oak woodland (from about 1,670 to 1,980 m) between encinal (oak woodland) below and ponderosa pine forest above in mountains of Arizona and New Mexico. Eggs are laid on leaf litter. Nests of Mexican Whip-poor-will may be next to or under an overhanging rock, with plants associated with it, providing shade from afternoon sun. Nest sites of Mexican Whip-poor-will in ponderosa pine forests are often described as shallow depressions in gravelly soil.
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.

APIF High Priority Species USFS and FWS Birds of Conservation Concern[1] by Habitat	Important Habitat Features and Life History Considerations
Evening Grosbeak	Primary Habitat: Mixed Conifer, Aspen and Maple. Evening Grosbeaks breed in mature and second-growth coniferous forests of northern North America and the Rocky Mountains, including spruce-fir, pine-oak, pinyon-juniper, and aspen forests. Evening Grosbeaks nest high in trees or large shrubs, such as spruce species, ponderosa pine, Douglas-fir, Aspen, Maple and willow.
Red-faced Warbler	Primary Habitat: Mixed conifer (open), Ponderosa Pine (including P-O), Montane Willow Riparian. Breeds in high elevation fir, pine, and pine-oak forests. Nest placed in small hole in ground, beneath a log or plant. Cup of bark, dead leaves or pine needles. Lined with grass and hair.
Band-tailed Pigeon	Primary Habitat: Mixed Conifer, Ponderosa Pine (Gambel oak subtype). Band-tailed Pigeons have two distinct breeding populations in North America, though individuals may move between the two regions. They breed in wet forests of the Pacific coast from southeastern Alaska to southern California, and in dry mountain forests in the southwestern United States (extending south through Mexico and Central America). Band-tailed Pigeons build nests on sturdy tree limbs, 10–180 feet from the ground, in trees such as Douglas-fir, acacia, lodgepole pine, or live oak.
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 snags for nesting. Use fire or silvicultural treatments to ensure continual regeneration of new stands.
Interior Chaparral	
Black-chinned Sparrow	Primary Habitat: Interior Chaparral. Black-chinned Sparrows are locally common in dry brushlands and chaparral from near sea level to 8,000 feet. They associate with sagebrush, rabbitbrush, ceanothus, and other chaparral species. They typically breed on rocky hillsides and winter downslope in desert scrub. Black-chinned Sparrows place their nests about 2 feet above the ground near the center of a dense shrub.
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. Can nests in large colonies. Pairs will renest 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.

APIF High Priority Species USFS and FWS Birds of Conservation Concern[1] by Habitat	Important Habitat Features and Life History Considerations
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. 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	
Swainson's Hawk	Stick nests constructed in scattered, lone trees within grasslands. Typical nest trees in Arizona are cottonwood, juniper, mesquite, ironwood and oak. 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 shrubsteppe. 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.
Grasshopper Sparrow	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. 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. 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.

APIF High Priority Species USFS and FWS Birds of Conservation Concern[1] by Habitat	Important Habitat Features and Life History Considerations
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.
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 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.
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.

APIF High Priority Species USFS and FWS Birds of Conservation Concern[1] by Habitat	**Important Habitat Features and Life History Considerations**
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; USFS = U.S.D A. Forest Service (Coconino NF), USFWS = U.S. Fish and Wildlife Service.

The following habitats would be affected by management activities in the project area. Not all bird species described above have been documented within the project area, but suitable habitat exists. While riparian habitat, cliffs, and rock habitats are found in the project area, the proposed activities would not affect these habitat types in any potentially adverse way for these species. Design features to reduce potential effects to habitat from proposed treatments were added to the project record (Appendix 5).

Mixed Conifer with Aspen (MCA) and with Frequent Fire (MCFF)

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 analysis 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 PIF 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 38 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 A-S NFs.

Pinyon-Juniper Habitat Type

It is estimated that there is 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 PJ 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 impacts, 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 or Semidesert Grasslands Habitat Type

The high elevation grassland habitat type is defined by APIF 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 <10% 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/Globally Important Biodiversity Areas

Mogollon Rim Snowmelt Draws IBA is the only Important Bird Area (IBA) within the project area. The IBA covers approximately 72,162 acres. This IBA encompasses drainages located within 8 km 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 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.

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 IBA. While most acres proposed for treatment are within ponderosa pine habitat, treatments in the IBA 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 IBA.

Design Features

Wildlife design features (Appendix 5) with examples below, would help mitigate effects from treatments and hauling harvested materials from other project areas and include:

- All Mexican spotted owl recovery plan guidelines included in the Design Features would be followed (see MSO analysis).
- All Northern goshawk Design Features would be followed (see northern goshawk anlaysis.
- In bald and golden eagle nest sites, mechanical treatments within 300-yards of bald or golden eagle nest trees would only occur outside of the breeding season or if the nest is inactive.
- Protect active raptor nest sites from disturbance by project-related activities by restricting activities during nesting season as specified in the applicable forest plan, or as determined by a local wildlife biologist. Known nest trees for any raptor species will be prepped, as needed, to avoid negative effects on survival or successful reproduction, prior to implementing management activities, including prescribed fire.

Other Species of Concern

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.

Table 9. Forest planning species

Species	Rare	Narrow Endemic	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

Very little is known about this species in its northern habitat and its distribution within the Rim Country project area, so inferences are drawn from what is documented about it from lower elevations or latitudinal habitats. 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 52-225 acres. 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 the 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, the AZGFD has observational data of Arizona toads from 2003 to 2018 from Chevelon, East Clear, Cherry, Webber, Crouch and Canyon creeks and some of their tributaries, as well as Big Canyon and 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.

Description of Alternatives

Three alternatives, including Alternative 1, were evaluated in detail in response to public comment. Details on alternatives considered but eliminated from detailed study can be found in chapter 2 of the DEIS. Mechanical and prescribed fire treatments would be conducted annually under the Alternatives 2 and 3.

Alternative 1 - No Action

Alternative 1 is the no action alternative as required by 40 CFR 1502.14(c). There would be no changes in current management; ongoing projects would continue to implement the forest plans. Approximately 302,686 acres of current and ongoing vegetation treatments and 538,175 acres of prescribed fire projects would continue to be implemented within and adjacent to the project area (see cumalitive effects section). Approximately 168,416 acres of vegetation treatments and 113,875 acres of prescribed fire and maintenance burning would be implemented within and adjacent to the project area by the forests in the foreseeable future (within 5 years; see Cumulative effects section). Alternative 1 is the point of reference for assessing Alternatives 2 and 3.

Mechanical and prescribed fire treatments in ongoing projects would create canopy gaps and interspace. Creating openings where sunlight can reach the forest floor would benefit most of the species of status analyzed in this report (see species-specific cumulative effects analyses for current and ongoing project effects). Most projects typically avoid treating steep slopes and are designed to retain nesting and roosting elements in goshawk and MSO habitat. Wildfire would continue to be managed primarily for suppression and/or resource benefit objectives, as appropriate. Change to forest structure would continue to occur at a pace similar to the recent past, therefore threats to forest health from insects, disease, drought, and high-severity fire would continue at recent levels or increase as effects from climate change increase.

Under the no action alternative, no new road restoration activities would take place and no additional use of existing roads would occur. Current rates of public and administrative use would continue. Under the no action alternative maintenance to provide public and administrative access would continue, contingent upon funding. No increase in road maintenance to accommodate restoration activities would occur. Under the no action alternative no road decommissioning would occur within the project area unless it is analyzed under separate NEPA analysis. No new temporary roads would be constructed, unless constructed under separate NEPA analyses.

Alternative 2 – Proposed Action

Alternative 2 is the Proposed Action as presented for scoping, with additional detail, clarifications, corrections, and modifications in response to public comments received. Changes made to the Proposed Action in response to public comment include:

- Modifications to acreages and mileage of treatments based on additional modeling.
- Additional clarity, details, and definitions of key terms used.
- Elimination of even-aged shelterwood silvicultural prescriptions to address dwarf mistletoe infections, replaced with regular restoration treatments. Design features will focus mechanical treatments on addressing dwarf mistletoe infections. This change was a result of additional collaboration with the 4FRI Stakeholder Group and the public.

In addition, the proposal to mechanically thin trees and implement prescribed fire on approximately 1,260 acres in the Long Valley Experimental Forest was dropped from this alternative, as well as from the Rim Country Project. In discussions with researchers with the Rocky Mountain Research Station, it was decided that experimental treatments for the experimental forest would be analyzed in a separate NEPA analysis.

This alternative, as modified, responds to the Dwarf Mistletoe Mitigation issue through the use of regular restoration treatments that focus on dwarf mistletoe infections. The restoration activities listed for Alternative 2 include vegetation treatments (mechanical thinning and burning), using the Flexible Toolbox Approach for Mechanical Treatments (see Appendix D); as well as comprehensive restoration treatments for meadows, springs, streams, riparian habitat, using the Flexible Toolbox Approach for Aquatic and Watershed Restoration Activities (see Appendix D), wildlife habitat, and rare species restoration (Table 2-2). Proposed activities include:

- Mechanically thin trees and/or implement prescribed fire up to 953,130 acres.
    - Implement mechanical thinning and prescribed fire on approximately 517,950 acres including –
        - Approximately 150,790 acres of intermediate thinning
        - Approximately 71,280 acres of stand improvement
        - Approximately 12,510 acres of single tree selection
        - Approximately 283,370 acres of uneven-aged group selection
        - Approximately 63,930 within ½ mile of non-FS lands with structures and critical infrastructure, including –
            - Approximately 16,970 acres of intermediate thinning
            - Approximately 8,560 acres of stand improvement
            - Approximately 38,390 acres of uneven-aged group selection
    - Implement prescribed fire alone on approximately 54,070 acres.
    - Mechanically thin and/or implement prescribed fire on approximately 82,280 acres of Mexican spotted owl (MSO) protected activity centers (PACs) including --
        - Approximately 23,550 acres of mechanical thinning and/or prescribed fire
        - Approximately 58,730 acres of prescribed fire only
        - Approximately 7,180 acres of facilitative operations
    - Mechanically thin and/or implement prescribed fire on approximately 25,290 acres of MSO replacement nest/roost recovery habitat.
    - Conduct facilitative operations in non-target cover types to support treatments in target cover types, including –
        - Approximately 123,400 acres of facilitative thinning and prescribed fire
        - Approximately 1,260 acres of facilitative prescribed fire only
        - Approximately 6,880 acres of facilitative prescribed fire only in PACs
        - Approximately 300 acres of facilitative thinning and prescribed fire in PACs
    - Restore aspen on approximately 1,230 acres, including about 30 acres in PACs.
    - Restore approximately 132,340 acres that have experienced severe disturbance, including about 3,610 acres in PACs.
    - Restore approximately 18,570 acres of savanna.
    - Restore approximately 36,320 acres of grassland, including –
        - Maintaining or restoring montane meadow connectivity in pronghorn corridors.
    - Restore hydrologic function and vegetation on approximately 6,720 acres of meadows.
    - Restore approximately 14,560 acres of riparian areas for aquatic stream habitat.

- Restore approximately 184 springs.
- Restore function and habitat in up to 777 miles of streams, including stream reaches with habitat for threatened, endangered, and sensitive aquatic species.

- Decommission up to 200 miles of existing system roads on the Coconino and Apache-Sitgreaves NFs, and up to 290 miles on the Tonto NF.
- Decommission up to 800 miles of unauthorized roads on the Apache-Sitgreaves, Coconino, and Tonto NFs.
- Construct or improve approximately 330 miles of new temporary roads or existing non-system roads to facilitate mechanical treatments; decommission all temporary roads when restoration treatments are completed.
- Relocate and reconstruct existing open roads adversely affecting water quality and natural resources, or of concern to human safety.
- Construct up to 200 miles of protective barriers around springs, aspen, native willows, and big-tooth maples, as needed for restoration.

Table 2-2. Alt 2 Mechanical and Fire Treatments

Treatment Type	Treatment Description/Objective	Acres
Intermediate Thin (IT) 10-25 (10 to 25% interspace)	Mechanical and fire treatments that thin stands that are up to moderate infection levels of dwarf mistletoe, thins tree groups to an average of 70 to 90 square feet of basal area (BA) in pine cover types and 40-100 BA in dry mixed conifer cover type, and establishes non-forested grass/forb interspace/openings between residual tree groups or individual randomly-spaced trees. Manages for improved tree vigor and growth by retaining the best growing dominant and co-dominant trees with the least amount of dwarf mistletoe and as many old and/or large trees as possible.	30,210
IT 25-40 (25 to 40% interspace)		53,620
IT 40-55 (40 to 55% interspace)		49,980
IT 55-70 (55 to 70% interspace)		16,970
Single Tree Selection (ST)	Mechanical and fire treatments that leaves fewer tree groups and more randomly spaced trees. Designed to increase or maintain age class diversity and reduce understory brush and shrub response, creating small openings less than or equal to ¼-acre in size where seedlings and saplings are underrepresented and brush cover is greater than 40%. Maintains higher basal area where brush competition is expected to be strong to suppress woody understory response.	12,510
Stand Improvement (SI) 10-25 (10 to 25% interspace)	Mechanical and fire treatments that thin young, even-aged stands dominated by trees less than 8.5 inches in diameter. Establishes tree groups and interspace adjacent to tree groups. Manages for improved tree vigor and growth by retaining the best growing dominant and co-dominant trees within each group and as many old and/or large trees as possible, and establishes non-forested grass/forb interspace/openings between residual tree groups or individual randomly-spaced trees. Begins conversion to uneven-aged structure.	13,660
SI 25-40 (25 to 40% interspace)		34,590
SI 40-55 (40 to 55% interspace)		14,460
SI 55-70 (55 to 70% interspace)		8,560
Uneven-aged (UEA) 10-25 (10 to 25% interspace)	Mechanical and fire treatments designed to develop uneven-aged structure and a mosaic of interspaces and tree groups of varying	77,820

Treatment Type	Treatment Description/Objective	Acres
UEA 25-40 (25 to 40% interspace)	sizes. Thins tree groups to an average of 20-80 BA in pine cover types and 30-100 BA in dry mixed conifer cover type, and establishes non-forested grass/forb interspace/openings between residual tree groups or individual randomly-spaced trees. Manages to enhance growing space for younger trees, while retaining as many old or large trees as possible. Establishes regeneration openings where seedlings and saplings are underrepresented. Locates interspace in currently non-forested areas and lacking pre-settlement evidence.	106,210
UEA 40-55 (40 to 55% interspace)		39,490
UEA 55-70 (55 to 70% interspace)		56,850
Prescribed Fire Only	Prescribed burning to improve structure, maintain and develop large trees, and reduce risk of high-severity. Retain old growth attributes, protect large oaks, and ensure snags and coarse woody debris post-fire.	54,070
Aspen Restoration	Mechanical treatment that removes post-settlement conifers within 66 feet (one chain) of the aspen clone. Managed to stimulate suckering by removing aspen, disturbing the ground, and/or applying fire as needed. Accompanied by prescribed fire.	1,200
Aspen Restoration in PACs		30
Facilitative Operations (FO) Mechanical	Mechanical treatment in non-target cover types to support the use of prescribed fire in cover types targeted for restoration. Includes mastication/chipping; lop and scatter; thinning/limbing; and moving, rearranging, or removal of jackpots or excessive surface fuels. Designed to improve safety, improve treatment effectiveness, expand burn windows, decrease undesirable fire behavior and effects, and minimize disturbance from fireline construction. Accompanied by prescribed fire.	123,400
FO Mechanical in PACs		300
FO Prescribed Fire Only	Fire treatment in non-target cover types to support the use of prescribed fire in cover types targeted for restoration. Includes broadcast burning, jackpotting, pile burning, and blacklining. Designed to improve safety, improve treatment effectiveness, expand burn windows, decrease undesirable fire behavior and effects, and minimize disturbance from fireline construction.	1,260
FO Prescribed Fire Only in PACs		6,880
MSO Recovery – Replacement Nest/Roost	Mechanical and fire treatments designed to develop uneven-aged structure, irregular tree spacing, and a mosaic of interspace and tree groups of varying size. Intent is to continue to develop replacement Nest/Roost where possible, and to develop a diverse mix of heterogeneous stand structures and densities to provide for owl dispersal and foraging.	25,290

<table>
<tr><th>Treatment Type</th><th>Treatment Description/Objective</th><th>Acres</th></tr>
<tr><td>MSO PAC Mechanical</td><td>Mechanical treatment outside core areas that thins to improve structure, maintain and develop large trees, and reduce risk of high-severity fire in PACs.
Designed to increase tree vigor and health, to promote irregular tree spacing, and to create canopy gaps more conducive to fire treatment (reduce fire risk). Retain old growth attributes, protect large oaks, and ensure snags and coarse woody debris post-treatment.
Accompanied by prescribed fire.</td><td>17,460</td></tr>
<tr><td>MSO PAC Prescribed Fire Only</td><td>Prescribed burning to improve structure, maintain and develop large trees, and reduce risk of high-severity fire in PACs. Fire may be implemented in core areas.
Retain old growth attributes, protect large oaks, and ensure snags and coarse woody debris post-fire.</td><td>50,830</td></tr>
<tr><td>Savanna Restoration
(70 to 90% interspace)</td><td>Mechanical and fire treatments that restore pre-settlement tree density and pattern by removing encroaching post-settlement conifers. Manages for a range of 70 to 90 percent interspace (grass/forb) between tree groups or individual trees using pre-settlement tree evidence as guidance. Retains all pre-settlement trees and the largest post-settlement trees as replacement trees adjacent to pre-settlement tree evidence (stumps, dead and down).</td><td>18,570</td></tr>
<tr><td>Severe Disturbance Area Treatment</td><td rowspan="2">Combination of restoration treatments: reforestation, prescribed fire, lopping/scattering, mastication, and other mechanical methods.
Objective is to identify treatments that would be effective in restoring the fuel structure that produces the types of fire to which ponderosa pine is adapted.</td><td>128,630</td></tr>
<tr><td>Severe Disturbance Area – MSO PAC</td><td>3,610</td></tr>
<tr><td>Grassland Restoration</td><td rowspan="2">Mechanical and fire treatments to reduce or eliminate tree encroachment (pines and junipers). Remove trees established since interruption of the historic fire regime. Promote and re-establish the historic meadow edge. Retain all pre-settlement trees and leave replacement trees where evidence of historical large trees exist.</td><td>36,320</td></tr>
<tr><td>Wet Meadow Restoration</td><td>6,720</td></tr>
<tr><td>Riparian Restoration</td><td>Combination of restoration treatments, including mechanical and fire treatments to maintain riparian vegetation and habitat. Remove encroaching upland tree and shrub species. Remove noxious or invasive plants. Promote, protect, or plant native aquatic or riparian species. Prescribed fire to regenerate riparian species and reduce fuels.</td><td>14,560</td></tr>
</table>

Spring Restoration

Specific treatments to restore springs would be identified prior to mechanical and fire treatments in the vicinity, using the Flexible Toolbox Approach for Aquatic and Watershed Restoration Activities (see Appendix D). Treatments could include: removing tree canopy close to the spring, applying fire, replumbing the spring improvements to conserve water, protecting the spring with fencing, and removing or relocating adjacent roads or trails.

Stream Restoration

Specific treatments to restore riparian streams and stream channels and their function would be identified prior to mechanical and fire treatments in the vicinity, using the Flexible Toolbox Approach for Aquatic and Watershed Restoration Activities (see Appendix D). Treatments could include: reestablishing former drainage patterns, stabilizing slopes, restoring vegetation, protecting sites from grazing ungulates, removal of upland species that compete with riparian species, returning fire to the system (prescribed fire), and/or removing stock tanks. The emphasis would be on non-structural rather than structural methods.

Riparian Habitat Restoration

Proposed stream habitat treatments may be needed within all or some portion of the fish-bearing streams. Specific treatments to restore riparian streams and stream channels and their function would be identified prior to mechanical and fire treatments in the vicinity, using the Flexible Toolbox Approach for Aquatic and Watershed Restoration Activities (see Appendix D). Restoration treatments may include channel restoration (one rock dams, grade control or induced meandering) and channel structural improvements (felling or girdling trees to provide large woody debris for cover and habitat complexity).

Road and Trail Relocation/Reconstruction

Specific treatments for roads, trails, and unauthorized routes that are affecting water resources would be evaluated prior to mechanical and fire treatments in the vicinity, using the Flexible Toolbox Approach for Aquatic and Watershed Restoration Activities (see Appendix D). Generally, routes crossing and those within 300 feet of streams and waterbodies are the highest priority for evaluation and treatment. Treatments could include: adding gravel to the road surface of existing authorized routes, stabilizing slopes, and restoring vegetation; closing roads, trails, or unauthorized routes by blocking the entrance or installing water bars; removing culverts, reestablishing drainages, removing unstable fills, pulling back road shoulders, and scattering slash on the roadbed; and obliterating the roadbed by restoring natural contours and slopes.

Specific treatments for improving stream crossings that are affecting water resources would be evaluated prior to mechanical and fire treatments in the vicinity. Treatments could include: armoring downstream outlets of culverts, upsizing existing culverts, installing culverts or additional culverts, installing culvert arrays to mimic existing channel width, installing low water crossings, installing bridges, restoring downstream channels created from crossings, using sediment reduction methods on connected disturbed areas upstream from roads that connect to the drainage, paving crossings, and relocating the segment of the road that has the crossing issue out of the stream.

Alternative 3 – Focused Restoration

This alternative is designed to focus restoration treatments in areas that are the most highly departed from the natural range of variation (NRV) of ecological conditions, and/or that put communities at risk from undesirable fire behavior and effects. High value assets will be better protected and burn boundaries will be designed to create conditions safe for personnel and to ensure fire can meet objectives. Treatment areas would be chosen to optimize ecological restoration, those areas that are most important to treat and can be moved the furthest toward desired conditions. Focusing on the higher priority ecological restoration will result in fewer acres being treated.

The restoration treatments proposed in Alternative 3 will be used to address moderate and high levels of mistletoe infection, but to a lesser extent on the fewer acres proposed for mechanical treatment and fire. The presence of dwarf mistletoe will not be used to prioritize areas for treatment, but it will be addressed where it exists, using the same types of treatments as Alternative 2. Design features will be developed to focus activity on addressing dwarf mistletoe infestations during implementation of mechanical treatments.

Alternative 3 responds to the Smoke/Air Quality, Economics, Roads, and Dwarf Mistletoe Mitigation issues. The restoration activities listed for Alternative 3 include vegetation treatments (mechanical thinning and burning), using the Flexible Toolbox Approach for Mechanical Treatments (see Appendix D); as well as the same comprehensive restoration treatments as proposed in Alternative 2 for grassland and meadows, springs, streams, riparian habitat, using the Flexible Toolbox Approach for Aquatic and Watershed Restoration Activities (see Appendix D), wildlife habitat, and rare species restoration (Table 2-4). Proposed activities include:

- Mechanically thin trees and/or implement prescribed fire on up to 529,060 acres.
    - Implement mechanical thinning and prescribed fire on approximately 311,800 acres including –
        - Approximately 112,090 acres of intermediate thinning
        - Approximately 37,300 acres of stand improvement
        - Approximately 5,630 acres of single tree selection
        - Approximately 156,780 acres of uneven-aged group selection
        - Approximately 46,260 within ½ mile of non-FS lands with structures and critical infrastructure, including –
            - Approximately 16,970 acres of intermediate thinning
            - Approximately 14,040 acres of stand improvement
            - Approximately 27,200 acres of uneven-aged group selection
    - Implement prescribed fire alone on approximately 40,630 acres.
    - Mechanically thin and/or implement prescribed fire on approximately 61,700 acres of Mexican spotted owl (MSO) protected activity centers (PACs) including --
        - Approximately 19,650 acres of mechanical thinning and/or prescribed fire
        - Approximately 42,050 acres of prescribed fire only
        - Approximately 3,370 acres of facilitative operations
    - Mechanically thin and/or implement prescribed fire on approximately 19,590 acres of MSO replacement nest/roost recovery habitat.
    - Conduct facilitative operations in non-target cover types to support treatments in target cover types, including –
        - Approximately 47,580 acres of facilitative thinning and prescribed fire
        - Approximately 630 acres of facilitative prescribed fire only
        - Approximately 3,070 acres of facilitative prescribed fire only in PACs
        - Approximately 300 acres of facilitative thinning and prescribed fire in PACs
    - Restore aspen on approximately 1,010 acres, including about 30 acres in PACs.
    - Restore approximately 31,750 acres that have experienced severe disturbance, including about 1,420 acres in PACs.
    - Restore approximately 2,470 acres of savanna.
    - Restore approximately 36,320 acres of grassland, including –
        - Maintaining or restoring montane meadow connectivity in pronghorn corridors.
    - Restore hydrologic function and vegetation on approximately 6,720 acres of meadows.
    - Restore approximately up to 14,560 acres of riparian areas for aquatic stream habitat.

- Restore approximately 184 springs.
- Restore function and habitat in up to 777 miles of streams, including stream reaches with habitat for threatened, endangered, and sensitive aquatic species.
- Decommission up to 200 miles of existing system roads on the Coconino and Apache-Sitgreaves NFs, and up to 290 miles on the Tonto NF.
- Decommission up to 800 miles of unauthorized roads on the Apache-Sitgreaves, Coconino, and Tonto NFs.
- Construct or improve approximately 170 miles of new temporary roads or existing non-system roads to facilitate mechanical treatments; decommission all temporary roads when restoration treatments are completed.
- Relocate and reconstruct existing open roads adversely affecting water quality and natural resources, or of concern to human safety.
- Construct up to 200 miles of protective barriers around springs, aspen, native willows, and big-tooth maples, as needed for restoration.

Table 2-3. Alt 3 Mechanical and Fire Treatments

Treatment Type	Treatment Description/Objective	Acres
Intermediate Thin (IT) 10-25 (10 to 25% interspace)	Mechanical and fire treatments that thin stands that are up to moderate infection levels of dwarf mistletoe, thins tree groups to an average of 70 to 90 square feet of basal area (BA) in pine cover types and 40-100 BA in dry mixed conifer cover type, and establishes non-forested grass/forb interspace/openings between residual tree groups or individual randomly-spaced trees. Manages for improved tree vigor and growth by retaining the best growing dominant and co-dominant trees with the least amount of dwarf mistletoe and as many old and/or large trees as possible.	24,260
IT 25-40 (25 to 40% interspace)		34,530
IT 40-55 (40 to 55% interspace)		39,260
IT 55-70 (55 to 70% interspace)		14,040
Single Tree Selection (ST)	Mechanical and fire treatments that leave fewer tree groups and more randomly spaced trees. Designed to increase or maintain age class diversity and reduce understory brush and shrub response, creating small openings less than or equal to ¼-acre in size where seedlings and saplings are underrepresented and brush cover is greater than 40%. Maintains higher basal area where brush competition is expected to be strong to suppress woody understory response. Accompanied by prescribed fire.	5,630
Stand Improvement (SI) 10-25 (10 to 25% interspace)	Mechanical and fire treatments that thin young, even-aged stands dominated by trees less than 8.5 inches in diameter. Establishes tree groups and interspace adjacent to tree groups.	7,480

Treatment Type	Treatment Description/Objective	Acres
SI 25-40 (25 to 40% interspace)	Manages for improved tree vigor and growth by retaining the best growing dominant and co-dominant trees within each group and as many old and/or large trees as possible, and establishes non-forested grass/forb interspace/openings between residual tree groups or individual randomly-spaced trees. Begins conversion to uneven-aged structure.	17,120
SI 40-55 (40 to 55% interspace)		7,690
SI 55-70 (55 to 70% interspace)		5,010
Uneven-aged (UEA) 10-25 (10 to 25% interspace)	Mechanical and fire treatments designed to develop uneven-aged structure and a mosaic of interspaces and tree groups of varying sizes. Thins tree groups to an average of 20-80 BA in pine cover types and 30-100 BA in dry mixed conifer cover type, and establishes non-forested grass/forb interspace/openings between residual tree groups or individual randomly-spaced trees. Manages to enhance growing space for younger trees, while retaining as many old or large trees as possible. Establishes regeneration openings where seedlings and saplings are underrepresented. Locates interspace in currently non-forested areas and lacking pre-settlement evidence.	48,500
UEA 25-40 (25 to 40% interspace)		53,740
UEA 40-55 (40 to 55% interspace)		11,110
UEA 55-70 (55 to 70% interspace)		43,440
Prescribed Fire Only	Prescribed burning to improve structure, maintain and develop large trees, and reduce risk of high-severity. Retain old growth attributes, protect large oaks, and ensure snags and coarse woody debris post-fire.	40,630
Aspen Restoration	Mechanical and fire treatments that remove post-settlement conifers within 66 feet (one chain) of the aspen clone. Managed to stimulate suckering by removing aspen, disturbing the ground, and/or applying fire as needed.	980
Aspen Restoration in PACs		30
Facilitative Operations (FO) Mechanical	Mechanical treatment in non-target cover types to support the use of prescribed fire in cover types targeted for restoration. Includes mastication/chipping; lop and scatter; thinning/limbing; and moving, rearranging, or removal of jackpots or excessive surface fuels. Designed to improve safety, improve treatment effectiveness, expand burn windows, decrease undesirable fire behavior and effects, and minimize disturbance from fireline construction. Accompanied by prescribed fire.	47,580
FO Mechanical in PACs		300
FO Prescribed Fire Only	Fire treatment in non-target cover types to support the use of prescribed fire in cover types targeted for restoration. Includes broadcast burning, jackpotting, pile burning, and blacklining. Designed to improve safety, improve treatment effectiveness, expand burn windows, decrease undesirable fire behavior and effects, and minimize disturbance from fireline construction.	630
FO Prescribed Fire Only in PACs		3,070

<table>
<tr><th>Treatment Type</th><th>Treatment Description/Objective</th><th>Acres</th></tr>
<tr><td>MSO Recovery – Replacement Nest/Roost</td><td>Mechanical and fire treatments designed to develop uneven-aged structure, irregular tree spacing, and a mosaic of interspace and tree groups of varying size.
Intent is to continue to develop replacement Nest/Roost where possible, and to develop a diverse mix of heterogeneous stand structures and densities to provide for owl dispersal and foraging.</td><td>19,590</td></tr>
<tr><td>MSO PAC Mechanical</td><td>Mechanical treatment outside core areas that thins to improve structure, maintain and develop large trees, and reduce risk of high-severity fire in PACs.
Designed to increase tree vigor and health, to promote irregular tree spacing, and to create canopy gaps more conducive to fire treatment (reduce fire risk). Retain old growth attributes, protect large oaks, and ensure snags and coarse woody debris post-treatment.
Accompanied by prescribed fire.</td><td>15,750</td></tr>
<tr><td>MSO PAC Prescribed Fire Only</td><td>Prescribed burning to improve structure, maintain and develop large trees, and reduce risk of high-severity fire in PACs. Fire may be implemented in core areas.
Retain old growth attributes, protect large oaks, and ensure snags and coarse woody debris post-fire.</td><td>37,960</td></tr>
<tr><td>Savanna Restoration
(70 to 90% interspace)</td><td>Mechanical and fire treatments that restore pre-settlement tree density and pattern by removing encroaching post-settlement conifers.
Manages for a range of 70 to 90 percent interspace (grass/forb) between tree groups or individual trees using pre-settlement tree evidence as guidance. Retains all pre-settlement trees and the largest post-settlement trees as replacement trees adjacent to pre-settlement tree evidence (stumps, dead and down).</td><td>2,470</td></tr>
<tr><td>Severe Disturbance Area Treatment</td><td rowspan="2">Combination of restoration treatments: reforestation, prescribed fire, lopping/scattering, mastication, and other mechanical methods.
Objective is to identify treatments that would be effective in restoring the fuel structure that produces the types of fire to which ponderosa pine is adapted.</td><td>30,340</td></tr>
<tr><td>Severe Disturbance Area – MSO PAC</td><td>1,420</td></tr>
<tr><td>Grassland Restoration</td><td rowspan="2">Mechanical and fire treatments to reduce or eliminate tree encroachment (pines and junipers). Remove trees established since interruption of the historic fire regime. Promote and re-establish the historic meadow edge. Retain all pre-settlement trees and leave replacement trees where evidence of historical large trees exist.</td><td>36,320</td></tr>
<tr><td>Wet Meadow Restoration</td><td>6,720</td></tr>
<tr><td>Riparian Restoration</td><td>Combination of restoration treatments, including mechanical and fire treatments to maintain riparian vegetation and habitat. Remove encroaching upland tree and shrub species. Remove noxious or invasive plants. Promote, protect, or plant native aquatic or riparian species. Prescribed fire to regenerate riparian species and reduce fuels.</td><td>14,560</td></tr>
</table>

The same amount of comprehensive restoration activities: spring restoration, stream restoration, riparian habitat restoration, and road and trail relocation/reconstruction, are proposed in Alternative 4 as in Alternatives 2 and 3. These activities are described above for Alternative 2 and will be implemented using the Flexible Toolbox Approach for Aquatic and Watershed Restoration Activities (see Appendix D).

Actions Common to Alternatives 2 and 3

Table 10. Detailed Mechanical and Fire Treatments by Alternative

Proposed Treatment	Acres Alt 2 (MPA)	Acres Alt 3 (FA)
Areas assigned treatments using the decision matrices	**522,310**	**316,580**
Intermediate Thin	**151,400**	**112,790**
IT 10% - 25%	26,940	21,060
IT 10% - 40%	6,370	5,980
IT 25% - 40%	51,920	32,860
IT 40% - 55%	63,930	52,070
IT 55% - 70%	2,240	820
Single Tree Selection	**14,320**	**7,250**
ST	14,320	7,250
Stand Improvement	**72,830**	**38,880**
SI 10% - 25%	10,960	6,370
SI 10% - 40%	4,510	2,620
SI 25% - 40%	33,790	16,140
SI 40% - 55%	23,110	13,750
SI 55% - 70%	460	0
Uneven Age	**283,760**	**157,660**
UEA 10% - 25%	77,490	47,890
2UEA 10% - 40%	11,650	9,500
UEA 25% - 40%	116,530	60,800
UEA 40% - 55%	50,930	18,780
UEA 55% - 70%	27,160	20,690
Areas not assigned treatments using the decision matrices	**377,020**	**158,350**
Aspen Restoration	**1,230**	**1,010**
Aspen Restoration	1,200	980
PAC - Aspen Restoration	30	30
Facilitative Operations Mechanical	**131,380**	**50,630**
Facilitative Operations Mechanical	131,080	50,330
PAC - Facilitative Operations Mechanical	300	300
Facilitative Operations Prescribed Fire Only	**6,670**	**2,840**
PAC - Facilitative Operations Prescribed Fire Only	6,670	2,840
MSO Recovery - Replacement Nest/Roost	**25,960**	**20,140**
MSO Recovery - Replacement Nest/Roost	25,960	20,140
PAC – Mechanical	**18,370**	**16,670**
PAC – Mechanical	18,370	16,670
PAC - Prescribed Fire Only	**49,930**	**37,000**
PAC - Prescribed Fire Only	49,930	37,000
Savanna	**17,590**	**2,400**
Savanna	17,590	2,400

Severe Disturbance Area Treatment	**125,890**	**27,660**
PAC - Severe Disturbance Area Treatment	3,610	1,410
Severe Disturbance Area Treatment	122,280	26,250
Total	**899,330**	**474,930**

Various restoration activities could occur under Alternatives 2 and 3. These activities include Grassland and Meadow Restoration, Spring Restoration, Riparian Stream and Stream Channel Restoration, Stream Habitat restoration, and Aspen restoration. Although small in scale, these habitats provide greater herbaceous biomass relative to the currently common, closed canopy conditions that dominant the ponderosa pine forests. These microhabitats occur as islands within the greater ponderosa pine forest and can provide concentrated areas of water, food, and cover for prey species. Proposed restoration treatments are the same in both action alternatives.

See The Rim Country Aquatic Watershed Flexible Toolbox (Appendix 3), for a complete description of activities proposed for; springs (184); riparian, and stream habitat restoration (777 miles with 14,730 acres of riparian areas for aquatic stream habitat restoration).

Stands designated as grasslands (31,293), savannahs (17,590 acres), or wet meadows (6,760 acres) would be given a specific restoration treatment and would not be assigned a treatment from the decision matrices. Stands or portions of stands that overlap with a grassland terrestrial ecosystem unit (TEU) were identified as grassland. Grassland-specific restoration includes a mechanical treatment that removes post-settlement conifers using pre-settlement tree evidence as guidance.

Facilitiative operations may be needed in non-target cover types (such as Pinon-Juniper) to support treatments in target cover types, including up to 131,380 acres of facilitated thinning and prescribed fire.

Severe disturbance areas are those where the spatial extent and/or the pattern of high severity effects is not within NRV. In some places this has resulted in aggressively sprouting species, such as alligator juniper and various species of oak dominating the vegetative response, making it difficult or impossible for ponderosa pine to establish or thrive. In other areas, extensive, overly dense patches of ponderosa pine regeneration have put stands on a trajectory toward stagnation, density-related mortality, or additional severe disturbance. In these areas of extensive, pure ponderosa pine regeneration, the decision matrices would be applied. 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.

Up to 200 miles of protective barriers around springs, aspen, native willows, and big-tooth maple could also occur as other restoration activies associated with both action alternatives.

Outside of a wildlife-urban interface area, pinyon-juniper treatments include direction for evaluating the community before developing prescriptions to ensure desired conditions are met, including retention of mature tree groups, habitat components like snags and logs, and development of the herbaceous growth (Silviculture Report). In addition to maintaining overstory structure, additional considerations include providing for habitat diversity such as openings and travel corridors.

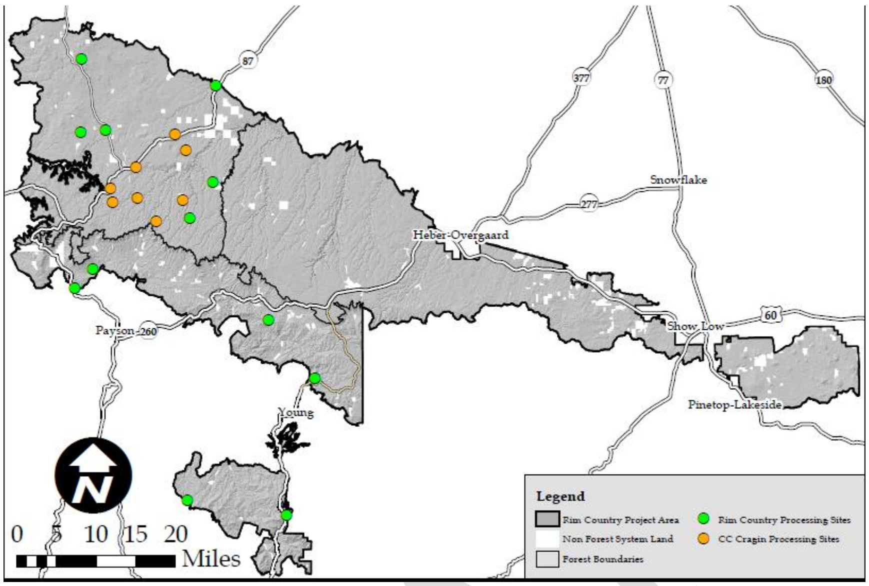
In-woods Processing Sites

Twelve processing sites are proposed for use in the Rim Country 4FRI project area (table 13 and figure 11). These are in addition to the processing sites included in the CC Cragin Watershed Restoration Project which could also be used to process 4 FRI Rim Country materials (figure 11). No processing sites are located on the Apache-Sitgreaves NF. Processing site location and siting considerations included the following: flat uplands less than 5% slope; more than 200 feet distant ephemeral and intermittent stream channels (except for two sites), more than 300 feet from meadows, springs and karst features; more than 0.25 miles from MSO PACs and outside of NOGO PFAs, more than 0.25 miles from system hiking trails, campgrounds and group event recreation sites; and more than 0.25 miles from private lands, residences or offices. Processing sites were located to provide for a buffer of 100 or 300 feet from Forest roads and state highways to provide for visual screening from Concern Level 1 and 2 travel ways. Site boundaries are approximate and may be further modified during implementation and layout.

Table 11. Processing Sites Analyzed in 4FRI Rim Country.

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 (12)	128

Figure 10. In-Woods Processing Sites in the Rim Country 4 FRI Project Area



The twelve processing site areas may be used as part of the 4FRI project over its implementation period from 10 to 20 years. Continuous use processing sites are those where use is expected to be continuous on a regular basis for 10-20 years. These sites typically consist of the larger sites 10-15 acres in area that are located close to major highways. Sites originally developed and operated as continuous use would frequently change to intermittent use or occasional use following initial harvest activities in the area. Intermittent use processing sites are those where use is expected to be shorter term and used for one or multiple timber sale or stewardship contract periods lasting from 3-10 years.
Design features for processing sites including: allowed operations and facilities, authorization, construction, operation, maintenance, rehabilitation, closure and monitoring are found in Appendix 5, and include examples such as:

- Shape and/or feather the edges of treatment areas to avoid abrupt changes between treated and untreated areas. Standing trees and shrubs around processing sites shall be left in strategic locations to serve as screening to sensitive viewsheds.
- All constructed features including but not limited to fencing, office trailers, sanitation facilities, fuel storage containers or temporary structures shall be designed to blend with surrounding environment. Color of proposed above ground features shall be non-reflective and treated to be forest service brown or for a rusty appearance, or as approved by FS landscape architect or other FS official.

The processing of biomass 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 biomass processing sites that have been proposed range in size from 5 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. These permits would help to minimize effects on soil productivity and function. Aboveground fuel storage tanks would have to be manufactured, installed, and operated in accordance with Federal, state, and local requirements. For example, a permit for installation of an aboveground storage tank would have to be obtained through the Arizona State Fire Marshall's Office (https://www.dfbls.az.gov/ofm/AGST.aspx) . Additionally, the processing sites would likely be regulated as industrial sites subject to permitting under Arizona Department of Environmental Quality's (ADEQ) Multi-Sector General Permit (MSGP) program. This permit program requires that certain industrial facilities, including those involved in the types of activities that would likely occur at the processing sites, implement control measures and develop site-specific stormwater pollution prevention plans (SWPPP) to comply with Arizona Pollutant Discharge Elimination System (AZPDES) requirements. Among other things, the SWPPP would have to identify best management practices that minimize non-point source water pollution including measures to minimize or prevent soil erosion and contamination.
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.

Rock Pits

In order to provide adequate sources of road surfacing material, rock pits would be needed to be utilized and expanded within the project area. The situation is different on all 3 forests within Rim Country (see below for a description of each NF). All rock pits are either greater than ¼ mile away from an MSO PAC or would have seasonal operating restrictions if owls are present (see design features below). All rock pits are located outside of goshawk PFAs. Design features (Appendix 5), would protect other wildlife species and natural resources from disturbance at rock pits.

Coconino- Pit expansion and new pit creation was previously analyzed for 8 pits within the Rim Country project area under the previous NEPA analysis, (Rock Pits Environmental Assessment Coconino and Kaibab National Forest June 2016). This work has already been analyzed for effects to natural resources and wildlife and requires no further analysis under Rim Country. In addition existing pits may have material removed from them but not expanded. All of the pits that could potentially have material removed from them as a part of work involved with Rim Country are shown in figure 12.

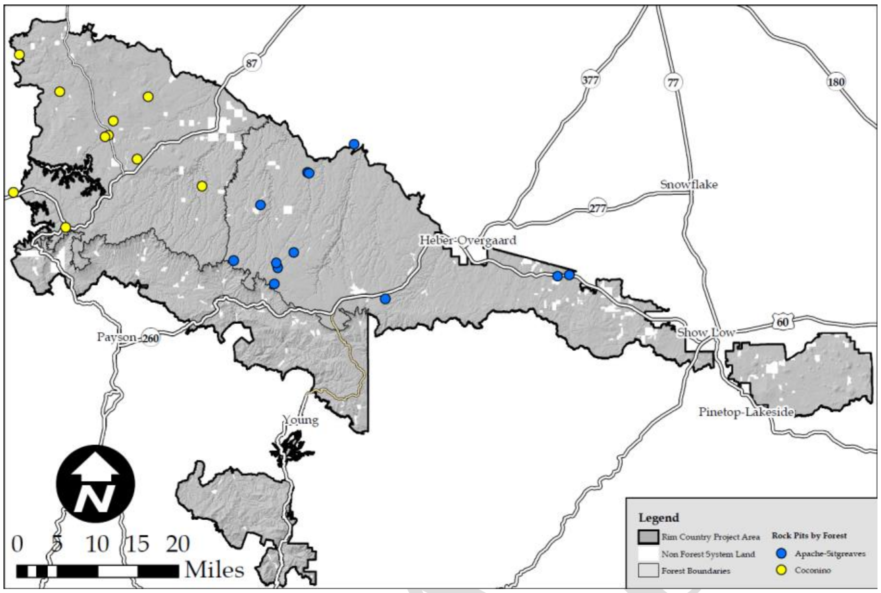
Apache- Sitgreaves- Only the Black Mesa and Lakeside district of the Apache-Sitgreaves are within the Rim Country project area. Surfacing material needs within the Lakeside district are met by a large county operated pit under special use permit and other commercial sources. No additional pit expansion or operations are proposed on the Lakeside district.

On the Black Mesa District 13 existing pits are proposed for expansion. The location of these pits are shown on the attached map. In order to allow for potential future material needs, all pits are proposed for a 30 percent expansion of their current foot print. Current acreage and proposed future acreage are shown in table 14 and figure 11

Table 12. Proposed Rock Pit Expansion on Black Mesa District of the A-S

Pit Name	Current Acreage	Increase in Acreage	Possible Future Acreage
Sand Draw	12	4	16
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
Dutch Tank	7	2	9
Borrow	12	4	16
Cottonwoods Wash	6	2	8
Total	98	33	131

Figure 11. 4 FRI Rim Country Rock Pits on the Coconino and A-S



Rock pits average 11.2 acres in size (range = 3.9 to 23.8 acres). It is expected that proposed rock pit sites would include some level of activity (for approximately 3-8 weeks every 2-5 years) for up to twenty years. All 13 rock pits on the Black Mesa District of the Apache-Sitgreaves NF would have expansion to the existing disturbance footprint.

The materials 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 (which had been authorized under other NEPA decisions). The proposed development and reclamation of rock pits would include hauling of equipment and aggregate materials to and from the pits for use in general and project-specific road maintenance, road repair, and erosion control.

Pits may also be used by other organizations such as county, city, or state entities, when consistent with the provisions in the "Disposal of Mineral Material" regulations at 36 CFR 228 Subpart C.[1] Many projects using aggregate materials cannot be predicted because they are needs-based (e.g., spot gravelling roads for general maintenance after a monsoon storm), or are scheduled in a way that allows for continual adjustment (e.g. permitting county access to a pit that can be used for maintenance of county roads).

The 4 FRI Rim Country proposed action incorporates a number of design features to limit the potential effects from rock pit development, operation, and hauling to wildlife (examples included below), and other resources (Appendix 5).

- Rock pits within ½ mile of MSO recovery and protected habitat would be surveyed to protocol to determine occupancy by owls before operations are initiated, unless a wildlife biologist determines this restriction is unnecessary.

- No ground disturbance from rock pit development or operation would occur in known protected activity centers (PACs), or within 1/4 miles of nests and roosts during the nesting season, unless a wildlife biologist determines this restriction is unnecessary.
- Material hauling from rock pits in or within ¼ miles of occupied PACs would occur outside of the Mexican spotted owl nesting season.
- Pit development and operation within occupied northern goshawk PFAs may occur when surveys have indicated there are no active nests. If surveys identified an occupied nest, all operational activities and hauling would be avoided March 1 – September 30th.
- If a Northern goshawk is detected at a rock pit location at any time, the local district biologist would be contacted prior to any additional activity to confirm goshawk activity in the area and determine additional mitigations, if necessary, to limit impacts to nesting goshawks.
- Prior to reinitiating operations in rock pits where standing water is pooled, a wildlife biologist will determine if surveys for sensitive or threatened species should occur.

Protect active raptor nest sites from disturbance by project-related activities by restricting activities during nesting season as specified in the applicable forest plan, or as determined by a local wildlife biologist. Known nest trees for any raptor species will be prepped, as needed, to avoid negative impacts to survival or successful reproduction, prior to implementing management activities, including prescribed fire.**Tonto**- The Tonto NF plans to meet all road surface material needs from local commercial sources and no pit operations or expansion on Forest Service lands are proposed under Rim Country on the Tonto Forest.

Environmental Consequences

A review of environmental consequences serves to highlight direct and indirect effects or unintended consequences that may occur from the proposed activities. These environmental consequences are presented below, starting with a discussion of climate change relative to the project alternatives. Species analyses begin 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 3 would realize the most benefit in terms of forest health and resiliency. The limited acres of treatment under Alternative 4 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 4 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

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.

From the Aquatics specialist report: The proposed project occurs within 142 6th code sub-watersheds. Of these watersheds, 38 have less than five percent of their total area within the project boundary. Overall, ponderosa pine vegetation types are dominant in functional-at-risk 6th HUC watersheds (about 451,500 acres, or 46 percent of the project area); with several impaired watersheds (about 316,800 acres, or about 32 percent of the project area) and a few properly functioning watersheds (about 220,400 acres, or about 22 percent of the project area).

Effects Common to Both Action Alternatives

Direct and Indirect Effects

The desired condition is to have watershed function maintained or improved towards functioning properly. 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. Soil and riparian condition and function would be improved and moving towards satisfactory and properly functioning.

Effects from treatments would largely be from sedimentation following thinning and burning in uplands near occupied habitat. Design features are included to minimize the effects of sedimentation from treatments (see below and Appendix 5).

Analysis was conducted to determine the possibility of frogs dispersing one mile overland, three miles in intermittent drainages, and 5 miles in perennial water. This analysis tiers to guidance in the CLF recovery plan. The wildlife biologist for the Payson Ranger District of the Tonto NF has documented small dispersals of CLFs from occupied habitat during extremely wet monsoon years (such as 2011). It is possible that under more favorable (wetter) conditions than present, leopard frogs could disperse from occupied habitat in the next five or more years to adjacent side drainages and stock tanks. While the currently occupied habitat on the Payson Ranger District is within one mile overland of the Verde River and of Tonto Creek, these waterways have higher flow than is preferred by CLFs and both systems have non-native predators that would likely prevent occupancy and breeding of frogs.

Alternative 1 No Action

Direct and Indirect Effects

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 specialist 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 ResourceReport), 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 cumulative effects analysis for Chiricahua 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 units are within the action area; the Ellison and Lewis Creek unit and the Crouch, Gentry, Cherry Creeks and Parallel Canyon unit (figures 2 and 3 above). No change is expected to occur in these critical habitat units under the No Action alternative.

Determination of Effect

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

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. DesignFeatures (see below and Appendix 5) 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%) of all Ponderosa Pine in the project area to 129,762 acres (23%) from alternative 2. Fire Hazard Index in grasslands is also greatly reduced from treatment in Alternative 2 (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 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 consultation with USFWS. An important consideration for restoration of springs is to restore discharge from the spring source except where prescribed by existing adjudicated water rights. Alternatives 2 and 3 would allow discharge from springs to resume flow through their historic spheres of discharge. Restoration implementation 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 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. Road decommissioning would include one or more of the following:

- Reestablishing former drainage patterns, stabilizing slopes, and restoring vegetation;
- Blocking the entrance to a road or installing water bars;
- Removing culverts, reestablished drainages, removing unstable fills, pulling back road shoulders, and scattering slash on the roadbed;
- Completely eliminating the roadbed by restoring natural contours and slopes; and
- Other method designed to meet the specific condition associated with the unneeded roads.

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 impact 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 5). Therefore, minimal potential for spread would exist.

Under the 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 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, and USFWS, occupied, critical breeding, and potential breeding sites have been identified and mapped and would be included in the individual task order map with a protected water designation. Project design features (see below and Appendix 5) 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.

Design Features included to reduce effects on leopard frogs:

- Utilize firing technique that ensure low severity and intensity fire in Chiricahua Leopard Frog occupied habitats or suitable habitat within dispersal distance from occupied sites. No direct ignition will occur in occupied habitat (unless to ensure low severity fire) or in riparian areas. If fuel conditions result in significant ash and sediment flow into an occupied site that cannot be mitigated though erosion control measures, the resource advisor or wildlife biologist will contact AGFD and USFWS. If thinning occurs in occupied riparian areas, timing restrictions would be placed on harvesting operations with 150 ft of each stream bank during or 3 days after a rain event greater than one tenth inch.
- WL044- In native leopard frog occupied sites (streams, tanks, etc), frog dispersal distances should be considered when establishing an appropriate AMZ. In general, a 200 m no-treatment buffer (no thinning, no direct ignition) is reasonable for leopard frog dispersal. Designated skid trail crossings through the buffer zone are allowed. Mechanical equipment may reach into the AMZ with coordination between the silviculturist and biologist to meet objectives.
- In leopard frog dispersal habitat, a 200-foot protection zone (100 feet either side of the stream) would be established around designated stream courses. There would be no thinning and no direct ignition within the protection zones. Designated skid trail crossings through the buffer

zone are allowed. Fall burning and burn plans should be coordinated with district wildlife biologists.

- In springs identified for restoration, springs would be surveyed for leopard frogs prior to implementation of restoration activities.
- Do not use tanks for water sources that are known to have populations of northern, lowland, and/or Chiricahua leopard frogs as water sources for prescribed fire activities. Activities in and around natural or constructed waters would use decontamination procedures to prevent the spread of Chytrid (Bd) fungus and other invasive aquatic species, unless an evaluation by a forest biologist determines it unnecessary.
- Prior to reinitiating operations in rock pits where standing water is pooled, a wildlife biologist will determine if aquatic surveys for sensitive or threatened species should occur.
- When moving wet equipment or people from one water site directly to another any equipment or personnel for activities in and around streams, natural or constructed waters, springs, or wetlands of any kind will use decontamination procedures to prevent the spread of disease (e.g., Chytrid fungus) and aquatic invasive species. Personnel entering water bodies for any reason will also follow these procedures. This applies to entry into every aquatic restoration site and in between sites."
- Given the potential for multiple aquatic species to occur in a given location, FS, USFWS, and AZGFD biologists will cooperatively prioritize aquatic species of concern on a site specific basis regarding timing restrictions for instream and riparian restoration activities.
- Work will occur during base-flow conditions, and on dry or frozen riparian soil conditions where possible.
- Biologists will be consulted during pre-planning for all treatments that will occur in springs, streams, and riparian areas, as well as fens or bogs where histic soils are present, to determine presence of federally listed or sensitives species (plants or animals), as well as mitigations needed for rare or sensitive species in/near the work areas.
- Imported gravel for use in or around aquatic systems must be free of invasive species, non-native seeds, and aquatic diseases. If necessary, wash gravel prior to placement and allow it to completely dry for a minimum of 2 days to prevent spread of chytrid fungus. More time for drying may be needed depending on the amount of gravel.

Critical Habitat

Effects on critical habitat PCEs are similar to effects on suitable CLF habitat as described above. No long-term changes are expected to occur to any PCE from implementing the proposed action. Short term effects on PCEs 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 PCEs for the CLF.

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 consultation 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 above and Appendix 5). 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 consultation with a 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 cumulative effects analysis area for northern 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 offset the combined cumulative effects from other forest activities, high-impact recreational use, livestock grazing, and habitat loss and degradation on private lands. 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

Direct and Indirect Effects

The direct and indirect effects 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 (included in Alternative 2 analysis for the CLF above) to reduce the potential effects on important breeding sites and the frogs using and moving between these sites.

Crirical Habitat

Same as in Alternative 2

Cumulative Effects

Same as in 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

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

Key features of MSO habitat described in the Recovery Plan include elementsof habitat important to the MSO such as:

- a range of tree sizes and ages with a preponderance of trees greater than 12 inches d.b.h.,
- BA and density of pine and Gambel oak,
- canopy cover and structure,
- tree sizes suggestive of uneven-aged management, and
- 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:

- high volume of fallen trees (mid-point diameter of 12 inches or greater) and other woody debris
- plant species richness, including woody species
- residual plant cover to maintain fruits, seeds, and regeneration to provide needs of MSO prey species, and
- other improvements to prey habitat

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

1. Acres treated and improved by habitat/vegetation type by alternative within MSO Habitat Type (Protected, recovery, and critical habitats).
2. Changes in BA by tree size-classes to show uneven aged management by alternative within MSO Habitats.
3. Percent Canopy cover in MSO habitats.
4. Changes in Quadratic Mean Diameter in inches, Trees per Acre, and Stand Density Index by alternative in MSO Habitats.

To analyse the effects of Alternatives to dead standing trees (Snags) with a diameter of 12 inches or greater, the following habitat variables were modeled and reviewed:

1. Change in numbers per acre of snags, with a diameter of 12 inches and greater by alternative in MSO Habitats (Average of Snags 12-18, 18-24, and greater than 24 inches DBH).

To analyse the effects of Alternatives to provide for MSO prey habitat measures in MSO Habitats the following variables were modeled and reviewed:

1. Coarse woody debris (CWD) surface fuel 3” or greater in tons per acre in MSO habitats.
2. Changes in tons per acre shrub and herbaceous biomass (to maintain fruits, seeds, and regeneration to provide needs of MSO prey species) in MSO Habitats.

To analyse the effects of fire by Alternatives MSO Habitats the following variables were modeled and reviewed:
1. Changes in tons per acre by alternative of total suface 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.

Fire

Fire Hazard Index

Changes in potential fire behavior (Fire Hazard Index; FHI) in MSO habitat types (table 15), 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 91,697 acres (76 percent) are in need of treatment as they are at a higher potential of high severity wildfire. The high need and extreme need for treatment categories of FHI are 49,888 acres (41%) of all PACs modeled in the project area are expected to experience high severity wildfire.

In Nest/Roost Recovery habitat, the fire hazard index modeled 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 need and extreme need for treatment categories of FHI are 4,174 acres (41 percent) of all nest/roost recovery habitat modeled 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 need and extreme need for treatment categories of FHI are 10,717 acres (25%) of all foraging-other recovery habitat modeled 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 Analysis for the MSO by Alternatives section).

Table 13. Fire Hazard Index Modeled in MSO Habitat Types in the Existing Condition

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

Crown fire potential in MSO habitat types (table 16 and figure 14) 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 in PACs in the existing condition total 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, crown fire potential modeled 10,288 acres, with 8,165 acres (80 percent) that have the potential to experience crown fire. Active crown fire in Nest/Roost Recovery Habitat in the existing condition total 3,773 acres (37 percent) of this habitat type modeled in the project area that would experience high severity crown fire.

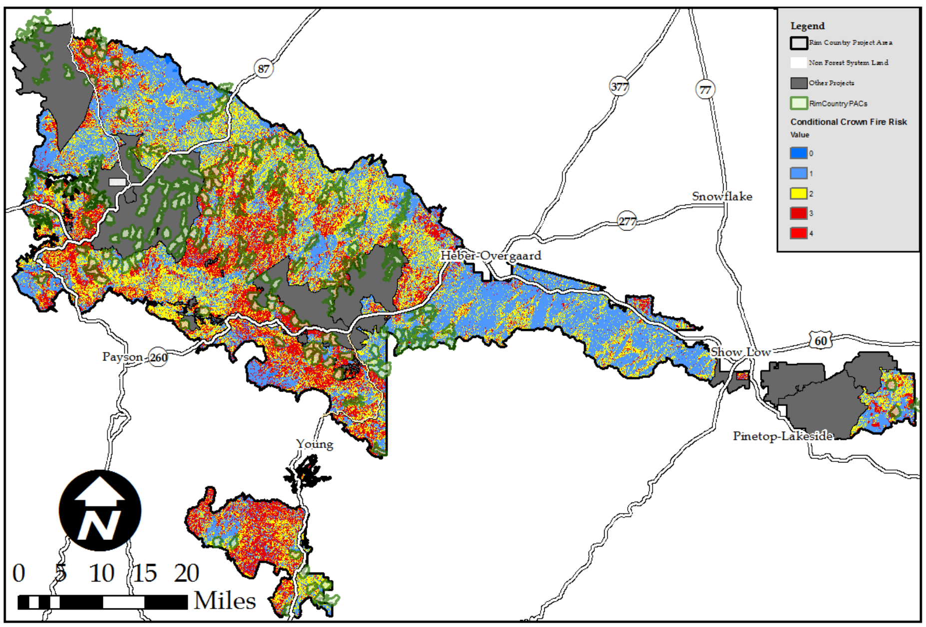
In Foraging/Non-Breeding habitat, crown fire potential modeled 41,878 acres, with 31,629 acres (85 percent) that could experience crown fire. Active crown fire in Foraging-Other Recovery Habitat in the existing condition total 10,210 acres (24 percent) of this habitat type modeled in the project area 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 potential of crown fire would be greatly reduced in the action alternatives (see Analysis for the MSO by Alternatives section below).

Table 14. Potential for Crown Fire Modeled in MSO Habitat Types in the Existing Condition

MSO Habitat Type	Active Crown Fire Acres	%	Conditional	%	Passive	%	Surface Fire Acres	%	Non Burnable	%
Protected PAC	43,630	36	14,613	12	37,352	31	24,996	20	1,632	01
Recovery Nest/ Roost	3,773	37	1,029	10	3,363	33	2,103	20	20	0.2
Recovery Foraging-Non-Breeding	10,210	23	4,879	12	16,540	40	2,102	24	206	0.5

Figure 12. Risk of Crown Fire in MSO PACs in 4 FRI Rim Country in the Existing Condition.



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 and in the Rim Country Flexible Toolbox for Mechanical Thinning (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/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 consultation with U.S. Fish and Wildlife Service (USFWS) personnel. In nest/roost recovery habitat, the Flexible Toolbox Approach for Mechanical Treatments (Appendix 2) 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 5).

Design Features

Design features (Appendix 5) for alternatives 2 and 3 have the following as examples of requirements to minimize affects from treatments for the MSO and its habitat:

- If nest or roosts are not known, treatments will not occur within 0.25-mile buffer of core areas unless surveys indicate the PAC is unoccupied.
- Trees greater than 24 inches in diameter would not be cut in Mexican spotted owl recovery and protected habitat except in overriding management situations such as for human safety.
- In Mexican spotted owl recovery foraging/non-breeding habitat, follow the most current Mexican spotted owl Recovery Plan and incorporate the following guidelines:
  • 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.
  • Tree thinning in pine-oak would target 40 to 110 BA; thinning in mixed conifer would target 40 to 135 BA. The goal is manage for a sustainable range of density and structural characteristics.
  • 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.
- Manage for forest plan levels of CWD when applying fire prescriptions.

- Ensure that the potential cumulative effects of multiple fires in a given area do not produce negative effects to local wildlife; coordinate burning between administrative units and between wildlife and fire management to minimize potential disturbance.
- When practicable, damage or mortality to old trees and large trees would be mitigated by implementing prescription parameters, ignition techniques, raking, wetting, thinning, compressing slash, or otherwise mitigating fire effects to the degree necessary to meet burn objectives and minimize fire effects and behavior in the vicinity of old trees. Trees identified as being of particular concern (e.g., trees with known nests or roosts for herons, eagles, osprey, or other raptors, occupied nest cores, or critical areas in Mexican spotted owl protected activity centers (PACs) would be managed in accordance with wildlife design features (see Wildlife). Prepare old trees 1 year or more before a burn if possible.
- Mexican spotted owl protected activity centers (PACs) and recovery nest/roost habitat will be managed to meet basal area, trees per acre, and canopy cover requirements as specified in the most current MSO Recovery Plan.
- In Mexican spotted owl protected activity centers (PACs), springs, riparian and stream restoration would not occur during the breeding season (March 1 to August 31), if occupied.
- In occupied Mexican spotted owl protected activity centers (PACs) with currently nesting owls, no mechanical or prescribed fire treatments or road or trail maintenance would occur during the breeding season (March 1 to August 31).
- Hauling would generally avoid Mexican spotted owl protected activity centers (PACs) during the breeding season (March 1 to August 31) unless specific analysis has documented that this would not lead to adverse effects. Thinning equipment would remain greater than or equal to 0.25 miles from PAC boundaries during breeding season unless topographic features would limit noise; trucks would drive less than or equal to 25 miles per hour in PACs.
- Coordinate and implement management activities within Mexican spotted owl protected activity centers (PACs) to reduce potential disturbance and minimize the frequency and duration of operations within and immediately adjacent to these areas.
- In Mexican spotted owl protected activity centers (PACs), no new wire fencing would be constructed in PACs to minimize the risk of owls colliding with new fences. Other alternatives would be used for aspen, sensitive plants, springs, and ephemeral channel restoration exclosures.
- In Mexican spotted owl protected activity centers (PACs), road maintenance would not occur during the nesting season (Effective March 1 to August 31).
- All stands included in the proposed mechanical treatments for Mexican spotted owl protected activity centers (PACs) would be hand-marked for thinning, and marking would be coordinated with the US Fish and Wildlife Service.
- Fireline associated with preventing fire from entering Mexican spotted owl protected activity centers (PACs) and/or core areas would be constructed outside the nesting season.
- In Mexican spotted owl protected activity centers (PACs) nest trees would be protected in the design and implementation of prescribed fires.
- Survey all potential spotted owl areas including protected, recovery nest/roost, and other forest and woodland types within the implementation area plus the area ½-mile beyond the perimeter of the proposed treatment area. Surveys should be conducted for two years, with the second-year survey either the year before or the year of (but prior to) project implementation.

- Coordinate burning spatially and temporally to limit smoke effects on nesting Mexican spotted owls, particularly for protected activity centers (PACs) with nests in low-lying areas (Effective March 1 to August 31).
- In Mexican spotted owl protected activity centers (PACs), recovery nest/roost, goshawk post-fledging family areas, no old trees would be cut during the rehabilitation of temporary roads.
- If new Mexican spotted owl protected activity centers (PACs) are established in areas with planned or ongoing 4FRI activities then existing design features would apply to management activities.
- All non-Forest Service personnel involved in thinning and burning activities, transportation of equipment and forest products, research, or restoration activities would be briefed on the Mexican spotted owl, know to report sightings and to whom, avoid harassment of the owl, and are informed as to whom to contact and what to do if an owl is incidentally injured, killed, or found injured or dead.
- If enough snags/acre are not present, then all snags will be maintained within the Aquatic Management Zones unless deemed a hazard to the restoration activity.
- All snags will be maintained within the Aquatic Management Zones unless deemed a hazard tree.
- Snags and Logs: Protect snags and logs wherever possible by placing landings in existing openings or in areas where snags and/or logs, and old trees would be minimally affected.
- Snags and Logs: In ponderosa pine, protect/provide snags and logs wherever possible through site prep, implementation planning, green tree selection, and ignition techniques to retain 1-2 snags per acre greater than or equal to 18 inches in diameter, and greater than or equal to 3 logs greater than or equal to 8 feet long and greater than or equal to 12 inches mid-point diameter, and 3-10 tons of coarse woody debris (greater than 3 inches in diameter) per acre in pine and pine-oak habitat.
- Rock pits within ½ mile of MSO recovery and protected habitat would be surveyed to protocol to determine occupancy by owls before operations are initiated, unless a wildlife biologist determines this restriction is unnecessary.
- No ground disturbance from rock pit development or operation would occur in known protected activity centers (PACs), or within 1/4 miles of nests and roosts during the nesting season, unless a wildlife biologist determines this restriction is unnecessary.
- Material hauling from rock pits in or within ¼ miles of occupied PACs would occur outside of the Mexican spotted owl nesting season.

Habitat Restoration in MSO Habitat

A total of 196 PACs (110,890 acres) occur in the Rim Country treatment 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 USFWS. Twenty nine PACs would have some other type of restoration (Riparian, wet meadow, grassland, aspen, etc. included in Alternatives 2 and 3. See below). In the 4 FRI 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 (see the activities common to Alternatives 2 and 3 section for a general description of each restoration activity). Acres and miles for other restoration activities were calculated for PACs (table 15). 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 These activities would be implemented in recovery habitat types under both Alternatives 2 and 3: however, design features inteneded to improve stand and habitat quality would also be applied to achieve restoration success (see Appendix 5). 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 15. General Description and Acres of Restoration Treatments in Alternative 2 in Mexican Spotted Owl Protected Activity Centers (PAC).

Treatment	Alt 2 PAC Acres	Alt 3 PAC Acres
Mechanical Vegetation Treatments Total	**23,550**	**19,590**
Aspen Restoration	30	30
Facilitative Operations	300	300
PAC – Mechanical	17,460	15,750
Severe Disturbance Area Treatments	3,610	1,420
Grassland Restoration	72	72
Riparian Restoration	2,142	2,142
Riparian/Wet Meadow Restoration (Overlap)	98	98
Wet Meadow Restoration	256	256
Prescribed Fire Total	**82,280**	**61,700**
Prescribed Fire Only	58,730	42,050
Facilitative Operations Prescribed Fire Only	7,180	3,370
Mechanical and Prescribed Fire Treatment	23,550	19,560
Riparian Restoration within Core Areas	610	610
Riparian/Wet Meadow Restoration (Overlap) within Core Areas	31	31
Wet Meadow Restoration within Core Areas	33	33
Stream Restoration (in miles)	**171**	**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, 030404017.

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 3,610 acres) could have severe disturbance restoration activities associated with them. Design features (see Appendix 5) have been included to mitigate disturbances to the 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 350 acres. Design features (see Appendix 5) 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 2,200 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, 3 percent associated with machine piling of slash, 3 percent associated with landings, and 3 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 method 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 4 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 are reduced from 330 miles in alternative 2 to 170 miles in alternative 3.

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 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 National Forests could be decommissioned. The Tonto National Forest Travel Management EIS has identified approximately 290 miles of road within the Rim Country analysis area for decommissioning. In addition to system road decommissioning, up to 800 miles of unauthorized roads on all 3 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 196 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 16 below) 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 multiply the skid trail width (12 feet) by the linear distance of the skid trail (in feet) divided by 43, 560 sq feet per acre. As the table below shows, these increased skid trail lengths would affect an additional 10 acres of MSO Protected habitat.

Table 16. MSO PACs with Greater than 20 Acres of Mechanical Treatment Proposed and Greater Than 1,250 Feet from an Existing Road.

PAC Name	Acres Proposed for Mechanical	Approximate Skid Trail Length in Feet	Acres of Disturbance
Horton Canyon	145	2,640	0.72
Oak Springs	135	1,800	0.49
West Weber	132	1,250	0.34
Wolf Mountain	116	1,200	0.33
Pine Mountain	100	3,000	0.82
Colcord	99	2,000	0.55
Wingfield	88	1,200	0.33
Turkey Peak NW	80	2,000	0.55
Cove	72	1,800	0.49
Yellowjacket	63	1,800	0.49
Deer Lake	61	2,500	0.68
Colcord Canyon	54	2,600	0.71
Maintenance Yard	45	1,600	0.44
Wishbone	45	2,500	0.68
Pivot Rock Canyon	38	1,600	0.44
South Alder	34	1,500	0.41
Meadow Canyon	32	1,500	0.41
Turkey Peak NE	29	2,000	0.55
260 Trailhead	24	3,960	1.09
Maxwell	21	2,500	0.68

Smoke from Prescribed Fire

Design Features to Reduce Effects from Smoke in PACs

- Coordinate burning spatially and temporally to limit smoke effects on nesting Mexican spotted owls, particularly for protected activity centers (PACs) with nests in low-lying areas (Effective March 1 to August 31).
- In Mexican spotted owl protected activity centers (PACs) nest trees would be protected in the design and implementation of prescribed fires.

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 owls. Burning would be managed to minimize the accumulation of smoke in PACs during the breeding season (see Design Features, Appendix 5). 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 impacts to 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 4 FRI Rim Country team and with 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 were to 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 settled 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 Modeling

The fire ecologist modeled fire hazard index and crown fire assessment for MSO and wildlife habitat types proposed for treatments by the 4 FRI Rim Country project. 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 120,970 acres in PACs, 10,288 acres in Nest/Roost recovery habitat, and 41,879 acres in foraging/non-breeding MSO recovery habitat (table 197). In the existing condition 49,889 acres, or (41 percent of all PACs within the project area) are at risk of high severity wildfire (table 18), 41 percent of Nest/Roost Recovery and 26 percent of Foraging-other Recovery habitatare at risk. Alternative 2 reduces this risk to 28 percent of PACs, 6 percent of Nest/Roost recovery habitat, and one percent of Foraging/non-breeding habitat.

Table 17. Fire Hazard Index Modeled in MSO Habitat Types in the Existing Condition

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 18. Fire Hazard Index Comparison for acres of High and Extreme Risk by Alternatives with Percentages of Total Habitat Modeled in the Project Area for Fire Risk in Wildlife Habitat

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%)

Table 19. 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

Table 20. Active and Conditional Crown Fire Assessment Comparison of Alternatives in Wildlife Habitat (with Percentages of Total habitat Modeled in the Project Area)

MSO Habitat Type	Existing	Alternative 1	Alternative 2	Alternative 3
PAC	58,243 (48%)	61,608 (50%)	34,068 (28%)	33,044 (30%)
Nest/Roost Recovery	4,802 (47%)	5,183 (50%)	407 (04%)	685 (07%)
Foraging-other Recovery	15,090 (36%)	16,302 (39%)	350 (01%)	2,317 (06%)
Risk of Crown Fire in PFAs	23,270 (39%)	24,653 (41%)	11,170 (19%)	11,421 (20%)

Active and conditional crown fire (with percentages of each habitat type in the project area that could experience these categories of crown fire) are shown in table 19. The action alternatives greatly reduce these risk categories of crown fire across MSO habitat types (table 20). 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 (4 percent) in Alternative 2, from 16,032 acres (50 percent) in Alternative 1. Risk of crown fire in Foraging/Non-breeding recovery habitat is reduced to 350 acres (1 percent) in Alternative 2.

Mechanical Thinning and Burning

Alternatives 2 and 3 would follow forest plan direction, and include implementing guidelines from the revised MSO Recovery Plan (USDI FWS 2012). 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 consultation with USFWS.

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 habitat 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 5), and above.

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 harvest 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 about 500 miles of road decommissioning.

Treatments in MSO habitat were modeled using FVS by the 4FRI Silvicultural Specialist. Tables 22-24 below show habitat variables in pine-oak, and mixed conifer cover types, as well as using the

Geophysical Model (Tonto NF Recovery Habitats) important to the MSO with modeled results in 2019 (existing condition), 2029, and 2039 to show effects from treatments through time. Key habitat variables important to the MSO and its prey base are included in table 21, below.

Table 21. Key Habitat Variables Modeled Important to the MSO

Column Label	Description
Sum of GIS Calculated Acres	Acres
Average of Tpa	Trees per acre
Average of BA	Basal Area (ft2/ac)
Average of SDI	Stand Density Index
Average of QMD	Quadratic Mean Diameter in inches
Average of SNAG1218	# snags 12-18" per acre
Average of SNAG1824	# snags 18-24" per acre
Average of SNAG2499	# snags 24"+ per acre
CANCOV Regression from BA	% canopy cover
Average of Surface Fuel TPA	total surface fuel (tons per acre)
Average of CWD 3"+ TPA	coarse woody debris, surface fuel 3"+ (tons per acre)
Average of Surface Herb TPA	Herbaceous biomass (tons per acre)
Average of Surface Shrub TPA	Shrub Biomass (tons per acre)
Average of ALL_BA1	BA 0-1"
Average of ALL_BA2	BA 1-5"
Average of ALL_BA3	BA 5-12"
Average of ALL_BA4	BA 12-18"
Average of ALL_BA5	BA 18-24"
Average of ALL_BA6	BA 24"+

MSO Protected Habitat

Table 22. FVS Modeling of Key Habitat Variables for the MSO in Mixed Conifer and Pine-Oak 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

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 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
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 BA was used to estimate canopy cover (Swetnam, 1998). These estimates indicate that treatments would 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 or increased 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.

MSO 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 (Appendix 2) and with associated design features (Appendix 5).

Table 23 below 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 Nest/Roost Recovery Habitat. In MSO Nest/Roost recovery habitat, the treatments would maintain or increase most habitat variables important to the MSO 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 would align with MSO Recovery Plan recommendations, staying above 60 percent canopy cover in mixed conifer and in pine oak and using the geophysical model. 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 23. FVS Modeling of Key Habitat Variables for the MSO in Mixed Conifer, Pine-Oak, and using the Geophysical Model (Tonto NF) Nest/Roost Recovery Habitat

NR Recovery MC = 11,065 Acres Modeled PO = 13,539 Acres Modeled Geophys. = 3,940 Acres Modeled	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
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

NR Recovery MC = 11,065 Acres Modeled PO = 13,539 Acres Modeled Geophys. = 3,940 Acres Modeled	Existing	No Action 2029	No Action 2039	Alt 2 2029	Alt 2 2039	Alt 3 2029	Alt 3 2039
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
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
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

NR Recovery MC = 11,065 Acres Modeled PO = 13,539 Acres Modeled Geophys. = 3,940 Acres Modeled	Existing	No Action 2029	No Action 2039	Alt 2 2029	Alt 2 2039	Alt 3 2029	Alt 3 2039
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

MSO Foraging/Non-breeding Recovery Habitat

Design features (Appendix 5) 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:

- 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.
- Tree thinning in pine-oak would target 40 to 110 BA; thinning in mixed conifer would target 40 to 135 BA. The goal is manage for a sustainable range of density and structural characteristics.
- 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 24 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 24. FVS Modeling of Key Habitat Variables for the MSO in Mixed Conifer, Pine-Oak, and using the Geophysical Model **(Tonto NF) Foraging/Non-breeding Recovery Habitat.**

Foraging/Non-breeding Recovery MC = 21,220 Acres Modeled PO = 85,458 Acres Modeled GM = 31,659 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	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
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

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 24). 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. These estimates indicate that treatments would align with MSO Recovery Plan recommendations. 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 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 below for effects from the specific action alternatives).

Direct and Indirect Effects

Effects of Disturbance from Project Implementation

This large scale restoration project proposes treatments in all MSO habitat types. While design features have been included to minimize disturbance affects to the species, it is possible that individual owls could be disturbed by thinning and burning operations. The effects of the proposed thinning is anticipated to result in minimal direct effects to the owl. The Forests intend to avoid activities within PACs during the breeding season unless the PAC is adequately surveyed and determined to be unoccupied with concurrence from the USFWS.

Noise Disturbance

Literature examining noise disturbance in regards to MSO is extensively reviewed in the 1st 4FRI wildlife specialist reports in the MSO analyses. In Rim Country, noise disturbance from project activities may affect foraging MSO, but are not expected to affect nesting or roosting owls due to design features intended to restrict all implementation to outside of the breeding season with ½ mile buffers and due to project planning. Numerous design features have been added to minimize disturbance to the MSO from implementation (Appendix 5).

Road-related Disturbance

Road maintenance and construction would have short-term negative effects to habitat from up to 330 miles of new temporary or existing non-system roads. These would be decommissioned after restoration activites are completed. No temporary roads in PACs are proposed so affects to the MSO from this activity are expected to be minimal. Long-term beneficial effects are expected from the decommissioning of 490 miles of existing roads and up to 800 miles of unauthorized roads in the project area. No road decommisioning activites would occur during the breeding season in PACs.

Available research does not address effect of noise to owls foraging outside of PACs or to owls outside the breeding season. Owls can be active during crepuscular hours and could, on occasion, forage during daylight, increasing the risk of noise disturbance from road activities to individual foraging MSOs. In addition, hauling of forest materials is also likely to occur at night. Disturbance to foraging owls would be site-specific and could cause owls to shift to areas that provide undisturbed foraging opportunities. There could be energetic costs and increased risk of predation associated with displacement of foraging owls. The likelihood of this occurring is unknown as are the actual effects.

Transportation-related activities have timing or distance restrictions in or near PACs and core areas. The intent and expectation is to avoid all mechanized equipment in core areas and avoid working in PACs with a ½ mile buffer during the nesting season. Hauling would require trucks to drive <25 mph within PAC boundaries. We expect to avoid noise disturbance to nesting and roosting owls as a result of preplanning, project design features, and mitigation. Foraging owls could be affected by noise, but based on research related to mechanical noise disturbance, we do not expect adverse effects. However, history has shown that timelines and circumstances can change in ongoing projects. It is not unreasonable to anticipate unforeseen circumstances leading to a need to conduct road work or hauling within a PAC during the breeding season. The risk of this occurring is exasperated by the spatial and temporal scales of the project. While this is not the intent of the project, if exceptions were to occur they would be limited in number and scale and the USFWS would be notified.

Collisions

In the short-term, road work and particularly hauling materials off forest increases the risk of collisions between MSOs and vehicles involved in forest harvest activities. There are documented mortalities of MSOs from collisions with moving vehicles, including unpaved forest roads (USDI 2012a). Little information is available on how frequently collisions might occur and what conditions might relate to owls being more or less vulnerable. Birds migrating or dispersing through unfamiliar terrain may be at higher risk than resident birds (USDI 2012a). While collisions are not typically analyzed in vegetation manipulation projects, we felt the scale of the 4FRI Rim Country project area in terms of time, area, and intensity of road traffic warranted this consideration.

Haul routes may cause noise disturbance to nesting owls and logging trucks could potentially hit owls, causing injury or death. Most logging traffic would occur during day time hours when owls are not as mobile; however there could be occasions when trucks are operating at times when owls would be foraging in the area during the late afternoon or early morning. Hauling would require trucks to drive <25 mph within PAC boundaries.

Task orders would be issued to implement work in defined portions of the 4FRI Rim Country project area on a yearly basis. Work would be spread across the treatment area and implementation would occur in an incremental manner as new annual task orders are issued. Vehicular activities resulting from harvest operations would increase current traffic levels well above existing conditions in portions of the treatment area on an annual basis for the duration of the project. This would typically create an increase in risk of collisions in localized areas for about 2 years before operations would shift to other areas. The level of short-term risk cannot be quantified, i.e., there is no defined relationship between open road miles or vehicle use and collisions with owls. Nevertheless, whatever the current risk level is, it would likely increase with implementation of the 4FRI Rim Country project. This localized, short-term risk would continue to move around the landscape for the duration of 4FRI Rim Country-related harvest activities, although not all harvest and related actions would overlap with MSO habitat. Once harvest activities are complete, about 500 miles of road would be decommissioned, decreasing the risk of collisions across the implementation area over the long-term.

Fire-Related Disturbance

Where there are no roads, trails, or natural barriers, new fireline would be built to prevent fire from entering core areas. Building fireline would occur outside the breeding season. Potential effects of fireline construction include effects to habitat such as erosion or loss of cover for prey species. Fireline “trails” (social trails) could increase recreation and access in PACs, increasing disturbance and potential loss of snags and logs. Building fireline would occur outside the breeding season.

Whenever possible prescribed burning would be applied to the entire PAC area, including the core, in conjunction with prescribed burning across the project area. When this approach is feasible the Forests Service would not separate prescribed burning of PACs from the surrounding project area. This strategy minimizes disturbance from fire containment actions (handline construction) and the prescribed fire operations that would be needed to preclude prescribed fire from entering the core areas. This also provides flexibility for fire managers to minimize burn severity (e.g. backing fire down slope) within core areas.

Fire experts on the three National Forests associated with Rim Country indicated smoke associated with prescribed fire typically does not settle into low-lying areas for more than 2 or 3 nights. Limited smoke within PACs represents an aspect of the evolutionary environment for wildlife in northern Arizona and, as such, should result in negligible effects to MSO (Horton and Mannan 1988). However, first-entry burns would include fuel loads above historical levels, causing quantities of smoke greater than what would likely have occurred during frequent fire return intervals. As a result, uncharacteristically dense smoke could settle into PACs during initial burn operations. Dense smoke from first-entry burns (i.e., areas that have not burned in 20 or more years) settling into core areas early in the season (March through June) could affect brooding females. While flushing is unlikely, leaving eggs unattended would be considered an adverse effect if an adult MSO interrupted egg incubation due to management activities.

Despite the possibilities discussed above, smoke is not expected to be a disturbance to MSOs for several reasons. Settling smoke has long been an issue that fire experts address on this landscape. This has led to knowledge of smoke patterns and developing ignition techniques to minimize undesirable smoke effects. In addition, smoke from prescribed fire would comply with Arizona Department of Environmental Quality requirements (ADEQ). Smoke effects are regulated and permits are required by ADEQ before burning is initiated. Air quality requirements specify management actions would meet air quality standards. ADEQ considers the cumulative effects of smoke emissions from multiple jurisdictions prior to approving daily prescribed fire activities. This mitigates the potential for severe smoke effects from multiple prescribed fire projects across the treatment area. Given the planning, design features, and ignition techniques, smoke from prescribed fire would not be expected to result in adverse effects to MSO. However, this cannot be guaranteed and adverse effects to owls could occur if smoke unexpectedly settled into PACs for three or more days and nights.

Thinning Related Disturbance

Short-term affects to MSO habitat is expected to occur as a result of restoration thinning activities (1-2 years after treatment) with long-term benefits occurring as vegetation responds to prescribed treatments. Forest structure and habitat for prey base (FVS model runs) are extensively analyzed below, by MSO habitat type and alternative, discussing these long-term improvements. Short term affects are considered to be minimized by design features, however it is possible that individual MSO could be disturbed either directly or indirectly from these activities due to the large spatial and temporal size of the Rim Country project.

Other Habitat Restoration Disturbance in PACs

Restoration of springs, riparian areas, stream channels, grassland, savanna, and wet meadows would occur in PACs outside of the breeding season or in PACs that are determined to be unoccupied with concurrence from USFW. Timing restrictions should minimize disturbance effects to the MSO from other habitat restoration implementation in PACs.

Alternative 1 (No Action)

Direct and Indirect Effects

Alternative 1 was analyzed to contrast the effects from Alternatives 2 and 3 with current conditions and expected future conditions should the Rim Country project not occur. This alternative proposes no restoration treatments, but habitat variables are modeled the same as for Alternatives 2 and 3.

This 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 25. Habitat Variables Analyzed in PAC cover types, Mixed Conifer (MC) and Pine-Oak (PO) for Alternative 1, No Action

PACs MC = 16,481 Acres Modeled PO = 56,180 Acres Modeled	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 $\geq$ 24 MC	1	1	1
Avg of SNAG $\geq$ 24 PO	0	0	0
Percent CANCOV MC MC	74	76	78
Percent CANCOV 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

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 25) shows trees per acre in mixed conifer and pine-oak 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. These decreases are a result of competition between trees as stand density index shows almost no change from the existing 398 MC and 339 P-O to 425 MC and 362 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 d.b.h. The average of all basal areas, from the sapling Size Class 1 to old growth 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 CWD and snags greater than 12 inches d.b.h. (table 25). 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 CWD (cover for prey species) under this alternative. However, accumulated CWD 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 25). However, canopy development combined with a lack of fire and increased needle accumulation would cause a continued decline in understory through time. The continued lossand 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 on 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 CWD greater than three inches, would be high under Alternative 1, moving from an existing condition of 18.7 tons per acre to just over 27 tons per acre in 2039 (Table 25). 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 26. 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

Potential for active and conditional crown fire is increased in the No Action Alternative compared to the existing condition from 58,243 acres (48 percent of the PACs in the project area) in the existing condition 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 27).

Table 27. 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	%	Non-Burnable Acres	%
Protected PAC 122,222 Acres Modeled	55,868	46	5,739	5	41,353	34	17,670	14	1,592	1
Recovery Nest/Roost 10,289 Acres Modeled	4,894	48	288	3	4,007	39	1,077	10	20	>1
Recovery Foraging-Non-Breeding 41,879 Acres Modeled	14,992	36	1,310	3	20,529	49	4,841	12	206	>1

Maintaining current forest conditions would maintain a high fire hazard index (88 percent is at risk of stand-replacing fire conditions and increased risk of crown fire). Over 86 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

Table 28. Habitat Variables Analyzed in Recovery Nest/Roost Habitat, Alternative 1, No Action

NR Recovery MC = 11,065 Acres Modeled PO = 13,539 Acres Modeled Geophys. = 3,940 Acres Modeled	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
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
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

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

Forest Structure

Under Alternative 1, No Action, FVS modeling (table 28) in MSO Nest/Roost Recovery Habitat shows that over time trees per acre are reduced, but not to within the natural range of variation 1,100 MC, 1,280 P-O, and 1,351 GM in the existing condition to 873 MC, 1,052 P-O and 1,134 in 2039). Stand density index would remain high, from 420 MC, 369 P-O, and 441 GM in the existing condition to 438 MC, 380 P-O, and 445 GM in 2039. The quadratic mean diameter would only increase 2 inches in MC and 1 inch in P-O over 20 years.

Snags

Snags greater than 12 inches d.b.h. 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 coarse woody debris (cover for prey species) 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 MC and P-O cover types, and 0.20 in GM, is maintained through 2039). Shrub biomass in tons per acre (cover for prey species) would decrease in MC and would be maintained in P-O and GM under Alternative 1, moving from 0.4 tons per acre in the existing condition in MC to 0.3 tons per acre in 2039 (table 28).

Fire Effects

Surface fuel loading in MSO Nest/Roost Recovery habitat, including litter, duff, and CWD greater than three inches, would be high under Alternative 1, moving from an existing condition of nearly 30 tons per acre in MC, 19 in P-O, and 23 GM to 37 tons per acre in MC, 26 in P-O, and 29 GM in 2039 (table 28).

Fire Hazard Index is increased from alternative 1 from 8,035 acres (78 percentof the Nest/Roost Recovery habitat modeled in the project area in need of treatment) in existing condition to 9,150 acres (89 percent). The highest and greatest hazard categories of FHI from alternative 1 in Nest/Roost Recovery habitat are 5,594 acres (50 percent) of all Nest/Roost Recovery habitat modeled in the project area are expected to experience high severity wildfire.

Potential for crown fire is increased in the No Action Alternative compared to the existing condition from 8,290 acres (81 percent) in the existing condition to 9,218 acres (90 percent) from Alternative 1. Active crown fire in Nest/Roost Recovery habitat in Alternative 1 total 5,414 acres (53 percent) of this habitat type modeled in the project area that would experience high severity crown fire.

Foraging/Non-Breeding Recovery Habitat

Table 29. Habitat Variables Analyzed in Foraging/Non-Breeding MSO Recovery Habitat, Alternative 1, No Action

Foraging/Non-breeding Recovery MC = 21,220 Acres Modeled PO = 85,458 Acres Modeled GM = 31,659 Acres Modeled	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
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
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

Forest Structure

Under Alternative 1, No Action, FVS modeling (table 29) shows that trees per acre in Foraging/Non-Breeding MSO Recovery Habitat would be reduced, but not to within the natural range of variation from 1,398 in MC, 1,192 in P-O, and 1,443 GM to 1,101 in MC, 952 in P-O, and 1,196 GM in 2039. Stand density index would remain high, from 376 in MC, 329 in P-O, and 407 GM to 182 in MC, 158 in P-O, and182 GM in 2039. The quadratic mean diameter would only increase by 1 inch over 20 years

Snags

Foraging/Non-Breeding Recovery Habitat under Alternative 1 would have an increase in snags greater than 12 inches d.b.h. (table 29). 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 (from 0.21 tons per acre in MC and P-O, and existing condition, 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 existing condition to 0.28 tons per acre in 2039 (table 29).

Fire Effects

Surface fuel loading in MSO Foraging/Non-Breeding Recovery Habitat, including litter, duff, and CWD greater than 3 inches, is high under Alternative 1, moving from an existing condition from as high as 24 tons per acre to 32 tons per acre in 2039 (table 29).

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 that 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

Use of Existing 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.

Road Maintenance-Under the no action alternative 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 the no action alternative no road decommissioning would occur within the project area unless it is analyzed under separate NEPA analysis.

Temporary Roads- No new temporary roads would be constructed, unless constructed 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.

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 30). The temporal component in this analysis was defined as 10 years for short-term effects and 30 years for long-term effects.

Table 30. Mexican Spotted Owl Protected Activity Centers (MSO PACs) Within or in Close Proximity to the Rim Country Project Area

PAC Location	Number of MSO PACs
Within Areas Proposed for Mechanical and Fire Treatments[1]	156
Within the Rim Country Project Area[2]	196
Within 0.5 mile of the Project Area Boundary	209

1. The area of treatments proposed under the 4FRI; this is a subset of the total areas with the 4FRI boundary
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. 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 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 d.b.h. Current numbers of TPA greater than or equal to 18 inches d.b.h., 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 BA 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 4 FRI Rim Country project **may affect, is likely to adversely affect the Mexican Spotted-owl.**

Alternative 2 – Modified Proposed Action

Under Alternative 2, mechanical treatments would occur in portions of all MSO habitats, except for core areas which would only be burned. 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 BA for nesting and roosting habitat would be 110 square feet per acre. Adjustments would be made during implementation to retain a BA 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 d.b.h. would be cut in MSO habitat. Trees up to 18 inches d.b.h. would be retained whenever possible but 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 (2019-2039).

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 31. Alternative 2 Summary of Thinning and Burning Treatments (Acres) in Mexican Spotted Owl (MSO) Habitat

	MSO Habitat Types			
Treatment Type	**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

Treatment Type	MSO Habitat Types			
	Protected	Nest/roost Recovery	Foraging/Non-Breeding Recovery	Total Acres
Prescribed Burns in Core Areas	610			610
Total	**74,549**			**241,585**
No Proposed Treatments from 4 FRI[2]	7,075			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 will be treated as planned through other NEPA decisions/other project areas.

Table 32. FVS Modeled Treatments in Cover Types by MSO Habitat Type, 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

A total of 196 PACs (110,890 acres) occur in the Rim Country treatment area. Approximately 7,075 acres occur in other project areas that overlap with the 4 FRI Rim Country project area but will be treated as those projects planned and consulted with USFWS. Approximately 17,500 acres that also occur in other overlapping project areas would have some other type of restoration (riparian, wet meadow, grassland, aspen, etc. see Actions common to Alternatives 2 and 3 above). In the 4 FRI Rim Country project area with Alternative two, 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 d.b.h. 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 5) were included to minimize effects on owls and to promote habitat recommended by the MSO Recovery Plan and the forest plans. Mechanical Treatments in PACs in Alternative 2 are summarized above in Effects Common to Both Action Alternatives section. The Mechanical Flexible Toolbox 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 consultation with U.S. Fish and Wildlife Service (USFWS) personnel.

Table 33. Summary Treatments in PACs, Alternatives 2 and 3

Proposed Treatment	**- Alternative 2 -** Modified Proposed Action Acres
PAC - Aspen Restoration	30
PAC - Facilitative Operations Mechanical	300
PAC - Facilitative Operations Prescribed Fire Only	7,180
PAC - Grassland Prescribed Fire Only	41
PAC - Grassland Restoration	23
PAC – Mechanical	17,460
PAC - Prescribed Fire Only	58,730
PAC - Riparian Prescribed Fire Only	911
PAC - Riparian Restoration	2,142
PAC - Severe Disturbance Area Treatment	3,610
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	256
Grand Total	**82,279**

Table 34. Habitat Variables Analyzed in Protected MSO Habitat In Mixed Conifer and Pine-Oak habitat, Alternative 2, the Modified Proposed Action

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- MC	74	67	66
Average of CANCOV- 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
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

Forest Structure

Under Alternative 2, the FVS modeling of treatments over the next 30 years indicates that most forest structure, as it pertains to habitat elements important to the MSO in PACs, would be preserved through time. Trees per acre would be reduced from the existing 1,291 in MC and 1,276 in P-O to 227 in MC and 232 in P-O in 2039 (table 34). Reducing TPA closer to NRV protects PACs and restores conditions for the 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 growth 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 2039. The basal area average would be decreased from the existing 173 in MC and 144 in P-O to 127 in MC and 106 in P-O in 2039. Increasing BA 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, 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 MC and 69 percent in P-O to 66 percent in MC and 61 percent in P-O 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 5) 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 MC and 339 in P-O to 218 in MC and 191 in P-O in 2039. A reduction in SDI competition would increase the quadratic mean diameter from the existing 6 inches in both MC and P-O to 12 inches in MC and 11 inches in P-O in 2039. By emphasizing for 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).

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 34). These habitat variables important to the MSO and MSO prey species would be preserved over time under this action alternative. Snags 12-18 inches d.b.h. would increase from four per acre in MC and 2 per acre in P-O to five per acre in both cover types in 2039. Snags 24 inches d.b.h. and greater would increase from 1 per acre in MC and 0 in P-O (existing) to 1 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, coarse woody debris 3 inches and greater would increase from the existing 10 tons per acre in MC and 8 tons per acre in P-O to 13 tons per acre in MC and 9 in P-O 2039.

Herbaceous biomass in tons per acre would increase slightly over 20 years. The existing 0.21 tons per acre in both MC and P-O cover types would increase to 0.26 tons per acre in MC and 0.23 tons per acre in P-O in 2039. Treatments would move the existing shrub biomass from 0.40 tons per acre in MC to 0.73 in 2039. Increasing these PCEs 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 MC and 20 tons per acre in P-O to 27 tons per acre in MC and 19 in P-O 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 FHI 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 91,697 acres (76 percent of the PACs in the project area in need of treatment) to 83,832 acres (69 percent). The highest and extreme need for treatment categories of FHI from alternative 2 in PACs are 33,410 acres (27 percent) of all PACs in the project area are 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 35. Fire Hazard Index Modeled in MSO Habitat Types for 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

Potential for active and conditional crown fire is decreased in Alternative 2 compared to the existing condition from 58,243 acres (48 percent) in the existing condition to 34,068 acres (28 percent) of this habitat type in the project area that would experience high severity crown fire as a result of treatment in Alternative 2.

Table 36. Potential for Crown Fire Modeled in Acres and Percentages in MSO Habitat Types for 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

For comparisons by alternatives see Actions Common to Alternative 2 and 3 smoke from prescribed burns and wildfire modeling sections.

Recovery Nest/Roost Habitat

There are 39,461 acres of Nest Roost Recovery Habitat in the Rim Country project area. Much of these acres (28,554 acres or 72 percent) could receive treatments through thinning and fire in Alternative 2. The Mechancal Flexible Toolbox (Appendix 2) 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 included in this project (Appendix 5) would ensure that elements of habitat important to the MSO and its prey base will be promoted through these treatments. Table 37 below summarizes the mechanical treatments in Nest/Roost recovery habitat in Alternative 2.

Table 37. Mechanical 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**

FVS modeling of these PCEs and habitat variables important to the MSO and its habitat types are discussed below.

Table 38. Habitat Variables Analyzed in Nest/Roost MSO Recovery Habitat in Mixed Conifer, Pine-Oak, and using the Geophysical Model (Tonto NF), Alternative 2, Proposed Action

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
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
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

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 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
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 habitat 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 MC, 1,280 in P-O, and 1,351 using the GM to 116 in MC, 137 in P-O, and 109 GM. Reducing TPA 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 growth (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 2039. Increasing BA 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, 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 MC, 164 in P-O, and 190 GM to 127 in MC, 112 in P-O, and 102 GM in 2029. The percent average canopy cover would be reduced from the existing 76 percent in MC, 73 percent in P-O, and 77 percent GM, to 66 percent in MC, 62 percent in P-O, and 60 percent GM 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 (see the Fire Effects section for Alternative 2 below). 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 MC, 369 in P-O, and 441 GM to 197, 183, and 164 GM in 2029. Reduction in SDI competition would increase the quadratic mean diameter from the existing 6 inches in MC, 7 in P-O, and 6 GM to 16 inches in MC, and 14 inches in both P-O and using the GM in 2029. By emphasizing for 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).

Snags

In Nest/Roost Recovery Habitat, snags would increase or be maintained from existing condition as a result of treatments under Alternative 2 (table 40). These habitat variables important to the MSO and MSO prey species are preserved over time under the 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 treatment from Alternative 2.

Coarse Woody Debris and Understory

Coarse Woody Debris greater than 3 inches would be maintained at 10 tons per acre in MC and increases in P-O from 6 tpa (existing) to 8 tpa in 2029. Using the GM CWD increases from the existing 10 tpa to 11 tpa in 2029. Herbaceous biomass increases over the 20 years modeled in MC and using the GM. The existing condition of 0.21 tons per acre in MC, and 0.20 GM would increase to 0.26 in MC and 0.23 GM in 2039. More pronounced is the effect of treatments on the shrub biomass, changing from 0.40 tons per acre in MC to 0.78 in 2029. In acres identified using the GM shrub biomass increases from 0.25 tons per acre (existing) to 0.30 tpa in 2029. Increasing these elements of habitat important to prey base for the MSO would be an added benefit to treatments in Nest/Roost Recovery Habitat from 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 MC, 19 in P-O, and 23 GM to 23 tpa in MC and 18 tpa in P-O and GM in 2029 (table 38).

Fire hazard index is decreased from Alternative 2 from 4,175 acres (41 percent of the Nest/Roost recovery habitat modeled in high or extreme need of treatment categories) in existing condition to 588 acres (06 percent). Reductions of this magnitude should preserve existing MSO habitat while encouraging conditions to create more over time through recovery habitats.

Potential for active and conditional crown fire is decreased in Alternative 2 compared to the existing condition from 4,802 acres (47 percent) in the existing condition to 407 acres (04 percent) from Alternative 2. Reducing active crown fires by this magnitude are a benefit to the 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 73 %) could be treated with thinning or prescribed fire with

Alternative 2. The following Design Features (Appendix 5) were added to ensure implementation would incorporate promotion of elements of habitat important for the MSO and its prey base.

In Mexican spotted owl recovery foraging/non-breeding habitat, follow the most current Mexican spotted owl Recovery Plan and incorporate the following guidelines:
- 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.
- Tree thinning in pine-oak would target 40 to 110 BA; thinning in mixed conifer would target 40 to 135 BA. The goal is manage for a sustainable range of density and structural characteristics.
- 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 39. Treatment in MSO Foraging/Non-breeding Recovery Habitat, Alternative 2

Proposed Treatment	**- Alternative 2 -** Modified Proposed Action Acres
Mixed Conifer Recovery	**21,220**
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
Wet Meadow & Riparian Restoration	5
Grand Total	138,337

Table 40. FVS Modeling of Key Habitat Variables for the MSO in Mixed Conifer, Pine-Oak, and using the Geophysical Model (Tonto NF) 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	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
Average of SNAG 18-24” GM	1	2	2
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 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
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 habitat elements important to the MSO are preserved through time. In MSO Foraging/Non-Breeding Recovery habitat trees per acre would be reduced from the existing 1,398 in MC, 1,192 in P-O, and 1,443 GM to 97 in MC, 81 in P-O, and 73 GM in 2039.

Reducing TPA 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*) is increased as a result of this treatment to restore forest structure.

The average of all basal areas from saplings (Size Class 1) to old growth (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 2039. Maintaining BA 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 MC, 140 in P-O, and 170 GM to 75 in MC, 66 in P-O, and 59 GM in 2039. The percent average canopy cover would be reduced from 71 percent in MC, 69 percent in P-O, and 74 percent GM to 51 percent in MC, 47 percent in P-O, and 45 percent GM 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 (see the Fire Effects section).

Promotion of large tree growth would be achieved with proposed treatments as the stand density index would change from 376 in MC, 329 in P-O, and 407 GM to 121 in MC, 108 in P-O, and 95 in 2039. A reduction in SDI competition would increase the quadratic mean diameter from the existing 5 in MC, 6 in P-O, and 5 GM to 14 in all cover types in 2039.

Snags

In Foraging/Non-Breeding Recovery Habitat, snags would increase slightly as a result of treatments under Alternative 2 (table 42). These elements of 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 3 inches would increase from the existing 8 tons per acre in MC, 5 tpa in P-O, and 6 tpa GM to 8 tpa in MC, 6 tpa in P-O, and 7 tpa GM in 2039.

Herbaceous biomass in tons per acre would increase over 20 years. Shrub biomass would also increase in MC and GM 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 an existing condition of 24 tons per acre in MC, 16 tpa in P-O, and 19 tpa GM to 15 tons per acre in MC, and 12 tpa in P-O and GM in 2039 (table 40).

Fire Hazard Index is decreased from Alternative 2 from 10,717 acres (26 percent of the Foraging/Other recovery habitat modeled in need of treatment) in existing condition 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.

Potential for crown fire is decreased in Alternative 2 compared to the existing condition from 15,090 acres (36 percent) in the existing condition to 350 acres (one percent) from Alternative 2 Reducing active crown fires by this magnitude are a benefit to the MSO and its critical habitat that would preserve Foraging/Other recovery habitat over time.

For effects from smoke see 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 under Actions Common to Alternatives 2 and 3. Grassland, savanna, and meadow treatments would include mechanical tree removal and prescribed burning within PACs under Alternatives 2 and 3.

Direct and Indirect Effects

Effects were discussed above in the Effects Common to Both Action Alternatives section. Alternative 2 proposes 82, 280 acres of thinning and burning in PACs. All implementation would occur outside of the breeding season in occupied PACs and within a ½ mile buffer. Effects are considered to be minimized by design features, however it is possible that individual MSO could be disturbed either directly or indirectly from these activities due to the large spatial and temporal size of the Rim Country project.

Cumulative Effects

Cumulative effects were evaluated across the 4FRI Rim Country project area, plus a 0.5-mile buffer beyond the project boundary (see table 29 above). The cumulative effects area includes 209 PACs. Most of the projects identified as part of the cumulative effects analysis occur outside of MSO habitat. Cumulative effects would likely be minimal, but include disturbance related to implementation, operations, and smoke drifting and settling away from ignition areas.

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 d.b.h. limits and some used up to 24-inch d.b.h. 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 BA in the short term. However, design features should ensure retention of large-diameter oak and small oak commonly sprout vigorously after fire. The total BA 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 CWD, 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 CWD 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 CWD 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

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 41. See Appendix 2, Mechanical Treatment Flexible Toolbox, and Appendix 5 Design Features.

Table 41. Summary of Treatments in MSO Protected Habitat, Alternative 3

Proposed Treatment	**- Alternative 3 -** Focused Alternative Acres
PAC - Aspen Restoration	30
PAC - Facilitative Operations Mechanical	300
PAC - Facilitative Operations Prescribed Fire Only	3,370
PAC - Grassland Prescribed Fire Only	41
PAC - Grassland Restoration	23
PAC – Mechanical	15,750
PAC - Prescribed Fire Only	42,050
PAC - Riparian Prescribed Fire Only	911
PAC - Riparian Restoration	2,142
PAC - Severe Disturbance Area Treatment	1,420
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	256
Grand Total	**61,695**

Table 42. Habitat Variables Analyzed in Protected MSO Habitat in Mixed Conifer and Pine-Oak Habitat, Alternative 3, Focused Alternative

PACs MC = 16,481 Acres Modeled PO = 56,180 Acres Modeled	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
Average of SNAG ≥ 24” MC	1	1	1
Average of SNAG ≥ 24” PO	0	1	1
Average of CANCOV- MC	74	67	67
Average of CANCOV- PO	69	64	64
Average of Surface Fuel TPA MC	29	27	27

PACs MC = 16,481 Acres Modeled PO = 56,180 Acres Modeled	Existing	Alt 3 2029	Alt 3 2039
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, FVS modeling of treatments over the next 30 years indicates that most forest structure as it pertains to habitat elements important to the MSO is preserved through time. Trees per acre are reduced from the existing 1,291 in MC and 1,276 in P-O to 379 in MC and 368 in P-O in 2029 (table 42). Reducing TPA closer to NRV protects PACs and restores conditions for the MSO by managing for a less dense, and encroached forested condition. Openings created by bringing these size classes closer 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 growth (Size Class 6) shows that intermediate-sized trees (Size 3 with BA 5-12 inches and Size 4 with BA 12-18 inches are predominant on the landscape and vastly departed from the natural range of variation) would be lowered, but not to desired conditions, as a result of treatments through 2039. The basal area average would be decreased from 173 in MC and 144 in P-O to 130 in MC and 117 in P-O. The percent average canopy cover would be reduced from the existing 74 percent in MC and 69 percent in P-O to 67 percent in MC and 64 percent in P-O 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 (see the Fire Effects section for Alternative 3 below).

Promotion of large tree growth would be achieved in Alternative 3 from proposed treatments as the stand density index changes from the existing 398 trees per acre in MC and 339 in P-O, to 235 in MC and 223 in P-O in 2039. A reduction in SDI competition would increase the quadratic mean diameter from the existing 6 inches in both MC and P-O habitat types to 12 inches in MC and 10 inches in P-O 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 42). These habitat variables important to the MSO and MSO prey species would be preserved over time under this action alternative. Of note: snags 12-18 inches d.b.h. would increase from two per acre to four per acre in 2039. Number of snags per acre, snags 24 inches d.b.h. 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 treatment from Alternative 3.

Course Woody Debris and Understory

In PACs course woody debris (CWD) 3+ inches increase from 10 to 12 tons per acre in MC and from 8 to 9 tons per acre in P-O 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 to 0.65 in MC in 2039. Shrub biomass would slightly increase in P-O as a result of treatments over 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 MC to 27 tons per acre in 2039.

Fire hazard index is decreased from Alternative 3 from 49,889 acres (41 percent of the PACs modeled in the project area in need of treatment) in existing condition 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 43. Fire Hazard Index Modeled in MSO Habitat Types for 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 58,243 (48 percent) existing condition of this habitat type in the project area that would experience high severity crown fire as a result of treatment in alternative 3.

Table 44. Potential for Crown Fire Modeled in Acres and Percentages in MSO Habitat Types for 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 41,879 Acres Modeled	2,177	05	140	>01	26,812	64	12,530	30	206	>01

Recovery Nest/Roost Habitat

Approximately 22,833 acres (58 percent) of MSO Nest/Roost Recovery habitat would be thinned under Alternative 3. Table 47 below summarizes the proposed mechanical treatments in MSO Nest/Roost Recovery habitat in Alternative 3.

Table 45. Mechanical Treatments Proposed 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 46. FVS Modeling of Key Habitat Variables for the MSO in Mixed Conifer, Pine-Oak, and using the Geophysical Model (Tonto NF) Nest/Roost Recovery Habitat, Alternative 3

NR Recovery MC = 11,065 Acres Modeled PO = 13,539 Acres Modeled Geophys. = 3,940 Acres Modeled	**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
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 MC	76	65	65
Percent CANCOV PO	73	66	66
Percent CANCOV 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
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

Forest Structure

Under Alternative 3, FVS modeling indicates that most forest structure as it pertains to habitat elements important to the MSO would be preserved through time. Trees per acre would be reduced from the existing 1,100 in MC, 1,280 in P-O, and 1,351 GM to 155 in MC, 432 in P-O, and 176 GM in 2039. Reducing TPA closer to NRV protects Nest/Roost 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.

The average of all basal areas from saplings (Size Class 1) to old growth (Size Class 6) show that intermediate-sized trees (Size Class 3 with BA 5-12 inches and Size Class 4 with BA 12-18 inches are predominant on the landscape and vastly departed from the natural range of variation) would be lowered as a result of treatments through 2039. The basal area average would be decreased from the existing 188 in MC, 164 in P-O, and 190 GM to 124 in MC, 127 in P-O, and 106 GM. The percent average canopy cover would be reduced from 76 percent in MC, 73 percent in P-O, and 77 percent GM to 65 percent in MC, 66 percent in P-O, and 61 percent GM 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 (see the Fire Effects section for Alternative 3 below).

Promotion of large tree growth would be achieved in Alternative 3 as the stand denstity index changes from an existing 420 in MC, 369 in P-O, and 441 GM to 199 in MC, 231 in P-O, and 179 GM in 2039. A reduction in SDI competition would increase the quadratic mean diameter from the existing 6 inches in MC, 7 inches in P-O, and 6 inches in GM to 15 inches in MC, 13 inches in P-O, and 16 inches GM in 2039.

Snags

In Nest/Roost Recovery habitat, standing snags, coarse woody debris, and downed logs over 12 inches would be maintained or increase as a result of treatments under Alternative 3 (table 47). 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 3 inches or greater increases as a result of treatments through 2039. Herbaceous biomass in tons per acre would increase over 20 years under Alternative 3. The existing 0.21 tons per acre in MC and P-O and the 0.20 tons per acre GM would all slightly increase. Shrub biomass would change from the existing 0.40 tons per acre to 0.73 tons per acre in MC by 2039. Increasing these PCEs important to prey base for the MSO is an added benefit to treatments in Nest/Roost Recovery habitat from this alternative.

Fire Effects

Surface fuel loading in MSO Nest/Roost Recovery habitat would be reduced under Alternative 3, moving from an existing 30 tons per acre in MC, 19 in P-O, and 23 GM to 22 in MC, 19 P-O, and 19 GM in 2039 (table 47).

Fire hazard index is decreased from Alternative 3 from 4,175 acres (41 percent of the Nest/Roost recovery habitat modeled in the project area in need of treatment) in existing condition to 7788 acres (6 percent). Reductions of this magnitude should preserve existing MSO habitat while encouraging conditions to create more over time through recovery habitats.

Potential for crown fire is decreased in Alternative 3 compared to the existing condition from 4,802 acres (47 percent) in the existing condition to 685 acres (7 percent) from Alternative 3. Reducing active crown fires by this magnitude are a benefit to the 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. Much of these acres (92,696 acres or 53 %) could be treated with thinning or prescribed fire with Alternative 3. The following Design Features (Appendix 5) were added to ensure implementation would incorporate promotion of Primary Constituent Elements of habitat elements important for the MSO and its prey base.

In Mexican spotted owl recovery foraging/non-breeding habitat, follow the most current Mexican spotted owl Recovery Plan and incorporate the following guidelines:
• 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.
• Tree thinning in pine-oak would target 40 to 110 BA; thinning in mixed conifer would target 40 to 135 BA. The goal is manage for a sustainable range of density and structural characteristics.
• 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 46. Mechanical Treatments in MSO Foraging/Non-breeding Habitat, Alternative 3

Proposed Treatment	- Alternative 3 - Focused Alternative Acres
Mixed Conifer Recovery	**18,374**

Proposed Treatment	**- Alternative 3 -** Focused Alternative Acres
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
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

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

Table 47. Mechanical Treatment Summary for thr MSO in Mixed Conifer, Pine-Oak, and using the Geophysical Model 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	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
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 MC	71	56	57
Percent CANCOV PO	69	59	59
Percent CANCOV 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
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

Forest Structure

Under Alternative 3 the Rim Country 4 FRI project FVS Modeling from treatments over the next 30 years indicate that most Forest Structure as it pertains to habitat elements important to the MSO are preserved through time. In MSO Foraging/Non-Breeding Recovery habitat Trees per Acre are reduced from the existing condition of 1,398 in MC, 1,192 in P-O, and 1,443 GM to 304 in MC, 394 P-O, and 244 GM in 2039. Reducing TPA 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*) is increased as a result of this treatment to restore forest structure.

Average of All Basal Areas from tree size classes saplings 1 to old growth 6 show that intermediate sized trees (Size Class 3 with BA 5-12 inches and Size Class 4 with BA 12-18 inches are predominant on the landscape in the existing condition and vastly departed from the natural range of Variation) are lowered closer to desired condition as a result of treatment through 2039. Maintaining BA 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.

Basal Area Average is decreased from 157 in MC, 140 in P-O, and 170 GM to 91 in MC, 98 in P-O, and 82 GM. Canopy Cover is reduced from 71 percent in MC, 69 percent in P-O, and 74 percent GM to 57 percent in MC, 59 percent in P-O, and 53 percent GM 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 (see Fire Effects for Alternative 3 below).

Promotion of Large tree growth is achieved in Alternative 3 from proposed treatments as Stand Denstity Index goes from an existing condition of 376 in MC, 329 in P-O, and 407 GM to 165 in MC, 192 in P-O, and 151 GM in 2039. Reduction in SDI competition would increase Quadratic Mean Diameter from 5 inches in MC, 6 inches in P-O and 5 inches GM in the existing condition to 13 inches in MC, 12 inches in P-O, and 13 inches GM in 2039.

Snags

In Foraging/Non-Breeding Recovery Habitat, Snags over 12 inches would all be maintained or increase slightly from existing condition as a result of treatments under Alternative 3.These Primary Constituent Element habitat variables important to the MSO and MSO prey species are preserved over time under alternative 3.

Course Woody Debris and Understory

In Foraging/Non-Breeding Recovery Habitat coarse woody debris is maintained or increases slightly as a result of treatments through 2039. Herbaceous biomass in tons per acre is slightly increased over the 30 year FVS model from treatments under Alternative 2 in the Rim Country 4 FRI project area. Shrub Biomass in tons per acre also increases from existing 0.29 tons per acre MC to 0.65 tons per acre in 2039.

Fire Effects

Surface fuel loading in MSO Foraging/Non-breeding Recovery Habitat is reduced under Alternative 3, moving from an existing condition of 24 tons per acre in MC, 16 in P-O, and 19 GM to 18 in MC, 15 in P-O, and 19 GM by 2039.

Fire hazard index is decreased from Alternative 3 from 10,717 acres (26 percent of the Foraging/Non-breeding MSO recovery habitat modeled in the project area in need of treatment) in existing condition to 1,845 acres (4 percent). Reductions of this magnitude should preserve existing MSO habitat while encouraging conditions to create more over time through recovery habitats.

Potential for crown fire is decreased in Alternative 3 compared to the existing condition from 15,090 acres (36 percent) in the existing condition to 2,317 acres (6 percent) from Alternative 3.

Direct and Indirect Effects

Effects were discussed above in the Effects Common to Both Action Alternatives section. Alternative 3 proposes 61,700 acres of thinning and burning in PACs. All implementation would occur outside of the breeding season in occupied PACs and within a ½ mile buffer. Effects are considered to be minimized by design features, however it is possible that individual MSO could be disturbed either directly or indirectly from these activities due to the large spatial and temporal size of the Rim Country project.

Cumulative Effects of Alternative 3

Same as in Alternative 2

Determination of Effect

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 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.

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

Mexican Spotted Owl Critical Habitat

Units of Measure

As with the Analyses above for Protected and Recovery habitats for the MSO, the following evaluation criteria were used to compare environmental consequences for alternatives in critical habitat:

- Impacts to PCEs related to forest structure
  1. Acres treated and improved by habitat/vegetation type by alternative within MSO Habitat Type (Protected and Recovery habitats).
  2. Changes in BA by tree size-classes to show uneven aged management by alternative within MSO Habitats.
  3. Percent Canopy cover in MSO habitats.
  4. Changes in Quadratic Mean Diameter in inches, Trees per Acre, and Stand Density Index by alternative in MSO Habitats.
- Impacts to PCEs related to dead standing trees (snags)
  1. Change in numbers per acre of snags, with a diameter of 12 inches and greater by alternative in MSO Habitats (Average of Snags 12-18, 18-24, and greater than 24 inches DBH).
- Impacts to PCEs related to maintenance of adequate prey species (Course Woody Debris and Understory)

1. Coarse woody debris (CWD) surface fuel 3" or greater in tons per acre in MSO habitats.
2. Changes in tons per acre 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 Alternatives MSO Habitats the following variables were modeled and reviewed:
1. Changes in tons per acre by alternative of total suface 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

Critical habitat includes a subset of both protected and recovery habitat, as defined in the Recovery Plan. Designated Critical habitat in the project area consists of 106,108 acres of protected habitat (PACs) and 160,041 acres of Recovery habitat. Primary Constituent Elements (PCEs) of MSO habitat and prey base were incorporated in to the analyses, allowing for effects determinations to the MSO and its Critical Habitat.

Table 48. Critical habitat within the Rim Country project area

	BR-W-5	UGM-10	UGM-11	UGM-7	Critical Habitat Total
PAC	**4,657**	**91,562**	**8,310**	**1,578**	**106,108**
Recovery Habitat	**21,553**	**113,185**	**15,052**	**10,251**	**160,041**
Recovery Replacement Nest/Roost	*2,933*	*21,864*	*2,647*	*956*	*28,399*
Recovery Foraging/Non-Breeding	*18,620*	*91,322*	*12,406*	*9,295*	*131,643*
Grand Total	**26,210**	**204,748**	**23,362**	**11,829**	**266,149**

Acres of MSO protected and recovery habitat occur outside of the critical habitat boundaries (Table 49). These 72,735 acres were analyzed for affects to PCEs above for habitat types for the MSO (Protected, and Recovery habitats) in the MSO Effects Analysis section above.

Table 49. Acres of Protected and Recovery Habitat Outside of the Critical habitat Boundary

	Within Critical Habitat	Outside Critical Habitat	Grand Total
PAC	**106,108**	**4,782**	**110,890**
Recovery Habitat	**160,041**	**67,953**	**227,994**
Recovery Replacement Nest/Roost	*28,399*	*11,062*	*39,461*
Recovery Foraging/Non-Breeding	*131,643*	*56,891*	*188,533*
Grand Total	**266,149**	**72,735**	**338,884**

Alternative 1

Forest Structure

Under Alternative 1, large trees in MSO Critical Habitat would not be replaced due to the stagnant growth rates. FVS modeling in MSO habitats under Alternative 1 shows Trees per Acre is only slightly decreased from the existing condition. These decreases are a result of competition between trees as Stand Density Index shows almost no change from existing condition. Quadratic Mean Diameter only increases by slightly over the 20 years of modeling (from 6 to 7 inches) indicating a system that is not growing large trees, greater than 12 inches d.b.h. Average of All Basal Areas from tree size classes saplings 1 to old growth 6 show that intermediate sized trees (Size 3 with BA 5-12 inches and 4 with BA 12-18 inches are predominant on the landscape in the existing condition and vastly departed from the natural range of Variation) are not lowered to desired condition as a result of no treatment through 2039.

Snags

With no action MSO Critical Habitat shows an increase in CWD and snags greater than 12 inches d.b.h. 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 CWD (cover for prey species) under this alternative. However, accumulated CWD 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 show no change in both the short term and long term under Alternative 1. Canopy development combined with lack of fire and needle accumulation would cause a continued decline in understory through time. The continued loss of and fragmentation of understory vegetation would limit invertebrate populations, including pollinators. If this pattern continued over time, a potential 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 in Alternative 1, increasing risks to ecosystem structure, pattern, composition, and function.

Surface fuel loading in MSO Critical Habitat, including litter, duff, and CWD greater than 3 inches, is high under Alternative 1. Crown fire is 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.

In all MSO habitats Fire Hazard Index is increased from Alternative 1. Approximately 57,191 acres (47 prercent of all MSO protected, and 4,992 acres (49 percent) of Nest/Roost recovery habitat modeled) would be at high or extreme risk of high severity wildfire (table 20). Potential for crown fire is 61,608 acres (50 percent) of all MSO protected and 5,183 acres (50 percent) of Nest/Roost recovery habitat modeled in Alternative 1. The likelihood of high-severity fire and the size of wildfires producing undesirable effects would continue to increase. Alternative 1 does not follow Recovery Plan guidance for retaining management flexibility for abating risk of high-severity fire in CH (USDI FWS 2012b).

MSO critical habitat does not meet desired conditions relative to fire behavior. The risk of undesirable fire behavior and effects would continue in 2039 with no management action. 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 Silviculture reports).

Alternative 1 does not meet the purpose and need for the project. Forest structure and health in MSO Critical 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 CH would be on a trajectory moving away from desired conditions as described in the Coconino, Tonto and A-S Forest Plans.

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 degraded within the project area with many included in MSO CH. Similarly, wildlife habitat associated with almost 171 miles of riparian stream channels would remain degraded 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 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 the loss continued under current conditions. 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 would decrease exponentially as conifer cover increased (Stam et al. 2008). Understory biomass provides the food and cover to support MSO prey species, including small mammals, birds, and arthropods.

Roads

Use of Existing 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.

Road Maintenance-Under the no action alternative 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 the no action alternative no road decommissioning would occur within the project area unless it is analyzed under separate NEPA analysis.

Temporary Roads- No new temporary roads would be constructed, unless constructed 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 critical habitat in the short term. In the long term, MSO CH 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 decrease 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 recovery for this species. Surface fuels would continue to increase and understory vegetation would continue to decrease or remain the same. Alternative 1 would not contribute to improving forest health or vegetation diversity and composition, or 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.

Cumulative Effects

Because of the size of the 4FRI Rim Country analysis area and the large portion of the western UGM Recovery Unit and a portion of the Basin and Range RU that it occupies, the analysis area itself was considered adequate for assessing habitat effects to PACs. However, due to the potential for disturbance to owls, the cumulative effects boundary was extended 0.5 mile beyond the analysis area periphery to account for the spatial component of this analysis. Cumulative effects include effects of alternative one. The temporal component in this analysis was defined as 10 years for short-term effects and 30 years for long-term effects.

The effects of 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 One 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 d.b.h. Current numbers of TPA greater than or equal to 18 inches d.b.h., 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 and mixed conifer habitat would remain outside the historical range of variability 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 BA 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 historical 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 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 the project's activities Alternative 1 of the 4 FRI Rim Country project **may affect, is likely to adversely affect Mexican Spotted-owl Critical Habitat.**

Alternative 2 – Proposed Action

Under Alternative 2, mechanical treatments would occur in portions of all MSO Critical Habitat except for core areas which would be burned only. Treatments in MSO CH are listed below in Table 52.

Table 50. Alternative 2 Proposed Treatments by Acres in MSO Critical Habitat

Row Labels	BR-W-5	UGM-10	UGM-11	UGM-7	Grand Total
PAC	**341**	**19,966**	**1,660**	**764**	**22,731**
Aspen Restoration			28		28

Row Labels	BR-W-5	UGM-10	UGM-11	UGM-7	Grand Total
Facilitative Operations		298			298
Grassland Restoration		6	13		19
IT 10% - 25%		0			0
IT 25% - 40%		0			0
IT 40% - 55%		0			0
MSO Recovery - Replacement Nest/Roost		0			0
PAC – Mechanical	316	13,775	1,600	764	16,455
Riparian & Wet Meadow Restoration		93			93
Riparian Restoration	25	1,994	15		2,034
Severe Disturbance Area Treatment		3,557			3,557
SI 40% - 55%		0			0
UEA 10% - 25%		0			0
UEA 10% - 40%		0			0
UEA 25% - 40%		0			0
UEA 55% - 70%		0			0
Wet Meadow Restoration		243	4		247
Recovery Habitat	**21,553**	**82,945**	**7,349**	**10,074**	**121,921**
Facilitative Operations	2,460	1,473	3	69	4,006
Grassland Restoration		14	33	14	61
IT 10% - 25%		6,493	576	994	8,063
IT 25% - 40%	92	6,630	872	428	8,022
IT 40% - 55%	1,332	9,756	907	2,120	14,115
MSO Recovery - Replacement Nest/Roost	2,720	16,137	889	758	20,505
Riparian & Wet Meadow Restoration		304			304
Riparian Restoration	283	2,505	21		2,809
Severe Disturbance Area Treatment		1			1
SI 10% - 25%	220	1,197	281	281	1,979
SI 25% - 40%	2,032	3,361	228	82	5,703
SI 40% - 55%	1,841	1,468	579	571	4,459
ST	2,733	180			2,913
UEA 10% - 25%	6,063	11,156	895	750	18,864
UEA 25% - 40%	1,387	13,867	1,127	2,390	18,771
UEA 40% - 55%	213	1,849	653	1,376	4,091
UEA 55% - 70%	178	6,085	276	109	6,647
Wet Meadow Restoration		468	9	132	609
Grand Total	**21,894**	**102,910**	**9,009**	**10,838**	**144,652**

Total treatments in MSO habitat include 144,952 acres of mechanical thinning and low severity prescribed fire (about 54 percent of the total MSO CH habitat in the treatment area). Low-severity prescribed fire would be applied to all MSO habitats. No trees greater than 24 inches d.b.h. would be cut in MSO habitat. Trees up to 18 inches d.b.h. could be thinned in PACs. Treatments in recovery nest/roost habitat are designed to move forests toward nest/roost 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 occur within the project timelines (2019-2039).

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 expected implementation of the entire project would require 30 or more years to complete.

Forest Structure

Primary Constituent Elements Related to Forested Structure:

- A range of tree species composed of different tree sizes reflecting different ages of trees, 30 – 45 percent of which are large trees (12 inches dbh or more).

Under Alternative 2 the Rim Country 4 FRI project FVS Modeling from treatments over the next 20 years indicate that most Forest Structure as it pertains to Primary Constituent Elements important to MSO Critical Habitat are preserved or increased through time (tables 24-26). Modeling FVS indicates trees per acre are reduced from the existing condition as a result of treatment through 2039. Reducing TPA closer to NRV protects MSO 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.

Average of All Basal Areas from tree size classes saplings 1 to old growth 6 show that intermediate sized trees (Size Class 3 with BA 5-12 inches and Size Class 4 with BA 12-18 inches are predominant on the landscape in the existing condition and vastly departed from the natural range of Variation) are lowered closer to desired condition as a result of treatment through 2039. For example in PACs (table 24) and in Nest/Roost recovery habitat (table 25) average of all BA 5 (18-24 inches) and 6 (24 inches or greater) age classes in mixed conifer and pine oak habitat increase over time as a result of treatment. Modeling predicts basal area average is decreased from the existing condition in 2039. Increasing BA 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, 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.

- Shade canopy created by the trees branches covering 40% or more of the ground

In MSO critical habitat percent average of canopy cover is reduced from the existing condition by 2039, while still remaining at 60 percent or higher in protected and Nest/Roost recovery habitat, and 45 percent or higher in Foraging/Non-breeding recovery habitat (tables 24-26). 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 would preserve the recommended habitat conditions in critical habitat wherever possible while protecting this habitat from severe fire intensity or stand replaceing effects from crown fire (see Fire Effects for Alternative 2 below).

Promotion of Large tree growth is achieved in Alternative 2 from proposed treatments as Stand Denstity Index is reduced from existing conditions as a result of treatments through 2039. Reduction in SDI competition would increase Quadratic Mean Diameter from the existing condition by 2039. By emphasizing for 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).

- Large dead trees (snags) with a dbh of 12 inches or more

Snags

In MSO CH, Standing snags, Coarse Woody Debris, and Downed Logs over 12 inches would all increase or remain the same from existing condition as a result of treatments under Alternative 2 (tables 24-26). These Primary Constituent Element habitat variables important to the MSO and MSO prey species are preserved over time under the 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 treatment from Alternative 2.

Primary Constituent Elements Related to Maintenance of Adequate Prey Species:

- High volumes of fallen trees and other woody debris

Course Woody Debris

Coarse Woody Debris in MSO CH increases from the existing condition as a result of treatments in Alternative 2. For example, in PACs coarse woody debris 3 inches or greater in tons per acre increases in mixed conifer from 10 tpa to 13 tpa as a result of treatment (table 24). Recovery habitats (tables 25 and 26) also show increases in CWD as a result of treatment.

- A wide range of tree and plant species, including hardwoods

Mixed conifer and ponderosa pine would be expected to respond favorably to thinning and broadcast burning treatments. The overall reduction of tree density along with creating openings in many areas would have the effect of exposing the forest floor to more sunlight and increasing understory diversity.

Plant species richness would increase following thinning and/or burning treatments that result in small, localized canopy gaps. Although MSO nest cores would remain relatively dense, MSO PAC treatments would provide for 10 percent openings across treatment areas from 0.1 – 2.5 acres in size. In recovery habitat openings would occupy about 10-20 percent of the treatment area. The openings would help to promote plant species richness. The creation of openings in mixed conifer would allow for early seral species such as aspen and pine to regenerate and would have the effect of helping to maintain uneven-aged characteristics.

Design Features are included focusing on retaining Gambel oaks and other hardwoods and coniferous species but some short-term loss of plant diversity could occur during logging operations, prescribed fires, or road relocation/maintenance/rehabilitation. In MSO recovery habitat, design features would manage for large oaks by removing conifers up to 18 inches dbh that do not meet the "old tree" definition within 30 feet of oak 10 inches diameter at root collar or larger.

- Adequate levels of residual plant cover to maintain fruits, seeds, and allow plant regeneration

Understory

Herbaceous biomass in tons per acre increases slightly over the 20 year FVS model from treatments under Alternative 2 (tables 24-26). Treatments under the proposed action for Shrub Biomass in tons per acre also increase as a result of treatments from Alternative 2 in most habitat types. For example in

Protected habitat the mixed conifer shrub biomass goes from 0.40 tpa in the existing condition to 0.73 tpa after 20 years of treatment. Increasing these PCEs important to prey base for the MSO is an added benefit to treatments in MSO CH from this alternative.

Fire Effects

Surface fuel loading in MSO Critical Habitat is reduced under Alternative 2, over the 20 years modeled in FVS.

Fire hazard index and risk of crown fire was modeled in PACs, Nest/Roost recovery habitat, and foraging/non-breeding MSO recovery habitat (table 19). In the exisiting condition 49,889 acres, or (41 percent of all PACs within the project area) are at risk of high severity wildfire (table 20), 41 percent of Nest/Roost Recovery and 26 percent of Foraging/non-breeding recovery habitat are at risk. Alternative 2 reduces this risk to 28 percent of PACs, 6 percent of Nest/Roost recovery habitat, and one percent of Foraging/non-breeding recoveryhabitat.

Active and conditional crown fire (with percentages of each habitat type in the project area that could experience these categories of crown fire) are shown in table 21. The action alternatives greatly reduce these risk categories of crown fire across MSO habitat types (table 22). 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 (4 percent) in Alternative 2, from 16,032 acres (50 percent) in Alternative 1. Risk of crown fire in Foraging/Non-breeding recovery habitat is reduced to 350 acres (1 percent) in Alternative 2.Alternative 2

Cumulative Effects.

Cumulative effects were evaluated across the 4FRI Rim Country analysis area plus a 0.5-mile buffer beyond the project's CH boundary. Most of the projects identified as part of the cumulative effects analysis occur outside of MSO habitat. Cumulative effects would likely be minimal, but include disturbance related to implementation operations and smoke drifting and settling away from ignition areas.

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 specifically occurring 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 d.b.h. limits and some used up to 24-inch d.b.h. limits in other recovery habitat. Total acres of treatment in MSO habitat within reasonably foreseeable projects include thinning and burning restoration and fuels reduction treatments are being developed for projects such as 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 BA in the short term. However, design features should ensure retention of large diameter oak and small oak commonly sprout vigorously after fire. The total BA 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. Reduced crown fire risk and increased understory production that result from these treatments tend to be short-term because creation of interspace and irregular tree spacing typically cannot be attained by using board diameter caps focused on mid-sized trees.

Changes are expected in MSO prey habitat. Decreases would occur in CWD, 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 CWD 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 CWD 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 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 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 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 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. Potential projects from the CC Cragin Watershed Restoration Project (on the Mogollon Rim Ranger District), Flagstaff Watershed Protection Project (the San Francisco Peaks and Mormon Mountain), reopening or developing rock pits (Coconino and A-S) and restoration work, such as in in the Beaver Creek, Rim Lakes and Larsen projects (Mogollon Rim) could cumulatively degrade but retain MSO CH 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 treatment 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 be at further risk of impacts to owls. Other restoration projects such as the C.C. Cragin Watershed Protection Project could cumulatively increase impacts to 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 is prescribed fire, which would be managed to be similar to the owl's evolutionary environment.

Given the various stages of planning or 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. Impacts 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 MSO 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 impact the 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 the project's activities Alternative 2 of the 4 FRI Rim Country project **may affect, is likely to adversely affect Mexican Spotted-owl Critical Habitat.**

Alternative 3 – Focused Alternative

Approximately 107,904 acres of MSO CH (40% of MSO CH in the project area) is proposed for treatments under Alternative 3.

Table 51. Alternative 3 Proposed Treatments by Acres in MSO Critical Habitat.

Row Labels	BR-W-5	UGM-10	UGM-11	UGM-7	Grand Total
PAC	**341**	**16,769**	**1,148**	**628**	**18,887**
Aspen Restoration			28		28
Facilitative Operations		298			298
Grassland Restoration		6	13		19
IT 10% - 25%		0			0
IT 25% - 40%		0			0
IT 40% - 55%		0			0
MSO Recovery - Replacement Nest/Roost		0			0
PAC – Mechanical	316	12,732	1,088	628	14,764
Riparian & Wet Meadow Restoration		93			93
Riparian Restoration	25	1,994	15		2,034
Severe Disturbance Area Treatment		1,403			1,403
SI 40% - 55%		0			0
UEA 10% - 25%		0			0
UEA 10% - 40%		0			0
UEA 25% - 40%		0			0
UEA 55% - 70%		0			0
Wet Meadow Restoration		243	4		247
Recovery Habitat	**9,988**	**72,432**	**3,162**	**3,434**	**89,017**
Facilitative Operations	1,097	1,414	3		2,514
Grassland Restoration		14	33	14	61
IT 10% - 25%		5,865	267	163	6,295
IT 25% - 40%		5,950	782	256	6,988
IT 40% - 55%	697	9,208	462	1,174	11,541
MSO Recovery - Replacement Nest/Roost	778	14,450	454	134	15,817

Row Labels	BR-W-5	UGM-10	UGM-11	UGM-7	Grand Total
Riparian & Wet Meadow Restoration		304			304
Riparian Restoration	283	2,505	21		2,809
Severe Disturbance Area Treatment		1			1
SI 10% - 25%	179	988		120	1,287
SI 25% - 40%	1,285	2,470	43	14	3,813
SI 40% - 55%	675	1,269	56	288	2,288
ST	1,444	180			1,624
UEA 10% - 25%	2,949	10,014	477	277	13,718
UEA 25% - 40%	495	10,580	357	465	11,897
UEA 40% - 55%	106	990	122	398	1,616
UEA 55% - 70%	0	5,760	76		5,836
Wet Meadow Restoration		468	9	132	609
Grand Total	**10,329**	**89,202**	**4,310**	**4,063**	**107,904**

Forest Structure

Primary Constituent Elements Related to Forested Structure:

- A range of tree species composed of different tree sizes reflecting different ages of trees, 30 – 45 percent of which are large trees (12 inches dbh or more).

Under Alternative 3 the Rim Country 4 FRI project FVS Modeling from treatments over the next 20 years indicate that most Forest Structure as it pertains to Primary Constituent Elements important to MSO Critical Habitat are preserved through time (tables 24-26). Modeling FVS indicates trees per acre are reduced from the existing condition as a result of treatment through 2039. Reducing TPA closer to NRV protects MSO 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.

Average of All Basal Areas from tree size classes saplings 1 to old growth 6 show that intermediate sized trees (Size Class3 with BA 5-12 inches and Size Class 4 with BA 12-18 inches are predominant on the landscape in the existing condition and vastly departed from the natural range of Variation) are lowered closer to desired condition as a result of treatment through 2039. For example in PACs (table 24) and in Nest/Roost recovery habitat (table 25) average of all BA 5 (18-24 inches) and 6 (24 inches or greater) age classes in mixed conifer and pine oak habitat increase over time as a result of treatment. Modeling predicts basal area average is decreased from the existing condition in 2039. Increasing BA 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, 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.

- Shade canopy created by the trees branches covering 40% or more of the ground

In MSO critical habitat percent average of canopy cover is reduced from the existing condition by 2039, while still remaining at 60 percent or higher in protected and Nest/Roost recovery habitat, and 45 percent or higher in Foraging/Non-breeding recovery habitat (tables 24-26). 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 would preserve the recommended habitat conditions in critical habitat wherever possible while protecting this habitat from severe fire intensity or stand replaceing effects from crown fire (see Fire Effects for Alternative 3 below).

Promotion of Large tree growth is achieved in Alternative 3 from proposed treatments as Stand Denstity Index is reduced from existing conditions as a result of treatments through 2039. Reduction in SDI competition would increase Quadratic Mean Diameter from the existing condition by 2039. By emphasizing for 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).

- Large dead trees (snags) with a dbh of 12 inches or more

Snags

In MSO CH, Standing snags, Coarse Woody Debris, and Downed Logs over 12 inches would all increase or remain the same from existing condition as a result of treatments under Alternative 3 (tables 24-26). These Primary Constituent Element habitat variables important to the MSO and MSO prey species are preserved over time under the focused 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 treatment from Alternative 3.

Primary Constituent Elements Related to Maintenance of Adequate Prey Species:

- High volumes of fallen trees and other woody debris

Course Woody Debris and Understory

Coarse Woody Debris in MSO CH increases from the existing condition as a result of treatments in Alternative 3. For example, in PACs coarse woody debris 3 inches or greater in tons per acre increases in mixed conifer from 10 tpa to 13 tpa as a result of treatment (table 24). Recovery habitats (tables 25 and 26) also show increases in CWD as a result of treatment.

- A wide range of tree and plant species, including hardwoods

Mixed conifer and ponderosa pine would be expected to respond favorably to thinning and broadcast burning treatments. The overall reduction of tree density along with creating openings in many areas would have the effect of exposing the forest floor to more sunlight and increasing understory diversity.

Plant species richness would increase following thinning and/or burning treatments that result in small, localized canopy gaps. Although MSO nest cores would remain relatively dense, MSO PAC treatments would provide for 10 percent openings across treatment areas from 0.1 – 2.5 acres in size. In recovery habitat openings would occupy about 10-20 percent of the treatment area. The openings would help to promote plant species richness. The creation of openings in mixed conifer would allow for early seral species such as aspen and pine to regenerate and would have the effect of helping to maintain uneven-aged characteristics.

Design Features are included focusing on retaining Gambel oaks and other hardwoods and coniferous species but some short-term loss of plant diversity could occur during logging operations, prescribed fires, or road relocation/maintenance/rehabilitation. In MSO recovery habitat, design features would manage for large oaks by removing conifers up to 18 inches dbh that do not meet the "old tree" definition within 30 feet of oak 10 inches diameter at root collar or larger.

- Adequate levels of residual plant cover to maintain fruits, seeds, and allow plant regeneration

Herbaceous biomass in tons per acre increases slightly over the 20 year FVS model from treatments under Alternative 3 (tables 24-26). Treatments under the proposed action for Shrub Biomass in tons per acre also increase as a result of treatments from Alternative 2 in most habitat types. For example in Protected habitat the mixed conifer shrub biomass goes from 0.40 tpa in the existing condition to 0.65 tpa after 20 years of treatment. Increasing these PCEs important to prey base for the MSO is an added benefit to treatments in MSO CH from this alternative.

Fire Effects

Surface fuel loading in MSO CH is reduced under Alternative 3 from existing condition as a result of treatments in 2039.

Fire hazard index and risk of crown fire was modeled in PACs, Nest/Roost recovery habitat, and foraging/non-breeding MSO recovery habitat (table 19). In the exisiting condition 49,889 acres, or (41 percent of all PACs within the project area) are at risk of high severity wildfire (table 20), 41 percent of Nest/Roost Recovery and 26 percent of Foraging-other Recovery habitat are at risk. Alternative 3 reduces this risk to 30 percent of PACs, 8 percent of Nest/Roost recovery habitat, and 4 percent of Foraging/non-breeding habitat.

Active and conditional crown fire (with percentages of each habitat type in the project area that could experience these categories of crown fire) are shown in table 21. The action alternatives greatly reduce these risk categories of crown fire across MSO habitat types (table 22). For example the risk of active and conditional crown fire in PACs is reduced to 30 percent in Alternative 3 from 50 percent in Alternative 1. Risk of active and conditional crown fire in Nest/Roost recovery habitat is reduced to just 407 acres (4 percent) in Alternative 2, from 16,032 acres (50 percent) in Alternative 1. Risk of crown fire in Foraging/Non-breeding recovery habitat is reduced to 2,317 acres (6 percent) in Alternative 3.

Cumulative Effects of Alternative 3

Same as in Alternative 2.

Determination of Effect

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. In areas assigned treatments using the decision matrix acres treated are reduced by 205,728 acres in alternative 3. In MSO habitat, the areas not assigned treatments using the decision matrix would be 218,670 less in alternative 3 from alternative 2. In PACs, 14,640 fewer acres would be thinned and burned. In Recovery Nest/Roost habitat 5,820 acres fewer acres would be treated in alternative 3. Savannah treatments in alternative 3 are reduced from 17,590, to 2,400 acres providing less restoration to benefit MSO prey base. 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.

Based on the above analysis of the project's activities Alternative 3 of the 4 FRI Rim Country project **may affect, is likely to adversely affect Mexican Spotted-owl Critical Habitat.**

Western Yellow-billed Cuckoo

Alternative 1 – No Action

Direct and Indirect Effects

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.

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 impacts to 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.

Critical Habitat

Proposed Critical Habitat unit 19, Beaver Creek is approximately 7 miles east of the project area and unit 22 (Tonto Creek) is approximately 7 miles southeast of the project area.

No change is expected to occur in these units under the No Action alternative.

Determination of Effect

Alternative 1 **May affect, is Likely to Adversely Affect**the Yellow-billed Cuckoo and its proposed Critical Habitat.

Alternative 2 – Proposed Action

Direct and Indirect Effects

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.

Design features to minimize the effects of treatments on wildlife are included in Appendix 5.
Some of the relevant Design Features are listed below, though many more exist for aquatic and soils protection that are an added benefit to cuckoos.

- Biologists will be consulted during pre-planning for all treatments that will occur in springs, streams, and riparian areas, as well as fens or bogs where histic soils are present, to determine presence of federally listed or sensitives species (plants or animals), as well as mitigations needed for rare or sensitive species in/near the work areas.
- Ensure that an experienced engineer, fisheries biologist, wildlife biologist, hydrologist and geomorphologist are involved in the design of all aquatic restoration projects. The experience should be commensurate with technical requirements of a project and needs to involve all.
- Only hand equipment—chain saws, axes, Pulaski's, etc.—may be used for felling trees in wetland and riparian areas.
- The project manager for an aquatic restoration activity will coordinate with a wildlife biologist in tree-removal planning efforts.
- Within the primary shade zone retain 100 percent of the over-story canopy closure with the exception of hardwood treatments, unless other exceptions listed below are met.
- During project implementation use existing system travel courses and stream crossings whenever possible, unless new construction would result in less resource disturbance.
- Minimize the number of temporary access roads and travel paths to lessen soil disturbance, compaction, and effects no vegetation.
- Temporary roads will not be built on slopes where grade, soil, or other features suggest a likelihood of excessive erosion or failure.
- Temporary roads will be obliterated or revegetated.

- Temporary roads in wet or flooded areas will be restored by the end of the applicable in-water work period.
- Construction of new roads is not permitted.
- At riparian habitat restoration sites, restore vegetation through:
  planting of native woody plants, seeding of native grass species, planting plugs of rushes, sedges, and spike rushes to improve success of regeneration efforts, and fence with ungulate proof fencing or use barriers for 1 to 2 years (or until plants are established) if grazing is inhibiting regeneration efforts.
- Apply the following direction if AMZ is within ½ mile of private land boundary or designated WUI: Treatment measures necessary to reduce the risk of wildfire encroachment on adjacent private lands may take priority over other considerations in these AMZs. Entry and treatments in these reaches will be considered on a case-by-case basis by ID teams.
- Stream channels to be protected with a prescribed aquatic management zone (AMZ) will be shown on the project task order, contract maps, or burn plan maps. AMZ widths will be clearly labeled or described.
- Burn Plans: Ensure that the potential cumulative effects from multiple fires burning in a given area do not produce negative effects on local wildlife; coordinate burning between administrative units and between wildlife and fire management to minimize potential disturbance.

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.

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. 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.

Determination of Effect

The effects from the proposed 4FRI Rim Country Project and the cumulative effects **May affect, is Likely to Adversely Affect**the western yellow-billed cuckoo and its proposed critical habitat. Reasoning:

- Prescribed burning in cuckoo riparian habitat might occur during migration and the early part of nesting season (May 15 – July 1), but it would not occur during the height of the breeding season (July 1 – September 30).
- Treatment in cuckoo riparian and adjacent foraging habitat prior to the breeding season might promote tree resprouting, herbaceous growth, and insect production during the monsoon when cuckoos are nesting.
- Low to moderate burn severity would target ground cover and dense shrubs in cuckoo riparian habitat.
- Although cuckoos might be adversely affected by loss of habitat and disturbance in the short-term in cuckoo riparian and adjacent foraging habitat, the proposed activities would benefit cuckoos long term by reducing the risk of a high-intensity fire that would destroy breeding and foraging habitat.

While Western yellow-billed cuckoos might be disturbed by proposed activities occurring in riparian and adjacent habitat while they are present (May 15 – September 30), design features in Appendix 5 and above contain several measures that would avoid or minimize the adverse effects of the proposed activities, including on cuckoo breeding and foraging habitat.

Alternative 3

Direct and Indirect Effects

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.

Cumulative Effects

Same as in Alternative 2.

Determination of Effect

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

Mexican 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.

Cumulative Effects on Mexican wolves from Alternative 1

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.

Determination of Effect

Alternative 1 would have No Effect to the Mexican wolf.

Alternative 2

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 will 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. The following design feature is included for proposed management activities to ensure potential conflicts with wolf dens and thinning operations are mitigated:

- Temporarily restrict human access and disturbance-causing land-use activities within a 1-mile radius around active Mexican wolf dens between April 1 and July 31, and around active rendezvous sites between June 1 and September 30. Exceptions include any authorized specific land use that was active and ongoing at the time Mexican wolves chose to locate a den or rendezvous site nearby. Coordinate with the Interagency Field Team (IFT) to determine current denning/rendezvous site locations.

Direct Effects

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.

Indirect Effects

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.

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 (IFT) will 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

Direct and Indirect Effects

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 treats 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.

Cumulative Effects

Same as in Alternative 2.

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

Direct and Indirect Effects

Direct effects are those caused by the management activities and occur at the same time and place. There would not be any direct effects on the northern goshawk from Alternative 1 because there would be no additional management activities occurring.

Indirect effects are those effects caused by the action and are later in time and/or further removed in distance. The physical changes to the quantity and quality of the goshawk's habitat and that of its prey species are indirect effects and are addressed here and in the Management Indicator Species analysis. Following are site-specific details regarding the effects of the no action alternative.

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 55). Post-fledging family areas (PFA) and lands outside PFAs (LOPFAs) would have less age-class diversity than either of the action alternatives. 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.

Table 52. Habitat Variables Modeled and Analyzed for Treatment by Alternative in PFAs

PFA PP 38,112 acres	Existing	No Action 2029	No Action 2039	Alt 2 2029	Alt 2 2039	Alt 3 2029	Alt 3 2039
Average of Tpa	872	793	721	136	88	271	224
Average of BA	139	150	158	74	73	89	91
Average of SDI	312	326	336	129	118	168	165
Average of QMD	6	7	7	12	14	11	12
Average of SNAG12-“18	2	2	2	4	3	3	3
Average of SNAG18-24”	1	1	1	1	2	1	1
Average of SNAG $\geq$ 24	1	0	0	1	1	1	1
% canopy cover	69	70	72	53	53	57	58
Average of Surface_Total	17	20	22	13	12	14	14
Average of Surface_ge3	7	8	9	7	6	7	7
Average of Surface_Herb	0.20	0.20	0.20	0.24	0.24	0.23	0.23

Average of Surface_Shrub	0.28	0.27	0.26	0.40	0.38	0.39	0.38
Average of ALL_BA1	0	0	0	0	0	0	0
Average of ALL_BA2	12	13	13	1	1	4	4
Average of ALL_BA3	47	47	48	13	9	20	18
Average of ALL_BA4	41	45	47	21	20	25	25
Average of ALL_BA5	22	26	29	21	22	22	23
Average of ALL_BA6	16	18	21	17	20	17	20

PFA

In PFAs the FVS modeling of the effects of treatments on Northern goshawk by alternative show that the average trees per acre would remain high under Alternative 1, from the existing 872 to 793 in 2029 and 721 in 2039. 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 BA of 312 to 336 after 20 years and canopy cover above 70% after 20 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 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.

Fuel loads in average of tons per acre increase from 17 tons per acre in the existing condition to 22 tons per acre after 20 years under alternative 1.

Fire hazard index and risk of crown fire was modeled in PFAs under existing conditions and by alternative (table 55). Of the 58,236 acres modeled Alternative 1 would result in 19,472 acres (33%) of the PFAs in the project that could potentially experience high severity wildfire. The risk of crown fire was modeled in PFAs based on the existing condition. Alternative 1 would result in 24,643 acres (41 percent) of PFAs in the Rim Country project area experiencing crown fire.

Table 53. Fire Hazard Index (High and Extreme Ratings) and Risk of Crown Fire (Active and Conditional) in PFAs by Alternative

NOGO PFA Fire Modeling in 58,236 acres	Existing	Alternative 1	Alternative 2	Alternative 3
FHI; High and Extreme	16,211 (28%)	19,472 (33%)	8,281 (14%)	9,621 (17%)
Risk of Crown Fire in PFAs	23,270 (39%)	24,653 (41%)	11,170 (19%)	11,421 (20%)

Lands Outside Of PFA (LOPFA)

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.

Table 54. Habitat Variables Modeled and Analyzed for Treatment by Alternative in Land Outside of PFAs (LOPFA).

LOPFA PP 915,020 acres	Existing	No Action 2029	No Action 2039	Alt 2 2029	Alt 2 2039	Alt 3 2029	Alt 3 2039
Average of Tpa	978	886	801	151	92	373	311
Average of BA	129	140	149	64	62	86	89
Average of SDI	296	312	323	116	103	173	170
Average of QMD	6	7	7	11	13	10	12
Average of SNAG12-18”	2	2	2	5	4	4	3
Average of SNAG18-24”	1	1	1	2	1	1	1
Average of SNAG >24”	0	0	0	1	1	1	1
% canopy cover	67	69	70	49	48	56	57
Average of Surface_Total	16	19	21	12	12	14	14
Average of Surface_ge3	6	7	7	6	6	6	6
Average of Surface_Herb	0.21	0.20	0.20	0.25	0.25	0.23	0.23
Average of Surface_Shrub	0.31	0.30	0.29	0.38	0.37	0.36	0.35
Average of ALL_BA1	1	1	0	0	0	0	0
Average of ALL_BA2	12	13	14	1	1	5	6
Average of ALL_BA3	42	42	43	11	8	20	19
Average of ALL_BA4	40	43	46	18	17	25	25
Average of ALL_BA5	20	24	27	18	19	20	21
Average of ALL_BA6	15	17	19	15	17	16	18
Average of PP_BA	70	76	80	39	40	49	51

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 978 to 886 in 2029 and 801 in 2039. The average of all basal area and canopy cover would continue to increase slightly, while the stand density index would remain high, from 296 to 323 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.

Cumulative Effects from Alternative 1

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.

Determination of Effect

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

Effects Common to Alternatives 2 and 3

Because goshawks are potential predators of spotted owls and survey crews could represent a disturbance to nesting and roosting owls, PACs and a 0.5 mile buffer beyond PAC boundaries would be excluded from surveys to avoid harassment of nesting owls.

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). Design (Appendix 5) criteria specific to these features include:

- Retain trees ≥18 inches d.b.h. or larger with dead tops, cavities, and lightning strikes wherever possible to provide cavity nesting and foraging habitat (i.e., the living dead) in ponderosa pine habitat.
- Snags and Logs: Protect snags and logs wherever possible by placing landings in existing openings or in areas where snags and/or logs, and old trees would be minimally affected.
- When practicable, damage or mortality to old trees and large trees would be mitigated by implementing prescription parameters, ignition techniques, raking, wetting, thinning, compressing slash, or otherwise mitigating fire effects on the degree necessary to meet burn objectives and minimize fire effects and behavior in the vicinity of old trees. Trees identified as being of particular concern (e.g., trees with known nests or roosts for herons, eagles, osprey, or other raptors, occupied nest cores, or critical areas in Mexican spotted owl protected activity centers (PACs) would be managed in accordance with wildlife design features (see Wildlife). Prepare old trees 1 year or more before a burn if possible.
- In Mexican spotted owl protected activity centers (PACs), recovery nest/roost, goshawk post-fledging family areas, no old trees would be cut during the rehabilitation of temporary roads.
- In areas of savanna restoration and wildland-urban interface pinyon-juniper mechanical treatment, seedling/sapling, young and mid-aged pinyon and juniper may be cut.

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). However, the Apache-Sitgreaves has a guideline that states:
Active raptor nests should be protected from treatments and disturbance during the nesting season to provide for successful reproduction. Specifically for northern goshawk nest areas, human presence should be minimized during nesting season of March 1 through September 30.

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.

Other design criteria have been identified to reduce disturbance-related effects on northern goshawks in Alternatives 2 and 3.

- In northern goshawk post-fledging family areas (PFAs), thinning activities would not occur in occupied PFAs during the breeding season unless the district biologist can document that effects would not trend to listing or loss of viability.
- In goshawk habitat outside of Mexican spotted owl protected activity centers (PACs): Goshawk surveys will be done prior to thinning activities where applicaple and with management guidelines (USFS Letter to the File, March, 2017). Surveys will include areas ½ mile beyond treatment boundaries and exclude a ¼ mile buffer beyond PAC boundaries.
- Fuels in goshawk nesting areas would be evaluated and, if necessary, would be manipulated outside of the breeding period (March 1 to September 30) to ensure low-severity fire effects from prescribed fire.

- In northern goshawk post-fledging family areas (PFAs), spring, riparian and stream restoration projects would not occur during the breeding season (March 1 to September 30) if occupied. However, work could potentially occur on an individual basis through coordination with the District biologist if specific analysis has documented that effects will not trend to listing or loss of viability.
- In northern goshawk nest stands, burn plans covering areas with nesting goshawks and/or known nest trees would include mitigations to minimize smoke effects on nesting birds and nest trees would be protected.
- Burn Plans and Ignition Techniques: Apply fire prescriptions to maintain forest plan levels of coarse woody debris.
- Burn Plans: Ensure that the potential cumulative effects from multiple fires burning in a given area do not produce negative effects on local wildlife; coordinate burning between administrative units and between wildlife and fire management to minimize potential disturbance.

Wildfire Modeling

Fire hazard index (FHI) was modeled for one treatment and two prescribed burns in 58,337 acres of PFAs within the project area. FHI by alternative for the high and extreme categories is in table 55.

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 table 55.

Design Features to Reduce Disturbance

Design features, best management practices, and mitigation have been developed to reduce the magnitude of short-term direct effects from disturbance in alternatives 2 and 3. These are located in Appendix 5 of the Wildlife Specialist Report and are listed below.

The following design criteria have been identified to reduce disturbance-related effects to northern goshawks in both action alternatives.

- Fuels in goshawk nesting areas will be evaluated and if necessary, will be manipulated outside of the breeding period (March 1 to September 30) to ensure low-severity fire effects from prescribed fire.
- Hauling will not occur within post-fledging family areas (PFAs) during the breeding season (March 1 through September 30) unless monitoring determines the PFA is not occupied, or the nest is 1/4 mile away, topographically isolated, or as determined by a wildlife biologist.
- In northern goshawk PFAs, road construction, obliteration, relocation, and maintenance would not occur during the breeding season (March 1 to September 30) if occupied or as determined aby a wildlife biologist.
- Pit development and operation within occupied northern goshawk PFAs may occur when surveys have indicated there are no active nests. If surveys identified an occupied nest, all operational activities and hauling would be avoided March 1 – September 30th.
- In Mexican spotted owl protected activity centers (PACs), recovery nest/roost, goshawk post-fledging family areas, no old trees would be cut during the rehabilitation of temporary roads.

Alternative 2 - Proposed Action

Direct and Indirect Effects

There are 106 PFAs on the Coconino, Tonto, and Apache-Sitgreaves National Forests, totaling 60,180 acres in the Rim Country project area. Of these acres, 22,320 are within other project areas (Figure 8).Approximately 37,860 acres of PFA habitat would be treated with mechanical thinning and/or prescribed fire in the proposed action.

PFA

Vegetation Changes

FVS Modeling of Alternative 2 treatments on 38,112 acres of PFAs in the project area would take trees per acre from 872 to 136 in 2029 and 88 in 2039. The stand density index would be greatly reduced, from the existing 312 to 118 after 30 years. The quadratic mean diameter would increase from six inches to 14 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)

Vegetation Changes

In LOPFAs the FVS modeling on 915,020 acres of Ponderosa Pine habitat shows that the average trees per acre would be lowered under Alternative 2, from 978 to 151 in 2029 and 92 in 2039. The average of all basal area and canopy cover would decrease, but the stand density index would be most reduced under Alternative 2, from 296 to 103 after 30 years. Lower competition for resources would increase the quadratic mean diameter, from six inches to nearly 13 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 increase from 15 tons per acre in the existing condition to less than 10 tons per acre after 40 years under Alternative 2.

Fire hazard index was modeled in PFAs. For alternative 2 (table 55). Of the 58,237 acres modeled Alternative 2 would result in a reduction over the existing condition from 16,211 (28 percent) of all PFA acres in the project area to 8,281 acres (14 percent) that could experience high severity wildfire.

Risk of Crown Fire was modeled in PFAs for alternative 2 (table 59). 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 (04 percent) acres that would experience active crowning under Alternative 2.

Cumulative Effects on Goshawk from Alternative 2

Alternative 2 would contribute to the improvement of forest structure and prey habitat within goshawk habitat.

Cumulative Effects from Alternatives 2 and 3.

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 (as seen in the Total Acres of Prescribed Fire Only, Current and Future Foreseeable Projects (table 62) in the cumulative effects section). However, most of the alternative treatments are mechanical thin with prescribed fire. Alternative 2 cumulatively has the most treatment acres whereas alternative 3 has 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 primarily decreased the number of trees less than 14 inches d.b.h. The degree of treatment intensity is highly variable, with some projects not cutting trees greater than 12 inches d.b.h. and others looking to lower the threat of high-severity fire in goshawk habitat. The overall ratio of trees greater than 12 inches d.b.h. is likely to increase as a result of removing smaller trees and increasing the growth and survivability of larger trees. Total BA of pine would decrease in the short term, but because the focus is on small trees, BA might not substantially change. Overall BA 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 BA in the short term. However, design features should ensure retention of large diameter oak and small oak commonly sprout vigorously after fire. The total BA 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 CWD, 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 CWD 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 CWD 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 treatment 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 impacts to 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. Impacts 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 impact 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.

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

Direct and Indirect Effects

PFA

Vegetation Changes

Alternative 3 would change trees per acre from the existing 872 to 271 in 2029 and 224 in 2039. The stand density index would be highly reduced, from 312 to 165 after 30 years. The quadratic mean diameter would increase, from six inches to nearly 12 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 or be maintained over 30 years. Herbaceous and shrub layers would be maintained over time under Alternative 3.

Lands Outside of PFAs (LOPFA)

Vegetation Changes

In LOPFAs, FVS modeling shows that the average trees per acre would be lowered under Alternative 3, from the existing 978 to 311 in 2039. The average of all basal area and canopy cover would decrease, but the stand density index would be reduced from 296 to 170 after 30 years. Lower competition for resources would increase the quadratic mean diameter, from six inches to nearly 12 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 16 tons per acre in the existing condition to less than 14 tons per acre after 30 years under alternative 3.

Fire hazard index was modeled in PFAs. For alternative 3 (table 55). Of the 38,112 acres modeled Alternative 3 would result in a reduction over the existing condition from 16,211 (28 percent) of all PFA acres in the project area to 9,621 acres (17 percent) that could experience high severity wildfire.

Risk of Crown Fire was modeled in PFAs for alternative 3 (table 55). Alternative 3 would result in a reduction over the existing condition from 23,270 acres (39 percent) to 11,421 acres (20 percent) of PFAs in the Rim Country Project area with the potential to experience crown fire.

Cumulative Effects

Same as in Alternative 2

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.**

Northern Leopard Frog

Alternative 1 No Action

Direct and Indirect Effects

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 the Silviculture, Water and Riparian Resource, and Aquatics Reports). Alternative 1 would have no direct effect 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 (see the Water and Riparian Resource and Aquatics Reports), 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 (Water and Riparian Resource and Aquatics Reports), 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 on Northern Leopard Frogs from Alternative 1

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.

Determination of Effect

Alternative 1 would have no effect on Northern leopard frogs

Alternative 2 - 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 would reduce the likelihood of direct effects on frogs from mechanical thinning, temporary road construction, spring and riparian restoration, road decommissioning, and prescribed fire (see CLF effects analysis and Appendix 5).

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 is also greatly reduced from treatment in alternative 2 (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 (Water and Riparian Resource Report). 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. Road decommissioning would include one or more of the following:

- Reestablishing former drainage patterns, stabilizing slopes, and restoring vegetation;
- Blocking the entrance to a road or installing water bars;
- Removing culverts, reestablished drainages, removing unstable fills, pulling back road shoulders, and scattering slash on the roadbed;
- Completely eliminating the roadbed by restoring natural contours and slopes; and
- Other method designed to meet the specific condition associated with the unneeded roads.

Long-term effects would habitat improvements over current conditions.

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 direct impacts are not likely, as most often, short term indirect impacts could occur due to sedimentation and increased ash flow. 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). Implementation of best management practices would curtail soil erosion and minimize the potential for inflow into potential northern leopard frog habitat.

Cumulative Effects of Alternative 2

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. This alternative 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.

Determination of Effect for Alternative 2

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

Direct and Indirect Effects

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.

Cumulative Effects

Same as in Alternative 2.

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**.

Bald Eagle

Alternative 1 - No Action

Direct and Indirect Effects

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.

Cumulative Effects to Bald Eagles from Alternative 1

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 this alternative 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.

Determination of Effect

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

Determination of Effect

Because of the design features included for both action alternatives to mitigate disturbance to eagles, Alternative 1 **would not result in take** as defined in the Eagle Act for bald eagles.

Effects Common to Both Action Alternatives

Design Features to Reduce Effects to Eagles

- No project activities would occur within 500 feet of confirmed bald eagle communal roost sites from October 15 – April 15.
- When practicable, damage or mortality to old trees and large trees would be mitigated by implementing prescription parameters, ignition techniques, raking, wetting, thinning, compressing slash, or otherwise mitigating fire effects to the degree necessary to meet burn objectives and minimize fire effects and behavior in the vicinity of old trees. Trees identified as being of particular concern (e.g., trees with known nests or roosts for herons, eagles, osprey, or other raptors, occupied nest cores, or critical areas in Mexican spotted owl protected activity centers (PACs) would be managed in accordance with wildlife design features (see Wildlife). Prepare old trees 1 year or more before a burn if possible.
- In bald and golden eagle nest sites, mechanical treatments within 300-yards of bald or golden eagle nest trees would only occur outside of the breeding season or if the nest is inactive.
- In bald and golden eagle nest sites, burn plans would be coordinated with the district wildlife biologist to ensure nesting eagles would not be adversely affected from smoke.

The A/S has a forest Plan guideline page 63:
Any action likely to cause a disturbance and take to bald and golden eagles in nesting and young rearing areas should be avoided per the Bald and Golden Eagle Protection Act.

Direct and Indirect Effects

FVS modeling on 915,021 acres of Ponderosa Pine habitat shows that Average Trees per Acre is lowered under Alternative 2, from 978 tpa in the existing condition to 151 in 2029 and 92 in 2039. Average of all Basal Area and Canopy Cover decrease, but Stand Density Index is most reduced under Alternative 2 from 296 in the existing condition to 103 after 30 years. Lower competition for resources increases the Quadratic Mean Diameter in inches, from 6 in the existing condition to nearly 13 inches after 30 years. Mid-aged forest BA3, 5-12 inches, and BA4, 12-18 inches are greatly reduced under Alternative 2, bringing these age classes to desired conditions after 30 years. Snags of all size classes would continue to increase or be maintained from existing conditions.

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 300 yards unless mitigated by topography, of an occupied bald eagle nest between January 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-yard 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 (see the Fire Ecology and Air Quality Report). 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 (Fire Ecology and Air Quality Report). 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 these areas, 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.

The direct and indirect effects of Alternative 3 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.

Cumulative Effects on Bald Eagles from Alternatives 2 and 3

The cumulative effects analysis area for bald eagles is the ponderosa pine cover types within the project area and a 0.5-mile buffer outside of the project boundary. Current, ongoing and reasonably foreseeable projects are discussed in the cumulative effects section and listed in table 17 and include fuels reduction, forest health treatments, aspen regeneration, and powerline development and maintenance. 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.

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. Golden Eagle

Alternative 1 - No Action

Direct and Indirect Effects

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.

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.

Effects Common to Both Action Alternatives

Direct and Indirect Effects

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 is 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 (Fire Ecology and Air Quality Report). In maintenance or second entry burns in ponderosa pine, fuel loads would be significantly lower and produce low-severity effects with fewer emissions (Fire Ecology and Air Quality Report).

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. Design features were included in the project for Bald and Golden Eagles:

- For golden eagles, all nests will be protected from disturbance during project implementation. Project design features will mitigate potential for disturbance from noise or smoke to nesting golden eagles. Project activities will not substantially interfere with foraging behavior. Restoration treatments will improve foraging habitat and reduced potential of high-severity fire affecting nest locations.
- In bald and golden eagle nest sites, mechanical treatments within 300-yards of bald or golden eagle nest trees would only occur outside of the breeding season or if the nest is inactive.
- In bald and golden eagle nest sites, burn plans would be coordinated with the district wildlife biologist to ensure nesting eagles would not be adversely affected from smoke.
- When practicable, damage or mortality to old trees and large trees would be mitigated by implementing prescription parameters, ignition techniques, raking, wetting, thinning, compressing slash, or otherwise mitigating fire effects on the degree necessary to meet burn objectives and minimize fire effects and behavior in the vicinity of old trees. Trees identified as being of particular concern (e.g., trees with known nests or roosts for herons, eagles, osprey, or other raptors, occupied nest cores, or critical areas in Mexican spotted owl protected activity centers (PACs) would be managed in accordance with wildlife design features (see Wildlife). Prepare old trees 1 year or more before a burn if possible

Cumulative Effects to Golden Eagles from Alternatives 2 and 3

The cumulative effects analysis area for the golden eagle is the project area and 0.5 mile outside of the project boundary.. 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.

Determination of Effects for Golden Eagles for Alternatives 2 and 3

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.

American Peregrine Falcon

Alternative 1 - No Action

Direct and Indirect Effects

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.

Cumulative Effects on Peregrine Falcons from Alternative 1

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.

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 Alternatives 2 and 3

Direct and Indirect Effects

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. These effects may affect individuals but are 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 - Proposed Action

Direct and Indirect Effects

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. These are mitigations from the AZGFD, June 15, 2016 Consevation Guidelines that are used in the Forest Service on the A-S:

- Managed activities, like trail clearing, logging, road construction, fire control measures and controlled burning, mining, and construction should, if possible, occur during the non-breeding season, or not occur within a ½ mile buffer zone of known eyrie locations, keeping in mind that Peregrine falcons appear more sensitive to above-eyrie disturbances to those that occur below the eyrie (Ellis 1982).
- Restrict human activities within approximately ½ mile of occupied nesting site March 1 through August 15. The ½ mile protection distance may vary depending on local topography, potential for disturbance, and location of important habitat components. Coordinate with local biologists to monitor nesting success to determine if restrictions are effective.
- Restrict prescribed fire within 1 mile (0.6 km) of cliffs with occupied eyries and within 2 miles (3 km) from the base of cliffs with occupied eyries (Ellis 1982).

While peregrines do not nest in ponderosa pine forest, active management in portions of the pine forest could potentially affect prey base habitat such as forests, 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.

Cumulative Effects on Peregrine Falcons from Alternative 2

The cumulative effects analysis area for peregrine falcons is grassland, savanna, and riparian habitat within the project area and within 0.5 mile of the project boundary. Under all alternatives, there would be an additive indirect effect from activities that modify vegetation. Other current and reasonably foreseeable projects are discussed in the cumulative effects section and listed in this report in the cumulative effects to all species section. 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.

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

Direct and Indirect Effects

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.

Cumulative Effects

Same as in alternative 2.

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.**

Western Burrowing Owl

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

Alternative 1 - No Action

Direct and Indirect Effects

Burrowing owls are closely associated with prairie dogs. Prairie dogs often occur in grassland habitats and colonies have a greater chance of being affected under this alternative due to continued encroachment of trees. 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 (appendix 6). 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.

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 and the surrounding grasslands, meadows, and savannahs.

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.

Cumulative Effects on Western Burrowing Owl from Alternative 1

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.

Determination of Effect

Implementation of Alternative 1 would not affect individuals and would provide limited improvement to burrowing owl habitat due to current and foreseeable projects. It is not likely to cause a trend toward federal listing or loss of viability.

Alternative 2 Proposed Action

Direct and Indirect Effects

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.

Cumulative Effects on Burrowing Owls from Alternatives 2

The cumulative effects analysis area for burrowing owls encompasses the project area and the associated prairie dog complexes. Cumulative activities such as implementing the Travel Management Rule are likely to decrease motorized use in grasslands, thus decreasing impacts 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.

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

Direct and Indirect Effects

Same as in Alternative 2.

Cumulative Effects

Same as in 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.**

Sulfer-bellied Flycatcher

Navajo Mogollon Vole

Alternative 1 No Action

Direct and Indirect Effects

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 and 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.

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. 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.

Determination of Effect

Alternative 1 would have **no effect** on the Navajo Mogollon voles.

Alternative 2 – Modified Proposed Action

Direct and Indirect Effects

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 BA, 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.

Cumulative Effects on Navajo Mogollon Voles from Alternatives 2 and 3

The cumulative effects analysis area for Navajo Mogollon voles is the project area. Current, ongoing, and reasonably foreseeable projects are listed in the cumulative effects to all species section and include fuels reduction, forest health, and powerline development and maintenance. 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 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.

Determination of Effect

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

Alternative 3

Direct and Indirect Effects

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.

Cumulative Effects

Same as Alternative 2.

Determination of Effect

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

Western Red Bat

Alternative 1 - No Action

Direct and Indirect Effects

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 (Fire Ecology and Air Quality Report). 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 (Silviculture Report). 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 (Water and Riparian Resources Report), 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 (Water and Riparian Resources Report), resulting in degradation of potential habitat for western red bats.

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, and consequently 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.

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

Direct and Indirect Effects

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).

Alternative 2 calls for a diverse range of mechanical treatments that would vary from 10 to 90 percent openings 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 roosting habitat and food for bats over the long term, resulting in indirect beneficial effects.

Cumulative Effects on Western Red Bats from Alternatives 2 and 3

The cumulative effects analysis area for western red bats is the project area. There is the potential for short-term disturbance to potential foraging and roosting habitat with long-term benefits. 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.

Determination of Effect

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

Alternative 3

Direct and Indirect Effects

Same as Alternative 2.

Cumulative Effects

Same as Alternative 2.

Determination of Effect

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

Pale Townsend's Big-eared Bat

Alternative 1 - No Action

Direct and Indirect Effects

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). 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.

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.

Determination of Effect

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

Alternative 2 - Proposed Action

Direct and Indirect Effects

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 (See Design Features in Appendix 5 to reduce effects on Caves and 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.

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 trees, 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.

Cumulative Effects on Townsend’s Big-eared Bats from Alternatives 2 and 3

The cumulative effects analysis area for pale Townsend’s big-eared bats is the project area. Current, ongoing, and reasonably foreseeable projects are listed in the cumulative effects to all species section and include fuels reduction, forest health, and powerline development and maintenance. There may be potential short-term disturbance to potential foraging and roosting habitat with long-term benefits. 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.

Determination of Effect

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

Alternative 3

Direct and Indirect Effects

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.

Cumulative Effects

Same as Alternative 2.

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.**

Allen's Lappet-browed Bat

Alternative 1 - No Action

Direct and Indirect Effects

Under Alternative 1, only current and reasonably foreseeable projects would continue (see cumulative effects to all species section). 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 BA and TPA 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.

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.

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 - Proposed Action

Direct and Indirect Effects

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.

Cumulative Effects on Allen's Lappet-browed Bad from Alternatives 2 and 3

The cumulative effects analysis area for Allen's lappet-browed bats is the project area; cumulative effects include the effects from Alternative 1. Current, ongoing, and reasonably foreseeable projects are listed in the cumulative effects to all species section and include fuels reduction, forest health, aspen regeneration, grazing, and powerline development and maintenance. There might be potential short-term disturbance to potential foraging and roosting habitat with long-term benefits. 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.

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.

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

Direct and Indirect Effects

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.

Cumulative Effects

Same as Alternative 2

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.**

Spotted Bat

Alternative 1 - No Action

Direct and Indirect Effects

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.

Cumulative Effects

The area analyzed for cumulative effects for spotted bat is the project area and includes the effects of Alternative 1. The cumulative effects of Alternative 1 are 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.

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

Direct and Indirect Effects

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.

Cumulative Effects on Spotted Bats from Alternatives 2 and 3

The cumulative effects analysis area for spotted bats is the project area. Current, ongoing, and reasonably foreseeable projects are listed in the cumulative effects to all species section and include fuels reduction, forest health, and powerline development and maintenance. There could be potential short-term disturbance to potential foraging and roosting habitat with long-term benefits. 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.

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

Direct and Indirect Effects

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.

Cumulative Effects

Same as Alternative 2

Determination of Effect

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

Forest Service Management Indicator Species (MIS)

Management Indicators Species for the Apache-Sitgreaves NF

Ponderosa Pine Indicator – Northern Goshawk

On the Apache-Sitgreaves NF, there are approximately 541,000 acres of ponderosa pine potential natural vegetation type (PNVT) (Keckler and Foster 2013). There are 189,407 acres of ponderosa pine within the project area on the Apache-Sitgreaves NF. This is approximately 37 percent of the ponderosa pine PNVT on the forest. Since the PNVTs are based on historical locations of ponderosa pine, the acres within the ponderosa pine PNVT would not change under any of the alternatives. The analysis will focus on the potential for improvement in the quality of the habitat.

Most trees in the mature and older age classes would be retained across all alternatives. Most old and large trees would be retained. Alternatives 2 and 3 would both follow the guidance in the flexible toolbox approach for stands with a preponderance of large young trees (SPLYT). The vegetation design features for Alternatives 2 and 3 have the following requirements for snags: Snags would be managed to meet forest plan requirement and move toward desired conditions; snags or hazard trees within a distance of twice their height from private land boundaries or along key roads may be felled; in all other areas, conifer snags greater than 12 inches d.b.h. would be maintained; and selection of snags to be retained after project operations would have a preference for snags greater than 18 inches d.b.h., except in cases of human health and safety. Live conifer trees with the potential to provide nesting habitat cavities such as dead-top trees and lightning-struck trees would also be favored for retention. Prescribed fires would be designed to maintain desired forest structure, tree densities, snag densities, and CWD levels (Silviculture Report).

Alternative 1 would not improve the quality of habitat available for Northern goshawk. Under Alternative 1, no treatments would be implemented to create a mosaic of interspaces and tree groups. Existing interspace would continue to be encroached upon by expanding tree crowns and ingrowth. Any large-scale tree mortality occurring has the potential to enhance interspace and create tree groups (Silviculture Report). Since the project area is within 37 percent of the forests' ponderosa pine habitat, this could result in a declining habitat trend. There would also be an increased risk of loss of habitat due to the threat of uncharacteristic high-severity wildfires. Population trends for the Northern goshawk would likely be stable to declining.

Treatments in Northern goshawk habitat would include mechanical thinning, mechanical thinning and prescribed fire, or prescribed fire only. The level of each of the different treatments would affect the quality of the habitat.

While all treatments within each alternative, with the exception of grassland restoration, are designed to reestablish forest openings and attain a mosaic of interspaces and tree groups of varying sizes and shapes, the intensity of the treatment would affect the degree to which this condition would be met. The lower intensity treatments within MSO protected, target, and nest/roost habitats and goshawk nest habitats would result in irregular tree spacing and subtle expansion of existing forest openings. The higher intensity treatments would remove more trees and extend greater flexibility in the size and shape of resulting tree groups and intervening interspaces (Silviculture Report). Alternatives 2 and 3 would both increase the number of large trees across the project area over time.

Differences in treatment intensity between Alternatives 2 and 3 would result in differences in how well the alternatives would achieve a mosaic of interspaces and tree groups. Alternative 2 would include more UEA treatments, providing more heterogeneity within the project area (Silviculture Report). Alternative 3 would treat fewer acres both mechanically and with fire, resulting in fewer acres developing the mosaic of interspaces and tree groups.

Alternatives 2 and 3 would change the habitat trend for the northern goshawk from stable to increasing in the long term and would likely keep the habitat trend at stable in the short term. While treatments would create tree groups, development of large trees would not occur in the short term. Goshawk population trends would likely stay as stable in the short term and change to increasing in the long term as more trees are recruited into the larger size classes. Alternatives 2 and 3 would have similar results, with Alternative 3 producing fewer acres of habitat change..

Ponderosa Pine-Oak, Mixed Conifer (dry), Mixed Conifer (wet) and Spruce-Fir Species Indicator - Mexican Spotted Owl

See Coconino MIS Section for the MSO.

Grassland Indicator - Pronghorn Antelope

See Coconino MIS Section for the Pronghorn Antelope.

Management Indicator Species for the Tonto NF

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. Under Alternative 1, the current unnatural stand densities within the project area would threaten the sustainability of elk habitat and could hinder the currently increasing population trend for this species forest wide over time by limiting understory production and creating a higher risk for uncharacteristic, high-severity fire for approximately 77% of the available elk habitat on the Tonto NF.

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 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 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 national forests in the project area. Alternative 1 would continue to provide large patches of trees with a higher BA, higher canopy density, and more interlocking crowns, thereby providing thermal and hiding cover for turkey. However, overstory suppression of oak, grass, and forb diversity and productivity would continue to limit foraging habitat for turkey in Alternative 1. Tree encroachment into openings and meadows would also limit turkey foraging habitat. Late-seral ponderosa pine would continue to be threatened by unnatural stand densities, creating risk for uncharacteristic, high-severity fire.

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 addresses 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 BA, 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. With rare exceptions, Alternatives 2 and 3 would not remove old growth trees, and there would be an emphasis on retention of large-diameter trees (Silviculture Report), which should benefit Abert's squirrels for nesting, winter cover, and cone production. Project design criteria include tree thinning using the goshawk guidelines. This should result in a mosaic of vegetation structural stages, interrupting canopy closure, and allowing more sunlight to reach the forest floor. The reduction in canopy connectedness would reduce safe travel routes for Abert's squirrels and expose them to higher rates of predation in treatments creating more higher degrees of openness,. These treatments would also expose more of the forest floor to direct sunlight which could remove the microsite habitat for mycorrhizal fungi production, thereby reducing an important food source for squirrels. However, Dodd et al. (2006) postulated that up to 75 percent of a forested landscape could be treated and still provide suitable squirrel habitat, if treatments were applied as a mosaic of patches and areas of optimal habitat were retained. The alternatives are also designed to provide closed-canopy corridors to provide connectivity for squirrels and other species.

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 BA, TPA, and stand density index depending on site-specific conditions (Silviculture Report). Areas that would likely maintain a BA and canopy cover high enough to support Abert's squirrels include MSO protected and recovery habitat, northern goshawk nest stands, other raptor nest sites, bald eagle roosts, buffers around caves and sinkholes, a portion of the older age class tree groups intended to support higher tree densities of mixed-age trees, and areas excluded from mechanical treatment such as wilderness or areas with slopes greater than 40 percent. As such, the patches of forest within the mosaic proposed by Alternatives 2 and 3 would vary in terms of Abert's squirrel habitat quality. A ratio of optimal to suboptimal patches that is skewed toward a more open condition would be less desirable to the squirrel and could lead to a short-term reduction in current squirrel populations. However, in the long term, post-treatment conditions would include tree growth and increased canopy connectedness, which should have a positive effect onto squirrel populations when viewed over longer time horizons.

Despite the proposed overall reduction in dense forest conditions, alternatives 2 and 3 would also provide for sustainable forests that include large, cone-bearing trees either as individual legacy trees or in groups, and clumps of mature and old-growth trees interspersed with patches suitable for fungi production. Canopy connectivity would be retained, but would no longer occur across so much of the landscape. In the long term, this should provide for more sustainable squirrel habitat over time because the risk of high-severity fire, and therefore long-term degradation or loss of squirrel habitat, would be significantly reduced (USDA FS 2010a). Landscape connectivity would be retained for canopy-dependent species.

Arizona gray squirrel

Alternative 1, No action could lead to a decreased habitat if effects from high severity wildfire is encountered in high elevation riparian habitat across the project area.

Alternatives 2 and 3 would not result in a type conversion of riparian habitat on the Tonto NF and therefore will have no effect to the population trend for Arizona gray squirrells. The action alternatives would emphasize maintenance and restoration of healthy riparian ecosystems through conformance with LRMP's riparian Desired Conditions. Management strategies should move degraded riparian vegetation toward good condition as soon as possible. Damage to riparian vegetation, stream banks, and channels should be prevented. Design features to mitigate effects on riparian species are included in Appendix 5. Alternatives 2 and 3 would improve riparian habitat.

Common black hawk

Alternative 1, No action could lead to a decreased species trend if effects from high severity wildfire is encountered by riparian and cottonwood-willow vegetation type habitats across the project area.

Alternatives 2 and 3 propose 14,560 acres of Riparian restoration. Improvement of stream function is proposed for 777 miles across the project area through the action alternatives. Black-hawks could be disturbed by restoration activities, however design features to protect raptor nests have been included in the project record. This should minimize disturbance to the Common Black-hawk, though it is possible that disturbance from thinning implementation and short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. The removal of any eggs or fledglings would not result in a measurable negative effect to the Common Black-hawk population from any of the two action alternatives as the implementation of these acres would occur intermittently over space and time over the next 10 years. Long-term effects to the Common Black-hawk population would be positive as a result of habitat restoration. Alternatives 2 and 3 would improve riparian and cottonwood-willow vegetation types habitats and would likely assist in keeping the population stable.

Ash-throated flycatcher

Alternative 1, could lead to a decreased species trend if high severity wildfire is encountered in the Pinyon-Juniper (PJ) vegetation type habitat across the project area.

Both action alternatives would include various levels of restoration implementation within PJ. The alternatives could mechanically thin and burn 114,753 acres of pinyon-juniper. Most large trees would not be removed and PJ woodlands would be managed for late-seral habitat, benefiting foraging and nesting habitat. 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. Unintentional take is expected to be minimized through the application of breeding season timing restrictions in Goshawk PFAs, deferral areas, and other design features described in Appendix 5. Alternatives 2 and 3 would improve the PJ vegetation type habitat and would likely keep the population stable.

Gray vireo

Alternative 1, could lead to a decreased species trend if high severity wildfire is encountered in the PJ vegetation type habitat across the project area.

Both action alternatives would include various levels of restoration implementation within pinyon-juniper. The alternatives could mechanically thin and burn 114,753 acres of pinyon-juniper. Most large trees would not be removed and PJ woodlands would be managed for late-seral habitat, benefiting foraging and nesting habitat. However, mechanical treatment and burning could destroy nests if these activities occur during breeding season. Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. Not all treatments would occur during the breeding season. Unintentional take of eggs or nestlings would not result in a measurable negative effect to the Gray Vireo population from both of the action alternatives. Alternatives 2 and 3 would improve the PJ vegetation type habitat and would likely assist in keeping the Gray Vireo population stable.

Juniper titmouse

Alternative 1, could lead to a decreased species trend if high severity wildfire is encountered in the PJ vegetation type habitat across the project area.

Both action alternatives would include various levels of restoration implementation within pinyon-juniper. The alternatives could mechanically thin and burn 114,753 acres of pinyon-juniper. Most large trees would not be removed and PJ woodlands would be managed for late-seral habitat, benefiting foraging and nesting habitat. However, mechanical treatment and burning could destroy nests if these activities occurr during breeding season. Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. Not all treatments would occur during the breeding season. Unintentional take of eggs or nestlings would not result in a measurable negative effect to the juniper titmouse population from either of the action alternatives.

Hairy woodpecker

Alternative 1 would increase the amount of late-seral forests in the long term. The risk of a large-scale wildfire is high. While fires promote recruitment of large snags, a study conducted locally, documented 40 percent of fire-killed snags falling within 7 years (Chambers and Mast 2005). Over 80 percent of ponderosa pine snags created by high-severity fire fell within 10 -years after a fire (Chambers personal communications 2008, Mast personal communications 2008). In addition, patches that burn with high-severity in today’s stand-replacing fires can reach several hundred hectares in size. Hairy woodpeckers do not use interior portions of larger burned areas, restricting much of their foraging to the edge habitat.

The uncharacteristically large fires of recent years are less valuable to hairy woodpeckers than the smaller overstory-removing fires that occurred historically (USDA FS 2010a).

Alternatives 2 and 3 are designed to restore ponderosa pine forests closer to the natural range of variation. The vegetation design features for these alternatives have the following requirements for snags: Snags would be managed to meet forest plan requirements and move toward desired conditions; Snags or hazard trees within a distance of twice their height from private land boundaries or along key roads may be felled; In all other areas conifer snags greater than 12 inches d.b.h. would be maintained; Selection of snags to be retained after project operations would have a preference for snags greater than 18 inches d.b.h., except in cases of human health and safety.

Live conifer trees with the potential to provide nesting habitat cavities such as dead-top trees and lightning struck trees would also be favored for retention. Prescribed fires would be designed to maintain desired forest structure, tree densities, snag densities, and CWD levels (Silviculture Report). Using the goshawk guidelines to direct management activities should have a positive effect on the species, as these prescriptions would result in forest structure that more closely resembles historic forests than those present today, including large trees and an abundance of snags (USDA FS 2010a).

Northern goshawk

In Alternative 1, the quality of the habitat would deteriorate as canopies close tree densities increase, and understory production decreases. Closed canopies associated with higher tree densities would not allow sunlight and water to reach the forest floor for understory vegetation to grow, or provide habitat for prey species including vegetative cover, nesting substrates, seeds and fruits, grasses, forbs, and shrubs, as evidenced by the declining index of biomass production. In the long term, understory species richness would decline, reducing food and cover for prey species. Increased tree densities would increase competition among trees. Tree growth would decrease or stagnate and tree health decline due to competition for limited resources and space. Meanwhile, the 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 cause high tree mortality rates, 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. Another result of increased tree density is increased risk of insect and/or disease outbreak. Mortality created by these outbreaks also contributes to increased fuel loads and associated increase in the risk of uncharacteristically intense wildfire.

In alternatives 2 and 3, the large tree habitat structure required for goshawk nesting (e.g., large, tall trees with large branches and adequate flight paths) would be more available across the landscape as the numbers of large trees increases, improving habitat for existing and future resident goshawks and potentially increasing recruitment into the population. Creating interspace between groups of trees would help support prey species. Trees used for nesting would be able to grow to larger size, retain more of their crowns, and live longer with less competition, thus providing higher quality habitat for nesting and foraging.

The quality of the late seral stage ponderosa pine habitat would be expected to improve as stand conditions move closer toward historic conditions with more open understories, less competition among trees, and healthier forest conditions. Increasing the understory response would improve the quality of goshawk foraging habitat by providing more food and cover for prey species. The improved development of understory could also increase the diversity and amount of prey species available to goshawks.

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

Alternative 1, No action could lead to a decreased species trend if high severity wildfire is encountered in the pinyon-juniper. (PJ) vegetation type habitat across the project area.

Both action alternatives would include various levels of restoration implementation within pinyon-juniper. The alternatives could mechanically thin and burn 114,753 acres of PJ. Most large trees would not be removed and PJ woodlands would be managed for late-seral habitat, benefiting foraging and nesting habitat. However, mechanical treatment and burning could destroy nests if these activities occur during breeding season. Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. Not all treatments would occur during the breeding season. Unintentional take of eggs or nestlings would not result in a measurable negative effect to the Northern Flicker population from both of the action alternatives. Alternatives 2 and 3 would improve the PJ vegetation type habitat and would likely assist in keeping the Northern Flicker population stable.

Pygmy Nuthatch

See Coconino NF MIS Section above.

Townsend's solitaire

Alternative 1, No action could lead to a decreased species trend if high severity wildfire is encountered in the PJ vegetation type habitat across the project area.

Both action alternatives would include various levels of restoration implementation within PJ. The alternatives could mechanically thin and burn 114,753 acres of PJ. Most large trees would not be removed and PJ woodlands would be managed for late-seral habitat, benefiting foraging and nesting habitat. However, mechanical treatment and burning could destroy nests if these activities occurr during breeding season. Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. Not all treatments would occur during the breeding season. Unintentional take of eggs or nestlings would not result in a measurable negative effect to the Townsend's solitaire population from both of the action alternatives. Alternatives 2 and 3 would improve the PJ vegetation type habitat and would likely assist in keeping the Townsend's solitaire population stable.

Violet-green swallow

Alternative 1 would lead to a decreased species trend if high severity wildfire is encountered in the Ponderosa pine/snags vegetation type habitat across the project area.

Alternative 1 would not result in an immediate change to the quantity or quality of habitat used by Violet-green swallows. Late-seral ponderosa pine would continue to be threatened by unnatural stand densities, creating risk for uncharacteristic, high-severity fire.

The proposed treatments in Alternatives 2 and 3 would protect nesting habitat. The proposed thinning and burning activities would also create canopy openings, allowing sunlight to reach more tree boles and increasing the prey base for swallows. Thinning and burning treatments are designed to return forest structure and composition to within the natural range of variation, which should benefit native wildlife species (Kalies et al. 2010). The vegetation design features for Alternatives 2 and 3 require that snags be managed to meet or move toward forest plan requirements and to move toward desired conditions. Snags or hazard trees within a distance of twice their height from private land boundaries or along key roads may be felled. In all other areas, conifer snags greater than 12 inches d.b.h. would be maintained, with an emphasis on snags greater than 18 inches d.b.h., except in cases of human health and safety. Live conifer trees with the potential to provide nesting habitat cavities, such as dead-top trees and lightning struck trees, would be favored for retention. Prescribed burns are designed to maintain desired forest structure, tree densities, snag densities, and CWD levels (Silviculture Report).

Western bluebird

Alternative 1 would lead to a decreased species trend if high severity wildfire is encountered in the Ponderosa pine open vegetation type habitat across the project area.

Alternative 1 would not result in an immediate change to the quantity or quality of habitat used by Western blubirds. Late-seral ponderosa pine would continue to be threatened by unnatural stand densities, creating risk for uncharacteristic, high-severity fire.

The proposed treatments in Alternatives 2 and 3 would protect nesting habitat. The proposed thinning and burning activities would also create canopy openings, allowing sunlight to reach more tree boles and increasing the prey base for bluebirds. Thinning and burning treatments are designed to return forest structure and composition to within the natural range of variation, which should benefit native wildlife species (Kalies et al. 2010). The vegetation design features for Alternatives 2 and 3 require that snags be managed to meet or move toward forest plan requirements and to move toward desired conditions. Snags or hazard trees within a distance of twice their height from private land boundaries or along key roads may be felled. In all other areas, conifer snags greater than 12 inches d.b.h. would be maintained, with an emphasis on snags greater than 18 inches d.b.h., except in cases of human health and safety. Live conifer trees with the potential to provide nesting habitat cavities, such as dead-top trees and lightning struck trees, would be favored for retention. Prescribed burns are designed to maintain desired forest structure, tree densities, snag densities, and CWD levels (Silviculture Report).

Western wood peewee

Alternative 1 would lead to a decreased species trend if effects from high severity wildfire is encountered by forested areas adjacent to riparian vegetation type habitats across the project area.

Alternatives 2 and 3 propose 14,560 acres of Riparian restoration. Improvement of stream function is proposed for 777 miles across the project area through the action alternatives. Restoration of approximately 900,000 acres of forested habitat could occur with the Alternative 2 and approximately 474,000 acres in Alternative 3.

Western wood peewees could be disturbed by restoration activities, however design features to protect raptor nests have been included in the project record. This should minimize disturbance to the Western wood peewees, though it is possible that disturbance from thinning implementation and short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. The removal of any eggs or fledglings would not result in a measurable negative effect to the Western wood peewee population from any of the two action alternatives as the implementation of these acres would occur intermittently over space and time over the next 10 years. Long-term effects to the peewee population would be positive as a result of habitat restoration. Alternatives 2 and 3 would improve areas adjacent to riparian vegetation habitats and would likely assist in keeping the population stable.

Cumulative Effects for Management Indicator Species

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 57). 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. Ongoing and reasonably foreseeable activities are listed in table 68. 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 would have been completed and the vegetation response to these actions would have occurred.

Table 55. Cumulative Effects by Species

Alternative 1

Analysis Area	Area of Analysis	Species	Reason for Selection
Within project area	Within analysis area	Mexican spotted owl, Pygmy Nuthatch, Merriams Wild Turkey, Abert's Squirrel, Hairy Woodpecker, Red-naped Sapsucker, Juniper Titmouse, Ash Throated Flycatcher, Gray Vireo, Northern Flicker, Townsend's Solitaire, Violet Green Swallow, Western Bluebird, Western Wood Peewee, Arizona Gray Squirrel, and Common Blackhawk.	Abert's and gray squirrel use is focused on the area around their nest trees. Birds may move to other areas, but their nesting and roosting habitat is the most limiting factor for these species.
Project area plus 0.25-mile buffer around project area	0.25-mile buffer around analysis area	Northern Goshawk	The 0.25-mile buffer takes into account potential disturbances from activities within the project area.
Game management unit	Game Management Unit	Elk, Pronghorn Antelope	These species have wider mobility; GMUs are designed to encompass herd movements.

The cumulative effects from the treatments occurring in current and within the reasonably forseeable 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 to 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 in up to 115,000 acres of pinyon-juniper habitat. Design features would 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 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 IBA, 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 habitat occurs in the IBA. 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

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 56. 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 Chaperral	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
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

Species	Habitat Links	Long-Term Effect to Habitat
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

1. PIPO = ponderosa pine forest

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 (USFWS) 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 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. Design features (Appendix 5) for Alternatives 2 and 3 have the following as examples of requirements for snags and wildlife species:

- If nest or roosts are not known, treatments will not occur within 0.25-mile buffer of core areas unless surveys indicate the PAC is unoccupied.
- Within goshawk PFAs, no treatments will occur from March 1 to September 30.
- Manage for forest plan levels of CWD when applying fire prescriptions.
- Ensure that the potential cumulative effects from multiple fires in a given area do not produce negative effects on local wildlife; coordinate burning between administrative units and between wildlife and fire management to minimize potential disturbance.
- When practicable, damage or mortality to old trees and large trees would be mitigated by implementing prescription parameters, ignition techniques, raking, wetting, thinning, compressing slash, or otherwise mitigating fire effects to the degree necessary to meet burn objectives and minimize fire effects and behavior in the vicinity of old trees. Trees identified as being of particular

concern (e.g., trees with known nests or roosts for herons, eagles, osprey, or other raptors, occupied nest cores, or critical areas in Mexican spotted owl protected activity centers (PACs) would be managed in accordance with wildlife design features (see Wildlife). Prepare old trees 1 year or more before a burn if possible.

- Mexican spotted owl protected activity centers (PACs) and recovery nest/roost habitat will be managed to meet basal area, trees per acre, and canopy cover requirements as specified in the most current MSO Recovery Plan. In Mexican spotted owl protected activity centers (PACs), springs, riparian and stream restoration would not occur during the breeding season (March 1 to August 31), if occupied.
- In Mexican spotted owl protected activity centers (PACs), springs, riparian and stream restoration would not occur during the breeding season (March 1 to August 31), if occupied.
- In occupied Mexican spotted owl protected activity centers (PACs) with currently nesting owls, no mechanical or prescribed fire treatments or road or trail maintenance would occur during the breeding season (March 1 to August 31).
- In occupied Mexican spotted owl protected activity centers (PACs) with currently nesting owls, no mechanical or prescribed fire treatments or road or trail maintenance would occur during the breeding season (March 1 to August 31).
- Coordinate and implement management activities within Mexican spotted owl protected activity centers (PACs) to reduce potential disturbance and minimize the frequency and duration of operations within and immediately adjacent to these areas.
- In Mexican spotted owl protected activity centers (PACs), no new wire fencing would be constructed in PACs to minimize the risk of owls colliding with new fences. Other alternatives would be used for aspen, sensitive plants, springs, and ephemeral channel restoration exclosures.
- Snags: Emphasize retention of snags exhibiting loose bark to provide habitat for roosting bats.
- If enough snags/acre are not present, then all snags will be maintained within the Aquatic Management Zones unless deemed a hazard to the restoration activity.
- All snags will be maintained within the Aquatic Management Zones unless deemed a hazard tree.
- Snags and Logs: Protect snags and logs wherever possible by placing landings in existing openings or in areas where snags and/or logs, and old trees would be minimally affected.
- Snags and Logs: In ponderosa pine, protect/provide snags and logs wherever possible through site prep, implementation planning, green tree selection, and ignition techniques to retain 1-2 snags per acre greater than or equal to 18 inches in diameter, and greater than or equal to 3 logs greater than or equal to 8 feet long and greater than or equal to 12 inches mid-point diameter, and 3-10 tons of coarse woody debris (greater than 3 inches in diameter) per acre in pine and pine-oak habitat.
- In pinyon-juniper cover type, snags 8 inches and greater in diameter at root collar would be managed for an average of 5 per acres, while snags 18 inches and greater in diameter would be managed for 1 per acre, and coarse woody debris would be managed for a post-treatment average of 2-5 tons per acre.

Unintentional take would be expected to 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 and to 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 action 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. APIF, the FS, and the USFWS 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 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 treatment 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 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 (Appendix 5) for restoration implementation in riparian habitat are included in the project record and would minimize disturbance to migratory birds.

Species-Specific Effects

The anticipated effects from proposed activities on priority species of migratory birds are presented in table 66.

Table 57. Migratory Bird Species and Their Associated Habitats Likely to be affected by Alternatives 2 and 3

APIF High Priority Species and USFWS Birds of Conservation Concern[1] by Habitat	Potential Changes Likely to Affect Species
Ponderosa Pine Forest	
Northern Goshawk	Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. Long-term effects from the action alternatives would include improvements to goshawk habitat and decreased risk of habitat loss from high-severity fire (sensitive species effects analysis).
Flammulated Owl	Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. Each of the alternatives would, for the most part, retain snags greater than 12 inches. Snags within a distance twice their height from private land boundaries or along key road or snags that may causes problems with human health and safety may be removed. If snag removal occurs during thinning or burning operations in the nesting season, there is a potential for unintentional take of young of the year. Only a small percentage of snags would be removed and, of the snags removed, only a small percentage would likely have active nest sites. The loss of any eggs or fledglings would not result in a measurable negative effect to the flammulated owl population from the two alternatives.
Cordilleran Flycatcher	Thinning, snag removal, and burning during the breeding season could potentially kill nestlings. Each of the alternatives would, for the most part, retain all snags greater than 12 inches. Snags within a distance twice their height from private land boundaries or along key road or snags that may causes problems with human health and safety may be removed. Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. It would be rare for snags to be removed. Both action alternatives would maintain late-successional forest habitat and all would move forests toward mature conditions. Live mature trees would not be targeted for removal during treatments except in rare circumstances.
Grace's Warbler	Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. Pre-settlement trees would rarely be removed during treatments and mature trees would generally be retained. Unintentional take of eggs or nestlings is possible from the loss of mature pine trees removed during the nesting season. Because of the desired conditions after treatment, not many mature trees are expected to be cut. The loss of any eggs or fledglings would not result in a measurable negative effect to the Grace's warbler population from either action alternatives.

APIF High Priority Species and USFWS Birds of Conservation Concern[1] by Habitat	Potential Changes Likely to Affect Species
Lewis's Woodpecker	Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. This species is primarily associated with snags in pine savanna habitat. Alternatives 2 and 3 would restore 18,570 and 2,470 acres respectively of former and current pine savanna. Snags would be maintained according to the vegetation design features. The alternatives would retain pre-settlement trees and the largest post-settlement trees that most closely resemble old trees in size and form as replacement trees adjacent to pre-settlement tree evidences. If a nest tree is removed during the breeding season, there is the potential for unintentional take of eggs or nestlings. However, none of these alternatives would be expected to result in a measurable negative effect to the Lewis' woodpecker population. Alternative 3 has less savanna treatments and so would accomplish less habitat improvement.
Purple Martin	Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. This species is primarily associated with snags in pine savanna habitat. Alternatives 2 and 3 would restore 18,570 and 2,470 acres respectively of former and current pine savanna. Snags would be maintained according to the vegetation design features. Pre-settlement trees would be retained and the largest post settlement trees that most closely resemble old trees in size and form would be left as replacement trees near pre-settlement evidences. If a nest tree is removed during the breeding season, there is the potential for loss of eggs or nestlings. Unintentional take of eggs or nestlings would not result in a measurable negative effect to the purple martin population in any of these alternatives. Alternative 3 has less savanna treatments and so would accomplish less habitat improvement for this species.
Cassin's Finch	Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to disturbance of wintering birds. The action alternatives would help improve Cassin's finch habitat by reestablishing groups within coniferous forests and creating openings. Live mature trees would not be targeted for removal except in very specific circumstances. Most of the project area is considered to be wintering habitat only for the species. It would be rare for a large mature pine tree to be removed and even rarer for trees with active nests to be impacted. Unintentional take of eggs or nestlings would not result in a measurable negative effect to the Cassin's finch population with either of the action alternatives.
Common Nighthawk	Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. This species nests on the ground in a variety of habitats that are found in the project area. Recently treated forests, meadows, and savannahs are all potential habitats where treatment could occur during the nesting season so there is the potential for loss of eggs or nestlings from trampling. Unintentional take of eggs or nestlings would not result in a measurable negative effect to the Common Nighthawk population in both of the action alternatives. Both alternatives include 36,320 acres of grassland restoration that would benefit the species in the long term. Alternative 2 proposes 18,570 acres of savannah restoration and 6,720 acres of meadow restoration. Alternative 3 has 2,400 acres proposed for savanna treatments and so would accomplish less habitat improvement.
Mexican Whip-poor-will	Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. This species nests on the ground in pine-oak woodlands of which 146,445 acres occur in the project area as well as in Mixed Conifer (50,499 acres). These habitats have proposed treatment from the action alternatives that could occur during the nesting season so there is the potential for loss of eggs or nestlings from trampling. The species often nests next to or under an overhanging rock so the likelihood that a nest would get trampled from treatment is low. Unintentional take of eggs or nestlings would not result in a measurable negative effect to the Mexican Whip-poor-will population in either of the two action alternatives.

APIF High Priority Species and USFWS Birds of Conservation Concern[1] by Habitat	Potential Changes Likely to Affect Species
Mixed Conifer	
Olive Sided Flycatcher	Pre-settlement trees would rarely be removed during treatments. Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. Unintentional take of eggs or nestlings is possible from the loss of mature pine trees removed during the nesting season. Because of the desired conditions after treatment, not many mature trees are expected to be cut. The loss of any eggs or fledglings would not result in a measurable negative effect to the Olive Sided Flycatcher population from the two action alternatives.
Evening Grosbeak	Pre-settlement trees would rarely be removed during treatments. Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. Unintentional take of eggs or nestlings is possible from the loss of mature pine trees removed during the nesting season. Because of the desired conditions after treatment, not many mature trees are expected to be cut. The loss of any eggs or fledglings would not result in a measurable negative effect to the Evening Grosbeak population from the two action alternatives.
Band-tailed Pigeon	Pre-settlement trees would rarely be removed during treatments. Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. Unintentional take of eggs or nestlings is possible from the loss of mature pine trees removed during the nesting season. Because of the desired conditions after treatment, not many mature trees are expected to be cut. The loss of any eggs or fledglings would not result in a measurable negative effect to the Band-tailed Pigeon population from the two action alternatives.
Red-faced Warbler	Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. As this species is a ground nester, unintentional take of eggs or nestlings is possible from trampling/implementation during the nesting season. Treatments would be staggered throughout the project area over 10 years of implementation. Therefore the loss of any eggs or fledglings would not result in a measurable negative effect to the Red-faced Warbler population from the two action alternatives.
Aspen	
Red-naped sapsucker	Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. The mechanical removal of ponderosa pine trees from aspen clones, scarification, and prescribed fire would help maintain older aspen being lost to conifer encroachment and stimulate regeneration. Aspen restoration could occur on 1,230 acres in Alternative 2 and 1,010 acres in Alternative 3. Barriers would allow growth of ramets. Overall, clones would be more resilient to weather extremes. There could be loss of large aspen and snags during the thinning of ponderosa pine trees and burning within aspen clones. If nest trees were removed during the nesting season, there is potential for destroying eggs or killing nestlings. Unintentional take of eggs or nestlings would not result in a measurable negative effect to the Red-naped Sapsucker population with either of the action alternatives because of the limited amount of habitat affected and low likelihood of removal of a nest tree.
Interior Chapperral	

APIF High Priority Species and USFWS Birds of Conservation Concern[1] by Habitat	Potential Changes Likely to Affect Species
Black-chinned Sparrow	Facilitative operations could treat up to 1,260 acres of chapperral through the Action Alternatives. Therefore short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. As this species typically nests on rocky hillsides, the likelihood of destoying nests or eggs is low. Unintentional take of eggs or nestlings would not result in a measurable negative effect to the Black-chinned Sparrow population with either of the two action alternatives because of the limited amount of habitat affected and low likelihood of removal of a nest shrub.
Pinyon-Juniper Woodland	
Gray Vireo	Both action alternatives would open up the canopy and allow development of understory plants, improving prey habitat and nesting habitat. However, mechanical treatment and burning could destroy nests if these activities occurred during the breeding season. Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. Not all treatments would occur during the breeding season. Unintentional take of eggs or nestlings would not result in a measurable negative effect to the gray vireo population from either of the two action alternatives.
Pinyon Jay	In Pinyon-Juniper woodlands, most large trees would not be removed. Historic PJ woodlands would be managed for late-seral habitat, benefiting nesting and Pinyon seed production. Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. Unintentional take of eggs or nestlings would not result in a measurable negative effect to the pinyon jay population from either of the two action alternatives.
Juniper Titmouse	Most large trees would not be removed and PJ woodlands would be managed for late-seral habitat, benefiting foraging and nesting habitat. However, mechanical treatment and burning could destroy nests if these activities occurred during breeding season. Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. Not all treatments would occur during the breeding season. Unintentional take of eggs or nestlings would not result in a measurable negative effect to the juniper titmouse population from either of the two action alternatives.
Black-throated Gray Warbler	The action alternatives would open up the canopy and allow for the development of understory plants. Most large trees would not be removed and PJ woodlands would be managed for late-seral habitat, improving nesting and foraging habitat. However, mechanical treatment and burning could destroy nests if these activities occurr during the breeding season. Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. Not all treatments would occur during the breeding season. Unintentional take of eggs or nestlings would not result in a measurable negative effect to the black-throated gray warbler population from either of the two action alternatives.
Gray Flycatcher	The two action alternatives would open up the canopy and allow for the development of understory plants. Most large trees would not be removed and PJ woodlands would be managed for late-seral habitat. This combination would benefit foraging and nesting habitat. However, mechanical treatment and burning could destroy nests if these activities occurred during breeding season. Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. Not all treatments would occur during the breeding season. Unintentional take of eggs or nestlings would not result in a measurable negative effect to the gray flycatcher population from either of the two action alternatives.
High Elevation Grasslands	

APIF High Priority Species and USFWS Birds of Conservation Concern[1] by Habitat	Potential Changes Likely to Affect Species
Swainson's Hawk	The action alternatives restore 36,320 acres of grassland and 18,570 acres of savannahs (Alternative 2) or 2,470 acres of savannahs (Alternative 3). Treatments would improve foraging habitat for the Swainson's hawk. Both action alternatives would mechanically remove post-settlement trees from grasslands, potentially improving nesting habitat. Known nest trees would be protected. Both action alternatives would protect nests form disturbance during the breeding season. Unintentional take of eggs or nestlings would only occur if nests were not detected during harvest operations. Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. Overall, project activities would not result in a measurable negative effect to the Swainson's hawk population from either of the two action alternatives.
Ferruginous Hawk	The action alternatives restore 36,320 acres of grassland and 18,570 acres of savannahs (Alternative 2) or 2,470 acres of savannahs (Alternative 3). Treatments would improve foraging habitat for the ferruginous hawk. All of the action alternatives would mechanically remove post-settlement trees from grasslands, potentially improving nesting habitat, and nest trees would be protected. Both of the action alternatives would protect known nests form disturbance during the breeding season. Ferruginous hawks can nest on the ground (on steep slopes), in low vegetation, and in trees. Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings.
Burrowing Owl	Burrowing owls nest below ground in grassland or savannah habitats, so there could be short-term effects from grassland restoration implementation. The action alternatives restore 36,320 acres of grassland and 18,570 acres of savannahs (Alternative 2) or 2,470 acres of savannahs (Alternative 3). Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. The loss of any eggs or fledglings would not result in a measurable negative effect to the Burrowing Owl population from either of the two action alternatives as the implementation of these acres would occur intermittently over space and time over the next 10 years. Long-term effects to the burrowing owl population would be positive as a result of habitat improvement.
Grasshopper Sparrow	The action alternatives restore 36,320 acres of grassland and 18,570 acres of savannahs (Alternative 2) or 2,470 acres of savannahs (Alternative 3). Grasshopper Sparrows are ground nesters. Short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. The loss of any eggs or fledglings would not result in a measurable negative effect to the grasshopper sparrow population from either of the two action alternatives as the implementation of these acres would occur intermittently over space and time over the next 10 years. Long-term effects to the Grasshopper Sparrow population would be positive as a result of habitat improvement. Burning would improve nesting and foraging habitat in the long term.
Bendire's Thrasher	The action alternatives restore 36,320 acres of grassland and 18,570 acres of savannahs (Alternative 2) or 2,470 acres of savannahs (Alternative 3). Bendire's Thrashers nest in shrubs or small trees. Distubance through thinning implementation and short-term noise and smoke disturbance is possible during thinning and broadcast burning operations, potentially leading to loss of egg viability or injury or death to nestlings. The loss of any eggs or fledglings would not result in a measurable negative effect to the Bendire's Thrasher population from either of the two action alternatives as the implementation of these acres would occur intermittently over space and time over the next 10 years. Long-term effects to the Bendire's Thrasher population would be positive as a result of habitat improvement. Burning would improve nesting and foraging habitat in the long term.

APIF High Priority Species and USFWS Birds of Conservation Concern[1] by Habitat	Potential Changes Likely to Affect Species
Chestnut-collared Longspur	The action alternatives restore 36,320 acres of grassland and 18,570 acres of savannahs (Alternative 2) or 2,470 acres of savannahs (Alternative 3). Chestnut-collared Longspurs are winter residents only in Arizona. Therefore birds would be mobile and without nests so affects form thinning and burning operations would be minimal. Long term effects from grassland and savannah restoration proposed in Alternatives 2 and 3 would benefit this species in its wintering grounds, an important piece of this species full life cycle.
Lark Bunting	The action alternatives restore 36,320 acres of grassland and 18,570 acres of savannahs (Alternative 2) or 2,470 acres of savannahs (Alternative 3). Lark Buntings are winter residents only in Arizona. Therefore birds would be mobile and without nests so affects form thinning and burning operations would be minimal. Long term effects from grassland and savannah restoration proposed in Alternatives 2 and 3 would benefit this species in its wintering grounds, an important piece of this species full life cycle.
Cottonwood Willow Riparian Forest	
Common Black-hawk	Alternatives 2 and 3 propose 14,560 acres of riparian restoration. Improvement of stream function is proposed for 777 miles across the project area through the two action alternatives. Black-hawks could be disturbed by restoration activities, however design features to protect raptor nests have been included in the project record. This should minimize disturbance to the Common Black-hawk, though it is possible that disturbance from thinning implementation and short-term noise and smoke disturbance is possible during thinning and broadcast burning operations. This could lead to loss of egg viability or injury or death to nestlings. The loss of any eggs or fledglings would not result in a measurable negative effect to the Common Black-hawk population from either of the two action alternatives as the implementation of these acres would occur intermittently over space and time over the next 10 years. Long-term effects to the Common Black-hawk population would be positive as a result of habitat restoration.
Bell's Vireo	Alternatives 2 and 3 propose 14,560 acres of riparian restoration. Improvement of stream function is proposed for 777 miles across the project area through the action alternatives. Bell's Vireos could be disturbed by restoration activities and it is possible that disturbance from thinning implementation and short-term noise and smoke disturbance could potentially lead to loss of egg viability or injury or death to nestlings. The loss of any eggs or fledglings would not result in a measurable negative effect to the Bell's Vireos population from either of the two action alternatives as the implementation of these acres would occur intermittently over space and time over the next 10 years. Long-term effects to the Bell's Vireos population would be positive as a result of habitat restoration improvements.
Elf Owl	Alternatives 2 and 3 propose 14,560 acres of riparian restoration. Improvement of stream function is proposed for 777 miles across the project area through the action alternatives. Elf owls nest in sycamores in Arizona, which occurs in riparian areas. Loss of large sycamore is not expected from either of the two action alternatives. Short term disturbance from thinning and burning operations could potentially lead to loss of egg viability or injury or death to nestlings. The loss of any eggs or fledglings would not result in a measurable negative effect to the Elf owl population from the action alternatives as the implementation of these acres would occur intermittently over space and time over the next 10 years. Long-term effects to the Elf Owl population would be positive as a result habitat restoration improvements.

APIF High Priority Species and USFWS Birds of Conservation Concern[1] by Habitat	Potential Changes Likely to Affect Species
Lucy's Warbler	Alternatives 2 and 3 propose 14,560 acres of riparian restoration. Improvement of stream function is proposed for 777 miles across the project area through the action alternatives. Lucy's Warblers nest in loose bark or cavities of riparian trees. Short term disturbance from thinning and burning operations could potentially lead to loss of egg viability or injury or death to nestlings. The loss of any eggs or fledglings would not result in a measurable negative effect to the Lucy's Warbler population from any of the three action alternatives as the implementation of these acres would occur intermittently over space and time over the next 10 years. Long-term effects to the Lucy's Warbler population would be positive as a result of restoration and habitat restoration improvements.
Yellow Warbler	Alternatives 2 and 3 propose 14,560 acres of riparian restoration. Improvement of stream function is proposed for 777 miles across the project area through both of the action alternatives. Yellow Warblers nest in dense thickets along streams or wetlands. Short term disturbance from thinning and burning operations could potentially lead to loss of egg viability or injury or death to nestlings. The loss of any eggs or fledglings would not result in a measurable negative effect to the Yellow Warbler population from either of the two action alternatives as the implementation of these acres would occur intermittently over space and time over the next 10 years. Long-term effects to the Yellow Warbler population would be positive as a result of restoration and habitat restoration improvements.
Wood Duck	Wood Ducks are winter residents only in Arizona. Effects to the Wood Duck population from implementation of the 3 action alternatives would be minimal, as birds are mobile or without nests when they occur in the project area and they would simply move to avoid short-term disturbance. Therefore birds would be mobile and without nests so affects form thinning and burning operations would be minimal. Alternatives 2 and 3 propose 14,560 acres of riparian restoration. Improvement of stream function is proposed for 777 miles across the project area through the action alternatives. Long term effects from riparian restoration proposed in Alternatives 2 and 3 would benefit this species in its wintering grounds, an important piece of this species full life cycle.
Montane Willow Riparian Forest	
Lincoln's Sparrow	Lincoln's Sparrows are mostly winter migrants in Arizona with a small number possibly breeding within the project area. Alternatives 2 and 3 propose 14,560 acres of riparian restoration. Improvement of stream function is proposed for 777 miles across the project area through the action alternatives. Lincoln's Sparrows are ground nesters, under a willow. Short term disturbance from thinning and burning operations could potentially lead to loss of egg viability or injury or death to nestlings. The loss of any eggs or fledglings would not result in a measurable negative effect to the Lincoln's Sparrow population from either of the two action alternatives as the implementation of these acres would occur intermittently over space and time over the next 10 years. Long-term effects to the Lincoln's Sparrow population would be positive as a result of habitat restoration improvements.
MacGillivray's Warbler	Macgillivray's Warblers are mostly winter migrants in Arizona with a small number possibly breeding within the project area. Alternatives 2 and 3 propose 14,560 acres of Riparian restoration. Improvement of stream function is proposed for 777 miles across the project area through the action alternatives. Macgillivray's Warblers nest at or near ground level under shrub cover. Short term disturbance from thinning and burning operations could potentially lead to loss of egg viability or injury or death to nestlings. The loss of any eggs or fledglings would not result in a measurable negative effect to the Macgillivray's Warblers population from either of the two action alternatives as the implementation of these acres would occur intermittently over space and time over the next 10 years. Long-term effects to the Macgillivray's Warblers population would be positive as a result of habitat restoration improvements.

APIF High Priority Species and USFWS Birds of Conservation Concern[1] by Habitat	Potential Changes Likely to Affect Species
Brewers Blackbird	In Arizona Brewer's Blackbirds are year round residents. Alternatives 2 and 3 propose 14,560 acres of Riparian restoration. Improvement of stream function is proposed for 777 miles across the project area through the action alternatives. Brewer's Blackbirds are colony nesters that can select for shrubs or trees depending on availability. Short term disturbance from thinning and burning operations could potentially lead to loss of egg viability or injury or death to nestlings. The loss of any eggs or fledglings would not result in a measurable negative effect to the Brewer's Blackbird population from either of the two action alternatives as the implementation of these acres would occur intermittently over space and time over the next 10 years. Long-term effects to the Brewer's Blackbird population would be positive as a result of habitat restoration improvements.
Desert Communities	
Phainopepla	Phainopepla habitat includes desert, riparian woodlands and chaparral. Nothing is proposed in desert habitat.In riparian and chaparral habitats short term disturbance from thinning and burning operations could potentially lead to loss of egg viability or injury or death to nestlings. The loss of any eggs or fledglings would not result in a measurable negative effect to the Phainopepla population from either of the two action alternatives as the implementation of these acres would occur intermittently over space and time over the next 10 years. Long-term effects to the Phainopepla population would be positive as a result of restoration and habitat restoration improvements.
Open Habitats	
Savannah Sparrow	Savannah Sparrows are primarily grassland birds. The action alternatives restore 36,320 acres of grassland and 18,570 acres of savannahs (Alternative 2) or 2,470 acres of savannahs (Alternative 3). Alternatives 2 and 3 would treat up to 6,720 acres of meadow restoration. Savanah Sparrows breed and over winter in Arizona. Short term disturbance from thinning and burning operations could potentially lead to loss of egg viability or injury or death to nestlings. The loss of any eggs or fledglings would not result in a measurable negative effect to the Savannah Sparrow population from either of the two action alternatives as the implementation of these acres would occur intermittently over space and time over the next 10 years. Long term effects from grassland and savannah restoration proposed in Alternatives 2 and 3 would benefit this species.
Shrub Species	
Virginia's Warbler	Virginia's Warblers breed in mixed-evergreen and pinyon-juniper forests in the project area. They are often found in dense thickets of shrubs in various habitats. Short term disturbance from thinning and burning operations could potentially lead to loss of egg viability or injury or death to nestlings. The loss of any eggs or fledglings would not result in a measurable negative effect to the Virginia's Warbler population from either of the two action alternatives as the implementation of these acres would occur intermittently over space and time over the next 10 years. Long term effects from restoration proposed in Alternatives 2 and 3 would benefit this species.

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

Important Bird Area

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.

Treatment objectives are to help restore forests to their historical range of variation. Overall, 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 IBA 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 analysis 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 would have been completed and the vegetation response to these actions would have occurred.

There are many ongoing or planned projects that would 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 would be an estimated 195,405 acres of prescribed burns in the project area. There would 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 forests in the Rim Country Project Area have begun planning 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 (GMUs), while the Coconino NF allows elk retrieval in all GMUs 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 both forests. The A-S and Coconino NFs have planned 7,040 acres to be treated 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 (ROWs) 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 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).

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.

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 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.

Cumulative Effects for all Alternatives

Cumulative effects are the potential changes to existing conditions due to past, present, and future activities, including the effects of the Alternatives being discussed. The effects of past actions are incorporated into the description of existing conditions. Present and reasonably foreseeable actions that are relevant to wildlife resources are described below for all alternatives. The cumulative effects analysis area will be described by species. Projects listed within the Rim Country Cumulative Effects Analysis Baseline were considered as reasonably foreseeable actions.

Present and reasonably foreseeable actions that can affect wildlife resources over space and/or time include the reauthorization of livestock grazing allotments, fuels reduction projects, forest thinning, prescribed fire, recreation management (obliteration of social trails and dispersed campsites, designation of trails and campsites), lands special use permits (new issuances and maintenance on existing structures), and aspen restoration. While these activities can directly and indirectly affect wildlife species and their habitats, these projects typically are planned to minimize or eliminate negative effects through design features, mitigation measures, and best management practices.

The spatial context being considered for the cumulative effects is the 1,240,000 acre project area, unless noted otherwise for individual species. Cumulative effects are discussed in terms of wildfire and vegetation management activities that have occurred in the past, are ongoing, or are reasonably foreseeable, including the effects of the alternatives discussed below. Reasonably foreseeable actions are considered for approximately 10 years into the future. At that time the majority of the actions proposed would have been completed and the vegetation response to these actions should have occurred. Effects can also be categorized temporally: in this analysis, short-term effects are those occurring within 10 years and long term is 30 years. Project impacts to wildlife are summarized below (table 16). These effects are summarized by project types and their potential effects on wildlife and wildlife habitat. Because effects from changes in habitat vary so much by species (e.g., opening the canopy can restore the habitat for one species while eliminating habitat for another species), cumulative effects to individual species are addressed in the respective species analysis.

Table 58. Cumulative Effects to Wildlife and Habitat from Present and Reasonable Foreseeable Projects.

Project Type	General Effects to Habitat	General Effects to Wildlife	Extent
Thinning without diameter limit	Move landscape toward desired conditions for interspersion age & size class distribution	Short-term spatial and temporal disturbance to wildlife; long-term improvements to habitat; forest plans include breeding season timing restrictions for MSO, goshawks, and fawning grounds	Occurs across each forest
Thinning with diameter limit	Typically results in even spacing ("jail bar spacing"), versus a groupy/clumpy structure, and lacks interspaces; with no open interspace between tree groups the benefits in understory response and decreased risk of high-severity fire are quickly lost due to resulting tree growth (less than 10 years); leads to loss of habitat structure	Short-term spatial and temporal disturbance to wildlife; long-term loss of habitat structure; forest plans include breeding season timing restrictions for MSO, goshawks, and fawning grounds	Occurs across each forest

Project Type	General Effects to Habitat	General Effects to Wildlife	Extent
Prescribed Fire	Reduces fine fuels, litter, and duff; provides a nutritional flush to trees and understory; decreases CWD (immediate response) and creates CWD (scorching and killing trees); may create canopy openings; short-term loss of snags with long-term increase in snag numbers, but includes replacing persistent snags with more ephemeral snags, long term decrease in large oaks, increased sprouting of shrubby oaks; mixed severity prescribed fire yield patchy mosaic of habitat; effective in grassland and meadow restoration; decreased threat of high-severity fire and subsequent habitat loss.	Short-term spatial and temporal disturbance to wildlife; maintenance of habitat aids in persistence of wildlife populations that evolved with frequent fire return intervals; increases in understory biomass benefits most landbirds and small mammals; Forest plan parameters including breeding season timing restrictions for raptors and ungulates	Occurs across each forest
TMR – Coconino	Habitat effectiveness increased across the forest due to scale of reductions in disturbance except in fall when big game retrieval is allowed	Habitat effectiveness improvements will benefit most wildlife species; increase in vehicular traffic directly related to Rim Country will be off-set from decrease in general vehicular traffic; decrease in illegal cutting of snags	4,474 miles of roads and motorized routes are no longer open; off-road driving for camping limited to 30 feet of open roads except in designated camping corridors where the limit is 300 feet; motorized elk retrieval open across most of Rim Country area GMUs 5a & 5b closed to big game retrieval on the Mogollon Rim
TMR – A-S	Localized increases in habitat effectiveness, but little change overall, particularly during big game retrieval; exception is in in grasslands where motorized use will be decreased	Decrease in disturbance in grasslands combined with forest restoration could provide more contiguous swaths of functional habitat for grassland and savanna dependent species; other benefits to wildlife will be limited, localized, and very site specific; limited decrease in illegal cutting of snags	143 miles of road on have recovery use; 15 miles of road constructed; 380 miles of road on Williams have recovery use; 34 miles of road constructed; off-road driving associated with camping limited to within 30 feet of open roads; most of the 2 districts are open to motorized big game retrieval

Project Type	General Effects to Habitat	General Effects to Wildlife	Extent
Private Land Development	Net effect is loss in habitat and/or habitat effectiveness; private lands in grasslands and savannas are typically developed as home sights; GFFP works closely with the CNF and non-Federal land owners & managers	Net loss of habitat & displacement: open-habitat species tend to be displaced; land development within forest may shift habitat use, but impacts likely to be less than in open habitats	Occurs across each forest
Thinning and Burning on State, DOD, and private lands	Vegetation treatments on State, other federal and private lands typically reduce TPA, increase openings, increase biomass production, and decrease risk of high-severity fires.	Short-term spatial and temporal disturbance to wildlife; long-term improvements to habitat on State and DOD lands; thinning on private home sites (GFFP) not likely to provide much long-term habitat but would decrease the risk of high-severity fire to adjacent lands	GFFP – 635 ac DOD – 19,816 ac
Forestwide dead and down fuel wood collection	Includes potential impacts from loss of snags, logs, and CWD; localized areas may be deficit in snags logs, and CWD; fuel wood activities may disturb wildlife in localized areas	Disturbance and displacement of animals spatially and temporally, including nesting and fawning seasons for a wide range of species; habitat loss for some species;	CNF and ASNF: the public is not allowed to travel cross country to search for fuelwood, but may drive off-road to gather cut wood. TNF: the public is allowed to drive off-road to collect fuelwood within designated areas only.
Fuelwood sales	Habitat removal – generally used as a restoration tool such as cutting trees to restore grasslands;	Disturbance and displacement of animals spatially and temporally, including nesting and fawning seasons for a wide range of species; habitat loss for some species/habitat gain for others	Occurs across each forest
Recreation	Localized decrease in habitat quality due to the loss of understory vegetation (trampling, removal) associated with camping; disturbance from motorized use and hikers	Localized disturbance and displacement of animals spatially and temporally, although many species have likely acclimated to areas with regular use	Occurs across each forest
Grazing	Ongoing and future grazing should maintain plant species composition and diversity; there may be short term effects to plant height, except around water and key grazing areas where trampling and effects to plant height are long term; elk use is factored into grazing utilization standards and is part of the baseline; grazing affects 80 percent of the project area	Pastures that are grazed in early summer may affect small mammal populations while animals are nesting or young are dispersing; pastures receiving spring use vary annually	790,985 acres of 988,764 total acres within the project area are classified as grazing allotments

Project Type	General Effects to Habitat	General Effects to Wildlife	Extent
ROW clearing	Removes key habitat elements like snags and woody shrubs along right of way; maintains early seral vegetation, provides open habitat; and decreases connectivity of closed canopy habitat	Negatively affects cavity nesters, shrub nesters, Abert's squirrels, and deer; positively affects understory development, small mammals, arthropods, and elk	Occurs across each forest
Annual road maintenance	Maintenance of existing roads; noise disturbance likely lower in intensity than many mechanical sources of noise due to equipment staying on or adjacent to roads and typically slowly moving.	Timing restrictions in MSO PACs apply; potential noise disturbance to other wildlife	About 500 miles of road work per year across the Rim Country area
Aspen restoration	Removes snags and overstory trees in short term; Improves and maintains aspen habitat in the long term.	Localized disturbance in short term; long-term provides habitat heterogeneity in the overstory and understory within the relatively homogeneous ponderosa pine for a range of birds species and small mammals	Occurs across each forest
Grassland/ savanna restoration	Typically includes removing encroaching trees and prescribed fire for maintenance	Positively affects populations of grassland associated birds and small mammals; restores, maintains, and improves habitat for pronghorn	Occurs across each forest
Water development maintenance	Increase effective areas available for resident elk; impacts of elk browsing likely to increase in areas already impacted by elk	Oak, sage, and young conifers already clubbed from winter browsing; increased use likely to increase impacts to birds, small mammals, and deer	
Weed treatments	Improving habitat quality by reducing/eliminating non-native plant species	– not related to elk trends as these are determined by state management – hunt guides overwhelm measureable effects of habitat changes;	Occurs across each forest
Pinyon-juniper thinning and burning	Removes woodland vegetation encroaching on grassland, shrubland, and savanna	Decreases habitat for woodland dependent species and increases habitat for open habitat-dependent species	Occurs across each forest

CNF = Coconino National Forest; TNF = Tonto National Forest; DOD = Dept. of Defense; GFFP = Greater Flagstaff Forest Partnership; ASNF = A-S National Forest; CWD = coarse woody debris; GMU = game management unit

Existing Conditions

Past actions include vegetation treatments and wildfires that have occurred within the project area from 2000 to 2018 (table 68). In general, effects of mechanical treatments predating this time would not be expected to have much influence on wildlife habitat except for the deficit of large trees common across the analysis area. Mechanical vegetation management activities have mainly consisted of habitat improvements and fuels reductions. Projects include treatments for habitat improvements for wildlife and to restore forest conditions closer to NRV (117,719 acres), treatments with a fuels reduction emphasis (79,405 acres), and ponderosa pine restoration emphasis (24,456 acres) to improve forest structure, health and growth. There have also been 5,000 acres of tree removal to restore savannas and encroached grasslands, Salvage of timber from large wildfires (31,391 acres), Range cover manipulation to reduce encroachment (24,611 acres), and Invasive Plant/weed removal (90,670 acres).

Table 59. Approximate Acres of Vegetation Management Activities Within the Project Area from 2000 to 2018.

Treatment	Treatment Type	Approximate Acres
	Thinning -Habitat Improvement	117,719
Mechanical Vegetation Management	Thinning – Fuels Reduction Emphasis	79,405
	Thinning – Restoration Emphasis	24,456
	Savanna/Grassland Restoration	5,000
	Salvage	31,391
	Range Cover Manipulation	24,611
	Invasive Plant/Weed Treatment	90,670
	Powerline Hazard Tree Removal and Right of Way	
Total Mechanical:		**373,252**
Fuels Treatments (With Mechanical)	Mechanical Fuels Treatment	49,165
	Pile and Burn	5,070
	Broadcast Burn	59,640
Total Fuels Treatments		**68,620**
Prescribed Fire (Burn Only)		**47,970**
Wildfire		431,114

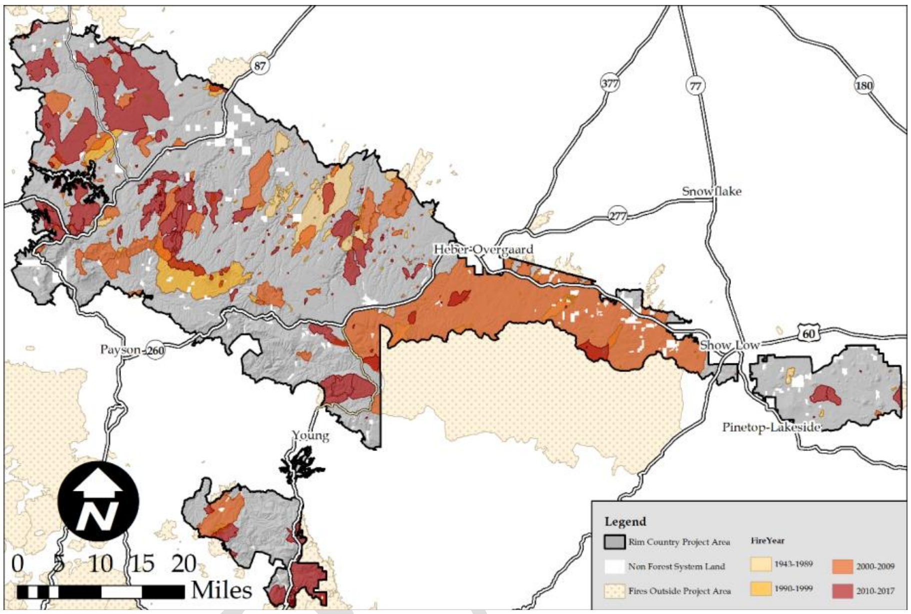
Fuels treatments that have been accomplished in association with the above listed mechanical treatments included 49,165 acres of mechanical fuels treatments (slash lopping, crushing, piling and jackpot burning), 5,070 acres of machine piling and burning and 59,640 acres of broadcast burning. The primary focus of these treatments was to rearrange and reduce activities generated fuels.

Prescribed fire proposed for 59,640 acres were intended to reduce fuels accumulations and/or reintroduce fire to fire-adapted ecosystems. Wildfires from 2000 to 2017 have burned on approximately 431,114 acres of the project area.

Forest Resilience

Past wildfires are summarized by time period (Figure 12). The Rodeo-Chedeski fire andWallow Fire were the largest fires with highest burn severity. Many small fires have occurred but conditions are set for another large scale event, causing loss of property and resources prompting the Proposed Action for the Rim Country 4 FRI project.

Figure 13. Past Wildfires in the 4 FRI Rim Country Project Area.



Forest Structure and Diversity

From the Silviculture Specialist Report:

Open, "frequent low-severity fire" forest structure has been altered by logging, grazing, and fire suppression and has led to overly dense forest structure and highly departed fire regimes.

Large, old ponderosa pines and oaks have become underrepresented in many areas. The remaining large, old ponderosa pines are suffering increased mortality rates as a result of competition with small trees, insects and disease, and climate change.

Ponderosa pine forests have increased in density as abundant tree seedlings have regenerated in canopy openings and replaced open, multiple age class forest structure with a dense and predominately single age class structure. This resulted from logging practices, protection from fire, grazing, and a relatively wet climatic cycle (Schubert 1974).

Frequent low-severity fire regime forests have increased densities from shade tolerant species. Dry mixed conifer forests are far denser and with a species composition that is not necessarily representative of their NRV.

Competition for moisture and nutrients is intense in currently dense stands, and results in stress that increases vulnerability to attack by insects such as pine bark beetles (*Dendroctonus* spp.) and *Ips* beetles (Kane and Kolb, 2014).

Though the extent of dwarf mistletoe infection is s have become more widespread with increased negative impacts in some areas due to closed forest conditions, lack of low severity fire, and lack of adequate mitigation management, thereby resulting in reduced forest health and growth, increased risks to insect attacks, accumulated ladder fuels, and negative effects from projected climate change.

Potential fire severity has changed from low-severity to mixed- and high-severity. The risk of stand replacing fires has increased.

High severity fires often result in ecosystem conversions, increased soil erosion, loss of hydrologic function, and invasion by nonnative species.

Stand-replacing wildfires within ponderosa pine ecosystems have resulted in conversion from forest to grass or persistent shrub for long periods or dense, even age structure. These areas would not again support old-growth forest structure for centuries.

Trees have significantly encroached into historical grasslands and meadows.

Habitat Improvement thinning with a restoration emphasis and savanna restoration treatments were designed to reestablish forest openings and attain a mosaic of interspaces and tree groups of varying sized and shapes. Both categories of treatments lead to increased understory development, lasting until overstory canopies again close. Thinning treatments with restoration objectives are very similar to the goshawk habitat and MSO recovery other habitat treatments proposed under this project and have resulted in similar diversity in age and size class.

Fuels reduction, including prescribed precommercial and commercial thinning generally had a d.b.h. limit, resulting in a "thin from below" approach. The main objective of thinning with a fuels reduction emphasis was to reduce canopy fuels and the potential for crown fire initiation. Generally, this type of treatment focused on removal of trees in the subordinate crown positions and retaining those trees in dominate and co-dominate crown positions and any pre-settlement trees. This type of treatment resulted in a moderately open canopy, even aged forest structure with very little age and size class diversity. When treatments are based on tree diameters there is little to no consideration for tree grouping, spacing, and rooting space, typically resulting relatively evenly spaced and evenly sized trees. Post-treatment stands have limited tree size classes and age-classes with a virtual removal of overstory habitat consisting of diameters below the specified limit. Understory response is typically limited and of short duration because the treatments were designed to maximize individual tree growth without providing for openings.

Current, Ongoing and Foreseeable Projects and Actions

Current, ongoing and foreseeable projects within watersheds of the Rim Country project area are shown in table 65. Some of these projects are on hold so implementation is speculative. Much of the acres proposed for fuels treatments and burning overlap with the thinned areas.

Table 60. Approximate Acres of Current, Ongoing and Foreseeable Vegetation Management Activities within the Project Area.

Treatment	Treatment Type	Current Projects Approximate Acres	Reasonable Foreseeable Projects Approximate Acres
	Thinning -Habitat Improvement	89,579	10,975
Mechanical Vegetation Management	Thinning – Fuels Reduction Emphasis	114,570	41,046
	Thinning – Restoration Emphasis	53,578	285
	Savanna/Grassland Restoration	0	39,000
	Salvage	5,678	0
	Range Cover Manipulation	34,701	54,147
	Invasive Plant/Weed Treatment	0	0
	Powerline Hazard Tree Removal and Right of Way	4,580	22,963
Total Mechanical:		**302,686**	**168,416**
Fuels Treatments (With Mechanical)	Mechanical Fuels Treatment	155,244	49,165
	Pile and Burn	133,168	5,070
	Broadcast Burn	250,373	59,640
Total Fuels Treatments		**538,175**	**113,875**

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