United States
Department of
Agriculture

Forest
Service

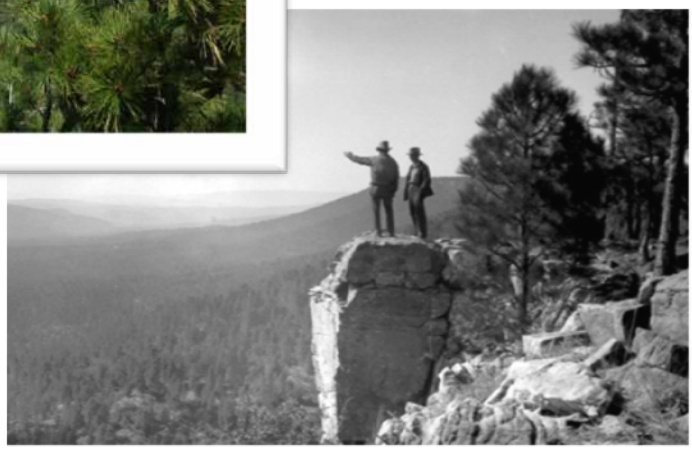
**Southwestern
Region**

MB-R3-01-5

September 2012

Draft Environmental Impact Statement for the Rim Lakes Forest Restoration Project

Apache-Sitgreaves National Forests, Coconino County, Arizona



Cover Photos: Fulton Point now and in 1909. Fulton Point is within the Rim Lakes Forest Restoration Project area.

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Draft Environmental Impact Statement for the Rim Lakes Forest Restoration Project

Apache-Sitgreaves National Forests
Coconino County, Arizona

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Abstract: This environmental impact statement discloses the effects of a proposal to treat vegetation in a 33,500-acre project area. The proposed action (alternative B) would selectively cut trees on approximately 23,615 acres and then broadcast burn on those acres. On approximately 9,340 acres, broadcast burning would occur without mechanical treatment. The proposed action includes an amendment to the "Apache-Sitgreaves National Forests Land and Resource Management Plan" (forest plan). Alternative C is the other action alternative considered in detail. It would implement the same proposal, except limit mechanical treatment to trees less than 16 inches in diameter, moving many treated stands toward even-aged conditions. This alternative also proposes an amendment to the forest plan in order to allow for this even-aged condition. Alternative B is the preferred alternative.

Reviewers should provide the Forest Service with their comments during the review period of the draft environmental impact statement. This will enable the Forest Service to analyze and respond to the comments at one time and to use information acquired in the preparation of the final environmental impact statement, thus avoiding undue delay in the decisionmaking process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewers' position and contentions. Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 553 (1978). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the final environmental impact statement. City of Angoon v. Hodel (9th Circuit, l986) and Wisconsin Heritages, Inc. v. Harris, 490 F. Supp. 1334, 1338 (E.D. Wis. 1980). Comments on the draft environmental impact statement should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3).

Send Comments to: Dee Hines, Black Mesa Ranger District

Date Comments Must Be Received: To be eligible to participate in the predecisional objection process pursuant to 36 CFR Part 218, comments on this draft environmental impact statement must be submitted during the 45-day comment period, which begins the day after the notice of availability is published in the Federal Register.

Summary

The Apache-Sitgreaves National Forests propose to conduct selective cutting and prescribed burning across approximately 33,600 acres of National Forest System lands. The project intends to conserve and restore the Rim Lakes Project Area to make—over time—the forest ecosystem more sustainable and resilient to natural disturbances such as drought and climatic variability, insects, disease, fire, and wind.

The purpose of the project is to restore forest health, move forests toward an uneven-aged forest structure with all age classes represented, and restore frequent, periodic surface fire as an ecological process, as well as reduce the risk of a stand-replacing fire. The project will also improve hydrologic function, improve wildlife habitat—in particular for northern goshawk and Mexican spotted owl—and improve scenic quality, as well as move the project area toward forest plan old growth management allocation goals.

In order to meet the purpose, this proposed action includes a site-specific, forest plan amendment to the "Apache-Sitgreaves National Forests Land and Resource Management Plan" (hereafter referred to as the forest plan). This amendment clarifies guidelines to assure the proposed action can meet its restoration objectives, and to assure consistency with the forest plan.

The Rim Lakes Forest Restoration Project is authorized under the Healthy Forest Restoration Act (HFRA) of 2003. The HFRA contains a variety of provisions aimed at expediting the preparation and implementation of hazardous fuels reduction projects on Federal land and assisting rural communities. HFRA focuses on four types of land: (1) the wildland-urban interfaces of at-risk communities; (2) at-risk municipal watersheds; (3) lands where threatened and endangered species or their habitats are at risk to catastrophic fire and where fuels treatment can reduce those risks; and (4) where windthrow or insect epidemics threaten ecosystem components or resource values. For the Rim Lakes Project, lands lie in the wildland-urban interface (WUI) and contain critical habitat for the threatened Mexican spotted owl.

To date, analysis for this proposed action was documented in an environmental assessment that underwent an objection period in September 2011. After reviewing objections, the Apache-Sitgreaves National Forests supervisor elected to document the analysis in an environmental impact statement (EIS). The forest supervisor also elected to include an amendment to the forest plan as part of the proposed action in order to achieve project restoration objectives and to assure consistency with the "Apache-Sitgreaves National Forests Land and Resource Management Plan."

The underlying purpose and need for the project has been determined by comparing the desired conditions to the existing conditions within the planning area. Currently, forested lands in the project area have departed from the structures and processes that historically kept them in a healthy, resilient condition. For example, 97 percent of the forested lands reflect a high stand density that makes these forests susceptible to insects and disease. Forests are also at risk of uncharacteristically high-severity wildfires, which can lead to loss of entire stands during one fire event. About 67 percent of the project area has potential for either active crown fire or passive crown fire because of the amount of ladder fuels and the continuous and interlocking tree crowns. As demonstrated by recent large fires in the lands adjacent to the project area—such as the Rodeo-Chediski in 2002—a crown fire would alter ecosystem functions, destroy much of the existing wildlife habitat, create sediment problems to the watersheds, and decrease the desirability of the area for recreation.

Desired conditions call for uneven-aged forests across the project area that exhibit a variety of forest densities, spatial arrangements, age/structure conditions, and interspaces between groups. The need for change derived from the difference between the existing condition and the desired condition is summarized as follows:

- Move stand densities toward desired conditions that promote forest health, large tree growth, and increased herbaceous understory species and composition.
- Reduce the risk of a stand replacing crown fire by reducing stand densities, reducing canopy bulk density/continuity, increasing crown heights, and creating more stand openness.
- Move goshawk habitat types toward desired conditions. For example, variable tree group sizes, age classes, and densities, as well as variable sized interspaces between groups.
- Move Mexican spotted owl habitat types toward the desired condition of stand density and forest structure consistent with the forest plan and Mexican spotted owl recovery plan.
- Reduce the basal area on most of the forest to reduce bark beetle hazard, and selectively reduce the level of dwarf mistletoe infection.
- Be consistent with the 1996 forest plan amendment, which calls for 20 percent of the area being designated for old-growth management.
- Amend the "Apache-Sitgreaves National Forests Land and Resource Management Plan" in order to achieve project restoration objectives and to assure consistency with the forest plan.

In response to the purpose and need, the forest proposes the following actions during the next 10 years or until objectives are met.

- Selectively cut trees and broadcast burn after treatment on approximately 23,615 acres: in ponderosa pine and pine-oak, maintenance burns would occur after these initial treatments; in dry mixed conifer, no reentry maintenance burns would occur as part of this proposal.
- Broadcast burn without selectively cutting trees on approximately 9,339 acres: in ponderosa pine and pine-oak, maintenance burns would occur after the initial prescribed burns; in dry mixed conifer, no reentry maintenance burns would occur as part of this proposal.
- Selectively cut trees with no followup broadcast burn on approximately 56 acres.
- Open approximately185 miles of existing closed roads to be used for treatment activity. Close roads when treatments are finished and rehabilitate as needed.
- Construct 2.6 miles of temporary road for haul access and obliterate after use (seven short segments approximately one-quarter to one-third of a mile each).
- Allocate approximately 6,900 acres of forest to be managed for old-growth characteristics.
- Amend the "Apache-Sitgreaves National Forests Land and Resource Management Plan" pages 56 and 57, to add clarifying language to: (1) describe desired conditions for the

project area managed for northern goshawk; (2) express relative amounts of forest cover, as well as the special distribution of that cover, including the interspaces between tree groups; (3) define the relationship between the interspaces and natural openings, such as meadows; and (4) clarify that canopy closure is evaluated at the tree group scale within vegetation structural stages (VSS) 4, 5, and 6.

In addition to the proposed action (alternative B), another alternative (alternative C) was analyzed that limited the cutting of trees to less than 16 inches in diameter (at breast height). Otherwise the alternative included the same mechanical equipment and prescribed burning to accomplish the treatments using the methods described in the proposed action. Because this alternative would result in even-aged management, it would not meet forest plan direction for uneven-aged management; therefore, if selected it would require a forest plan amendment to allow for even-age management (forest plan as amended, page 54).

During development of the environmental assessment, comments received were examined for issues, or unresolved conflicts directly or indirectly caused by implementing the proposed action. Issues serve to highlight effects that may occur from the proposed action and alternatives. The Forest Service identified the following issue: Issue 1: Cutting trees and prescribed burning may cause unforeseen mortality among larger size classes of "leave" trees. Removal of trees larger than 16 inches in diameter when combined with potential mortality, may place post treatment large tree densities below target densities. This may negatively affect old growth quality and quantity and wildlife habitat quality, quantity, and populations.

Scoping for development of this environmental impact statement began with publication of a notice of intent in the Federal Register on March 29, 2012. Although several issues were raised during this scoping period—in particular the human health effects of smoke from prescribed burning—none rose to the level of a significant issue and, therefore, no new alternatives were developed in detail (see page 31 for how a "no burn" alternative was considered).

The proposed Rim Lakes Forest Restoration Project is subject to the HFRA predecisional objection process pursuant to 36 CFR Part 218 Subpart A and is not subject to notice, comment, and appeal procedures under 36 CFR 215. The 36 CFR 218 predecisional objection process requires a 30-day notice and objection period for the final environmental impact statement before a decision can be made by the responsible official. Only those who commented during scoping or during the comment period for the draft environmental impact statement may file objections (36 CFR 218.7).

Major conclusions of this analysis include:

1. Effects from either action alternative were similar, except alternative B more comprehensively meets the purpose and need of the project. With alternative B, the benefits would last longer than those benefits realized through alternative C.
2. Alternative B—by opening up canopy gaps—provides a marked reduction in the risk of crown fire when compared with either alternative A or alternative C. Although alternative C provides some short-term risk reduction, the benefits would require more followup treatments to maintain this reduction when compared with alternative B. Alternative B treatments are expect to last up to three times longer than those proposed in alternative C.

3. Effects to people from smoke, truck traffic, and other potential hazards were mitigated to minimize public safety exposure.
4. Alternative B and alternative C would have similar benefits to vegetation where they both reduce stand density. However, because the 16-inch-cutting limit in alternative C would require retention of more mid-sized trees, a greater number of small trees would need to be removed to meet the density objectives. Therefore, these stands would move toward even-aged conditions, with fewer smaller sized trees available for future forest development. Alternative C would also retain higher levels of diseased forest, specifically from mistletoe.

Given the purpose and need of the project, the forest supervisor will review the proposed action, other alternatives, and the environmental consequences in order to make the following decisions: (1) whether to select the proposed action or an alternative; (2) the location, design, and scheduling of the proposed thinning, burning, and road maintenance, (3) mitigation measures and monitoring requirements; and, (4) the significance of the proposed forest plan amendments. Alternative B is the preferred alternative.

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Chapter 1. Purpose of and Need for Action

Document Structure

The Forest Service has prepared this environmental impact statement in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and state laws and regulations. This environmental impact statement discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into four chapters:

- *Chapter 1. Purpose of and Need for Action:* The chapter includes information on the history of the project proposal, the purpose of and need for the project, and the Agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- *Chapter 2. Alternatives, including the Proposed Action:* This chapter provides a more detailed description of the Agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- *Chapter 3. Affected Environment and Environmental Consequences*: This chapter describes the environmental effects of implementing the proposed action and other alternatives.
- *Chapter 4. Consultation and Coordination:* This chapter provides a list of preparers and agencies consulted during development of the environmental impact statement.
- *Appendix:* The appendix consists of multiple parts and provides additional information to support the analyses presented in the environmental impact statement.
- *Index:* The index provides page numbers by document topic.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Black Mesa Ranger District office.

Background

The Rim Lakes Forest Restoration Project (Rim Lakes Project) is authorized under the Healthy Forest Restoration Act (HFRA) of 2003. The HFRA contains a variety of provisions aimed at expediting the preparation and implementation of hazardous fuels reduction projects on Federal land and assisting rural communities. HFRA focuses on four types of land: (1) the wildland-urban interfaces of at-risk communities; (2) at-risk municipal watersheds; (3) lands where threatened and endangered species or their habitats are at risk to catastrophic fire, and where fuels treatment can reduce those risks; and (4) where windthrow or insect epidemics threaten ecosystem components or resource values. For the Rim Lakes Project, lands lie in the wildland-urban interface (WUI) and contain important habitat for the Mexican spotted owl, a species listed as threatened under the Endangered Species Act.

The proposed action has been developed using a collaborative process that spans several years. After developing the proposal and conducting environmental analysis in collaboration with the public, the environmental assessment for this project underwent an objection process in

September 2011 pursuant to 36 CFR 218. An objection was raised during that period, and after consideration of that objection, the forest supervisor for the Apache-Sitgreaves National Forests elected to document the project's analysis in an environmental impact statement. A notice of intent to prepare an EIS was published in the Federal Register March 29, 2012. The forest supervisor also elected to include a forest plan amendment, as described in detail below (page 25), as part of the proposed action.

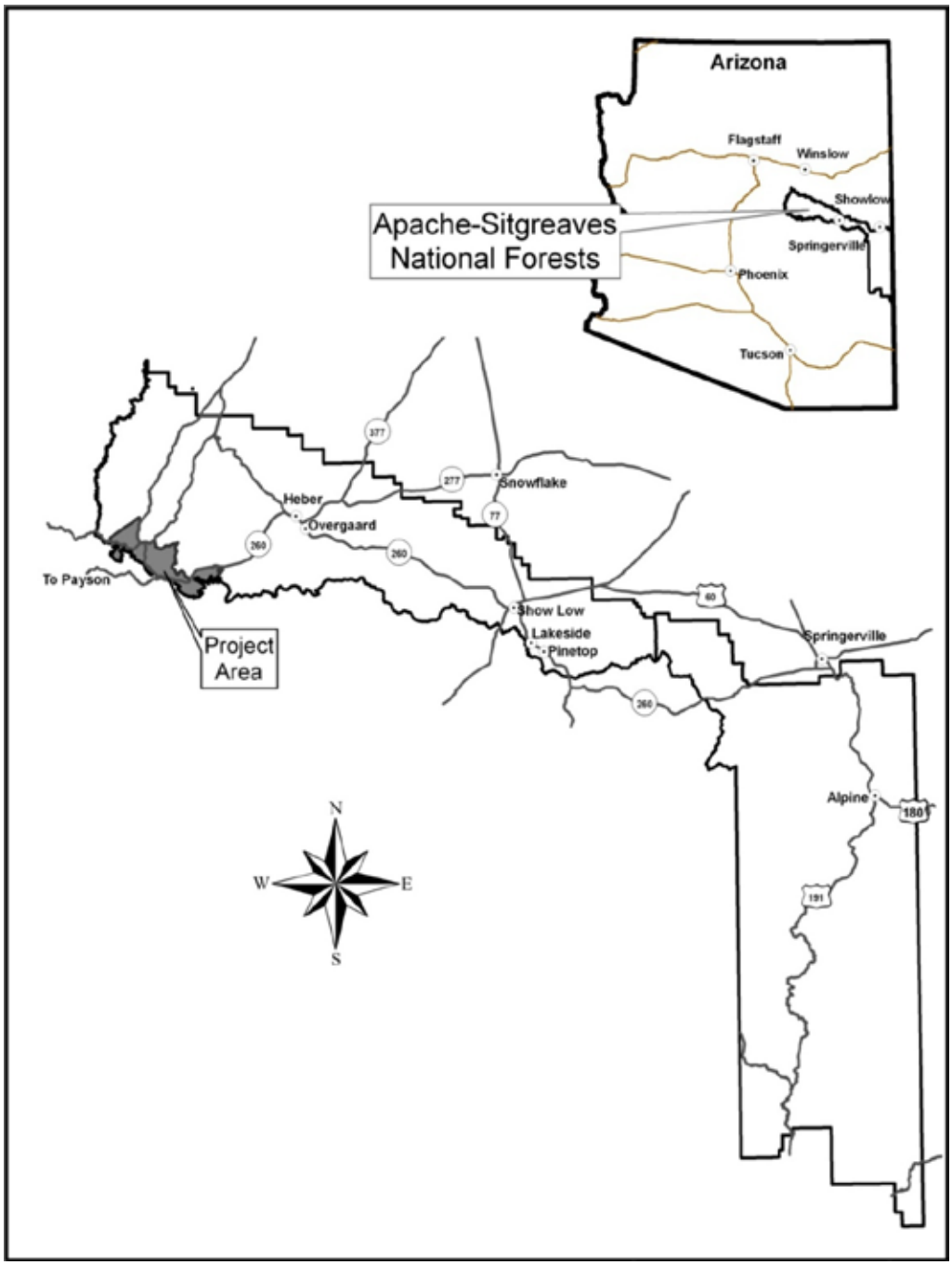

Figure 1. Project vicinity

Location

The project area is the Rim Lakes Ecosystem Management Area (EMA) and encompasses approximately 33,600 acres on the Black Mesa Ranger District, Apache-Sitgreaves National Forests[1] (figure 1).

The northeastern boundary of the project area abuts the community of Forest Lakes. A small subdivision, Rancho Allegre, is a private land inholding in the western portion of the project area. The general boundaries are the 500KV power line near the Dude Fire on the west and along the Mogollon Rim to Forest Lakes on the east (figure 2). The Rim Lakes Recreation Area (RLRA) is within the project area and is a highly desirable recreation destination for the southern Arizona population for climatic relief, inspiring vistas from the edge of the Mogollon Rim, and water-based recreation. Most of the district's developed recreation facilities are located within the RLRA.

The Chevelon Canyon Inventoried Roadless Area (IRA) overlaps the eastern portion of the project area but no mechanical treatments are proposed within the IRA and no roads would be constructed in the IRA for this project. The Chevelon Creek Wild and Scenic River (eligible at a "wild" status) is located in the project area, but no mechanical treatments are proposed in the corridor.

Purpose and Need for Action

The underlying purpose and need for the Rim Lakes Forest Restoration Project has been determined by comparing the desired conditions to the existing conditions. Desired conditions relevant to this project relate to forest health and ecosystem function and resiliency, as defined in the Apache-Sitgreaves forest plan.

The need for change derives from the difference between the existing condition and the desired condition. It is summarized as follows:

- Move stand densities toward desired conditions that exhibit forest health, promote large tree development, and promote herbacious understory species richness.
- Reduce the risk of a stand-replacing crown fire by reducing stand densities, reducing canopy bulk density/continuity, increasing crown heights, and creating more stand openness.
- Move Mexican spotted owl (MSO) habitat types toward the desired condition of stand density and forest structure consistent with the forest plan and MSO recovery plan.
- Move goshawk habitat types toward desired conditions. For example, variable tree group sizes, age classes, and densities, as well as variable sized interspaces between groups.
- Reduce the basal area on most of the forest to reduce bark beetle hazard, and selectively reduce the severity and continuity of dwarf mistletoe infection.

[1] The Apache National Forest and the Sitgreaves National Forest remain two separate forests but are managed together as one commonly referred to as the Apache-Sitgreaves National Forests.

- Be consistent with the 1996 forest plan amendment with respect to old growth management, which means increasing the allocated old growth toward a 20 percent goal from the 7 percent current condition.
- Amend the "Apache-Sitgreaves National Forests Land and Resource Management Plan" (forest plan) in order to achieve project restoration objectives and to assure consistency with the forest plan. See amendment details on page 25.

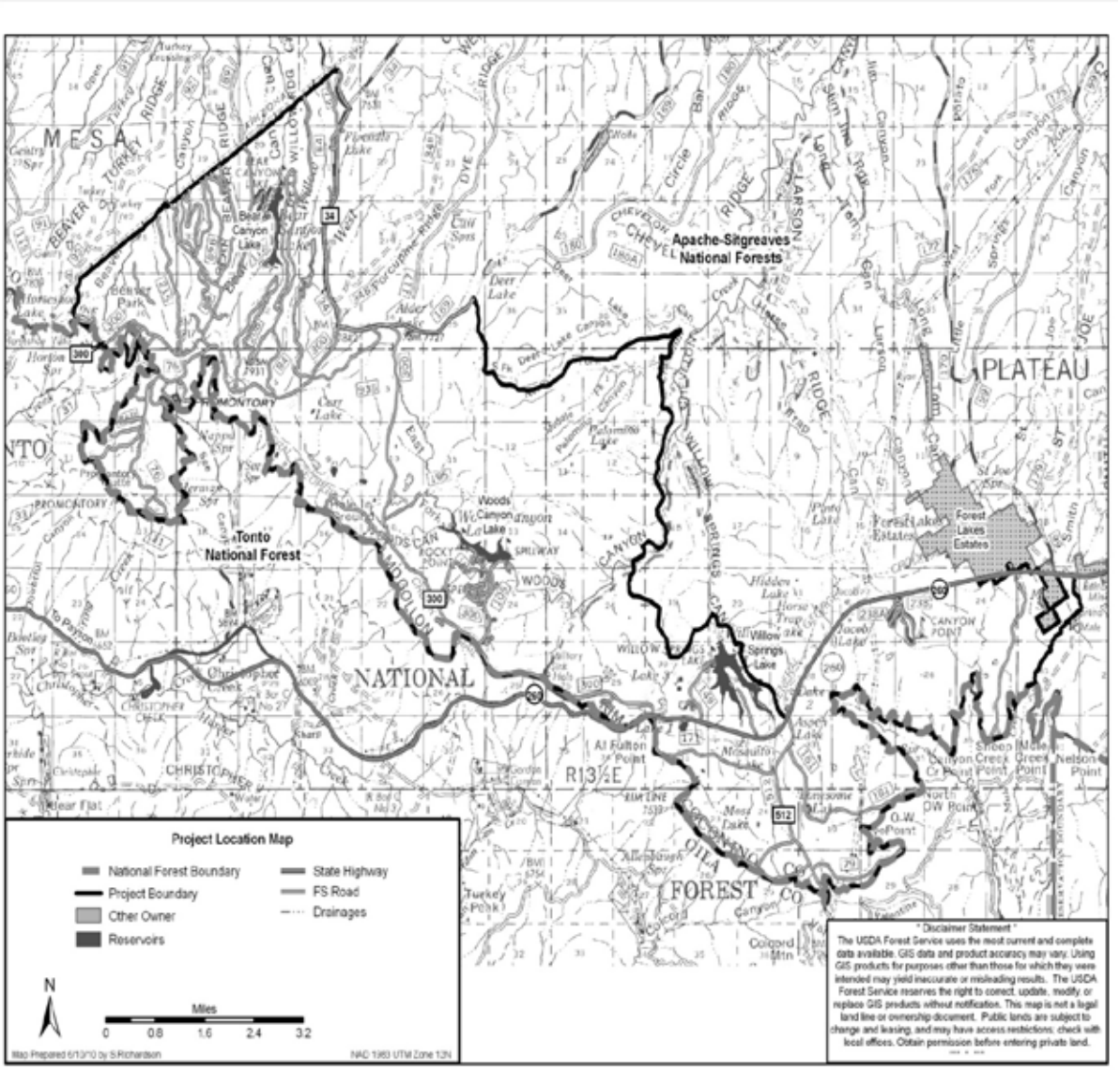

Figure 2. Project area

General Desired Conditions

The following is a description of the general desired conditions for the project area. With forest vegetation, desired conditions are often described in terms of composition (species mix), structure (size, density, and vertical or horizontal arrangement), and function (interaction with other

physical, chemical, and biological elements of the forest environment). Composition, structure, and function bear directly on forest values, whether timber production, wildlife habitat, recreational opportunity, aesthetics, livestock grazing, soil and watershed condition, or fire regime.

The desired condition would be an uneven-aged forest structure that would reflect a distribution of age classes, with a conifer species composition that would favor shade intolerant forest species. These species—which are most resistant to fire effects—include ponderosa pine, Douglas-fir, and white pine. Shade tolerant conifer species such as white fir would occur, but not be dominant. Other species such as aspen, oak, and other hardwood species would be well represented and would regenerate successfully across the landscape, where local forest biophysical conditions are appropriate for development of these species. Forests would be generally vigorous with endemic or characteristic levels of native insect and disease. southwestern white pine would be present throughout the mixed conifer forest type, retaining existing genetic diversity, and regenerating in suitable locations.

The desired condition includes open grass–forb–shrub interspaces totaling 20 percent of the area of each stand. This condition also includes canopy gaps for regeneration of small trees (less than 5 inches in diameter) totaling up to another 20 percent of the area of each stand.

A variety of forest density, spatial arrangement, and age/structure conditions would exist across the landscape, similar to historic conditions. In conifer forests, a distribution of age classes would comprise a sustainable balance of structural stages (see page 8), meet general forest plan guidelines, and be consistent with the proposed forest plan amendment for this project. In MSO protected and restricted/threshold, and goshawk nesting areas, this openness would not be as pronounced.

Figure 3 depicts an example of the relationship among three scales of consideration. The project area scale illustrates multiple stands, as well as natural meadows and grasslands. The middle and small scales illustrate open grass–forb–shrub interspaces and uneven-aged stand conditions consisting of single and grouped trees of different vegetation structural stages, young to old, represented by different shades and sizes. Note that because figure 3 is a hypothetical example, specific prescriptions written for site-specific implementation of this concept would not result in identical arrangements.

These canopy gaps and interspaces mimic historic spatial patterns and provide a number of benefits:

- allow regeneration of shade intolerant tree species,
- promote grass/forb and shrub growth,
- improve hydrologic function,
- encourage development of rooting zones for tree groups, and
- facilitate reintroduction and maintenance of frequent surface fire as an ecological process.

Forest canopy gaps and interspaces would be dynamic. The intent of the interspaces is for them to remain open over time, recognizing that natural vegetation development would allow some of them to develop into new tree groups/patches. Also over time, new young tree groups may be created because of natural disturbances, such as insect mortality and fire.

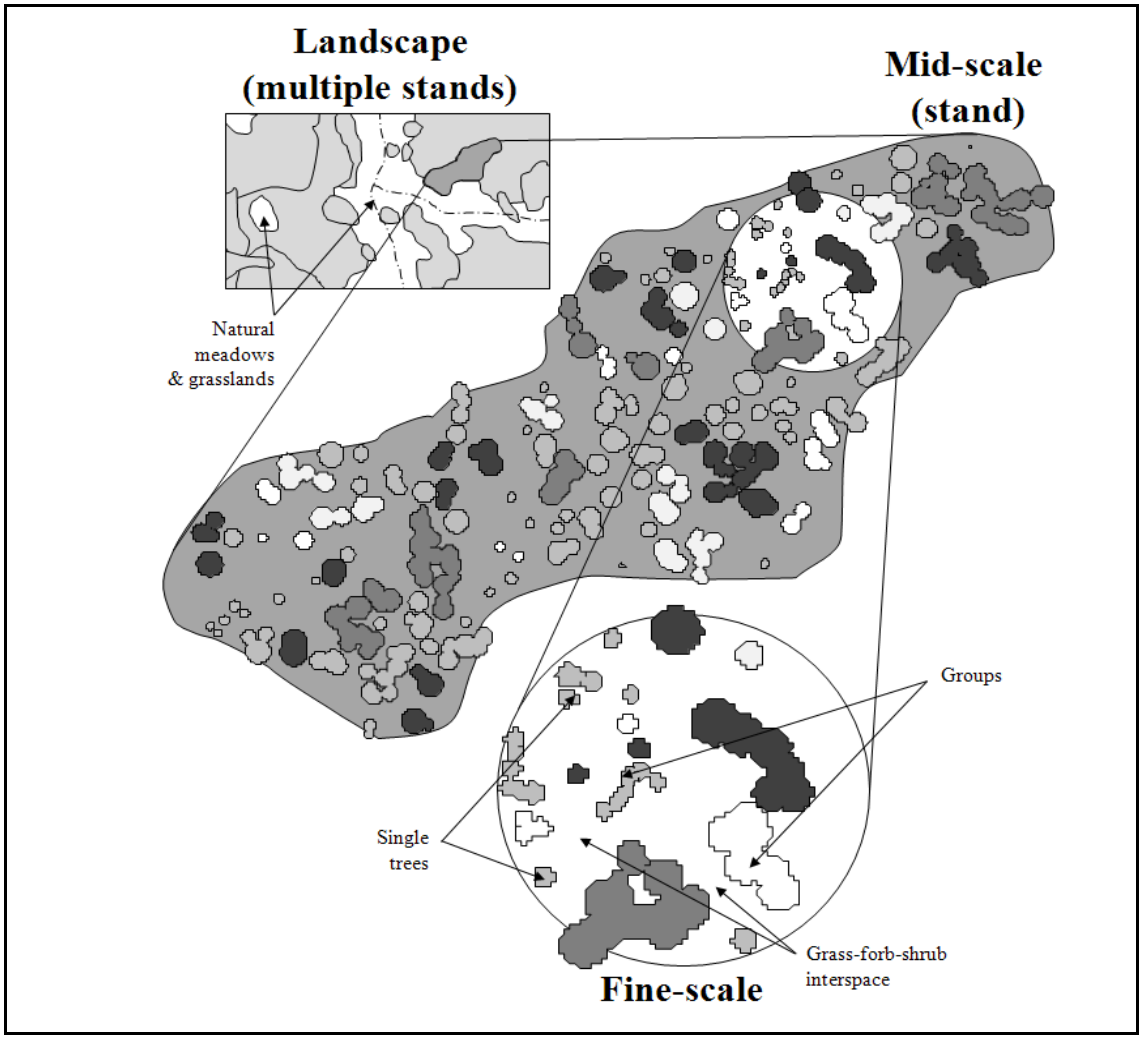

Figure 3. Relationship among scales

In this desired condition, managed uneven-aged stands would be less than 45 percent of maximum stand density index. In areas outside of MSO protected and restricted threshold habitats, the average basal area[2] would be less than 80 square per acre, so that bark beetle hazard would be low. Ponderosa pine and mixed conifer forest types would exhibit uneven-aged characteristics (multistoried), except for stands focused on providing goshawk nest and MSO protected and restricted/threshold habitats.

[2] Basal area (BA) – the cross-sectional area of a single tree stem, including bark, measured at breast height in square feet (SAF 1998).

Existing Conditions Comparison

The following discussion compares the existing condition to the desired condition.

Stand Density

Stand density is the dominant factor affecting the health and vigor of the forest. Stand density is measured through stand density index (SDI)[3] or basal area (BA). In terms of forest health, high stand density means the onset of density-related mortality. Currently, 97 percent of the area is considered high density. The lower stand densities are concentrated in areas of recent timber sales on the west and south side of the project area, within power line corridors, and within the Rodeo-Chediski Fire on the east side of the project area.

Insect and Disease

Bark beetle hazard ranges from low to high over much of the analysis area. In general, ponderosa pine stands that have an average diameter greater than 12 inches are hazard-rated based upon BA: BA greater than 120 square feet per acre is considered at high hazard to bark beetle attack; a BA of 80–120 square feet per acre is considered moderate hazard; and BA less than 80 square feet per acre is considered low hazard[4].

Dwarf mistletoe infection in ponderosa pine and Douglas-fir is common throughout the project area. Dwarf mistletoe species slow growth and cause mortality of conifers. Within the project area, southwestern dwarf mistletoe was observed in ponderosa pine on approximately 72 percent of stands, with about half of these stands lightly infected, and the other half of infected stands moderately infected or heavily infected. A few stands have more than 80 percent of the trees infected, where even the smallest diameter size classes are severely infected, which severely impedes stand structure development. Douglas-fir dwarf mistletoe is less common, observed in 35 percent of the mixed conifer stands. Most mixed conifer stands are uninfected with Douglas-fir dwarf mistletoe (65 percent) or are lightly infected. Only 16 percent of forested stands have moderate or higher infection levels.

The desired condition would be to have infection levels of dwarf mistletoe that do not impede achieving and sustaining desired uneven-aged forest conditions. To achieve this condition, desired dwarf mistletoe infection levels in a stand would not exceed 20 percent infection of the host species (trees per acre basis), or 25 percent of the area infected for any given tree species. Further, the desired condition for dwarf mistletoe infections would be irregularly distributed among tree groups, such that effects are limited to the forest group and patch scale.

White pine blister rust (an exotic disease) has recently been detected in eastern Arizona on both the Apache-Sitgreaves National Forests and Fort Apache Indian Reservation. White pine blister rust poses a threat to the sustainability of southwestern white pine, and causes high levels of mortality throughout its range. Some genetic resistance to this disease has been identified on selected individual white pines on the Lincoln National Forest. For this reason, it is critical that

[3] SDI is a measure of stand density in relationship to the number of trees in a stand expressed as a percentage of the biological maximum density, which is a species-specific measure.

[4] McMillin, Joel, "Stand hazard rating for bark beetles attacking southwestern ponderosa pine," Unpublished paper, provided by the Forest Service Southwestern Region Entomologist, October 20, 2004.

the full genetic diversity of southwestern white pine be maintained throughout its range. The best known practice for accomplishing this is to favor healthy southwestern white pines so populations are retained and allowed to regenerate wherever possible.

Forest Structure

Mexican Spotted Owl Forest Habitat: MSO forest habitats within the project area currently provide for the desired distribution of tree sizes specified in the forest plan, except for tree groups in the 24 inches and larger d.b.h. class, which are currently slightly below desired representation. Based upon growth projections, the desired representation for this class would be achieved within the next decade. Inside MSO restricted/threshold habitat, the risks remain higher of loss to insect/disease or fire because the current value of the habitat outweighs this risk. However, this risk is mitigated somewhat by applying uneven-aged management strategy outside protected and restricted/threshold habitat, which would reduce risks to large trees posed by insects/disease and fire. These large structural stage tree groups (larger than 24 inches in diameter) are already below the desired area representation and, if lost, they would be the most difficult habitat component to replace.

Goshawk Forest Habitat: Because of their homogenous nature, the existing even-aged stands within the Rim Lakes Project area are not desired for goshawk forest habitat, except as nesting stands. The existing forest structure does not reflect a balance of vegetation structural stage (VSS)[5] classes. Most stands lack or have limited amounts of habitat components such as forest canopy gaps and interspaces (grass–forb–shrub). Young forests (VSS 3) and mid-aged forests (VSS 4) are overrepresented. Grass/shrub, seedling/sapling (VSS 1 and 2) are underrepresented, as are mature forests (VSS 5) and old forests (VSS 6), when compared to the desired distribution of age/structure in uneven-aged condition. Overall, uneven-aged stand conditions currently represent 46 percent of all goshawk habitat in the project area, with the remainder being even aged (54 percent). Of the even-aged stands, one third is mid-aged to mature (VSS 4+), and two thirds is immature (VSS 1–3).

Since group VSS is determined by the predominant density (by basal area) within the group, the numbers referred to above do not represent the many smaller trees—1 to 5 inches in diameter—that are being overtopped by larger trees. These smaller trees are often not free to develop because of the shading from the closed canopy of larger trees in the VSS 3 and 4 classes. Similarly, many of the larger trees greater than 18 inches in diameter are competing with the densely stocked mid-aged trees for water and nutrients. This decreases the vigor and longevity of these large trees.

Old Growth

The forest plan defines old growth as a condition of the forest having structural attributes based on the number of large trees per acre, basal area, canopy cover percent, dead standing trees, and down logs. The two vegetation groups identified for developing old growth in the project area are

[5] VSS abbreviates the term vegetation structural stages, which classify stages of stand development. Thus, VSS 1 represents open areas with tree regeneration and little canopy structure but would be managed over time to develop toward mid-aged and mature forest structure. VSS 6 represents the late mature and/or old structural stage with abundant large trees and structure.

interior ponderosa pine and the mixed species group consisting of Douglas-fir, white fir, and southwestern white pine.

Approximately 2,279 acres, or 7 percent of the forested project area, have been identified and allocated through previous analyses to be managed to meet old growth criteria. Areas currently allocated do not necessarily meet old growth standards in the forest plan but are managed to move toward those conditions to meet old growth structural attributes over time.

Fire Hazard

Two factors that contribute to stand-replacing crown fires are surface fuels and canopy fuel distribution. Surface fuels are the accumulation of fuel on the soil surface. Canopy fuels are measured by using canopy bulk density and canopy base heights. Currently, when compared with forest plan standards, surface fuels in the Rim Lakes area, especially in the form of logs, are deficit. Stand canopy fuels are overly abundant and too continuous in all vegetation types. Of the project area, 67 percent is subject to crown fire behavior. This poses a high safety risk to surrounding communities and increases the likelihood of the area experiencing stand-replacing crown fire.

The area also has little opportunity for sunlight penetration to the forest floor which in part has reduced the herbaceous cover. Desired conditions would increase cover, diversity, and production of herbaceous species in the understory. These herbaceous plants are important to soil productivity, wildlife, and the maintenance of fire as an important and natural ecosystem disturbance.

Fire regime condition class (FRCC) is a metric that quantifies how departed a system is from historical conditions in relation to fire and the role fire historically played in that system. The entire project area (100 percent) is FRCC 3, which means the project area has been significantly altered from the historical range. The desired condition is FRCC 1.

Proposed Action

In response to the purpose and need, the Black Mesa Ranger District, Apache-Sitgreaves National Forests, proposes the following actions:

- Selectively cut trees to create canopy gaps for regeneration and interspaces, which are to be managed as non-forest areas. Intermediate thinning and broadcast burn after treatment on approximately 23,615 acres: in ponderosa pine and pine-oak, maintenance burns would occur. In dry mixed conifer, no reentry maintenance burns would occur as part of this proposal.
- Broadcast burn without selectively cutting trees on approximately 9,339 acres: in ponderosa pine and pine-oak, maintenance burns would occur. In dry mixed conifer, no reentry maintenance burns would occur as part of this proposal.
- Selectively cut trees only with no broadcast burn on approximately 56 acres.
- Open approximately185 miles of existing closed roads to be used for treatment activity. Close roads when treatments are finished and rehabilitate as needed.

- Construct 2.6 miles of temporary road for haul access and obliterate after use (seven short segments approximately one-quarter to one-third mile each).
- Allocate approximately 6,900 acres of forest for old growth characteristics especially large tree health and vigor. Figure 6 shows total old growth allocated for this project, as well as previously allocated old growth.
- Amend the Apache-Sitgreaves forest plan pages 56 and 57 to add clarifying language to: (1) describe desired conditions for the project area managed for northern goshawk; (2) express relative amounts of forest cover, as well as the distribution of that cover, including the interspaces between tree groups; (3) define the relationship between the interspaces and natural openings, such as meadows; and (4) clarify that canopy closure is evaluated at the tree group scale within vegetation structural stages (VSS) 4, 5, and 6 (see page 25 for details).

Decision Framework

Given the purpose and need of the project, the forest supervisor will review the proposed action, other alternatives, and the environmental consequences in order to make the following decisions: (1) whether to select the proposed action or an alternative; (2) the location, design, and scheduling of the proposed thinning, burning, and road maintenance, (3) mitigation measures and monitoring requirements; and, (4) the significance of the proposed forest plan amendments.

Forest Plan Direction

The analysis area includes four management areas as described in the forest plan. Forested Land (MA-01) makes up 98 percent of the project area, with Riparian (MA-03), Water (MA-11), Chevelon Canyon (MA-16), and private lands comprising smaller portions of the analysis area (table 1).

Table 1. Forest plan management area context

Forest Plan Management Areas	Forest Plan Management Area Acres (Forestwide)	Project Area Management Acres	Percent of Forest Plan Management Area in the Project Area	Percent of Management Areas in the Project Area
Forested Lands (MA-01)	836,288	32,956	3.9	98
Riparian (MA-03)	6,870	24	0.4	<1
Water (MA-11)	3,962	286	7.2	<1
Chevelon Canyon (MA-16)	11,534	241	2.1	<1
Private Lands, Gravel Pits	NA	41	NA	<1
Total		33,548		100

* Not included in active treatment (thinning or burning) units.

The management emphasis for MA-01 is to emphasize a combination of multiple uses including sustained yield of timber and firewood production, wildlife habitat, livestock grazing, watershed condition, and dispersed recreation.

Management emphasis for MA-03 recognizes "the importance and distinctive values of riparian areas when implementing management activities" by: (1) giving preferential consideration to riparian area dependent resources as defined in the forest plan in cases of unsolvable conflicts; (2) managing to maintain or improve riparian areas to satisfactory riparian condition; and (3) implementing other resource uses and activities to the extent that they support or do not adversely affect riparian dependent resources. Management emphasis of MA-03 is directed at areas with riparian dependent resources in the priority of: (1) threatened and endangered species; (2) cold water fisheries; (3) warm water fisheries; and (4) all other riparian areas."

Management Area 11 emphasizes the production of fish and wildlife, including waterfowl. Forest plan direction is to manage these areas for dispersed recreation use.

Management Area 16 is to emphasize semiprimitive nonmotorized recreation opportunities (except at Chevelon Crossing), strive to maintain the current opportunities for solitude, protect the high scenic values, and maintain the current wildlife habitat values.

Chapter 4 of the forest plan contains detailed descriptions of forestwide resource direction and direction specific to each management area. How the alternatives are consistent with the forest plan is displayed in chapter 2, "Alternatives." Key forest plan direction is contained in each specialist report.

All mechanical treatments are proposed in MA-01. Some prescribed burning is proposed in MA-16.

Public Involvement

The notice of intent (NOI) was published in the Federal Register on March 29, 2012. The NOI asked for public comment on the proposal, especially the new element to the proposed action, the forest plan amendment. Letters were sent to 187 people and organizations who had expressed interest in the project previously. In addition, as part of the public involvement process, the Agency conducted an open house to familiarize the interested public with the revised proposal. This open house was held in Show Low, on April 11, 2012, where three interested people attended.

During the spring 2012 comment period, 10 comment letters were received, including a letter of support from the Arizona Department of Game and Fish. Most supported the goals of the project but raised concerns about impacts, in particular to human health from smoke.

Earliest collaboration of this project began in May 2004. The "Community Wildfire Protection Plan for At-Risk Communities of the Sitgreaves National Forest in Apache, Coconino, and Navajo Counties" was completed with participation from Apache, Coconino, and Navajo Counties. The proposed action has been listed on the Apache-Sitgreaves National Forests schedule of proposed actions (SOPA) since January 2006 using the original project title "Rim Lakes Forest Health Project," which was changed to "Rim Lakes Forest Restoration Project" to more accurately reflect its objectives; the new title will be used throughout this document.

In December 2007, letters providing information and seeking public comment were mailed to approximately 100 individuals and groups that included Federal and State agencies, municipal offices, businesses, interest groups, and individuals. Thirteen responses to this initial mailing were received. Announcements about the project were printed in the Mogollon Connection

(January 16, 2008), The Pioneer (January 16, 2008) and in the White Mountain Independent (January 18, 2008) and were available on the Apache-Sitgreaves National Forests Web site newsroom.

As required by HFRA, an announcement was published to give the public notice of a meeting held on January 26, 2008, in Overgaard, Arizona, to provide project area information, present the proposed action, and discuss local concerns and interests that should be addressed in the analysis. Six people attended the meeting. Comments in response to this meeting were favorable. On July 8, 2008, and October 23, 2008, field trips were held that included individuals from the Arizona Game and Fish Department, White Mountain Stewardship Project's Multi-Party Monitoring Board (MPMB), Natural Resources Working Group (NRWG), and the Center for Biological Diversity (CBD). Although the project was mostly well received, concerns for cutting trees larger than 16 inches arose and were given to the analysis team to address (see the "Issues" section below).

In April 2011, a public meeting with the White Mountain Stewardship Project's MPMB and the NRWG was held in Show Low, Arizona, to present the project and answer questions. The project's environmental assessment was presented to collaborators and the public in September 2011 as part of the HFRA objection period. An objective was filed by the Center for Biological Diversity, which resulted in reconsideration of the planning process for the project.

On April 11, 2012, another public meeting was held in Show Low during the scoping period for this EIS. Members of a wide range of collaborative efforts—including the 4FRI collaborative—were invited to attend, but only three members of the local community participated.

On June 13, 2012, a presentation was made to the NRWG on the Rim Lakes Project, timelines, and current status. Collaboration with the 4FRI collaborative group most recently included two field trips to discuss the alternatives and view sample marking prescriptions on July 23 and August 2, 2012.

Tribal Consultation

In July 2008, the forests sent a consultation letter providing information and seeking involvement and comments to nine tribes including the White Mountain Apache, San Carlos Apache, Tonto Apache, Yavapai-Apache Nation, Yavapai-Prescott Indian Tribe, Pueblo of Zuni, Hopi Tribe, Navajo Nation, and Fort McDowell Indian Community who all have historic ties and an interest in the Apache-Sitgreaves National Forests. Three responses were received. No tribes identified any concerns with the project or specific traditional cultural properties that would be affected by the proposed activities.

In 2012, the tribal governments were contacted and updated about the progress of the project.

Issues

The Forest Service separated the issues into two groups: significant and nonsignificant issues. Significant issues were defined as those directly or indirectly caused by implementing the proposed action. Nonsignificant issues were identified as those: (1) outside the scope of the proposed action; (2) already decided by law, regulation, forest plan, or other higher level decision; (3) irrelevant to the decision to be made; or (4) conjectural and not supported by

scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations explain this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…." A list of nonsignificant issues and reasons regarding their categorization as nonsignificant may be found in the project record.

The Forest Service identified the following as significant issues during scoping. Scoping in 2012 did not change the significant issues:

> Issue 1: Thinning and burning activities may cause unforeseen mortality among larger size classes of "leave" trees. Removal of trees larger than 16 inches in diameter when combined with potential mortality, may place posttreatment large tree densities below target densities. This may negatively affect old growth quality and quantity and wildlife habitat quality, quantity, and populations.
>
> The indicators used to evaluate this issue are:
>
> - Total number of trees 16 inches and greater (pre- and post-treatment);
> - pre- and post-treatment three-level analysis of habitat structure for northern goshawk, and old growth; and
> - vegetation structural stage (VSS) for northern goshawk.

Chapter 2. Alternatives, Including the Proposed Action

Introduction

This chapter describes and compares the alternatives considered for the Rim Lakes Forest Restoration Project. It includes a description of each alternative considered and maps of the action alternatives. This section also presents the alternatives in comparative form, displaying the differences among alternatives and providing a clear basis for choice. Some of the information used to compare the alternatives is based upon the design of the alternative (e.g. the 16-inch diameter limit is a design feature of alternative C) and some of the information is based upon the environmental, social, and economic effects of implementing each alternative (e.g. the different levels of achieving the project's purpose and need).

Alternatives for the project were developed according to the provisions of the Healthy Forest Restoration Act, which states that "the Secretary shall study, develop, and describe: (A) the proposed action; (B) the alternative of no action; and (C) an additional action alternative, if the additional alternative: (1) is proposed during scoping or the collaborative process under subsection f and (2) meets the purpose and need of the project, in accordance with the regulations promulgated by the Council of Environmental Quality."

The Forest Service interdisciplinary team (IDT) used information from scoping, including the key issue identified for the project (chapter 1), in conjunction with the field-related resource information, to formulate the alternative to the proposed action. Both action alternatives represent a site-specific proposal developed through intensive interdisciplinary evaluation of current and desired conditions, based on field verification.

As a result of public comment in 2008 and additional analysis, the proposed action was modified as allowed by 36 CFR 220.7(b)(2)(iii), which states that "the description of the proposal and alternative(s) may include a brief description of modifications and incremental design features developed through the analysis process to develop the range of alternatives considered." See Project Record 84, pages 16-17 for the list of modifications.

Forest Plan Consistency

Forestwide and management area standards and guidelines have been incorporated into the design of alternatives B and C. Alternative B includes a forest plan site-specific amendment. This amendment is necessary in order to assure the project's restoration objectives can be met and to assure consistency with the forest plan.

Alternative C includes a forest plan site-specific amendment. This amendment is necessary to allow for this alternative's even-aged management result.

Alternatives Considered in Detail

The Forest Service analyzed three alternatives, including the no action.

Alternative A—No Action

As required by the Healthy Forest Restoration Act, the no action alternative (alternative A) has been analyzed to contrast the impacts of the action alternatives with the current condition and expected future condition if the proposed action were not implemented.

This alternative proposes no vegetative treatments or prescribed fire in the project area. Alternative A does not meet the purpose and need for the project as it would not move the project area toward forest plan vegetation (forest health, forest structure) desired conditions.

Alternative B—Proposed Action

Alternative Summary

In response to the purpose and need, the Black Mesa Ranger District, Apache-Sitgreaves National Forests, proposes the following:

- Selectively cut trees and broadcast burn after treatment on approximately 23,615 acres: in ponderosa pine and pine-oak, maintenance burns would occur. In dry mixed conifer, no reentry maintenance burns would occur as part of this proposal.
- Broadcast burn without selectively cutting trees on approximately 9,339 acres: in ponderosa pine and pine-oak, maintenance burns would occur. In dry mixed conifer, no reentry maintenance burns would occur as part of this proposal.
- Selectively cut trees only with no broadcast burn on approximately 56 acres.
- Open approximately185 miles of existing closed roads to be used for treatment activity. Close roads when treatments are finished and rehabilitate as needed.
- Construct 2.6 miles of temporary road for haul access and obliterate after use (seven short segments approximately one-quarter to one-third mile each).
- Allocate approximately 6,900 acres of forest for old growth characteristics especially large tree health and vigor. Figure 6 shows total old growth allocated for this project, as well as previously allocated old growth.
- Amend the Apache-Sitgreaves forest plan pages 56 and 57 to add clarifying language to: (1) describe desired conditions for the project area managed for northern goshawk; (2) express relative amounts of forest cover, as well as the distribution of that cover, including the interspaces between tree groups; (3) define the relationship between the interspaces and natural openings, such as meadows; and (4) clarify that canopy closuure is evaluated at the tree group scale within vegetation structural stages (VSS) 4, 5, and 6 (see next section for details).

See details below and see appendix A for details on how various habitat types for Mexican spotted owl and northern goshawk would be treated.

Mechanical Treatments

Mechanical treatments refer to a variety of possible tools used to meet objectives. These include, but are not limited to: the use of chain saws or feller-bunchers to cut trees and lop slash, skidders to move material to landings, bulldozers to pile slash, and specialized equipment to cut, chop, break, lop or in some way treat the fuels to meet objectives.

The work would be accomplished in many ways including the use of Forest Service personnel and contractors. Some of the trees that are cut may be sold in personal use and commercial wood product sales. This would help to offset the total cost for treatments by reducing the cost of cutting trees and treating slash.

The following terms are useful to understand the proposed treatment methods:

- **Group Selection:** a cutting procedure that creates a new age class[6] by removing trees in groups or patches to allow seedlings to become established in the new opening (Helms, 1998).
- **Irregular-density Thinning:** similar actions as those to implement group selection, but the openings in forest canopy are intended for long-term openness, not to regenerate trees.
- **Intermediate Treatment**: also referred to here as intermediate thinning. The thinning or cutting of trees to improve the composition, structure, condition, health, and growth of remaining trees (Helms, 1998). Proposed intermediate thinning treatments include "low thinning" which removes the smallest sized trees of the age class, and "free thinning" which selects from all size trees and age classes.

Prescribed Fire

Prescribed fire refers to a controlled application of fire to wildland fuels in either their natural or modified state, under specified environmental conditions that allow the fire to be confined to a predetermined area, and produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives. Broadcast, maintenance, and pile burning are all types of prescribed fires.

Broadcast Burning

As it applies to this project, broadcast burning is a prescribed fire within a predetermined area (burn block) and with predetermined burning parameters (prescription) designed to meet the objectives stated in the proposed action. Broadcast burns would be located in areas where fuel loadings (dead fuels and/or live fuels) are unnaturally high due to exclusion of natural fire and/or an accumulation of activity slash from past treatments.

In most cases, prescribed burning would occur following mechanical treatments. One objective of prescribed burning would be to reduce dead fuel loadings to an average of 5–10 tons per acre in the pine vegetation type and 10–15 tons per acre in the mixed conifer vegetation type. Target fuels would be all size classes normally considered in management of dead fuels (including 1-hour, 10-hour, 100-hour, and 1000-hour [7]). Live fuels would not be targeted, but some reduction is expected and could occur (see "Fire Effects" discussion).

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[6] Age class – a distinct aggregation or group of trees originating from a single natural event or activity.

[7] A frequently used method to classify fuels is by how quickly they respond to changes in moisture content. One-hour fuels—such as dead grasses and needle-cast from trees—respond most quickly and could change during one day from damp to dry. Larger wood—1000-hour fuels such as logs—respond slowly and take days or weeks to dry out during dry periods, or dampen during wet periods.

Low to moderate severity effects may occur across 80 percent of the area treated with fire. As described in the fire modeling, high severity effects are a possible result of actions across up to 20 percent of the area. Fire or burn severity is defined as a qualitative assessment of the heat pulse directed toward the ground during a fire. Burn severity relates to soil heating, large fuel and duff consumption, consumption of the litter and organic layer beneath trees and shrubs, and the mortality of buried plant parts.

Fire severity would be the product of a low to moderate intensity ground fire with flame lengths that average less than 2 feet and rarely exceed 4 feet. In most areas, more than one treatment may be required to achieve the objectives. Additional treatments may occur at an interval of 3 to 5 years until the objectives are met and conditions can be maintained through regular maintenance burns (see “Maintenance Burns” below).

Treated areas that become “restored meadows” may be treated again as maintenance burns. This would be done on a regular basis (2–5 years depending of funding, weather, and grass accumulations) to maintain their meadow characteristics.

Meadows

All treatments using fire in areas classified as a “meadow vegetation type” or “restored to a meadow vegetation type” would be treated as maintenance burns.

Maintenance Burning

As it applies to this project, maintenance burning is a prescribed fire within a predetermined area and with predetermined burning parameters designed to meet the objectives stated in the proposed action. Maintenance burns would be located in areas where fuel loadings (dead fuels and live fuels) are close to their natural/historic state (generally less than 10 tons per acre). The objective would be to maintain dead fuel loadings and live vegetation density, composition, and structure within their natural range.

The objective would be to reduce dead fuel loadings to an average of 5–10 tons per acre in the pine vegetation type and 10–15 tons per acre in the mixed conifer vegetation type. Target fuels would be needle cast and small (finger sized) dead fuels, and much of the understory vegetation up to 6 feet in height for live fuels.

The burns would be managed to produce a low intensity ground fire with average flame lengths that rarely exceed 18 inches. Additional entries could consist of maintenance burns on a schedule of every 2 to 10 years.

Activity slash is created from mechanical treatment activities. It may be removed from the site to landings or be cut and scattered to within 3 feet of the ground and may be treated later as part of a broadcast burn. The objective would be to ignite 90 to 100 percent of the slash piles, expecting 80 percent or more consumption. Unconsumed material would consist of an occasional charred log or small, unburned piles.

Mexican Spotted Owl (MSO) Treatments

Through the Mexican spotted owl recovery plan, as adopted in the forest plan, MSO habitats are divided into protected and restricted categories. Restricted is divided among threshold, target

threshold, and "other." Each strata serves an important role in the conservation of the species (see page 84).

MSO Protected Habitat: Intermediate thinning[8] would be used in stands with diameter limits of 9 inches d.b.h.. Thinning would promote health and vigor of the larger trees and reduce the fire hazard. Smaller trees would be cut maintaining the largest, healthiest trees. Where areas are dominated by trees greater than 12 inches in diameter, treatments would remove trees less than 9 inches d.b.h.. Where areas are dominated by young aged trees (5–12 inches in diameter), prescriptions would retain 60–80 square feet of basal area (BA) [9]. Where trees are dominated by grass/forbs and seed/saplings (in other words, where trees are less than 5 inches in diameter), prescriptions would retain trees at the rate of 200 trees per acre. Residual basal area would vary by stand. Where possible, early seral species (southwestern white pine, ponderosa pine, Douglas-fir, aspen) should be favored for retention and regeneration.

MSO Restricted Habitat (Threshold): All treatments in these stands would maintain 150–170 BA where present. The remaining area would receive an intermediate treatment removing the smaller trees to reduce fire hazard. No hardwood species would be removed. No trees 24 inches d.b.h. or larger would be removed. Early seral species (southwestern white pine, ponderosa pine, Douglas-fir, aspen) would be favored for retention and regeneration.

MSO Restricted Habitat (Target Threshold): Intermediate thinning would be used removing the smaller trees and leaving the larger, healthier trees, increasing health and vigor of the remaining larger dominant and codominant trees and reducing fire hazard. These stands would be thinned to reach a target BA of 150–170. No trees 24 inches d.b.h. or larger would be removed. No hardwood species would be removed. Early seral species (southwestern white pine, ponderosa pine, Douglas-fir, aspen) would be favored for retention and regeneration.

MSO Restricted Habitat (Other): Group selection would be used to regenerate ponderosa pine, white pine, and Douglas-fir in openings 0.25–4 acres in size over 20 percent of the area within excess VSS classes and/or diseased patches. Where necessary, prescriptions would retain additional seed trees of desirable species and characteristics. The remaining matrix area would receive intermediate thinning, cutting smaller trees to leave the larger, healthier trees, increasing health and vigor of the remaining larger dominant[10] and codominant[11] trees and reduce fire hazard. Southwest-facing slopes would be thinned to 60–80 BA and north-facing slopes 80–100 BA. No hardwood species would be removed. Stands with no large trees would be thinned from below with an intermediate thinning to promote health and vigor of the larger trees and reduce fire hazard. Smaller trees would be cut maintaining the largest, healthiest trees. Groups of trees smaller than 12 inches d.b.h. would be thinned to a lower density of 40–60 BA while trees in the larger size classes would be thinned to 60–80 BA. Early seral species (southwestern white pine,

[8] Intermediate Treatment – also referred to here as intermediate thinning. The thinning or cutting of trees to improve the composition, structure, condition, health, and growth of remaining trees (SAF 1998).

[9] Basal area (BA) – the cross-sectional area of a single tree stem, including bark, measured at breast height in square feet (SAF 1998).

[10] Dominant – trees that receive full light from above the canopy and partially from the sides. Crowns extend above the general level of the canopy (USDA 2008).

[11] Codominant – Tree crowns receive full light from above, but comparitively little from the sides (USDA 2008)

ponderosa pine, Douglas-fir, aspen) would be favored for retention and regeneration. Table 2, table 3, and figure 4 show the treatments in Mexican spotted owl habitat.

Table 2. Mexican spotted owl habitat treated by mechanical with prescribed burning

Habitat Type	Acres
MSO Protected – Even-aged Intermediate Thinning < 9"	309
MSO Threshold – Intermediate Thinning < 24"	112
MSO Target Threshold – Group Selection/Intermediate Thinning < 24"	654
MSO Restricted – Group Selection/Intermediate Thinning < 24"	5,512
Total	6,587

Table 3. Mexican spotted owl treatments by mechanical without prescribed burning

Habitat Type	Acres
MSO Protected – Intermediate Thinning < 9"	50
MSO Restricted – Group Selection/Intermediate Thinning < 24"	6
Total	56

Table 4. Northern goshawk habitat treatment by mechanical with prescribed burning

Habitat Type	Acres
Foraging - Group Selection/Intermediate Thinning	16,216
PFA/Nest - Group Selection/Intermediate Thinning	619
Total	16,835

Northern Goshawk

Table 4 and figure 5 show treatments in northern goshawk habitat.

Goshawk Foraging Areas (FAs) and Post-Fledgling Family Areas (PFAs) Habitat Stands: Group selection would be used to regenerate ponderosa pine, white pine, and Douglas-fir in openings of 0.1–4 acres in size over 20 percent of the area within excess VSS classes and/or diseased patches. When openings exceed 1 acre in size, 5–10 desirable seed trees per acre would be retained, with 3–5 seed trees at least 15 inches d.b.h. and larger. Tree groups would be maintained by VSS class, ranging from 0.25 to 1 acre in size and generally in groups of 4–20 trees (on a 0.1-acre basis). Prescriptions would strive to align percentages according to desired VSS class distribution described in the forest plan. Residual stand density would vary, but would average 50–70 square feet of basal area per acre in foraging areas, and would average 70–80 square feet in PFA.

Where stand structures are predominantly even aged, thin the stand matrix in an irregular-density fashion, striving to create groups and clumps of residual trees. Desirable dominant and codominant white pine and ponderosa pine would be left as single trees or groups throughout the area. Details are located in the silvicultural report (Richardson et al., 2012).

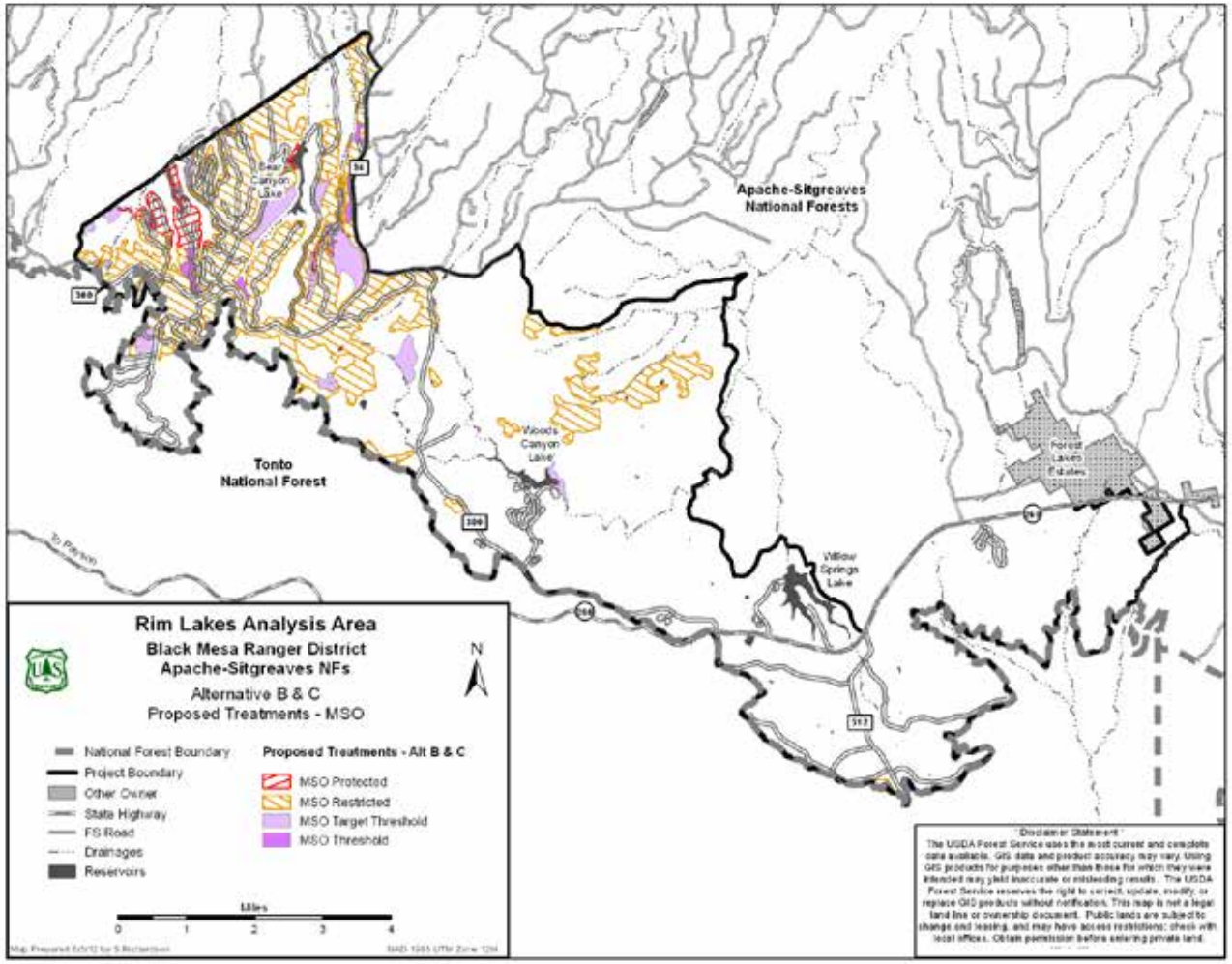

Figure 4. Mechanical treatments in alternative B and alternative C in Mexican spotted owl habitat

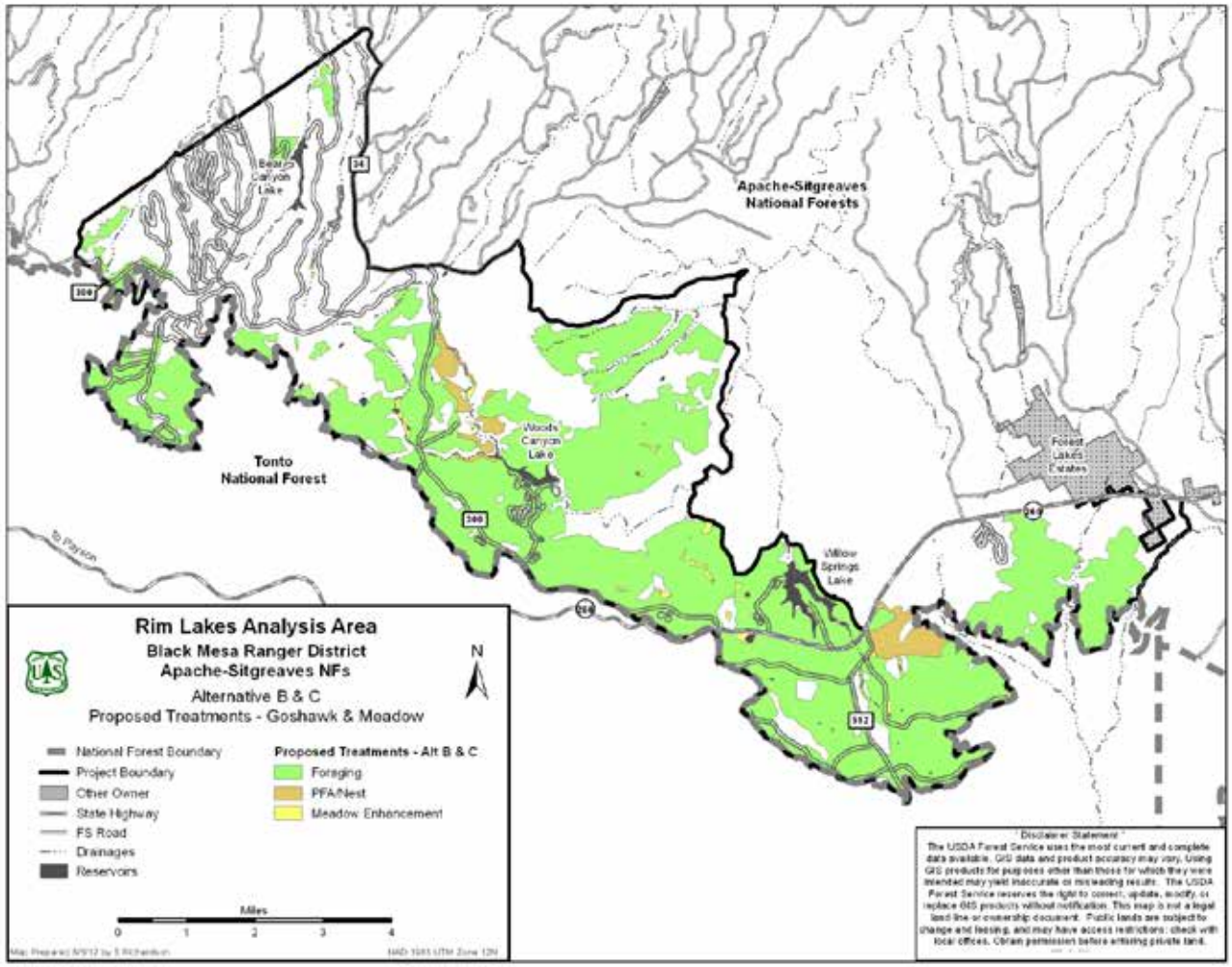

Figure 5. Mechanical treatments in alternative B and alternative C in goshawk habitat, with meadow enhancement

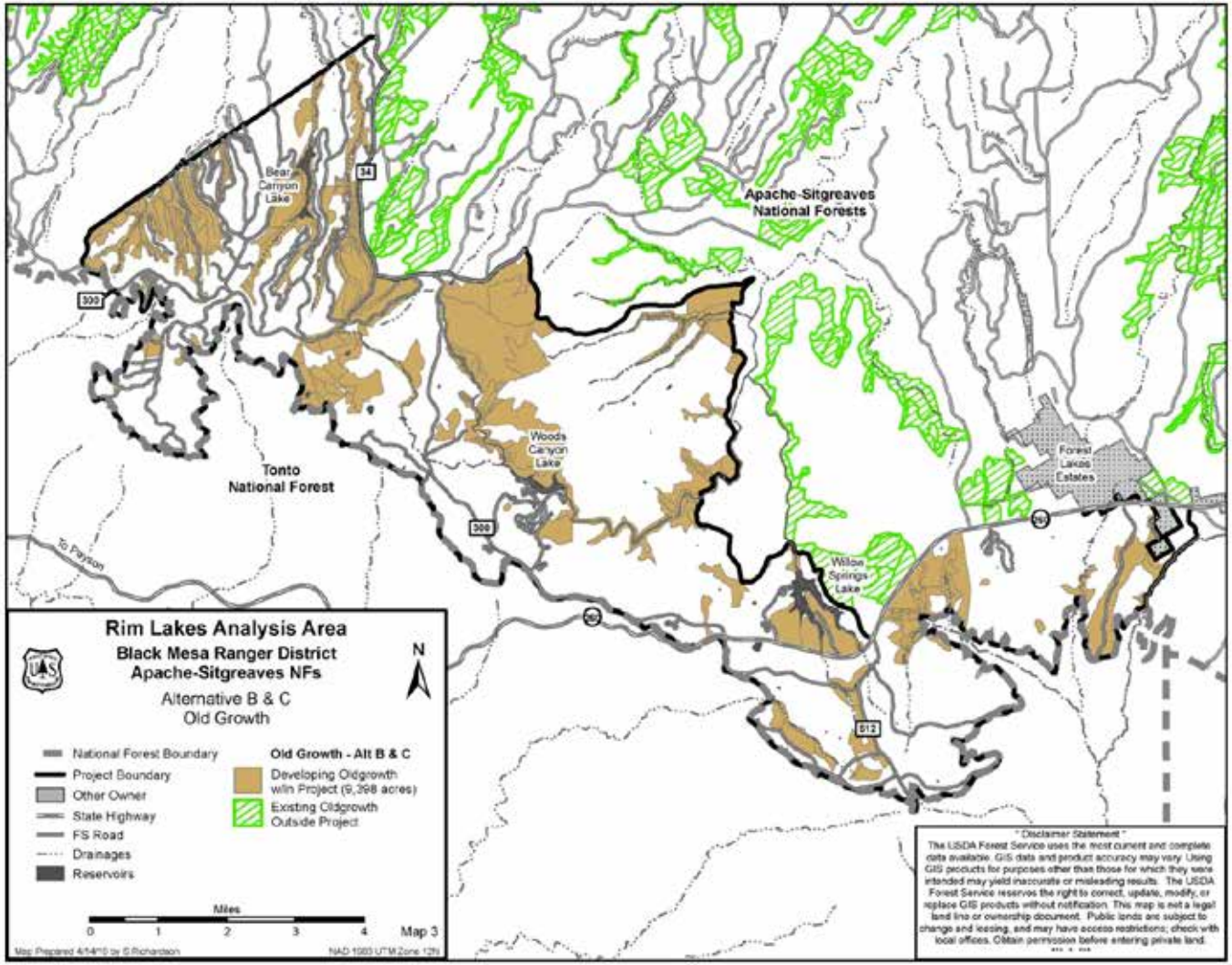

Figure 6. Old growth allocation for alternative B and alternative C

Meadow and Riparian Enhancement

All conifers would be removed and cleared where they have encroached into existing meadows and riparian areas favoring hardwood species. Trees that provide streambank stability would be maintained regardless of size. Slash would be removed from the drainage and hand piled or lopped to the ground. Three existing and potential snags would be left around meadows for wildlife. Alternative C would remove conifers up to 16 inches d.b.h..

Table 5. Meadow and riparian enhancement

Habitat	Acres
Grassland	176
Wetland	17
Total	193

Table 5 and figure 5 show goshawk and meadow treatments.

Other Treatment Objectives

The following objectives would be considered in applying treatments to the stands in the project area.

Aspen and Oak Exclosures: All encroaching conifers would be removed from areas previously fenced to exclude elk. Fences would continue to be maintained to exclude elk from aspen and oak regeneration. Alternative C would remove conifers up to 16 inches d.b.h..

Dwarf Mistletoe Infection in Ponderosa Pine Stands*:* In goshawk foraging areas and MSO restricted habitat (other)—where severe dwarf mistletoe infection centers are located—focus on removal of infected trees to establish new regeneration groups (VSS 1) or to favor existing uninfected regeneration. Where regeneration groups are not to be established, focus on reduction of severely infected trees (DMR = 3+) within the leave tree groups.

Old Growth Management: Stands designated for management of old growth would be treated to move toward old growth management objectives found in the forest plan. Specifically, treatments that help develop large trees where few exist, while maintaining the health and vigor of existing large trees, especially those greater than 18 inches diameter.

Aspen Management: In goshawk foraging areas and PFA areas, as well as MSO restricted (other) habitat, small inclusions of aspen remnants within portions of ponderosa pine would be regenerated by removing all conifers in the immediate area, 33 to 66 feet from the clone, with some removal of aspen or site disturbing activity such as ripping of aspen roots adjacent to large aspen clone. The preferred method is removal of all trees within and adjacent to the clone, retaining all healthy aspens in the clone. Where aspen is present in mixed conifer, it may be promoted through group selection described above with removal of all conifers 33 to 66 feet from the aspen clone. Aspen clones would be evaluated and fenced as needed. Trees would be retained according to the diameter limit for specific stands.

White Pine Management: Where white pine is found, it should be favored in order to provide the best genetic diversity to increase disease resistance across the landscape.

Table 6. Treatment summary

Habitat Treatments Alternative B and Alternative C	Acres
MSO forest habitat	6,643
Northern goshawk	16,835
Meadow/riparian	193
Total mechanical with prescribed burning or mechanical only	**23,671**
Broadcast burning only all habitat types. Areas proposed for broadcast burning only include goshawk habitat, MSO habitat, gravel pits, grassland, and wetland.	9,339
Total acres treated	**33,010**
No treatments proposed: Areas where no treatment is proposed under alternatives B and C include MSO habitat, private land, reservoirs, and grassland.	538
Total project area acres (goshawk PFAs and MSO PACs overlap onto nonforested areas so acres may vary from total nonforested acreage)	**33,548**

Road Maintenance

No new permanent road construction is planned. The existing road system would be used and maintained with minor reconstruction and maintenance, commensurate with use. Roads that are presently closed may be opened to access treatment areas and to accommodate project activities. Temporary roads would be constructed in order to avoid impacts to recreation use of system roads. After project completion, temporary roads would be returned to closed status.

Alternative B—Forest Plan Amendment

As described in the purpose and need for this project, a forest plan amendment is proposed in order to achieve project restoration objectives and assure consistency with the forest plan.

For the purpose of this amendment, the following definitions apply:

- A **stand** is defined as a contiguous area of trees sufficiently uniform in forest type, composition, structure, and age class distribution, growing on a site of sufficiently uniform conditions to be a distinguishable unit. Four classification characteristics are generally used to distinguish forest stands: biophysical site (soils, aspect, elevation, plant community association, climate, etc.), species composition, structure (density and age (1-aged, 2-aged, uneven-aged)), and management emphasis (administrative requirements and local management emphasis that will shape structure over time). Based upon Agency guidelines, the minimum stand mapping size is 10 acres.
- **Interspaces** are defined as the open space between tree groups intended to be managed for grass–forb–shrub vegetation during the long term. Interspaces may include scattered single trees.

Consistent with the forest plan standard to “manage for uneven-aged stand conditions in northern goshawk habitat”; the “Apache-Sitgreaves National Forests Land and Resource Management Plan” would be amended for the Rim Lakes Forest Restoration Project as follows (**Guidelines):**

Existing Guideline Language Apache-Sitgreaves Land and Resource Management Plan (2009 update) Pages 56-58	Proposed New Guideline Language
Management Scale	
Distribution of habitat structures (tree size and age classes, tree groups of different densities, snags, dead and down woody material, etc.) should be evaluated at the ecosystem management area level, at the mid-scale such as drainage, and at the small scale of site.	Distribution of habitat structures (tree size and age classes, tree density, snags, dead and down woody material, etc.) should be evaluated at the ecosystem management area level, at the mid-scale such as drainage, and at the small scale of site.
Where VSS 6 is deficit within the ecosystem management area, all VSS 6 will be maintained regardless of location. However, over time, the intent is to sustain a relatively even distribution (again, based on site quality) of VSS 6 across the ecosystem management area.	Where VSS 6 is deficit within the ecosystem management area, all VSS 6 will be maintained regardless of location, except in situations when occasional trees may be removed in order to provide for understory health and development. For example, the exemption might be used for protection of young tree groups from diseased overstory trees. Threats to public health and safety would be another example when this exception is exercised. However, over time, the intent is to sustain a relatively even distribution (again, based on site quality) of VSS 6 across the ecosystem management area.

Existing Guideline Language Apache-Sitgreaves Land and Resource Management Plan (2009 update) Pages 56-58	Proposed New Guideline Language
Guidelines	
Vegetation Management	
Landscapes Outside Goshawk Post-Fledgling Family Areas	
No similar direction in forest plan.	General: Within ponderosa pine stands, manage over time for uneven-aged stand conditions composed of heterogeneous mosaics of tree groups and single trees, with interspaces between tree groups. The size of tree groups, as well as sizes and shapes of interspaces should be variable.
No similar direction in forest plan.	Manage to develop and maintain a highly diverse vegetation mosaic: 60–80 percent of the uneven-aged stand should be under conifer and deciduous tree crowns.
General: The distribution of vegetation structural stages for ponderosa pine, mixed conifer, and spruce-fir forests is 10 percent grass–forb–shrub (VSS 1), 10 percent seedling-sapling (VSS 2), 20 percent young forest (VSS 3), 20 percent mid-aged forest (VSS 4), 20 percent mature forest (VSS 5), 20 percent old forest (VSS 6). NOTE: The specified percentages are a guide and actual percentages are expected to vary + or – up to 3 percent.	For the areas managed for tree crown development, the distribution of vegetation structural stages for ponderosa pine, mixed conifer, and spruce-fir forests is 10 percent grass–forb–shrub (VSS 1), 10 percent seedling-sapling (VSS 2), 20 percent young forest (VSS 3), 20 percent mid-aged forest (VSS 4), 20 percent mature forest (VSS 5), and 20 percent old forest (VSS 6). Note: the specified percentages are a guide and actual percentages are expected to vary plus or minus up to 3 percent.
No similar direction in forest plan.	Manage to develop and maintain 20–40 percent of the uneven-aged stand as canopy gaps (VSS 1 and VSS 2) and interspaces between tree groups. Interspaces consist of mixtures of grass, forbs, shrubs, scattered single trees, and small areas of nonforested conditions.
No similar direction in forest plan.	Tree group spatial distribution may be highly variable based on

Existing Guideline Language Apache-Sitgreaves Land and Resource Management Plan (2009 update) Pages 56-58	Proposed New Guideline Language
	local site and current conditions; the interspaces between groups may range from 20–200 feet, but generally between 40 and 100 feet apart from drip line to adjacent drip line. This spacing of groups is not affected by single trees in the interspaces.
No similar direction in forest plan.	Natural meadows, grasslands, savanna grasslands, wetlands, talus slopes, and other nontree dominated areas may also occur as inclusions within the general forest; these inclusions will not be managed for forest conditions, and are not included within the uneven-aged stand structure.
No similar direction in forest plan.	Over time the spatial location of the tree groups and interspaces may shift within the uneven-aged stand.
No similar direction in forest plan.	Each tree group is generally dominated by one vegetation structure stage. The spatial arrangement of trees, high dispersion of VSS structural stage diversity, and interspaces comprise each uneven-aged forest stand. Collectively these stands aggregate to uneven-aged forest landscapes, similar to natural conditions.
The distribution of VSS, tree density, and tree age are a product of site quality in the ecosystem management area. Use site quality to guide in the distribution of VSS, tree density, and tree ages. Use site quality to identify and manage dispersal PFA and nest habitat at 2 to 2.5 mile spacing across the landscape.	No change.
Snags are 18 inches or larger d.b.h. and 30 feet or larger in height, downed logs are 12 inches in diameter and at least 8 feet long, woody debris is 3 inches or larger on the forest floor, canopy cover is measured with vertical crown projection on average across the landscape.	Snags are 18 inches or larger d.b.h. and 30 feet or larger in height, downed logs are 12 inches in diameter and at least 8 feet long, woody debris is 3 inches or larger on the forest floor.
The order of preferred treatment for woody debris is: (1) prescribed burning, (2) lopping and scattering, (3) hand piling or machine grapple piling, and (4) dozer piling.	No change.
Canopy Cover: Canopy cover guidelines apply only to mid-aged to old forest structural stages (VSS 4, VSS 5, and VSS 6) and not to grass–forb–shrub to young forest structural stages (VSS 1, VSS 2, and VSS 3).	Canopy Cover: Canopy cover is evaluated with vertical crown projection within mid-aged to old forest structural stage groups (VSS 4, VSS 5, and VSS 6) and not within grass–forb–shrub to young forest structural stage groups (VSS 1, VSS 2, and VSS 3) or in interspaces, natural meadows, and grasslands, or other areas not managed for forest conditions.
Spruce-Fir: Canopy cover for mid-aged forest (VSS 4) should average 1/3 60 percent and 2/3 40 percent, mature forest (VSS 5) should average 60+ percent, and old forest (VSS 6) should average 60+ percent. Maximum opening size is 1 acre with a maximum width of 125 feet. Provide two groups of reserve trees per acre with six trees per group when opening size exceeds 0.5. Leave at least 3 snags, 5 downed logs, and 10–15 tons of woody debris per acre.	No change.
Mixed Conifer: Canopy cover for mid-aged forest (VSS 4) should average 1/3 60+ percent and 2/3 40+ percent, mature forest (VSS 5)	No change.

Existing Guideline Language Apache-Sitgreaves Land and Resource Management Plan (2009 update) Pages 56-58	Proposed New Guideline Language
should average 50+ percent, and old forest (VSS 6) should average 60+ percent. Maximum opening size is up to 4 acres with a maximum width of up to 200 feet. Retain one group of reserve trees per acre of three to five trees per group for openings greater then 1 acre in size. Leave at least three snags, five downed logs, and 10–15 tons of woody debris per acre.	
Ponderosa Pine: Canopy cover for mid-aged forest (VSS 4) should average 40+ percent, mature forest (VSS 5) should average 40+ percent, and old forest (VSS 6) should average 40+ percent. Opening size is up to 4 acres with a maximum width of up to 200 feet. One group of reserve trees, three to five trees per group, will be left if the opening is greater then an acre in size. Leave at least two snags, three downed logs, and 5–7 tons of woody debris per acre.	Ponderosa Pine: Canopy cover for mid-aged forest (VSS 4) should average 40+ percent, mature forest (VSS 5) should average 40+ percent, and old forest (VSS 6) should average 40+ percent within tree groups. One group of reserve trees, three to five trees per group, will be left in created regeneration openings greater than an acre in size. Leave at least two snags per acre, three downed logs per acre, and 5–7 tons of woody debris per acre.
Woodland: manage for uneven-age conditions to sustain a mosaic of vegetation densities (overstory and understory), age classes, and species composition well distributed across the landscape. Provide for reserve trees, snags, and down woody debris.	No change.
Landscapes Inside Goshawk Post-Fledgling Family Areas	
General: Provide for a healthy sustainable forest environment for the post-fledgling family needs of goshawks. The principle difference between "within the post-fledgling family area" and "outside the post-fledgling family area" is the higher canopy cover within the post-fledgling family area and smaller opening size within the post-fledgling family area. Vegetative structural stage distribution and structural condition are the same within and outside the post-fledgling family area.	No change.
No similar direction in forest plan.	Canopy cover is evaluated with vertical crown projection within mid-aged to old forest structural stages groups (VSS 4, VSS 5, and VSS 6) and not within grass–forb–shrub to young forest structural stage groups (VSS 1, VSS 2, and VSS 3) or in interspaces, natural meadows and grasslands, or other areas not managed for forest conditions.

Alternative C—Diameter limit

Alternative C Summary

Alternative C responds to issue 1. Actions are identical to alternative B in location and treatment method, except that this alternative includes a limit size so that only trees tress than 16 inches

d.b.h. would be included in the cutting and removal. Otherwise, the alternative includes using mechanical equipment and prescribed burning to accomplish the treatments using the methods described in alternative B.

In addition to those actions, this alternative would amend the Apache-Sitgreaves forest plan page 54 to clarify that even-aged management would be the emphasis of this alternative.

Alternative C Forest Plan Amendment

Alternative C does not meet the following forest plan direction, therefore, if selected it would require a forest plan amendment (emphasis in the existing plan has been added).

Existing A-S Forest Plan Page 54	Amendment Language
Establish, and delineate on a map, a post-fledgling family area (PFA) that includes six nesting areas per pair of nesting goshawks for known nest sites, old nest sites, areas where historical data indicates goshawks have nested in the past, and where goshawks have been repeatedly sighted over a 2-year or greater time period but no nest sites have been located. **Manage for uneven-age stand conditions for live trees** [emphasis added] and retain live reserve trees, snags, downed logs, and woody debris levels throughout woodland, ponderosa pine, mixed conifer, and spruce-fir forest cover types. Manage for old age trees such that as much old forest structure as possible is sustained over time across the landscape. Sustain a mosaic of vegetation densities (overstory and understory), age classes, and species composition across the landscape. Provide foods and cover for goshawk prey.	Establish and delineate on a map, a post-fledgling family area (PFA) that includes six nesting areas per pair of nesting goshawks for known next sites, old nest sites, areas where historical data indicates goshawks have nested in the past, and where goshawks have been repeatedly sighted over a 2-year or greater time period but no nest sites have been located. Manage for uneven-age stand conditions for live trees and retain live reserve trees, snags, downed logs, and woody debris levels throughout woodland, ponderosa pine, mixed conifer, and spruce-fir forest cover types. **Due to cutting treatment limitations in alternative C, portions of the project area will be managed for even-aged stand conditions.** [emphasis added] Manage for old age trees such that as much old forest structure as possible is sustained over time across the landscape. Sustain a mosaic of vegetation densities (overstory and understory), age classes, and species composition across the landscape. Provide foods and cover for goshawk prey.

Common Mitigation Measures—Alternatives B and C

All applicable forest plan standards and guidelines will be incorporated into the project design. A list of mitigation measures and best management practices is found in appendix B, based on the specialist report. The purpose of these measures is to reduce adverse impacts.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate a reasonable range of alternatives. For alternatives that were not considered in detail, agencies must briefly discuss the reasons for eliminating them (40 CFR 1502.14). The range of alternatives considered by the responsible official includes alternatives to the proposed action that are analyzed in the document, as well as other alternatives considered but eliminated from detailed study.

Public comments provided suggestions for alternative methods for achieving the purpose and need. These alternatives were reviewed during the analysis as described in this section.

Alternatives that Limit Treatment to a Specific Diameter

During the 2008 scoping period for this project, concerns were raised about removing larger trees were made to have alternatives that limit treatments to cutting trees less than 12 inches d.b.h., less than 14 inches d.b.h., and less than 16 inches d.b.h.. These types of restrictive treatments would concentrate on mechanically thinning the understory and moving treated stands to a more even-aged condition. Forest plan direction is to manage for uneven-aged stand conditions.

As has been demonstrated in past projects (see PR 81, pages 50–60), even-aged treatments that concentrate on any one size class would only partially meet the purpose and need of improving forest health or reducing the risk of uncharacteristic fire, with limited longevity. Movement toward the desired conditions for forest heath, vegetation structure, fuels, and wildlife habitat would be limited and short term. For this reason, the proposals for the 12-inch- and 14-inch-cutting limits were considered but eliminated from further analysis.

The proposal to limit cutting to trees less than 16 inches d.b.h. was analyzed in detail as alternative C. This alternative was analyzed in detail to display the differences between tree size cutting limit constraints on uneven-aged management (alternative C) and uneven-aged management without tree size cutting limit constraints (alternative B). Alternative C responds to the issue regarding large tree retention. Differences in alternatives representing the three different d.b.h. thresholds suggested are a matter of degree.

Therefore, the other diameter limit alternatives were not analyzed in detail.

Alternative to Retain All Trees Germinated Prior to Regular Fire Suppression

A suggestion to have an alternative to retain all trees that germinated prior to the regular suppression of fires as a genetic legacy of prefire suppression/fire-adapted trees was considered. The forest plan does not require retention of trees that germinated prior to the regular suppression of fire. The best available science indicates that the genetic legacy of prefire suppression/fire-adapted trees is contained in trees in the mid-aged to mature trees (70–100 years+) that are dominant across the current landscape (VSS 3, 4, and 5), as well as the VSS 6 groups that currently exist. Dominant tree groups of all age classes would be retained and favored throughout

the Rim Lakes Project area to meet the forest plan VSS objectives and, therefore, genetic traits would be retained and managed for sustainability over time.

The greatest threat to loss of locally adapted genetic traits is removal of stands and forest landscapes by uncharacteristic wildfire. In the case of a stand-replacing wildfire, artificial regeneration, such as planting, is often required. Planting seldom restores the breadth of genetic diversity present in the predisturbance natural stands. Avoidance of high-severity disturbances is the most effective strategy for retention of genetic diversity, and this objective is a primary focus of alternatives B and C, therefore, this alternative was eliminated from detailed study.

Original Proposed Action

According to 36 CFR 220.7(b)(2)(iii) and FSH 1909.15 (ch. 14, 3), modifications and incremental changes to the alternatives may be considered as part of the range of alternatives. The original proposed action first scoped in 2008 was modified in response to public comment and internal analysis. Therefore, the 2008 proposed action was not analyzed in detail and is considered part of the range.

No Burn Alternative

During scoping for the environmental impact statement, a concern was raised about the effects of prescribed burning in two aspects. First is the concern about the effects of smoke to human health, and second is the concern with the existence of radionuclides in the forest litter and vegetation, which would be released in smoke during burning. This radionuclide concern is based on the postulated downwind accumulation of these elements after the above ground nuclear bomb testing that occurred in Nevada.

In order to respond to both of these concerns, an alternative was considered but not analyzed in detail that would conduct only mechanical treatments. This alternative would exclude burning in order to avoid smoke-related effects.

This alternative was not considered in detail because without putting fire as a process back into the ecosystem, the purpose and need of the project could not be met with existing technology. Although mechanical treatments alone can begin the process of forest restoration, only reintroducing fire as a process can achieve restoration of forest ecosystem functions and processes.

In addition, no evidence has been presented to substantiate the claim that levels of radionuclides exist in the project area that could pose an additional threat. Intensive monitoring in Los Alamos, New Mexico, during the Las Conchas Fire in 2011 suggests that no radionuclides were present in smoke created by that fire, which occurred at much higher intensity than a planned prescribed fire. This location is similarly downwind of Nevada test sites, and has been studied for both locally produced contamination, as well as “background” radionuclides attributed to aboveground tests.

Therefore, the best available evidence suggests there is no additional hazard above and beyond that posed by smoke, which admittedly contains many materials that can be harmful to people when exposed. Because of this known hazard, smoke is regulated by the State of Arizona to minimize impacts to human health.

This alternative was not analyzed in detail because following Arizona guidelines for burning, as well as other mitigation measures listed in appendix B, serves to minimize the potential effects of smoke.

Monitoring

Chapter 5 of the forest plan includes the monitoring and evaluation activities to be conducted as part of forest plan implementation. There are three categories of forest plan monitoring: implementation monitoring, effectiveness monitoring, and validation monitoring. Effectiveness and validation monitoring are not typically done as part of project implementation. Implementation monitoring will be performed as required by the forest plan.

Comparison of Effects

Table 7 contains a comparison summary of key measures related to the purpose and need and environmental effects of the alternatives considered in detail. See chapter 3 for detailed discussion of the measures and description of effects.

Table 7. Comparison of alternatives

	Desired Condition	Current Condition	Alternative B	Alternative C
Species Composition	Shade intolerant species dominate. southwestern white pine, aspen, oak, and other hardwood species are well represented and increasing.	Dominant species composition shifting toward shade tolerant, fire intolerant species (southwestern white pine, aspen, oak, and other hardwood species decreasing).	Shade intolerant species favored on 100% of the treated area (excluding MSO protected).	Shade intolerant species favored on 30% of the treated area (excluding MSO protected).
Density (stand average including regeneration gaps/openings)	Ponderosa pine: BA range 45–55 Mixed conifer: BA range 55–75	Ponderosa pine: BA range 11–360 Ponderosa pine: BA average 91 Mixed conifer: BA range 30–235 Mixed conifer: BA average 99	Ponderosa pine average: BA @1 yr = 45 Ponderosa pine average: BA @20 yr = 65 Mixed conifer average: BA @1 yr = 59 Mixed conifer average: BA @20 yr =78	Ponderosa pine average: BA @1 yr = 51 Ponderosa pine average: BA @20 yr = 79 Mixed conifer average: BA @1 yr = 67 Mixed conifer average: BA @20 yr = 89
Age Class Distribution	Uneven-aged stands 100 percent of forest areas. Balance of young, middle, and old aged.	Uneven-aged stands 55% of forested area. Even-aged stands are 45% of forested area.	Uneven-aged stands maintained (55%). Regeneration gaps/openings created to develop a balance of young, middle, and old aged in a mosaic. Even-aged stands moved toward uneven-aged conditions (45%).	Uneven-aged stands (55%) moved toward an even-aged structure (reduced balance of ages). Mature even-aged stands maintained as even-aged conditions (15%). Immature even-aged stands maintained/or progressed toward balanced uneven-aged conditions (30%).
Trees > 16 inches d.b.h. Longevity and Cost	NA	287,000 trees >16 inches d.b.h. (in stands proposed for cutting treatment only).	89% of trees >16 inches d.b.h. would remain (256,000) 11% of trees >16 inches d.b.h. removed to achieve canopy gaps with a longevity of 30+ years. Cost slightly less than alternative C (open market).	100% of trees >16 inches d.b.h. would remain (287,000) Development of canopy gaps developed to a lesser degree with a longevity of 10–15 years. Cost of treatments slightly more than alternative B.
Spatial	Variable canopy density.	Typically closed canopy with few	Variable canopy density, groups	Variable canopy density, with little definition between groups,

Table 7. Comparison of alternatives

	Desired Condition	Current Condition	Alternative B	Alternative C
Arrangement	Groups/clump with regeneration gaps/openings average 30–40% overall.	regeneration gaps/openings.	and clumps. Regeneration gaps/openings average 20–40% overall.	clumps, and patches. Regeneration gaps/openings average less than 10% overall.
Old Growth Forest Allocation/ Management	Allocate at least 20% of each forest type to be managed for old growth forest criteria according to the forest plan.	Project area current allocation: Mixed species = 8.5% Ponderosa pine = 6.7% District current allocation: Mixed species = 15% Ponderosa pine = 11%	Project area allocation: Mixed species = 43% Ponderosa pine = 26.5% District allocation: Mixed species = 35% Ponderosa pine = 12%	Project area allocation: Mixed species = 43% Ponderosa pine = 26.5% District allocation: Mixed species = 35% Ponderosa pine = 12%
Herbaceous/Shrub Understory	Herbaceous/ shrub understory provides greater biological diversity due to effects from canopy gaps, spatial distribution of tree groups, and reduced canopy cover.	Scarce herbaceous/shrub understory and reduced biological diversity due to effects from dense trees and canopy cover	Greater herbaceous/shrub understory provides greater biological diversity than alternative C due to effects from canopy gaps, spatial distribution of tree groups and reduced canopy cover in treated areas. Herbaceous response decline after 30 years as canopy gaps fill in.	Less herbaceous/shrub understory provides less biological diversity than alternative B due to effects from less distinct canopy gaps spatial distribution of tree groups and reduced canopy cover in treated areas. Herbaceous response decline after 10–15 years as canopy closes.
Sustainability and Resilience (Forest Health)	Create resilience to disturbance, insect disease, uncharacteristic fire, climate variability, resulting from reductions in forest density, heterogeneity of forest structure, and understory vegetation. Sustainable over time. High severity forest vegetation mortality unlikely to occur following wildfire. Bark beetle induced mortality is occurring at the large forest patch and stand scale across the project area, well above the	Limited resilience to disturbance, insect, disease, uncharacteristic fire, climate variability (dense forest conditions). Not sustainable over time. High severity forest vegetation mortality likely to occur following wildfire. Bark beetle induced mortality occurs at the tree group and small forest patch scale across the project area, at levels similar to historic conditions.	Improved resilience to disturbances insect, disease, uncharacteristic fire, and climate variability (better than alternative C). Sustainability decreases beyond 30 years. High severity forest vegetation mortality unlikely to occur following wildfire for 30+ years following treatment. Bark beetle risk is significantly reduced in all treated stands (except MSO protected and	Improved resilience over first 10–15 years, decreasing over time as canopy gaps close. Sustainability decreases beyond 10–15 years. High severity forest vegetation mortality likely to occur as canopy gaps close after 10–15 years. Bark beetle risk is significantly reduced in most treated stands (except MSO protected and threshold habitats). Bark beetle risk is slightly or not reduced in

Table 7. Comparison of alternatives

	Desired Condition	Current Condition	Alternative B	Alternative C
	historic condition level. Dwarf mistletoe induced mortality occurs at the tree group and small forest patch scale across the project area. Distribution is discontinuous, facilitating regeneration development and forest growth over much of the area similar to historic conditions.	Dwarf mistletoe is severely impacting and facilitating mortality at the large patch and stand scale across the project area (continuous high severity distribution across ponderosa pine approximately 25–30% of the area). Current distribution jeopardizes the ability to manage for uneven-aged stand structures and the development of forest regeneration.	threshold habitats). Dwarf mistletoe severity is reduced in each treated stand. Post treatment, dwarf mistletoe occurs at the tree group and small forest patch scale across the project area. Distribution is less continuous, better facilitating regeneration development and forest growth.	some treated stands. Dwarf mistletoe severity and distribution is reduced in each treated stand, but not to the extent of alternative B. There would be more continuity of diseased forest patches due to less canopy gaps overall. Some stands and patches would still have significant dwarf mistletoe impacts to forest regeneration and growth following treatment. Uneven-aged management in these patches is unlikely to be successful due to disease impacts on regeneration and development.
MSO Habitat Risk	MSO habitat at reduced risk due to 100% of non-MSO constrained area in FRCC 1.	MSO habitat at risk due to 100% of area being in FRCC 3.	MSO habitat at reduced risk due to 54% of area in FRCC 1 (46% in FRCC 2 and 3).	MSO habitat at risk due to 14% of area in FRCC 1 (86% in FRCC 2 and 3).
FRCC	FRCC 1 = 100% of area. High degree of consistency with reference conditions and the natural disturbance regime. Low risk of losing key ecosystem components.	FRCC 3 = 100% of area. Substantially departed from reference conditions and the natural disturbance regime. High risk of losing key ecosystem components.	FRCC 1 = 54% of area after 20 yr FRCC 2 and 3 = 46% of area after 20 yr Lower risk of losing key ecosystem components than alternative C.	FRCC 1 = 14% of area after 20 yr FRCC 2 and 3 = 86% of area after 20 yr Higher risk of losing key ecosystem components than alternative B.
Fire Behavior Potential	Reduced potential for high severity, stand-replacing fires. Surface fire >75% Passive crown fire is occasional at the group or clump scale. Active crown fire at smaller	High potential for high severity, stand-replacing fires. Surface fire = 32% Passive crown fire = 44% Active crown fire = 23%	Reduced potential for high severity stand-replacing fires for 30+ years. Surface fire = 66% Passive crown fire = 16% Active crown fire = 17%	Reduced potential for high severity, stand-replacing fires for 10–15 years. Surface fire = 51% Passive crown fire = 30% Active crown fire = 18%

Table 7. Comparison of alternatives

	Desired Condition	Current Condition	Alternative B	Alternative C
	scale under extreme conditions.			
Fire Management Potential	Increased opportunity to manage prescribed fire or wildfire to meet resource objectives under a wider range of fire conditions.	Limited opportunity to manage prescribed fire or wildfire to meet resource objectives under a limited range of fire conditions.	Increased opportunity to manage prescribed or wildfire to meet resource objectives under a wider range of fire conditions than current. Opportunities to manage fire to meet resource objectives decline as canopies close in 30+ years.	Increased opportunity to use prescribed or wildfire to meet resource objectives under a wider range of fire conditions than current. Opportunities to manage fire to meet resource objectives decline as canopies close in 10–15 years.
Hydrologic Function	Improved hydrologic function due to reduced density and canopy gaps.	Hydrologic function decreased due to dense forest conditions.	Improved hydrologic function due to reduced density and increased canopy gaps. Greater effective capture of precipitation, and soil moisture increase than alternative C.	Short-term improvement of hydrologic function (10–15 years) decreasing as canopy closes and density increases. Less effective capture of precipitation and soil moisture increase than alternative B.
Visuals	Increased visual diversity and variation due to reduced forest density with canopy gaps.	Limited visual diversity and variations due to high density forest with closed canopy.	Increased visual diversity and variation due to reduced forest density with canopy gaps (better than alternative C).	Limited visual diversity and variation decreasing as canopy gaps close 10–15 years (less than alternative B).
Treatment Longevity/Cost	No change.	No change.	30 plus year benefits. $13 per acre per year.	10 plus years benefit. $40 per acre per year.

Chapter 3. Affected Environment and Environmental Consequences

This chapter summarizes the physical, biological, social, and economic environments of the affected project area, and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for the comparison of alternatives (40 CFR 1502.16). This chapter describes the tradeoffs among the alternatives for the public and the forest supervisor, showing as concisely as possible the relative change among the alternatives. This chapter supports table 7 found at the end of chapter 2 (page 33).

The CEQ regulations intend that agencies reduce excessive paperwork by preparing analytic rather than encyclopedic documents (40 CFR 1500.4(b)) and incorporate material by reference to reduce bulk without impeding agency and public review of the action (40 CFR 1502.21). This environmental impact statement attempts to follow that direction, limiting discussions to important effects and incorporating the complete specialists' reports by reference.

Appendix C contains a list of the specialists reports that contain extensive lists of literature cited which will not be repeated in this environmental impact statement. Relevant documents are in the project record located at the Black Mesa Ranger District office.

The Basic Components of an Effects Analysis

This section explains the basic components of an effects analysis conducted and documented under the National Environmental Policy Act for those who are not familiar with the process.

The Affected Environment

An effects analysis starts by describing the affected environment. As the name implies, this section describes those parts of the environment or project area that would change as a result of the proposed action. The Council on Environmental Quality describes it this way:

> *"The environmental impact statement shall succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration. The descriptions shall be no longer than is necessary to understand the effects of the alternatives." (40 CFR 1502.15).*

The Apache-Sitgreaves National Forests propose to restore a portion of the Black Mesa Ranger District to a more resilient condition. Therefore, the affected environment relates to the social, physical, and biological environment that may be affected by these restoration activities. Resources that would not be affected—either for better or worse—do not need to be included in order to properly analyze the effects of the actions. Resources of the affected environment include wildlife habitat and recreational use. Conditions such as the weather would not change no matter what is proposed and so will not be discussed as part of the affected environment.

Effects

An effect is the result of an action. A rock thrown in a pond makes ripples. Throwing the rock is the action, and the ripples are the effects of that action. The environmental consequences are all the effects considered together.

The Council on Environmental Quality lists different kinds of effects that need to be analyzed under the National Environmental Policy Act:

- Direct effects, which are caused by the action and occur at the same time and place.
- Indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.
- Cumulative effects, which are the sum of the incremental impacts from the action combined with other actions. These are described in the next section.

Environmental effects can be both beneficial and detrimental (40 CFR 1508.8). For example, for this restoration project, beneficial effects are those for wildlife species whose habitat is improved, while negative effects are those that reduce the effectiveness of habitat for other species.

The regulations do not require agencies to separate the direct and indirect effects, so in this document, these are described together. Cumulative effects have their own sections when appropriate.

Cumulative Effects

The Council on Environmental Quality defines a cumulative effect as follows:

> *" 'Cumulative impact' is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (40 CFR 1508.7).*

To be cumulative, effects must overlap in space and time. Cumulative impacts are important because they could cause a tipping point, either beneficial or negative. To analyze cumulative effects, the EIS describes the effects from this proposal and adds them to the effects from past, present, and reasonably foreseeable future actions.

Past and Present Actions

The interdisciplinary team considered the effects of past actions as described in table 8. The Council on Environmental Quality recognizes "agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions" (Council on Environmental Quality 2005). Listing the past actions can show trends.

Reasonably Foreseeable

Courts have interpreted a "reasonably foreseeable future action" as a human action that has been proposed and is in the planning stages (e.g., Weinberger v. Catholic Action of Hawaii, 454 US 139, 70 E.Ed.2d 289 (1981)). For example, a subdivision would not be reasonably foreseeable until the owner submitted plans to the county.

To analyze the cumulative effects of reasonably foreseeable future actions, each resource specialist looked at the list of projects and identified the ones expected to cause effects on their resource at the same time and in the same place as effects from the proposed action or alternatives. Some specialists analyzed additional actions that pertained only to their resource.

Except as noted in specific sections of this chapter, the spatial bounds, for the direct and indirect effects fall within the National Forest System lands within the proclaimed boundary of the Black Mesa Ranger District, Apache-Sitgreaves National Forests. An example of this exception would be the possible watershed effects that could occur beyond these boundaries Air quality considers effects to a wider area as well. For all resources, the temporal bound for the direct and indirect effects is the next 2 decades.

Affected Environment for Cumulative Effects

This information was used by all the specialists for the cumulative effects analysis.

The current condition of the project area was shaped by natural processes and past human activities. The first recorded major activity by European settlers was the introduction of livestock (cattle, sheep, and horses) to the Mogollon Rim region during the 1880s. Unregulated grazing greatly impacted grass–forb–shrub forest understories, in many cases so severely that naturally occurring frequent-fire activity ceased. In some locations, no fire has occurred since the 1880–1890s time period. This has resulted in regeneration and development of high forest tree densities and downed woody fuels that can lead to uncharacteristic fire behavior.

The first timber harvest entries in the project area occurred in the 1940s. These actions focused on removal of large dying trees and high grade lumber. From the 1950s to 1970s, management focused on sanitation/salvage of dying, diseased, or damaged trees. Minimal amounts of forest density management occurred during this period. In the 1960s, the practice of cutting snags to reduce fire hazard also reduced the number of snags currently standing but may have increased the number of logs present in some areas. Starting around 1980, forest management focused on even-aged timber sales, i.e., cutting all the trees and developing stands of the same age and size. Treatments were conducted on selected stands and large blocks throughout the project area (approximately 44 percent of the area).

Individual stand treatments focused on overstory removal of mature trees where a younger age class was present. Where mature trees dominated, regeneration treatments focused on removal of most overstory trees and retention of scattered low density seed trees. Where sapling or mid-aged trees dominated, treatments focused on thinning to manage stand density. Much of the thinning treatments yielded pulpwood products for paper, and the removal and regeneration treatments yielded sawtimber products primarily for lumber.

Past timber sales in and near the project area, such as Carr Lake, Deer Lake, Palomino, and others, all implemented prior to the 1996 forest plan amendment for owl and goshawk, targeted the harvest of medium and large diameter trees. In some cases, all trees over 12 inches in diameter were removed. This even-aged forest management focus continued until the mid-1990s, leaving the legacy of current forest structural conditions across the landscape. All of the areas where regeneration treatments were conducted have adequately regenerated. Many stands are currently single-aged or two-aged, with homogenous forest canopy structures and high density. During the recent past (mid-1990s to present), selected small areas were thinned to reduce fire

hazard adjacent to public areas, such as residential areas and campgrounds. These thinning treatments focused on removal of the smallest trees, producing results similar to the mid-aged stand thinning treatments conducted during the 1980s period.

Several large-scale fires have occurred around and within the project area. The 2002 Rodeo-Chediski Fire overlaps a portion on the east side of the project area. Reforestation efforts occurred within and adjacent to the project area following the Dude Fire in 1990 resulting in small plantations within dense forested areas.

Table 8 contains a list of vegetation treatments and fire events that have influenced the project area since 2000. Ongoing activities include grazing and recreation. The Long Tom Allotment accounts for approximately 34 percent of the project area. It is grazed by sheep for approximately 6 months of the year. Sheep grazing is monitored for utilization, and pastures rested and rotated for recovery. The Limestone Allotment accounts for approximately 3 percent of the project area, but has not been grazed by cattle for the past 15 years and grazing is not anticipated within the near future. In terms of recreation, activities in the project area include dispersed and developed camping, hunting, and hiking.

Foreseeable future actions within the project area include thinning trees within power line corridors as ongoing maintenance. Forest Road 300 has been scheduled for upgrades that would allow it to become a state highway. Analysis is scheduled in 2013, with construction beginning in 2014 following a decision.

Table 8. Past vegetation treatments and fire events in the Rim Lakes Project area

Project	Year	Acres	Activity
Power line clearing	2001	122	Mastication of all trees greater than 5 feet tall within power line right-of-way.
Fulton precommercial thinning	2002	25	Thinning up to 6 inches to improve growth. Material chipped.
Rodeo-Chediski Fire erosion seeding	2003	105	Watershed and erosion completed with aerial seeding and straw in places.
Bark beetle reduction thinning	2004	34	Reduced density of trees up to 6 inches by cutting and chipping.
300 Road daylighting	2005	78	Thinning and chipping up to 7 inches, 66 feet from roadway. Some burning of piles next to road. Removal of hazard trees.
Bark beetle reduction thinning	2005	191	Reduced density of trees up to 6 inches by cutting and chipping.
Legacy Salvage Sale	2006	276	Salvage removal of dead trees within the Rodeo-Chediski Fire. Branches and limbs left onsite.
Rim Top Broadcast Burn	2006	681	Broadcast burning to reduce ground fuels and improve grasses and forbs.
Forest Lakes WUI	2007	836	Reduced density of trees up to 16 inches by cutting and removing. Material piled and burned.
OW Salvage Sale	2007	92	Salvage removal of dead trees within the Rodeo-Chediski Fire. Branches and limbs left onsite.
Power line clearing	2006-2007	122	Mastication of all trees greater than 5 feet tall within power line right-of-way.
Promontory pile burning	2007	127	Burning of piled material created by dozer lines.

Woods Canyon bark beetle prevention	2007	360	Thinning trees greater than 5 inches in diameter to reduce basal area and lower beetle susceptibility within the campground.
Woods Canyon bark beetle prevention	2008	360	Burning of piles from campground thinning.
Forest Lakes WUI broadcast burning	2009	900	Broadcast burning to reduce ground fuels and improve grasses and forbs.
Woods Canyon bark beetle prevention	2009	306	Thinning and handpiling trees up to 5 inches within the Woods Canyon Campground.
Woods Canyon bark beetle prevention	2011	306	Pile burning of material from precommercial thinning.
Power line clearing	2011	240	Removal of all trees greater than 5 feet tall within power line right-of-way.
Hwy. 260 hazard tree removal	2011	25	Removal of dying trees along State Highway 260.

Vegetation

This section summarizes the key effects and assumptions from the silviculure specialist report (Richardson et al., 2012) located in the project record.

Affected Environment—Vegetative Cover Types

Forest stands are often classified by their forest type and by habitat type or plant associations. This analysis will analyze forest cover types found in the forest plan for Mexican spotted owl and northern goshawk habitat (USDA 1987, as amended). All forested habitat was stratified to meet analysis requirements in the forest plan for Mexican spotted owl (MSO) and northern goshawk as displayed in figure 7. This analysis is located in the “Wildlife” section of this document (page 77). Table 9 displays the vegetation and other land use cover types within the project area.

Nonforest Vegetative Cover Types

Dry and wet meadows are present in the analysis area. Riparian inclusions occur along drainages and within stands identified as ponderosa pine, pine-oak, or mixed conifer cover type. Bear Canyon Lake, Woods Canyon Lake, and Willow Springs Lake fall within the project area.

Forest Plant Community Types

Habitat types are an aggregation of units of land capable of producing similar plant communities at its natural developmental end point, or climax (Helms, 1998). Each habitat type is usually named for the most shade-tolerant species regenerating successfully, and usually considered the climax in the absence of disturbances such as fire. The majority of the project area is a ponderosa pine habitat type with the remaining stands identified as Douglas-fir or white fir habitat types (referred to generally as “mixed conifer” types). Deciduous species of Gambel oak, Rocky Mountain maple, big tooth maple, box elder, and New Mexican locust can be found scattered throughout the project area as inclusions in the ponderosa pine and mixed conifer forest types, but most young sprouts and seedlings are destroyed by browsing of elk, deer, and other ungulates such as cattle.

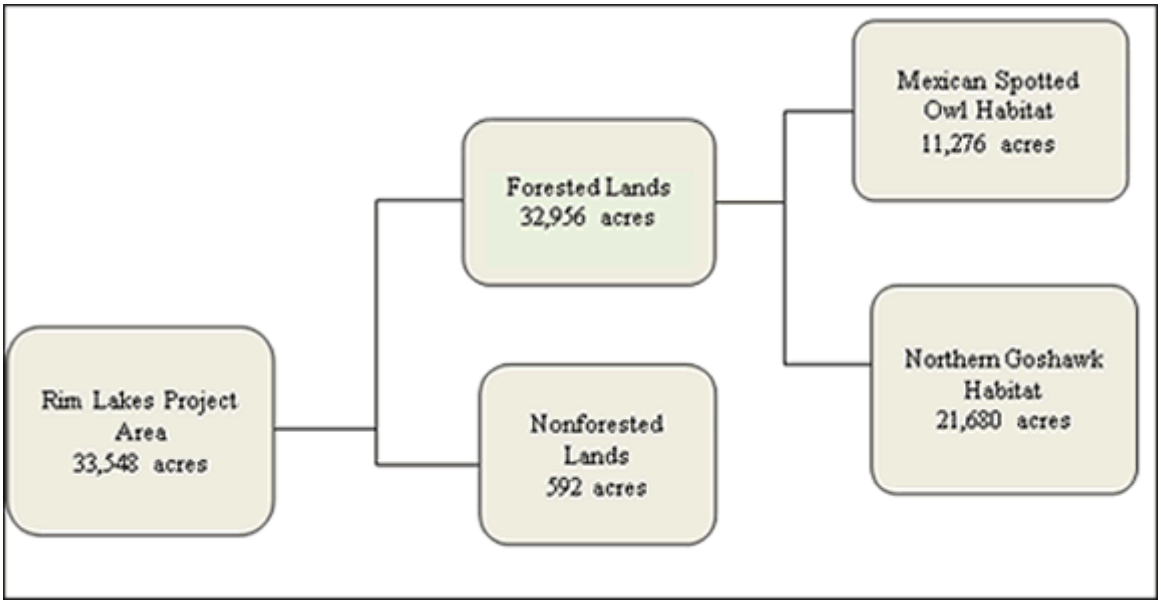

Figure 7. Stratification of forested and nonforested land

Table 9. Forested and nonforested acres by stratum

Stratum	Cover Type Acres
Forested	
Ponderosa pine	22,258
Mixed conifer	8,127
Pine-oak	2,571
Total Forested	32,956
Nonforested	
Wetland	24
Reservoir	286
Gravel pit	17
Private land	24
Grassland	241
Total nonforested	593
Total	33,548

Ponderosa Pine and Pine-oak

In the project area, ponderosa pine commonly grows in pure stands and currently is found in even-aged[12] and uneven-aged[13] structural conditions across the project area. These stands provide habitat for species such as northern goshawk. A portion of the stands have a large enough component of Gambel oak to be considered pine-oak habitat for Mexican spotted owl (MSO) as described in the forest plan and MSO recovery plan. Ponderosa pine also occurs as an early successional or early seral[14] species in mixed conifer stands, where over time it gives way to more shade-tolerant species such Douglas-fir and white fir. Limited remnant patches of aspen can be found throughout the project areas within the pine stands.

Mixed Conifer

Mixed conifer stands found within the project area hold a variety of tree species, including ponderosa pine, Douglas-fir, white fir, southwestern white pine, and patches of aspen. The majority of mixed conifer found in the project area is dominated by ponderosa pine and Douglas-fir, and is considered to be a dry mixed conifer forest type, which historically saw frequent fire. Portions of the mixed conifer type are in mid-succession or climax condition with an understory of white fir. The cessation of frequent fire has resulted in increasing regeneration of shade-tolerant white fir. Over time, species composition would shift from fire-resistant, shade-intolerant species to nonfire-resistant, shade-tolerant species dominance. Some stands within the project area have transitioned to dominance of shade-tolerant species, such as Douglas-fir. Ponderosa pine and southwestern white pine are regenerating where old logging roads and scattered openings occur in the stands. Some wet mixed conifer forest type can be found within canyons and along some of the major drainages and lakes. Wet mixed conifer vegetation types are found where historically fire occurred infrequently.

Aspen

Aspen exists over approximately one-third of the assessment area in small isolated patches. It is a early seral phase of the wet mixed conifer forest cover type development, but only occurs as scattered patches within the dry mixed conifer forest cover type. In the project area these patches typically consist of a few overstory trees with a sapling component of 3-inch to 8-inch diameter trees. Currently there are no aspen stands within the project area. Elk are particularly damaging to aspen, browsing on aspen suckers, rubbing antlers on mid-sized trees, and eating bark from larger trees. Several aspen patches or clones show signs of decline marked by mortality and dieback of crowns, similar to what has been observed across Arizona over the past several years. Aspen are regenerating successfully where wildlife is excluded by fencing. Mature aspen in the project area are dying due to defoliation by various insects and disease agents, or age-related senescence (Fairweather 2008).

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[12] Even-aged – pertaining to a stand composed of a single age class in which the tree ages are within $\pm$ 20 percent variability based upon the mature stand age (Helms 1998).

[13] Uneven-aged – pertaining to a stand with trees of three or more distinct age classes (Helms 1998).

[14] "Seral stage" is a term used in biology to describe the series of relatively transitory plant communities that develop during ecological succession from bare ground (early seral) to the climax stage (late seral). Early seral species of plants are those that come into a system soon after disturbance. Late seral species are those that come in later in the succession, are more tolerant of shade, and represent the final stages of succession (climax). Ponderosa pine is an example of an early seral species because it reenters an ecosystem soon after disturbance but eventually—without disturbance—would be shaded out by species such as white fir that are more shade tolerant.

Historic Range of Variability

Extensive research—particularly by Dr. Wallace Covington and colleagues of Northern Arizona University—has demonstrated that current ponderosa pine forests of the Southwest are greatly altered in terms of forest structure, density, and ecological function. Most forest conditions are at much higher risk of high intensity and severity fire than they were prior to European settlement (Covington 1993, Moore et al., 1999).

A century ago the pine forests had widely-spaced large trees with a more open, herbaceous forest floor (Cooper 1960). Typical historic tree group/patch size ranged from 0.1 to 0.75 acre in size, (2 to 40 or more trees) (White 1985). These conditions were maintained by fairly frequent low-intensity ground fires that did not kill the large trees (Fiedler et al., 1996). These fires occurred every 2 to 12 years and maintained an open canopy structure (Moir et al., 1997). The herbaceous understory fueled frequent fires started by lightning, and thinned and/or eliminated thickets of small trees keeping the forest open and park-like (Allen et al., 2002). This historic range of variability condition was estimated to have an average of 23–56 trees per acre on the Fort Valley Experimental Forest near Flagstaff, Arizona (Covington 1993).

Dr. Margaret Moore reported that on permanent plots located throughout southwestern ponderosa pine forests, remeasurements conducted from 1997 to 1999 show that average trees per acre have increased by up to 33-fold since the plots were established in 1909–1913 (Moore et al., 2004). On the Long Valley Experimental Forest, which is very similar to the project area (sedimentary soils on the Mogollon Rim, central Arizona), the sampled trees per acre in 1938 ranged up to 99 trees per acre, with an estimated 75 trees per acre being present prior to the cessation of frequent fire (circa 1880–1900).

In his 1911 report, Woolsey (USFS Assistant District Forester, District (Region) 3) described historic conditions for ponderosa pine forests in the Southwest. Reporting on the general character of ponderosa pine forests, Woolsey noted:

> *The typical western yellow (ponderosa) pine forest of the Southwest is a pure park-like stand made up of scattered groups of from 2 to 20 trees, usually connected by scattering individuals. Openings are frequent and vary in size. Because of the open character of the stand and the fire-resisting bark, often 3 inches thick, the actual loss in yellow (ponderosa) pine by fire is less than with other more gregarious species. A crown fire in mature timber is almost unheard of, and in a ground fire in the virgin forest young saplings often escape complete destruction, though with a fair wind and on a steep slope destruction of seedlings and saplings is often complete…In June 1910, a fire occurred on the Gila, Datil and Apache National Forests which burned over about 60 square miles. The area burned was steep and rocky, with an unusual quantity of dry forage. An investigation showed that injury to the yellow (ponderosa) pine was confined very largely to the reproduction. On the area as a whole, from 40 to 50 percent of the seedlings were killed." (Woolsey 1911)*

Historic mixed conifer forests were typically uneven aged in structure, and tree spatial patterns varied from open and clumped to moderately sized homogeneous patches. Density ranged from openings with very low density to patches with moderate density. The warmer/drier mixed conifer forest types experienced more frequent fire and were typically uneven aged, growing in a patchy structure, contained many fewer trees per acre than existing stands and experienced relatively

frequent low to moderate intensity fire, similar to ponderosa pine forests. The cooler/wetter mixed conifer forest types historically experienced less frequent, moderate intensity fire, resulting in larger patches of homogeneous tree ages and higher patch density overall (Smith 2006). Due to the frequent disturbance regime, historic species composition in the warmer/drier mixed conifer forests was dominated by fire resistant, shade-intolerant conifer species such as ponderosa pine, southwestern white pine, and Douglas-fir. Historically shade-tolerant species were absent or present as a minor stand component on the drier sites such as ridgetops and southwest-facing slopes, with more abundant but still subdominant representation on cooler, wetter, north-facing slopes.

While it is not considered necessary—or even desirable in some cases—to mimic these historic conditions throughout pine and mixed conifer forests today, this condition represents a state of being that is in harmony with the natural disturbance regime. This disturbance pattern of frequent, low-intensity fires shaped this ecosystem and so restoring it to that pattern offers a means of returning the forests to their more natural resilience.

Social, political, and economic factors are much different today than a century ago and there are valid considerations for leaving areas of higher tree density to meet management needs. But restoration of some portion of the landscape to conditions reminiscent of pre-European settlement times would provide greater ecosystem stability and sustainability.

Desired conditions for this project are described in detail in the silviculture report and summarized in chapter 1 (page 4).

Environmental Consequences—Vegetation

Summary

Table 10 compares the project purpose and need vegetation management objectives/effects between the two action alternatives.

Alternative A: By taking no action, no vegetation management activities would occur under alternative A. No opportunities for timber or other biomass products to be produced, and no costs would be incurred for thinning or burning treatments under alternative A. Stands that would be left untreated would continue to become denser and decrease in vigor and health over time, and increases in insect, disease, and density-related mortality is probable. Grass/forb and shrub presence would decrease, and growth would continue to decline. No canopy gaps would be created for seedling regeneration, or to restore forest openings. Growth of trees would be slower than the treated stands.

Alternative B: Alternative B makes rapid progress in moving stand structures and other forest conditions toward desired conditions, compared to no change in current conditions (alternative A), and much more effectively than alternative C.

Fire hazard would be less than alternative A and alternative C by creating gaps in the canopy and forest openings.

The forest plan amendment proposed as part of this alternative would assure that the vegetation treatments are consistent with forest plan direction. Effects of this amendment to vegetation are the same as those described in this section.

Alternative C: Alternative C would result in many posttreatment stands with lower stand densities than alternative A, but with higher density than alternative B; therefore, these stands would retain a lower resistance to bark beetles, and lower forest resiliency to environmental stressors such as climate variability and change. There would be fewer openings in the canopy than in alternative B, limiting the development of forest openings to less than 10 percent of the area, reducing development of VSS 1 and VSS 2 classes, which would remain deficit compared to alternative B. Based upon past examples where this alternative was implemented in other locations on the Apache-Sitgreaves National Forests, implementation of this alternative in existing uneven-aged stands would result in homogenization of forest structure such that stands would become single or two-aged after treatment, and existing even-aged stands would be maintained in even-aged condition.

Fire hazard would be less than alternative A, but greater than alternative B due to fewer gaps in the canopy and forest openings. Selection for the removal groups may be difficult and the best trees may not always be chosen for retention as seed trees; this may even result in the retention of genetically inferior trees, while smaller genetically superior trees are removed to meet objectives for stand density and fire reduction.

The effects to vegetation of the amendment for alternative C are the same as those described in the “Effects” section for this alternative.

Table 10. Comparison of alternatives: project purpose and need

Alternative B	Alternative C
Achieve target stand density in most treated stands.	Achieve target stand density in most treated stands.
Reduce bark beetle hazard in most treated stands.	Reduce bark beetle hazard in most treated stands.
Reduce and manage dwarf mistletoe severity and extent in some stands.	Partially reduce and manage dwarf mistletoe severity and extent in some stands. Limited ability to deal with situations when larger trees have mistletoe and must be left, while healthy understory is removed to meet density objectives.
Achieve desired stand structure and species composition in most stands.	Across about 70 percent of the treated stands, uneven-aged structure could not be achieved with the diameter limit. Stands would move toward even-aged condition, away from desired conditions. On about 30 percent of the treated stands—where immature even-aged stands (VSS 1, 2, 3) dominate—this alternative would achieve desired stand structure and species composition. This includes goshawk habitat as well as MSO restricted habitats). In these areas constraints seldom limit attainment of age/size/density objectives, although they may have minor effects on meeting forest health/species objectives. Few trees larger than 16" d.b.h. exist in these stands and those that occur, would be retained to add necessary structural diversity and as seed trees to facilitate regeneration treatments to recruit a new age class cohort.
Achieve basal area requirements for Mexican spotted owl in PACs, threshold, and target threshold habitats.	Achieve basal area requirements for Mexican spotted owl in PACs, threshold, and target threshold habitats.

Alternative B	Alternative C
Restore historic forest spatial patterns; forest canopy gaps and openings on 20–40 percent of each stand area (excluding MSO protected and restricted/threshold, and goshawk nesting areas). These canopy gaps and forest openings mimic historic spatial patterns and provide for regeneration of shade intolerant tree species, development of grass/forbs and shrubs, rooting zones for tree group development, and facilitate reintroduction and maintenance of frequent surface fire as an ecological process.	Will not restore historic forest spatial patterns; forest canopy gaps and openings as described for alternative B.
Maintain existing uneven-aged stands (currently represent 55 percent of the forested area), and progress toward a balance of VSS classes by creation of sufficient regeneration canopy gap openings.	Uneven-aged stands would move toward even-aged stand conditions, resulting in less than 55 percent of the area in an uneven-aged forest condition.
Convert existing even-aged stands (currently represent 45 percent of the forested area) to uneven-aged structure by creation of sufficient regeneration canopy gap openings.	Constraints limit creation of sufficient regeneration group openings to develop an uneven-aged structure. Even-aged forest stands would continue to represent 45 percent of the area.
Achieve target stand density, while providing for maintenance and development of a balance of VSS.	Constraints force a tradeoff between forest structure and density. Uneven-aged forest structure is reduced or lost to meet density objectives. Treated stands move toward even-aged structure.
Manage mixed conifer stands to favor/regenerate forest species composition commensurate with the desired conditions.	Constraints limit opportunities to manage for desired species composition (tree regeneration and overall stand species mix).
Achieve basal area requirements for Mexican spotted owl in PACs, threshold, and target threshold habitats.	Achieve basal area requirements for Mexican spotted owl in PACs, threshold, and target threshold habitats.
Achieve target stand density, while providing for maintenance and development of a balance of VSS.	Mature even-aged stands (VSS 4) would remain at about 15 percent of forested area. Constraints limit creation of sufficient regeneration group openings to initiate conversion of even-aged stands to all-aged structure
Fully address and manage forest health issues such as stand density, dwarf mistletoe, forest genetics, and favoring development/regeneration of southwestern white pine.	Partially address and manage forest health issues such as dwarf mistletoe, forest genetics, and favoring development/regeneration of southwestern white pine.

Vegetation Effects Details

Forest Health

Alternative A

Under this alternative, no forest vegetation treatment activities would occur. Stand densities would not be reduced. During the next 20 years, growth modeling simulation shows that stand densities would increase to levels ranging from an average of 46–62 percent of maximum stand density. These density levels are at the threshold or well within the zone of density-related mortality.

Bark beetle hazard is moderate over much of the analysis area, and would increase as stands become denser. Alternative A has the highest bark beetle hazard (Richardson et al., 2012) and would result in higher probable tree mortality than alternatives B or C.

Dwarf mistletoe in ponderosa pine and Douglas-fir would continue to intensify within the areas of current infections, and the size of the current infection centers would slowly spread over time. Dwarf mistletoe severely impacts regeneration, and infected sapling-sized trees seldom survive to develop to maturity. Over time (2–4 decades) this would severely limit sustainability of uneven-aged stands where current infection levels exceed 25 percent of host trees (40 percent of the analysis area). Trees with severe dwarf mistletoe infection levels exhibit low vigor overall, and these trees are more susceptible to bark beetle and density-induced mortality.

Alternative B

Alternative B moves the treated areas toward healthier forest conditions by restoring vigorous growth conditions and reducing losses due to tree mortality, high-severity wildfire, and insects and diseases. Alternative B would be most effective at increasing forest health and vigor, thereby improving forest resiliency and sustainability to stresses such as insects, disease, and climatic variability. Based upon all forest stands (treated and untreated), 80 percent of northern goshawk habitat forest types (by area) and 75 percent of MSO restricted habitat forest types (by area) are projected to meet desired maximum density conditions post treatment (Richardson et al., 2012).

In MSO protected habitat forest areas (where thinning is restricted to cutting trees up to a maximum 9 inches d.b.h.), a reduction of excess density in understory trees would occur, but overall forest canopy cover and continuity would remain unchanged. Beneficial effects to forest health and vigor would be minimal as a result of these treatments, but minor improvements in the ability to implement and control prescribed fire treatments would be realized.

This alternative is the most effective treatment for reducing bark beetle hazard. However, the differences with alternative C are slight on a stratum-level basis. Some individual stands would experience a large reduction in beetle hazard relative to alternative C, based upon the existing conditions and the local effects resultant from the alternative C constraints (Richardson et al., 2012).

Decreasing stand densities would release dominant[15] and codominant[16] trees allowing them to become more vigorous, more resistant to insect and diseases (McMillin 2004), and grow at a faster rate into larger tree size classes. After treatment, it is projected that approximately 72 percent of the analysis area would be in the low hazard category (Richardson et al., 2012). Therefore, 28 percent of the analysis area beetle hazard remains high, where stands would not receive treatments to reduce forest canopy density (no treatment, broadcast burning only treatment, or limited treatment—MSO protected and threshold habitats). In these areas, stand density would not be reduced enough to affect bark beetle hazard.

Alternative B would provide opportunities to manage dwarf mistletoe severity, incidence, and distribution in order to move toward desired endemic forest disease levels within the project area. Treatments would alternately focus on removal of infected trees in locations where new regeneration groups (VSS 1) would be established or favored, and where forest openings would be developed/restored (20–40 percent of the area). Elsewhere within the stands, treatment would

[15] Dominant – trees that receive full light from above the canopy and partially from the sides. Crowns extend above the general level of the canopy (USDA 1987).

[16] Codominant – Tree crowns receive full light from above, but comparatively little from the sides (USDA 1987).

focus on reduction of the percentage of severely infected trees. Severe dwarf mistletoe infection centers are typically circular in shape, but seldom exceed 4 acres in size within the project area.

Because the forest plan amendment allows for greater than a 200-foot-opening width, this alternative should allow for creation of replacement regeneration openings sufficient to manage dwarf mistletoe toward desired conditions. The restoration of canopy gaps and forest openings would greatly reduce continuity of mistletoe occurrence, spread, and mortality, such that the host-pathogen biological dynamics function similar to historic conditions.

Generally, the focus would be on managing dwarf mistletoe locations, severity, and spread potential such that it is present at endemic levels that do not jeopardize short- and long-term attainment of desired forest vigor, structure, and species composition. In mixed conifer stands, nonhost species would be favored over severely diseased trees, as local forest conditions permit. On forest lands managed for northern goshawk habitat, where diseased single trees greater than 24 inches d.b.h. exist, they would be removed to favor other trees or promote regeneration.

No trees greater than 24 inches d.b.h. would be removed on lands designated as MSO restricted or protected habitat.

Based upon forest plan amendment (see page 25), occasional VSS 6 groups would be treated where they are severely infected with dwarf mistletoe, in order to allow for forest development and growth and/or regeneration.

Alternative B also provides flexibility to manage for maintenance or improvement of forest genetics within the project area. In many locations within the project area historic high-grade cutting has resulted in mature seed trees with “poor formed” (stunted) characteristics, relative to the original genetic diversity that existed prior to cutting. These genetically-stunted trees typically do not develop into VSS 6 forest structural stages or large individual trees, even at advanced ages. Therefore, most of these trees remain small in size relative to age, and neither these trees nor their progeny develop desirable mature forest habitat characteristics. In some locations, it would be advantageous to remove these individual “poor formed” trees to favor seed trees with more desirable and “normal formed” traits. On a case-by-case basis, alternative B permits the favoring of seed trees with desirable growth traits over those remnant examples of the poorest formed individuals from the original forest stands.

Alternative B is more effective than alternatives A or C in providing forest resiliency to climatic variability and other environmental stressors. This alternative moves stands toward an uneven-aged condition which is more desired for forest health and improving resilience. Tree growth would increase through thinning and would sequester more carbon than other alternatives. This alternative provides opportunities for renewable products such as lumber and biomass energy.

Alternative C

Alternative C moves the treated areas toward healthier forest conditions by restoring more vigorous growth conditions, and reducing losses due to tree mortality, wildfires, insects, and diseases relative to alternative A.

Alternative C would be less effective than alternative B for increasing forest health and vigor, and forest resiliency to stresses such as insects, disease, and climatic variability. Stand densities would be reduced in all of the harvest units, but the ability to reduce densities to desired conditions

would be limited by the 16-inch-diameter cutting constraint, and some stands or areas would not achieve desired density objectives (Richardson et al., 2012). Based upon all forest stands (treated and untreated), 80 percent of northern goshawk habitat forest types (by area) and 75 percent of MSO restricted habitat forest types (by area) are projected to meet desired maximum density conditions post treatment (Richardson et al., 2012). Overall stratum-level differences in stand density are slight relative to alternative B.

However, the forest vegetation spatial patterns would be different under this alternative than under alternative B. The posttreatment tree distribution would be more uniform under alternative C, leading to more rapid canopy closure (5–15 years) of the forest as it develops post treatment. Research has shown that diameter constraints maintain more tree canopy and result in more rapid in-growth of the canopy following treatments (Abella et al., 2006). The constraints of this alternative reduce opportunities to restore historic forest spatial patterns (forest canopy gaps and openings on 20–40 percent of each stand area (excluding MSO protected and restricted/threshold, and goshawk nesting areas).

As with alternative B, in MSO protected habitat forest areas (where thinning is restricted to cutting trees up to a maximum 9 inches d.b.h.), a reduction of excess density in understory trees would occur, but overall forest canopy cover and continuity would remain unchanged. Beneficial effects to forest health and vigor would be minimal as a result of these treatments, but minor improvements in the ability to implement and control prescribed fire treatments would be realized.

Alternative C is slightly less effective at a small scale than alternative B for reducing bark beetle hazard. Overall hazard reduction is the same. After treatment, it is projected that approximately 72 percent of the analysis area would be in the low hazard category (Richardson et al., 2012). On 28 percent of the analysis area, beetle hazard remains high due to stands which would not receive treatments to reduce forest canopy density (no treatment or broadcast burning only treatment). In these areas, stand density would not be reduced enough to affect bark beetle hazard**.**

Dwarf mistletoe management treatments proposed under this alternative are the same as described for alternative B, with the added 16-inch diameter constraint and with retention of all VSS 6, regardless of their health. As a result of these constraints, alternative C is less effective than alternative B for management of dwarf mistletoe. Alternative C would provide some opportunities to manage dwarf mistletoe severity, incidence, and distribution, but management opportunities would be more limited than alternative B. Treatments would alternately focus on removal of infected trees (less than 16 inches d.b.h.) in locations where new regeneration canopy gaps (VSS 1–2) would be established or favored, and reduction of the percentage of severely infected trees (less than 16 inches d.b.h.) elsewhere within the stands.

These constraints greatly reduce the ability to create regeneration canopy gaps and forest openings (Richardson et al., 2012), thereby maintaining high continuity of mistletoe occurrence, spread, and effects in most currently infected stands. This continuity greatly limits opportunities to manage for characteristic dwarf mistletoe distribution patterns and effects, and would maintain current uncharacteristic conditions, albeit at a less severe level than alternative A. The focus would be on managing dwarf mistletoe locations, severity, and spread potential to the extent possible under the tree size cutting constraint. In many cases the constraint of this alternative would result in favoring diseased trees/species over noninfected trees/species in order to balance the tradeoff of stand density objectives over forest health objectives.

Mistletoe often increases in the understory trees when thinning occurs and dwarf mistletoe is not removed from the overstory trees. Thinning from below would leave mistletoe in the larger trees allowing them to infect regeneration which would establish after treatment. This alternative would limit the ability to manage for desired uneven-aged forest conditions, and over time (2–4 decades) would limit sustainability of uneven-aged stands where current infection levels exceed 25 percent of host trees (currently 40 percent of the analysis area). It would also severely limit the ability to convert existing diseased even-aged stands to uneven-aged stands. Trees with severe dwarf mistletoe infection levels exhibit low vigor overall, and these trees are more susceptible to bark beetle and density induced mortality.

Table 11. Habitat conditions, goshawk foraging post treatment and 20 years (stratum averages)

Measure	Alt. A	Alt. A +20	Alt. B	Alt. B +20	Alt. C	Alt. C +20
Basal Area	92	120	45	65	51	79
Beetle Hazard	Moderate	Moderate	Low	Low	Low	Low
SDI	196	249	77	111	87	168
Percent of Max SDI	44	55	17	25	19	37
Snags per Acre	0.8	1.5	0.8	1.4	0.8	1.5

Table 12. Habitat conditions, PFA/nest, post treatment and 20 years (stratum averages)

Measure	Alt. A	Alt. A +20	Alt. B	Alt. B +20	Alt. C	Alt. C +20
Basal Area	80	106	62	81	70	91
Beetle Hazard	Low	Moderate	Low	Moderate	Low	Moderate
SDI	158	207	109	136	122	152
Percent of Max SDI	35	46	24	30	27	34
Snags per Acre	0.7	1.3	0.7	1.1	0.7	1.2

Table 13. Habitat conditions, MSO mixed conifer post treatment and 20 years (stratum averages)

Measure	Alt. A	Alt. A +20	Alt. B	Alt. B +20	Alt. C	Alt. C +20
Basal Area	112	137	59	78	67	89
Beetle Hazard	Moderate	High	Low	Low	Low	Moderate
SDI	244	292	102	135	117	152
Percent of Max SDI	51	62	22	28	25	32
Snags per Acre	2.4	2.1	2.4	1.7	2.4	1.8

Table 14. Habitat conditions, MSO pine oak post treatment and 20 years (stratum averages)

Measure	Alt. A	Alt. A +20	Alt. B	Alt. B +20	Alt. C	Alt. C +20
Basal Area	100	127	57	84	64	90
Beetle Hazard	Moderate	High	Low	Moderate	Low	Moderate
SDI	214	269	100	158	113	164
Percent of Max SDI	47	60	22	35	25	36
Snags per Acre	1.3	1.9	1.3	1.8	1.3	2.0

Compared with alternative B, alternative C provides much less opportunity to manage for maintenance or improvement of forest genetics within the project area. In areas where group selection is utilized, selection for the removal groups may be difficult because of the 16-inch d.b.h. limit and the best trees may not always be chosen for retention as seed trees. This may even result in genetically inferior trees being retained (Uneven-aged Management: Opportunities, Constrainsts and Methodologies, 1995). Where phenotypically undesirable trees are greater than 16 inches d.b.h., these trees would remain to provide the regeneration seed source for the future.

Vegetative Structure

Alternative A

The primary forest vegetation management direction found in the forest plan (USDA 1987, as amended) is to develop or maintain sustainable uneven-aged forest structure. Under alternative A, no conifer regeneration treatments would occur. Even-aged stands would remain even-aged in structure, and no new age classes would be created and/or managed. Uneven-aged stand structures would not be maintained over time, due to lack of regeneration of new age classes. Restoration of sustainable forest mosaic patterns with canopy gaps and forest openings would not occur, and canopy continuity would remain high throughout the project area. Mixed conifer forest stands would continue to be dominated by shade-tolerant species, or would continue to convert to dominance of these species over time. No forest habitat or allocated old growth stands would be treated to improve health and vigor of the stand, or to manage forest structure toward desired conditions. Natural meadows and openings would not be maintained. Quaking aspen and Gambel oak patches would not be released or favored to develop. Opportunities to actively favor and regenerate southwestern white pine would not occur as systematically under this alternative.

Alternative B

Desired forest structure conditions are uneven-aged forests with a balance of structural stages (age classes), arranged in a clumped, open forest condition (excepting MSO protected and restricted-threshold habitats, and goshawk nest habitats).

A primary objective is the restoration of sustainable forest mosaic patterns with canopy gaps and forest openings totaling 20–40 percent of stand areas to facilitate uneven-aged forest stand dynamics and other ecological functions.

- One element of the proposed treatments is the initiation of conditions conducive to regenerate or develop VSS 1 and 2 classes (establish or release existing

seedlings/saplings), totaling approximately 20 percent of the open area. Opening size would range from between 0.25 and 4 acres in size with most averaging 0.33–0.75 acre. Details are found in the silviculture report (Richardson et al., 2012).

- The remainder of the openness created by treatment would be interspaces (up to another 20 percent) to provide for other ecological functions.

Under alternative B, existing even-aged stands would be managed to develop a new age class, and would become two-aged stands within 1 decade post treatment. Existing uneven-aged stand structures would be maintained as uneven-aged stands, and managed over time to develop a balance of age classes in a mosaic of tightly interspersed structural groups. Stands would be evaluated to determine excess or deficit vegetation structural stages, where VSS is roughly equivalent to age class. Groups/individual trees would be removed or favored to move toward the desired balance. Restoration of sustainable forest mosaic patterns would occur, and the resulting forest canopy would be discontinuous and clumped throughout much of the project area, based upon desired conditions.

As noted in the silviculture report, similar treatment strategies (Richardson et al., 2012) achieved the following objectives:

1. Regeneration group openings of sufficient size were established on sufficient areas to develop and maintain uneven-aged forest conditions;
2. Grouped tree spatial patterns were maintained and created;
3. Stand canopy continuity was broken (provide habitat diversity and greatly reduce crown fire potential); and
4. Progress toward a balance of VSS classes was promoted (balanced representation was maintained/promoted, but overall balanced VSS was not achievable during the initial treatment).

While each stand within the project area varies by forest structure and other conditions, it is expected that many of the same posttreatment outcomes can be achieved in existing uneven-aged stands through implementation of the like treatment prescriptions proposed for alternative B. Within the project area, many of the stands are existing even-aged forest structures. Application of the alternative B proposed selection cutting treatments would fully achieve results number 1, 2, and 3 above, and partially achieve result number 4 (a full representation/balance of VSS classes is not possible because the initial treatment would only begin the process of conversion from an even-aged to uneven-aged condition).

Mixed conifer forest stands would be managed to favor dominance by shade-intolerant species over much of the project area (except for MSO protected forest habitat and restricted habitat managed for threshold habitat values). Allocated old growth stands and other areas would be treated to improve health and vigor of the stand, and to manage forest structure toward desired conditions. Natural meadows and openings would be maintained by removing conifers which have encroached upon these areas, post-European settlement. Quaking aspen and Gambel oak patches would be released or favored to develop. Understory grasses, forbs, and shrubs would respond to these opened canopy conditions, and increase in abundance and vigor. Management would focus on favoring and regeneration of southwestern white pine in locations where it currently exists.

Some effects of these treatments would be increased tree growth and favoring of the dominant trees within groups. Groups or stands currently classified as VSS 3 would be classed as VSS 4 and 5 post treatment (resultant from favoring dominant trees for retention). Increasing the percentage of acres in the VSS 4 class allows for a greater number of residual trees for development into future VSS 5 and 6. These effects would occur in both the existing even and uneven-aged structured stands.

Enhanced vegetative ground cover would also improve forest soil nutrient cycling and stability (Dahms et al.,1997). Forest regeneration is expected to occur within 5 years of the broadcast burning treatment. Within 10 years these openings would become VSS 1 and 2 tree groups. Due to the moderately sized regeneration canopy gaps that would be created (average 0.33–0.75 acre), the site conditions would favor regeneration of shade intolerant species in ponderosa pine and mixed conifer stands. Broadcast burning is expected to reduce densities of the new regeneration but not eliminate it, due to the size of the canopy-free openings which would moderate fire effects.

Selected natural meadow locations would be maintained/restored to grassland or wet meadow by removal of all conifer trees (except VSS 6 tree groups and yellow pine individuals).

Alternative C

This alternative would not achieve the desired forest structure conditions, which should be uneven-aged forests with a balance of structural stages (age classes), arranged in a clumped, open forest condition (excepting MSO protected and restricted-threshold habitats, and goshawk nest habitats). This alternative would typically not achieve the objective of restoration of sustainable forest mosaic patterns with canopy gaps and forest openings. This alternative would limit regeneration or development of VSS 1 and 2 classes. It would typically not meet the target regeneration gap size for foraging areas. Canopy gaps smaller than 0.33 acre would not effectively facilitate regeneration and future development of tree groups of sufficient size necessary to produce and sustain desired wildlife habitat conditions.

Treatments on much of the project area would likely not achieve these objectives, because it is often difficult to create and place sufficiently sized openings when silvicultural prescriptions are constrained by a tree size limit (Abella et al., 2006). It is very likely that alternative C would result in much fewer canopy gaps/openings of sufficient size to achieve objectives than alternative B on 70 percent of the project area (55 percent uneven-aged forest, 15 percent mature even-aged forest, goshawk + MSO restricted other habitats). Initial treatment objectives would likely be achieved on the remaining 30 percent of the area (immature even-aged stands).

Failure to achieve regeneration/development openings over 20 percent of the area results in the inability to implement the uneven-aged management strategy required by forest plan direction. Sustainability of uneven-aged forest characteristics cannot be achieved without effective creation of proportional regeneration areas. Over time, these conditions would result in domination of the site by the overstory trees, effectively creating or maintaining a functional even-aged, closed forest condition. Additionally, failure to develop and restore forest openings would limit attainment of other ecological objectives, such as improving biological diversity and reinitiation of frequent surface fire.

Relevant examples were examined to determine expected outcome effects of alternative C. (Richardson et al., 2012). These areas were selected as representative of forest stands and

probable treatment. Pretreatment and posttreatment aerial photography was analyzed to calculate the canopy openings created under the constraints of this treatment. This analysis shows that regeneration/release openings (greater than 0.33 acre) were created on between 1 and 8 percent of the treated area. None of the openings created were greater than 0.33 acre in size. (Richardson et al., 2012).

Creation of regeneration group openings over 20 percent of the area was not achievable on either example treatment area, due to the constraints of the maximum tree size cutting limitation. Neither the regeneration canopy gap objectives, nor the other forest opening objectives were achieved (desired objective is 20–40 percent in openings overall).

This alternative would result in the greatest increase in the VSS 5 class but moves stands toward even-aged stand conditions because so many small and mid-sized trees would be removed in order to lower the tree density to meet some fuels reduction objectives. Because a 16-inch d.b.h. limit would result in retention of the larger trees, more small trees would need to be removed to meet desired residual density levels, and those that remain would need to compete for resources with these larger trees.

A deficit of small trees (VSS 1 and 2) would occur due to the intensive thinning of small tree structural stages necessary in order to meet stand density objectives rather than achieve forest structure objectives. Results were reviewed from actual projects implemented with similar prescriptions in similar stands. These results indicate that when the diameter limit was implemented, achieving structure objectives was difficult (Richardson et al., 2012).

The deficit in small trees created by this treatment would be further exacerbated by the lack of opportunities to create regeneration development canopy gaps, as previously discussed. Also, remaining VSS 1 and 2 size/age classes would stagnate and would not develop over time, because of the shading effects of uniform forest overstory without gaps. This creates a functional even-aged stand, despite the limited presence of some age class diversity.

Alternative C would limit opportunities to manage for desirable species composition in the mixed conifer forest type. In many cases, the 16-inch diameter constraint would require that less desirable shade-tolerant species be retained in place of highly desirable species such as southwestern white pine in order to balance the tradeoff of stand density objectives over species composition objectives.

Creation of openings for aspen and oak regeneration would be more limited or not occur due to the project constraints. Therefore, these species would continue to decline in abundance and vigor. The stands that are being treated for meadow enhancement would have a decrease in tree cover but less so than alternative B. Regeneration is expected to occur within 5 years of the broadcast burning treatment, but since the openings are smaller (average less than 0.33 acre) than under alternative B, regeneration of shade-intolerant species in ponderosa pine and mixed conifer stands would be less vigorous and limited in distribution. In mixed conifer stands, regeneration would be dominated by shade-tolerant species such as white fir. Broadcast burning is expected to greatly reduce densities of the new regeneration and where regeneration openings are small, may eliminate it.

Selected natural meadow locations would be partially maintained or restored to grassland or wet meadow by removal of all conifer trees less than 16 inches d.b.h.

Alternative C is less effective than alternative B in providing forest resiliency to climatic variability and other environmental stressors, but greater than alternative A. This alternative limits management of stands toward uneven-aged conditions (on much of the area), thereby limiting improvement of forest health and tree resilience. Tree growth would increase through thinning and would sequester slightly more carbon than alternatives A and B. This alternative provides opportunities for renewable products such as lumber and biomass energy.

Habitat Comparison

A comparative analysis of the alternatives for MSO habitat is found in tables 15 and 16. Based upon FVS modeling, both alternatives B and C meet forest plan direction for forest structure in MSO forest habitat (mixed conifer and pine-oak forest types) immediately post treatment. Immediate posttreatment shifts in VSS classes represent statistical average shifts in tree size, due to low thinning within tree groups. In 20 years (Plus 20), both alternatives depart from the desired condition.

Table 15. Percent of total SDI by size class for MSO restricted mixed conifer habitat

d.b.h. Class	Desired Condition	Alt. A	Alt. A +20	Alt. B	Alt. B +20	Alt. C	Alt. C +20
12–18"	10%+	31%	31%	33%	33%	37%	37
18–24"	10%+	12%	15%	14%	19%	16%	22
24"+	10%+	8%	9%	10%	12%	11%	14

Table 16. Percent of total SDI by size class for MSO restricted pine-oak habitat

d.b.h. Class	Desired Condition	Alt. A	Alt. A +20	Alt. B	Alt. B +20	Alt. C	Alt. C +20
12–18"	15%+	34%	35%	32%	30%	36%	33
18–24"	15%+	14%	17%	15%	20%	17%	23
24"+	15%+	10%	9%	10%	12%	12%	14

As noted previously for goshawk habitat, in most uneven-aged and mid-even-aged stands it would be difficult to create openings with a 16-inch-diameter limit constraint. Estimates were made for alternative C that openings would be created for 10 percent of the area. Based upon analysis of projects with the same treatment prescription; suitable regeneration openings ranged from less than 1 percent to 8 percent of the area.

Ten percent of VSS 1 and 2 represents canopy gaps created to regenerate and favor existing seedlings (VSS 1 - 10 percent); and to favor existing saplings (VSS 2 - 10 percent) where release[17] is feasible. Existing saplings are not accounted in distribution because inventory plot classification is based on overstory trees.

[17] Removing shade "releases" the understory for growth when these understory trees are in a condition to take advantage of this change.

Table 17. Goshawk foraging even-aged percent post treatment and plus 20 years

VSS Class	Alt. A	Alt. A +20	Alt. B	Alt. B +20	Alt. C	Alt. C +20
VSS 1	0	1	10	7	5	3
VSS 2	0	0	10	13	5	7
VSS 3	72	31	54	6	61	7
VSS 4	28	65	26	59	29	67
VSS 5	0	3	0	14	0	16
VSS 6	0	0	0	0	0	0

Table 18. Goshawk foraging uneven-aged percent post treatment and plus 20 years

VSS Class	Alt. A	Alt. A +20	Alt. B	Alt. B +20	Alt. C	Alt. C +20
VSS 1	4	9	10	7	5	3
VSS 2	0	0	13	16	9	11
VSS 3	51	40	41	3	46	4
VSS 4	30	30	24	18	26	21
VSS 5	15	17	12	35	14	44
VSS 6	0	4	0	21	0	17

Table 19. Goshawk PFA stand comparison post treatment and plus 20 years

VSS Class	Alt. A	Alt. A +20	Alt. B	Alt. B +20	Alt. C	Alt. C +20
VSS 1	0	0	10	7	5	3
VSS 2	0	0	10	13	5	7
VSS 3	0	0	0	0	0	0
VSS 4	80	80	60	60	70	60
VSS 5	20	20	20	40	20	40
VSS 6	0	0	0	0	0	0

Large Tree Retention

Tables 20 and 21 display the approximate number of existing trees per acre greater than or equal to 16 inches d.b.h., and the total number of residual trees following implementation of alternative B.

Alternative A

All trees larger than 16 inches d.b.h. would be retained. See table 20 for a display of existing trees greater than 16 inches d.b.h.. Stand density would continue to increase reducing the growth and health of the larger trees. All trees would grow at a slower rate over time than alternatives B and C due to increased stand densities as shown in tables 20 and 21.

Alternative B

Alternative B proposes retaining approximately 89 percent of the trees 16 inches d.b.h. and greater. Removal of a portion of trees 16 inches d.b.h. and larger moves the treated stands toward

the desired conditions for VSS 1 and 2 over 20 percent of the treatment area, improves the health and growth of the remaining large trees, and decreases fire hazard by creating canopy gaps and forest openings. Moving toward the desired conditions would result in the removal of approximately 11 percent of trees 16 inches d.b.h. and larger. Selection for the removal groups would retain the most vigorous and genetically superior trees as seed trees, allowing unhealthy and genetically inferior trees to be removed to manage for desired stand density, mistletoe infection, and forest spatial arrangement. The remaining trees 16 inches d.b.h. and larger would be the more resilient, therefore, in-growth of smaller trees into the larger size classes would occur rapidly. Tables 20 and 21 display the approximate number of existing trees per acre and the total number of residual trees following treatment. Untreated stands would be the same as alternative A.

Alternative C

This alternative would limit cutting to trees less than 16 inches d.b.h., therefore, the posttreatment distribution of large trees would remain the same as the existing condition (tables 20 and 21).

Table 20. Residual trees per acre (TPA) ≥16" d.b.h. for treatment stands only for alternative B following treatment (2011)

Strata	Treatment Acres	Existing TPA ≥16" d.b.h. Alts. A & C	TPA Harvested ≥16" d.b.h. Alt. B	Residual TPA ≥16" d.b.h. Alt. B
Nothern goshawk Forage, Even-aged	9,512	7.2	0.7	6.4
Nothern goshawk Forage, Uneven-aged	6,703	17.3	1.9	15.4
Nothern goshawk PFA/Nest	619	14.0	1.4	12.6
MSO Mixed Conifer	4,868	14.5	1.7	12.8
MSO Pine-oak	1,415	14.3	1.4	12.9

TPA = trees per acre

Table 21. Total number of residual and harvested trees for alternative B (total treated areas) in 2011

Strata	Total Existing Trees ≥16" d.b.h. Alts. A & C	Total Trees Harvested > 16" d.b.h. Alt. B	Total Residual Trees >16" d.b.h. Alt. B	Percent Harvested ≥16" d.b.h. Alt. B
Nothern goshawk Forage, Even-aged	68,106	6,849	61,257	10
Nothern goshawk Forage, Uneven-aged	115,895	13,004	102,891	11
Nothern goshawk PFA/Nest	8,678	867	7,812	10
MSO Mixed Conifer	70,391	8,227	62,164	12
MSO Pine/oak	20,249	2,023	18,225	10
Total	287,095	31,366	255,730	11

Old Growth

Alternative A

This alternative would not meet the forest plan percentages for allocated old growth within the project area as no additional stands would be allocated for old growth management (table 22). Stands previously allocated for old growth management which were severely burned by the Rodeo-Chediski Fire and stands identified under past timber sale decisions would continue to be managed as allocated old growth even though a portion of them lack a large tree component, and tree size development would be limited by existing high stand density. Stands would not receive thinning or burning to reduce the fire hazard or improve health and individual tree growth. Stand density would continue to increase reducing the growth and health of the larger trees. Stands with potential to develop toward quality old growth characteristics may or may not achieve these objectives without receiving restorative management treatments.

Alternatives B and C

Alternative B would meet the forest plan percentages for old growth allocation within the project area, and would move the total district acres toward meeting the percentages for mixed species and for ponderosa pine as shown in table 22. This alternative proposes allocating 9,394 acres with an existing large tree component and thinning to improve forest health, increase tree size growth, and reduce fire hazard. Stands proposed for thinning would develop toward old growth characteristics described in the forest plan over time (Richardson et al., 2012). Stands identified as MSO protected habitat, target threshold, threshold, and goshawk habitat on slopes 40 percent and greater, were allocated for old growth development within the project area. Alternative C would allocate the same amount of area for old growth management as alternative B.

Table 22 displays a comparative summary of the alternatives relative to existing and proposed old growth forest structure allocation.

Table 22. Allocated old growth displayed by alternative for the project area and district

Old Growth Forest Cover Type	Total Acres	Alt. A Old Growth Allocated Acres	Alt. A Old Growth Percent Allocated	Alt. B & C Proposed Acres Allocated for Old Growth	Alt. B & C Percent Allocated	Percent Desired Allocation
Mixed species	3,842	329	8.5	1,667	43	>20
Ponderosa pine	29,114	1,948	6.7	7,727	26.5	>20
Old Growth Forest Cover Type	**Black Mesa District Total Acres**	**Alt. A District Old Growth Allocated Acres**	**Alt. A District Old Growth Percent Allocated**	**Alt. B & C District Proposed Acres**	**Alt. B & C District Percent Allocated**	**Desired Allocation per Cover Type**
Mixed species	18,161	2,774	15	6,287	35	>20
Ponderosa pine	304,961	32,167	11	37,946	12	>20

Forest Understory Vegetation

Alternative A

Understory grasses, forbs, and shrubs would continue to decline in abundance and vigor. Important wildlife browse plants such as fire dependent *Ceanothus* species may become rare or absent within the project area as time progresses. Forest density would continue to increase, and the few existing canopy gaps would continue to close, resulting in a continued decline of herbaceous understory productivity (Clary 1975). Exotic species are not expected to increase.

Alternative B

Alternative B would have the highest herbaceous/shrub understory response and greatest understory plant diversity. Native grasses, forbs, and shrubs would improve in number and vigor with reduced forest canopy in stands which fall below 35 percent maximum SDI. Openings in the canopy would produce approximately 800–1,000 pounds of forage on approximately 20–40 percent of the mechanically treated area. In the remaining 60–80 percent of the treated areas, forage may range from 200 to 400 pounds per acre (Clary 1975). Production in the thinned forest areas would peak approximately 6 years after treatment (Clary 1975) but production in the forest gaps would be longer in duration, and far higher than alternative C due to the larger number of openings and gaps in the canopy. Exotic species are expected to increase slightly over alternatives A and C (Abella and Covington 2004), but not significantly due to the weed mitigation measures employed during project implementation (e.g., equipment washing, etc.). Shrub response would be more variable than herbaceous vegetation and depends upon the ecological site location. Some biophysical sites would support very little shrubs before and after treatment, while other ecological sites would respond with vigorous shrub development following treatments, particularly within openings. Some fire-dependent shrubs such as *Ceanothus* species would respond vigorously post burning.

Alternative C

Alternative C would result in less understory plant diversity than alternative B but greater than alternative A, due to limited creation of canopy gaps and forest openings. This alternative leaves more trees in the upper canopy, resulting in a slightly lower production of herbaceous and shrub understory than alternative B (Abella 2006). Openings in the canopy would produce approximately 800–1,000 pounds of forage on approximately 10 percent of the mechanically treated ground. In the remaining 90 percent of the treated area, forage may range from 200 to 400 pounds per acre (Clary 1975). Production would peak approximately 6 years after treatment (Clary 1975). Understory production would be of short duration as the canopy would close in within 10–15 years. Exotic species are expected to respond the same as alternative B (Abella and Covington 2004). Shrub response would be similar to alternative B within the forest matrix but less than alternative B overall, due to fewer openings and canopy gaps.

Treatment Longevity

Alternative A

No change.

Alternative B

Based upon proposed irregular spacing and creation of regeneration group openings, the mosaic patterns and open, uneven-aged forest character would persist for 30+ years following the initial treatment. The VSS 3 tree groups would develop interlocking crowns and closed forest canopy within the first 1 to 2 decades following treatment (based upon residual density ranges and average growth rates, Ronco et al., 1985), and the VSS 4, 5, and 6 tree groups would remain closed canopy following treatment (based on treatment objectives). However, the VSS 1–2 regeneration would not fully occupy the created canopy gaps or develop to a height approaching two-thirds of the general forest canopy until tree age 40–60 years, maintaining the canopy gaps during this period. Also the forest openings would be maintained for a like period (indefinitely if low-severity fire occurs at frequent intervals). Therefore, the desired forest structure biological diversity and crown fire hazard reduction effects would be evident for at least 30 years following the proposed treatment.

Current treatment costs on the Apache-Sitgreaves NFs range from $250 to $800 per acre to accomplish similar forest vegetation management objectives. The overall average current costs for similar treatments on this forest are approximately $400 per acre. Assuming that treatment benefits (increased biological diversity, reduced crown fire potential) would be derived from this alternative for approximately 30 plus years, the cost over time is approximately $13 or less per acre per year.

Alternative C

Due to the small size of created openings and the current spacing of trees greater than 16 inches d.b.h. most treated areas within the project area would quickly develop interlocking or nearly interlocking crowns within a relatively short timespan following this treatment (less than10 years), based on resulting density and average growth rates (Ronco et al., 1985). Continuous interlocking crown conditions inhibit regeneration, growth, and vigor, reduce biological diversity, and greatly increase crown fire potential. Additional treatments would need to be considered within 10 years to reduce fire hazard as a result of the interlocking canopy of trees. These treatments would need to include the removal of trees 16 inches d.b.h. and larger which contribute to the interlocking canopy.

Current treatment costs on the Apache-Sitgreaves National Forests range from $250 to $800 per acre to accomplish similar forest vegetation management objectives. The average current costs for similar treatments on this forest are approximately $400 per acre. Assuming that treatment benefits (reduced crown fire potential) would be derived from this alternative for approximately 10 years, the cost over time is approximately $40 per acre per year (nearly 4 times that of alternative B).

Climate Change

All background information on climate change is from Malmsheimer et al. (2008) unless otherwise noted. Climate shapes our forests and forests shape our climate. The Rim Lakes Forest Restoration Project is proposed on a local scale and is not intended to have cumulative effects that are measurable on a global scale in regards to climate change; however, management of the project has a small-scale effect on mitigating climate change when combined with other management actions regionally. Ninety-eight percent of the project area is currently considered overstocked and at risk for stand-replacing fires which are the greatest cause of carbon release or

greenhouse gases (GHG). Both alternatives B and C reduce the fire hazard within the project area associated with stand-replacing fires.

None of the alternatives affect climate change to any measurable level. Alternative A has the highest potential to release carbon in a relatively large quantity over a short period of time, due to increased risk of stand-replacing wildfire occurrence. Resistance to bark beetle mortality would continue to decline. Carbon would still continue to be stored but at a slower rate than alternatives B and C. Alternative B is more effective than alternatives A and C in providing forest resiliency to climate change and other environmental stressors. Alternative B moves stands toward an uneven-aged stand condition which is more desired for forest health and improving resilience. Tree growth would increase through thinning and would sequester more carbon than other alternatives. Alternative B alternative provides opportunities for renewable products such as lumber and biomass energy.

Alternative C is less effective than alternative B in providing forest resiliency to climate change and other environmental stressors, but greater than alternative A. This alternative does not move stands toward an uneven-aged stand condition that can be sustained which is more desired for forest health and improving tree resilience. Tree growth would increase through thinning and would sequester slightly more carbon than alternatives A and B. This alternative provides opportunities for renewable products such as lumber and biomass energy.

Cumulative Effects for Vegetation

Past, present (ongoing), and reasonably foreseeable future activities evaluated in more detail within the Rim Lakes Project areas are displayed in the silviculture report, appendix A (Richardson 2011). See also the cumulative effects discussion at the beginning of the "Vegetation" section. The project boundary is the boundary for cumulative effects for this project.

Past Actions

The past activities that have influenced vegetation described in the "Affected Environment" section are described on table 8. Activities include timber sales, precommercial thinning, salvage sales, and broadcast burning occurring within the boundary of the Rim Lakes Project area and were used in the vegetation cumulative effects. Existing stand densities display the cumulative effects of past vegetation modifying treatments as well as wildfires (even though wildfires are not actions in the NEPA sense, they did have a major effect on the current condition of the area and are accounted for in the existing condition). Past activities and wildfires that modified vegetation contributed to that VSS distribution and stand density percentages.

Ongoing Present Actions

There are no other ongoing vegetation management actions in the project area other than highway and power line maintenance. Any tree removal is limited to imminent hazards from dead, dying, and defective trees (such as in campgrounds or along roads), but amounts are not large enough to change the overall structure and composition of the area impacted so there are no measureable cumulative effects. The Long Tom Allotment accounts for approximately 34 percent of the project area. It is grazed by sheep for approximately 6 months of the year. Sheep grazing is monitored for utilization and pastures rested and rotated for recovery. The Limestone Allotment accounts for approximately 3 percent of the project area but has not been grazed by cattle for the past 15 years, and grazing is not anticipated within near future. Since this project has no direct/indirect effects to

grazing, grazing was considered and determined to have no cumulative effect on forest health and structure.

Future Actions

Other ongoing and potential future actions within the project area include further removal of trees for power line maintenance within the corridors. Forest Road 300 has been scheduled for upgrade to a state highway, which would result in some tree removal during construction, currently expected in 2014.

The effects of alternative A, B, or C when combined with foreseeable treatments would not provide measurable cumulative effects. The mastication of trees within the power line corridor is very limited in size (less than .06 percent of the analysis area) and the power lines are continually maintained as openings by both the Salt River Project and Arizona Public Service. Removal of trees along Forest Road 300 for upgrade to a state highway is not considered to have measurable cumulative effects.

The 4-Forest Restoration Initiative (4-FRI) is developing a proposed action for a large-scale restoration project on the Coconino and Kaibab National Forests. Implementation of forest restoration activities including thinning of trees and prescribed fire treatments within 724,000 acres on the Kaibab and Coconino National Forests would not overlap with the Apache-Sitgreaves, so there are no cumulative effects in terms of vegetation.

Effects of the Forest Plan Amendments

As described in this section, the amendment proposed as part of alternative B would have beneficial effects to the long-term condition of the vegetation in the project area.

Effects of alternative C, which allows for the even-aged emphasis, are also described in this section. In summary, this amendment would result in a less resilient forest that is more prone to insect and disease as well as uncharacteristic fire. Stands would be less open, providing less herbaceous ground cover for a shorter period of time. Benefits to vegetation of thinning in alternative C would be shorter lived.

Fuels and Fire Potential

This section presents a summary of key effects and conclusions from the fuels specialists report (Nicolet, 2011) which is located in the project record.

The Rim Lakes Forest Restoration Project area is located at the top of the Mogollon Rim in central Arizona. The Mogollon Rim in general is highly susceptible to lightning and fire. Fire detection data indicate that during the months of June and July (highest risk for severe fire weather) the Rim Lakes area has averaged 23 fires a year with 45 percent of those from lightning and the remaining from human causes over the past 40 years (FIRESTAT[18]). This would indicate that fire is a prominent disturbance agent and would have influence on this ecosystem in the future.

[18] The Fire Statistics System (FIRESTAT) is a U.S. Department of Agriculture (USDA), Forest Service (FS) application used to electronically enter, update, and delete required information on the individual fire report (form FS-5100-29).

The Mogollon Rim has experienced many fires over the past several decades including several that burned with high severity and caused significant change and damage to the rim ecosystem. Two notable examples are: the Dude Fire of June 1990, which burned 24,000 acres west of the Rim Lakes area, and the Rodeo-Chediski Fire of 2002, which burned 460,000 acres to the east of the Rim Lakes Project area. The fire history along, below, and above the Mogollon Rim has created an island of forested vegetation that begins below the Mogollon Rim (south) and continues through and to the north of the Rim Lakes area. It is expected that the Rim Lakes area would burn with similar high severity as its surroundings if no management treatments occur in the area.

Overall Analysis Summary

As described in the fuels specialist report (Nicolet, 2011), criteria used for this analysis include forest characteristics that contribute to uncharacteristically severe wildfire effects, such as area that has high potential for active or passive crown fire, crown bulk density, surface fuel loading, and fire regime condition class (FRCC). The rating is shown in table 23 with the highest number meeting desired conditions better than a low number. The fuels specialist report explains in detail the ranking system.

As shown, both action alternatives rank higher than no action, especially in how they change potential for passive crown fire across the project area, how they reduce crown bulk density, and how they change the FRCC. Alternative B is ranked higher than alternative C in how it reduces passive crown fire potential and changes the FRCC for a longer period.

Table 23. Alternative scores based on scoring logic (The highest score would meet more of the desired conditions and purpose and need.)

Rating Criteria		Alt. A - No Action	Alt. B - Uneven	Alt. C - 16" Limited
Active Crown Fire (percent)		77	83	82
Passive Crown Fire (percent)		56	84	70
Crown Bulk Density	PIPO (<.05k/.m3)	20	40	40
	PIPO-Oak (<.05kg/m3)	40	40	40
	Dry Mixed Conifer (<.08kg/m3)	0	40	40
Surface Fuel Loading	PIPO – Oak (5–10 tons/acre)	0	40	40
	PIPO (7–14 tons/acre)	20	40	40
	Dry Mixed Conifer (8–16 tons/acre)	40	40	40
FRCC 1 Year Post Treatment (percent)		0	70.5	42
FRCC 20 Years Post Treatment (percent)		0	67.5	27
Rating Score		253	545	461

Analysis Details

Crown Fire Potential

Canopy fuel distribution and the risk of stand replacing crown fire can be measured by looking at average canopy bulk density (CBD) and canopy base height (CBH) across a stand. Canopy bulk density is defined as the mass of available canopy fuel per unit volume (Scott and Reinhardt

2001). For any given tree species, widely-spaced trees have a lower CBD which makes it more difficult to sustain a stand replacing crown fire. Tightly spaced trees with interlocking crowns would have higher CBD and, therefore, would have more potential to sustain and propagate a stand-replacing fire. Furthermore, stands with high CBD can also sustain a crown fire that initiated outside of the stand and become independent of surface fire intensity. Canopy base height is the lowest height above the ground at which there is sufficient amount of canopy fuel to propagate fire vertically into the canopy (Scott and Reinhardt 2001). The lower the canopy base height, the easier it is for a given surface fire to initiate a crown fire (Van Wagner 1977). Canopy base height coupled with canopy bulk density allow managers to understand how likely a crown fire is to initiate and sustain itself across a stand.

The existing conditions in the Rim Lakes area are canopy bulk densities ranging from $0.03kg.m^3$ to $0.1kg/m^3$ and canopy base height lower than 10 feet in most areas. In ponderosa pine forest types, desired conditions would be to have canopy bulk densities below $0.05kg/m^3$ and average stand canopy base heights above 18 feet. In dry mixed conifer types, desired conditions would be to have crown bulk density of $.08kg/m^3$ and canopy base height above 10 feet. Because these measures are stand averages, groups of trees could have higher densities if surrounded by areas of lower densities, which would break up the continuity of canopy fuels and, therefore, the potential for crown fire.

The desired condition for crown bulk density and canopy base height would reduce the percent of the Rim Lakes landscape with potential to burn as passive and active crown fire. Passive crown fire refers to fire that does not carry continuously through the crown fuels, but burns crown fuels intermittently, such as when individual trees or groups of trees torch. Active crown fire carries continuously through the canopy of trees. Current conditions show 23 percent of the area having the potential to burn as an active crown fire and another 44 percent of the area with potential for passive crown fire. The desired conditions for forest structure and canopy openings would also allow for discontinuous canopy fuels.

Effects of Alternatives on Crown Fire Potential

The effect of canopy openings and distribution of tree groups and clumps on potential fire behavior can be seen by looking at maps of potential fire type for the area. Figures 8, 9, and 10, and tables 24 and 25 display the changes in fire behavior type and distribution by alternative.

Alternative A represents current conditions for this landscape. Alternative A demonstrates much of the north and central portions of the Rim Lakes area exhibiting active crown fire and passive crown fire (23 percent active, 44 percent passive). Alternative B shows a marked reduction in passive crown fire (16 percent), which would indicate much less resistance to control and less spotting potential. It can also be seen that areas with active crown fire are interspersed with surface fire. Alternative C also exhibits a reduction in active crown fire (18 percent). There is a reduction in passive crown fire (30 percent), but it is not as big of a reduction as alternative B.

Table 24. Percent of the Rim Lakes area demonstrating potential for types of fire by alternative

Potential Fire Type	Alt. A	Alt. B	Alt. C
No Fire	1	1	1
Surface Fire	32	66	51
Passive Crown Fire	44	16	30
Active Crown Fire	23	17	18

Both action alternatives move the Rim Lakes area toward desired conditions. Alternative A, the no action alternative, maintains and regresses the ecosystem toward unsustainable characteristics. Canopies would continue to close and provide continuous fuel across the landscape. This can be concluded when comparing the amount of passive and active crown fire potential in alternative A compared to alternatives B and C (table 25). Alternative A would maintain 67 percent of the area with potential for high severity fire effects, while alternatives B and C reduce this potential to 33 percent and 48 percent respectively. This canopy fuel accumulation has negative effects on understory vegetation and would continue to suppress the production of forbs, grasses, and shrubs. Over time it can be expected that most forests would have little to no understory without sunlight penetrating the canopy.

Table 25. Percent of different habitat type area and old growth with fire type potential by alternative

Habitat Type	Potential Fire Type	Alt. A	Alt. B	Alt. C
Goshawk PFA/Nest	Surface Fire	50	72	61
	Passive Crown Fire	36	18	28
	Active Crown Fire	14	10	11
Goshawk Foraging	Surface Fire	35	65	50
	Passive Crown Fire	39	15	29
	Active Crown Fire	26	20	21
MSO Protected	Surface Fire	25	66	66
	Passive Crown Fire	60	27	27
	Active Crown Fire	15	7	7
MSO Restricted	Surface Fire	26	73	50
	Passive Crown Fire	54	16	35
	Active Crown Fire	20	14	15
MSO Threshold/Target Threshold	Surface Fire	28	87	72
	Passive Crown Fire	63	8	23
	Active Crown Fire	9	5	5

Alternatives B and C would increase surface fine fuels in the form of understory vegetation. Much of the species diversity in ponderosa pine forests is contained in understory vegetation (Moore et al., 1999). Understory vegetation can be greater than 10 times higher in restored openings than under a sparse but continuous ponderosa pine cover (Clary 1975). This understory

vegetation is important in supporting fire spread similar to that under which Southwestern forests have evolved. This carrier of fire is needed in order to maintain forests over time with fire. Surface vegetation would also affect fire behavior. More surface fuels would increase surface fire rates of spread. Reducing stand density can increase surface fire behavior.

Modifying canopy fuels as prescribed in this method may lead to increased surface fire intensity and spread rate under the same environmental conditions, even if surface fuels are the same before and after canopy treatment. Reducing crown bulk density to preclude crown fire leads to increases in the wind adjustment factor (the proportion of a 20-foot windspeed that reaches mid-flame height). Also, a more open canopy may lead to lower fine dead fuel moisture content. These factors increase surface fire intensity and spread rate. Therefore, canopy fuel treatments reduce the potential for crown fire at the expense of slightly increased surface fire spread rate and intensity. However, critical levels of fire behavior (limit of manual or mechanical control) are less likely to be reached in stands treated to withstand crown fires, as all crown fires are uncontrollable. Though surface intensity may be increased after treatment, a fire that remains on the surface beneath a timber stand is generally controllable (Scott 2003).

When comparing the two action alternatives, a major difference becomes the ability to cut any size tree versus being limited to only cutting trees less than 16 inches in diameter. Several factors are important to consider when looking at management of the Rim Lakes area with and without diameter cutting limits.

The following are just a few forest ecosystem components of importance in the analysis for Rim Lakes: canopy openings, understory vegetation, and fire behavior. In general, canopy openings were greatly reduced during the 1900s by postsettlement trees (Moore and Huffman 2004). Canopy openings provide for wildlife habitat, understory diversity (Kerns et al., 2003, Moore et al., 1999), and discontinuous canopy fuels, which in turn affect fire behavior. In this sense, all three of these ecosystem components are interconnected.

The ability to create canopy opening becomes very important to restoring the function and resiliency of the ecosystem. Having a 16-inch diameter constraint limits capabilities to create these gaps.

In looking at the FlamMap[19] analysis results, the major difference between alternatives B and C is the amount of passive crown fire. Alternative C exhibits more areas with potential passive crown fire due to the inability to affect canopy fuels without removing some trees larger than the 16-inch diameter limit. This would in turn affect how the area can be managed when faced with naturally occurring wildfires. Fires that exhibit torching (passive crown fire) are more likely to produce lofted embers to start more fires, and generally burn hotter than a fire burning only surface fuels. These types of fire would cause higher severity and more ecosystem damage.

[19] FlamMap is a fire behavior mapping and analysis program that computes potential fire behavior characteristics over an entire landscape for given weather and fuel moisture conditions (see fuels report, appendix A, for more information).

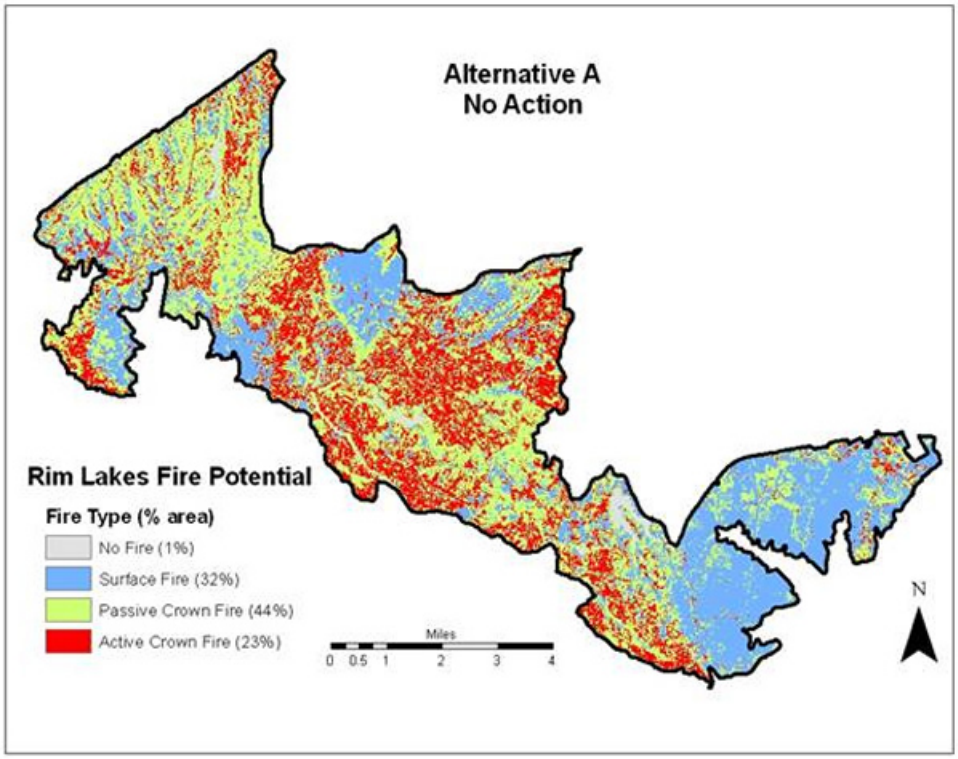

Figure 8. Map of fire potential alternative A

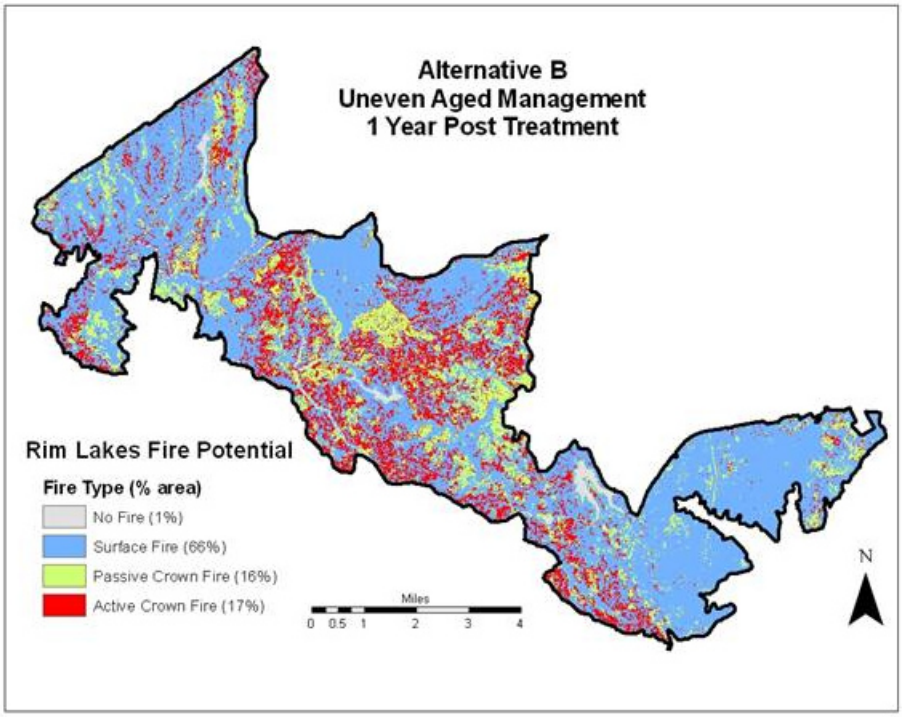

Figure 9. Map of fire potential alternative B

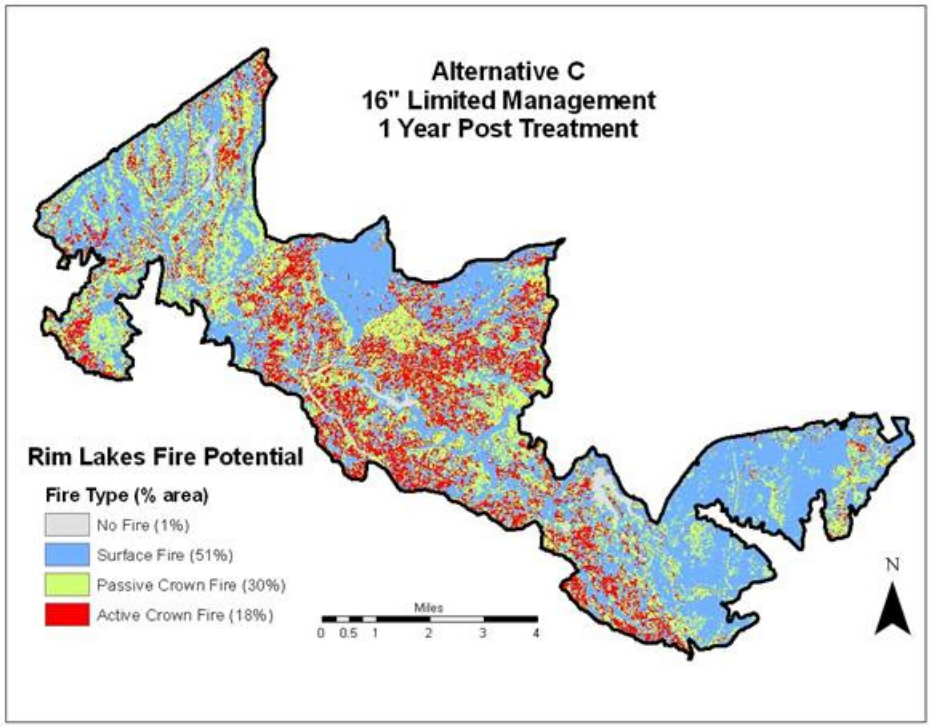

Figure 10. Map of fire potential for alternative C

In conclusion, the Rim Lakes area would benefit from both action alternatives from a potential fire severity perspective. The overall ecosystem health in the form of restoring the vegetation types to resilient and historic conditions would also benefit from both action alternatives although alternative B provides the most opportunity to meet desired conditions.

This analysis used the Fire and Fuels Extension (FFE) to the Forest Vegetation Simulator (FVS) links models of fire behavior, fire effects, fuels loading and snag dynamics to tree growth metric. In this analysis, basic outputs for surface fuel loading, crown base height, and crown bulk density were recorded using default parameters from the Central Rockies variant to FVS. Data used in FVS and FFE were from field sampled stand exams conducted in the Rim Lakes area.

All results from FFE are stand averages and, therefore, can give a general idea of what stand conditions look like but cannot address the spatial distribution of specific metrics. The desired conditions are for stand averages and, therefore, allow for some areas within a stand to be outside of the desired condition range but be surrounded with conditions closer to overall desired conditions. For example, crown bulk density is desirable below .08kg/m3 as an average over a mixed conifer stand. This could mean that many patches within the stand have much higher CBD but have interspaces between these dense clumps of trees where CBD is much lower than .08 and, therefore, the average for the stand is within acceptable limits. Where CBD is high, it is important to also have higher CBH (crown base height). Surface fuel loading is easily managed with fire and felling techniques to increase or decrease woody debris in different size classes. Overall the Rim Lakes area is deficient in larger woody debris and, therefore, prescriptions in both action alternatives include strategies to increase downed logs.

Table 26. Fire and fuels extension to the Forest Vegetation Simulator results by alternative post treatment

FVS/FFE Calculation Results					
Forest Types	Criteria	Desired Conditions	Alt. A	Alt. B	Alt. C
Pine-Oak	Surface Fuel loading (tons per acre)	5–10	2–3	5–10	5–10
	Canopy Base Height (ft)	> 18	15	29	29
	Canopy Bulk Density (kg/m3)	< 0.05	0.05	0.02	0.02
Ponderosa pine	Surface Fuel loading (tons per acre)	7–14	3	7–14	7–14
	Canopy Base Height (ft)	>18	12	28	28
	Canopy Bulk Density (kg/m3)	< 0.05	0.04	0.02	0.02
Dry Mixed Conifer	Surface Fuel loading (tons per acre)	8–16	6	8–16	8–16
	Canopy Base Height (ft)	> 10	7	23	21
	Canopy Bulk Density (kg/m3)	< 0.08	0.09	.03	0.04

Fire Regime Condition Class

Fire regime condition class (FRCC) was measured using stand data, Landfire remotely sensed data, and as described in the FRCC interagency guidebook (Hann et al., 2004). FRCC is a metric that quantifies how departed a system is from historical conditions in relation to fire and the role fire historically played in that system (Hann and Bunnell 2001, Hardy et al., 2001, and see Nicolet 2011 for more details on FRCC). The Rim Lakes Project area exhibits two distinct vegetation types in relation to FRCC: ponderosa pine vegetation (includes pine-oak types) and dry mixed conifer vegetation. Ponderosa pine type ecosystems are composed primarily of ponderosa pine with some Douglas-fir, southwestern white pine, oak, and juniper depending on the stands development. Mixed conifer stands are derived of ponderosa pine, Douglas-fir, white fir, and southwestern white pine, with Douglas-fir dominating in late stages of succession.

According to the western United States Biophysical Settings Key (Comer et al., 2003), ponderosa pine and dry mixed conifer forests in the Southwest have a dominant fire regime I and a mean fire interval of 2 to 10 years in ponderosa pine, and 5 to 25 years in dry mixed conifer. A fire regime I has a frequent fire interval with low to mixed severity. Fires typically maintained open areas and replaced or opened up areas that exhibited a more closed canopy. With the absence of fire, both the ponderosa pine and mixed conifer stands have accumulated unnatural amounts of fuel primarily in the form of dense trees that would cause a natural fire to exhibit more extreme fire behavior. Both the ponderosa pine and mixed conifer have missed multiple natural mean fire intervals. With the combination of missed burn intervals, the encroachment of mixed conifer, and the accumulation of old suppressed understory, these areas are currently best represented as a condition class 3, or FRCC 3.

In both vegetation types defined by Comer et al. (2003) the ability to create canopy openings, redistribute dominance to fire resistant tree species, and allow for diversity in age classes are essential in moving stands toward a naturally-functioning fire regime and, therefore, FRCC 1. Furthermore, forests in a fire regime 1 are maintained in that state by understory vegetation. Much of the forest structure in FRCC 1 would have open canopies which result in healthy and

vigorous understory plants that serve as fuel to carry surface fire through stands. Stands in FRCC 1 would demonstrate little potential for active crown fire and would experience relatively little overstory mortality post wildfire.

Areas where some canopy openings can be created and some sunlight can penetrate and invigorate understory forbs and grasses would have decreased threat of crown fire and would have a reestablished understory that could support surface fire. If these areas do not contain a well-balanced mix of strata with reproducing fire resilient species, they are still considered departed but not as departed as stands with closed canopies. These areas are classified as FRCC 2.

Continuous areas in an even-aged condition with closed canopy are considered very departed from historical conditions. These areas would not be able to support understory vegetation and have potential for continuous crown fire, therefore, are classified as FRCC 3.

See table 27 and figure 11 for FRCC results.

Alternative A

The combination of abundant and continuous canopy fuels, the lack of understory vegetation, and high severity fire potential maintains the area in a FRCC 3 into the foreseeable future.

Alternative B

Alternative B begins to restore the area toward the desired condition of FRCC 1.

Using data from the silviculture report (Richardson et al., 2012) and looking at FFE and FVS stand data outputs, it was determined that 80 percent of the goshawk foraging and MSO restricted habitat areas treated with uneven-aged management under alternative B would move to FRCC 1, where they could be maintained as such with one fire entry for at least the next 20 years. The other 20 percent of foraging and restricted habitat would only be able to progress to FRCC 2 due to stands still exhibiting even-aged characteristics.

In 20 years, 10 percent of these even-aged stands would continue to mature as single-aged stands and demonstrate canopy closures in some areas and, thus, would regress to FRCC 3 without further mechanical treatment.

Alternative C

Although this alternative, like alternative B, begins to restore the area toward the desired FRCC 1, only 20 percent of the foraging and restricted habitat treated with a 16-inch cutting limit would move and be maintained in FRCC 1. Furthermore, stands that initially moved toward FRCC 2 but remain in an even-aged state would return to FRCC 3 in 20 years due to the canopy closing and the stand still exhibiting even-aged characteristics. As a result of cutting much of the trees below 16 inches d.b.h. to provide for some fire protection, another 20 percent of the uneven-aged stands that initially could move to FRCC 2 would also progress backwards to FRCC 3 in 20 years due to canopy closure and lost age class diversity.

Burning prescriptions in the Rim Lakes area—which is prone to high severity fire effects—would not be able to progress and maintain stands in FRCC 1 without some mechanical treatment. Sixty

percent of the burn only areas would progress to FRCC 2 due to fuel consumption, however, over the next 20 years, 30 percent of those areas would regress to FRCC 3.

Alternative Comparison by Habitat Types

Part of the Rim Lakes area falls under Mexican spotted owl management guidelines. These guidelines require that no tree above 24 inches in diameter be cut in restricted habitat and no tree above 9 inches in diameter be cut in protected habitat. MSO restricted habitat that is considered to be threshold further requires stands to remain at 150–170 basal area.

Under these guidelines, protected habitat would have less to no canopy openings. High density requirements in threshold would reduce the ability to reduce canopy fuel continuity or for understory vegetation to respond to treatment. Areas in protected and threshold habitat would remain as FRCC 3 or move to FRCC 2 in situations where some canopy can be affected without losing the desired BA. Restricted habitat that is not threshold can be restored to an FRCC 1 where the species composition, structure, and function of these stands would be in concert with a surface fire regime.

Under alternative B or C, the protected and threshold habitat would remain as FRCC 3. In alternative B, the greatest amount of change would occur in MSO restricted habitat, but this would not occur in alternative C, where treatments would be subject to a 16-inch diameter limit. This limit would constrict the ability of the prescriptions to open canopy gaps and remove much of the uncharacteristic species. Therefore, in restricted habitat alternative C would move approximately 20 percent of the area to FRCC 1. Areas with trees of fire-intolerant species that have encroached the understory of the stands and are larger than 16 inches in diameter would remain as FRCC 3, while those where some smaller diameter fire-intolerant species could be removed and have small effects on canopy fuel discontinuity would move to an FRCC 2.

Table 27. Percent of area in each FRCC by alternative 1 year and 20 years post treatment

Dominant Vegetation Type	Habitat Type	FRCC	Desired Condition		Alternative A		Alternative B		Alternative C	
			1 Year Post	20 Years Post	1 Year Post	20 Years Post	1 Year Post	20 Years Post	1 Year Post	20 Years Post
Dry Mixed Conifer Vegetation Type	MSO Protected	1	100	100						
		2					42	26	42	26
		3			100	100	58	74	58	74
	MSO Restricted	1	100	100			67	67	17	17
		2					27	22	60	37
		3			100	100	7	11	23	46
	MSO Threshold	1	100	100						
		2					66	42	60	39
		3			100	100	34	58	40	61
	MSO Target Threshold	1	100	100						
		2					63	42	60	40
		3			100	100	37	58	40	60

Dominant Vegetation Type	Habitat Type	FRCC	Desired Condition		Alternative A		Alternative B		Alternative C	
			1 Year Post	20 Years Post	1 Year Post	20 Years Post	1 Year Post	20 Years Post	1 Year Post	20 Years Post
Pine-Oak Vegetation Type	MSO Target Threshold	1	100	100			46	46	12	12
		2					37	28	60	38
		3			100	100	17	26	28	50
	MSO Restricted	1	100	100			46	46	12	12
		2					37	28	60	39
		3			100	100	17	26	28	50
Ponderosa Pine Vegetation Type	MSO Protected Habitat w/in PAC	1	100	100						
		2					57	39	57	39
		3			100	100	43	61	43	61
	Northern Goshawk PFA/Nest	1	100	100			50	50	12	12
		2					35	27	60	30
		3			100	100	15	23	28	58
	Northern Goshawk Foraging	1	100	100			63	63	16	16
		2					28	23	60	20
		3			100	100	9	14	24	64
		2					9	34	9	34
		3			100	100	3	8	3	8

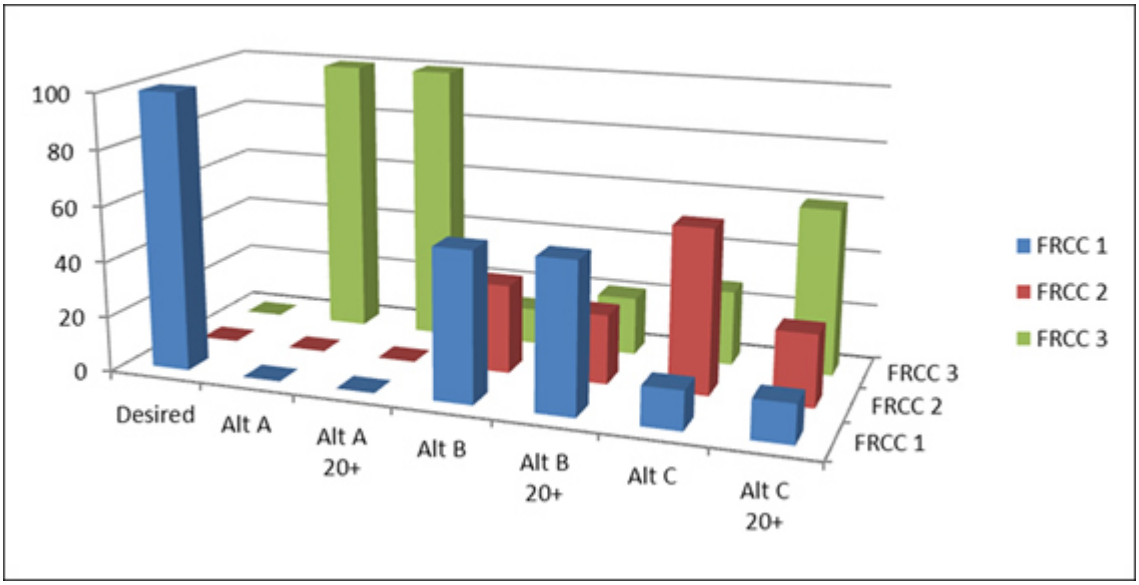

Figure 11. FRCC changes by alternative

Figure 11 displays summary changes in FRCC distribution for the entire Rim Lakes area for each alternative 1 year post fire and 20 years post fire. Alternative A (no action) would maintain 100 percent of the area in FRCC 3 over the next 20 years (20+). Alternative B 1 year post treatment would see 54 percent of the area in FRCC 1 and would maintain those areas in FRCC 1 over 20 years. Alternative C would move 14 percent of the area into FRCC 1 which could then be maintained for 20 years. Alternative C would also move toward FRCC 2, but much of that would revert to FRCC 3 after 20 years.

Air Quality

Six Class 1 airsheds are within an 80-mile radius of the project area. Seven communities were identified as smoke sensitive areas near the Rim Lakes Project area and were combined into four main areas. No current nonattainment areas exist within an 80-mile radius. Careful consideration of atmospheric conditions and winds can mitigate the impacts on the three Class 1 airsheds with impacts. Smoke impacts to the communities of Heber/Overgaard and Forest Lakes are almost inevitable, therefore, consideration for smoke duration would be included in individual burn plans.

The Mogollon Rim area is heavily used as a recreation area for many people. This area represents clear and clean air for many visitors and is important to the continued health of surrounding communities both economically and physically. Smoke in general is a nuisance and can be adverse to health, but is also part of the natural disturbance associated with these types of ecosystems. Two criterion pollutants, carbon monoxide and particulate matter, are produced in wood smoke and are regulated by the Clean Air Act. The Arizona State Smoke Management Rule implements the Clean Air Act and contains regulations that all state and Federal natural resource agencies must follow before a prescribed burn is ignited.

Effects of Alternatives B and C

Both prescribed fire and wildfire would create smoke; however, the amount and timing of these smoke events can be mitigated with management of prescribed fire. Any prescribed burning would be conducted only with approved site specific burn plans with standard smoke management mitigation and approvals.

Burning would be conducted in favorable atmospheric conditions so as to minimize effects from smoke to nearby communities, Class 1 airsheds, and recreationists. All burning would be conducted according to the Arizona State Smoke Management Rule to mitigate smoke impacts. These regulations ensure that effects from all burning within the area are mitigated and that Clean Air Act requirements are met. The three scenarios used in the SASEM analysis of smoke impacts can be used as a benchmark of the types of conditions and fuel loading burns should be conducted in (table 28). Results from the three scenarios show that Class 1 airsheds south of the project area would not be impacted by burning in the project area under the prevailing south-southwest winds. In general, south-southwest winds are preferable so as to avoid impacting Class 1 airsheds, as are days with good transport winds and ventilation categories.

The communities of Forest Lakes and Heber/Overgaard would have the most smoke impacts due to their proximity to the project area and that they lie in line with prevailing winds. Therefore, measures to mitigate long durations of smoke would be implemented. Prescribed fires are initiated under conditions that allow managers control and favorable effects. Prescribed fires

would be conducted when conditions are such that overstory tree mortality would be low, which leaves much of the live tree carbon pool intact. This results in less biomass being combusted than if the area were to burn under higher severity wildfire, therefore, less carbon emissions are expected in controlled situations (Wiedinmyer and Hurteau 2010).

Smoke impacts from wildfires are less easily mitigated. Wildfires primarily occur during summer months when the Rim Lakes area is most used by recreationists and, therefore, would most likely have more of an impact on recreation values. The amount of biomass consumed during a wildfire is also not easily mitigated; the more biomass is consumed by fire, the more smoke would be produced. When comparing alternatives, alternatives B and C propose prescribed burning which would have an impact on surrounding communities but in a controllable manner. The outcome of these alternatives would also reduce the amount of biomass available to fire during wildfire which would reduce the impact of smoke from such a wildfire. Alternative A does not propose any prescribed burning; however, it would continue to maintain large amounts of biomass available for consumption in the event of a wildfire which would have direct and most likely uncontrollable impacts on recreation, the six class 1 airsheds within 80 miles of the project area, and surrounding communities.

Table 28 describes the results from the SASEM analysis for smoke impacts. Three scenarios were developed to capture smoke impacts from prescribed burning. Scenario 1: Initial broadcast burning emulates burning mechanical treatment slash post thinning. Scenario 2: Pile burning represents smoke effects from burning piles. Scenario 3: Maintenance broadcast burning was developed to capture the possible burning occurring after initial burns are completed and used to maintain the ecosystem using fire. Both action alternatives were analyzed using the same inputs as these would not show enough difference to analyze separately. No prescribed burning is proposed in the no action alternative, therefore, it was not analyzed using SASEM. For purposes of this analysis, the Kosh visual range estimate was used. This estimate of visibility is based on the concentration of plume $PM_{2.5}$ emissions. Values of Kosh visibility are in miles of clear visibility.

Cumulative Effects

Past projects and fire events shaping the existing condition are located in table 8. Over the past 25 years, management surrounding the Rim Lakes area has included prescribed burning, pile burning, mechanical thinning, and various harvests as well as grazing and wildlife focused projects.

Within the Apache-Sitgreaves National Forests boundary, three current projects are adjacent or in close proximity to the Rim Lakes Project area. The Nagel Forest Health Project area is north of Rim Lakes, and the Little Springs Project areas are located east of Rim Lakes.

All these areas are being treated for wildland-urban interface protection from wildfire. Furthermore, private land owners have made efforts and would foreseeably continue to make efforts in the area to treat for fuels reduction and restoration.

To the south and southwest of Rim Lakes, the Tonto National Forest is implementing the Chamberlain and Christopher Hunter Projects. These include mechanical thinning followed by prescribed burning in phases over the next several years below the Mogollon Rim.

Table 28. Results of SASEM Model for class 1 airsheds and smoke sensitive areas

Air Quality Type	Location	Distance from Rim Lakes Project Area	Direction from Rim Lakes Project Area	Scenario 1: Initial Broadcast	Scenario 2: Pile Burn	Scenario 3: Maint. Broadcast
				Kosh* Visual Range (Miles)	Kosh* Visual Range (Miles)	Kosh* Visual Range (Miles)
Class 1 Airsheds	Mazatzal Wilderness	25	SW	No Impact	No Impact	No Impact
	Sierra Ancha Wilderness	25	SW	No Impact	No Impact	No Impact
	Mount Baldy Wilderness	75	SE	No Impact	No Impact	No Impact
	Petrified Forest NP	60	NE	75.4	>99.9	67.4
	Pine Mountain Wilderness	40	W	43.4	87.8	37.7
	Sycamore Canyon Wilderness	65	NW	83.2	>99.9	74.7
Smoke Sensitive Areas	Payson	15	SW	No Impact	No Impact	No Impact
	Heber/Overgaard	13	NE	8.7	16.7	1.8
	Winslow	60	NNE	75.4	>99.9	67.4
	Forest Lakes	0	N	52.6	1.4	6.5

Kosh values taken under good stability conditions with 7 m.p.h. winds. Kosh visual range is a measure of the distance in miles of visibility; the higher the number, the more visibility. Therefore, the less impact from smoke $PM_{-2.5}$ emissions.

The combined effect of these ongoing projects and many foreseeable projects along, above, and below the Mogollon Rim for restoration and fuel reduction provide for a mosaic of stand conditions, allowing for wildlife habitat and vegetative diversity. This same mosaic would allow for a diversity of fire effects, thereby increasing opportunities for the maintenance of forest structure and function using wildfire and prescribed fire in the long-term future. Both action alternatives proposed in the Rim Lakes area would continue to create a mosaic of fuel along the Mogollon Rim. Alternative A would continue to maintain the Rim Lakes area with high potential for severe fire effects.

Effects of the Forest Plan Amendments

As described in this section, the amendment proposed as part of alternative B would have beneficial effects to the long-term fire conditions in the project area. Effects of alternative C, which allows for the even-aged emphasis, are also described in this section. In summary, this amendment would result in a forest that would return to an undesired FRCC sooner, and remain at risk of active/passive crown fires. Stands would be less open, providing less herbaceous ground cover to restore surface fire function to the project area.

Wildlife

This section includes key effects analysis and conclusions for threatened, endangered and proposed species and critical habitat listed under the Endangered Species Act of 1973, as amended, and Region 3 sensitive species, management indicator species, and migratory birds and their habitats within the Rim Lakes Project area, Black Mesa Ranger District.

The wildlife specialist report uses and incorporates the results of the silviculture (Richardson et al., 2012), fire and fuels (Nicolet, 2011), watershed (Nelson, 2011) and transportation (Johnson, 2011) reports in its analysis.

The wildlife report contains detailed information and background on law, regulation, policy, forest plan requirements, methodology, species descriptions, etc., which are not repeated here. The wildlife specialist report and addendum (Brown et al., 2011 and Brown 2012) are located in the project record.

The project area supports the most diverse suite of wildlife habitats on the Black Mesa Ranger District, including threatened species, sensitive species, management indicator species (MIS), game and nongame species. While the majority of the area is ponderosa pine (66 percent), other habitat types within the analysis area include mixed conifer (24 percent), pine/oak (8 percent), water (<1 percent), and meadows (<1 percent) (table 29). Aspen, Rocky Mountain maple, Gambel oak, box elder, and big-toothed maple are also present as minor and usually understory species.

Table 29. Wildlife habitat cover types

Forested Cover Types	Acres	Percent of Project Area
Ponderosa pine	22,258	66.3
Mixed conifer	8,127	24.2
Pine-oak	2,571	7.7
Total Forested	**32,956**	**98.2**
Nonforested cover types		
Wetland	24	<0.1
Reservoirs*	286	0.9
Gravel pits*	17	<0.1
Private land*	24	<0.1
Grassland	241	0.7
Total Nonforested	**593**	**1.8**
Total Project Area Acres	**33,548**	**NA**

The “Wildlife” section describes the affected environment and the effects of the alternatives to wildlife species classified in a number of ways: (1) federally listed as threatened or endangered under the Endangered Species Act; (2) listed sensitive by the Southwestern Region regional forester; (3) classified as management indicator species (MIS) under the “Apache-Sitgreaves National Forests Land and Resource Management Plan;” and (4) analyzed under the Migratory Bird Treaty Act. Each category has its own requirements and standards for analysis.

Some species, such as the Mexican spotted owl, New Mexico jumping mouse, and northern goshawk, are analyzed in more than one category in this section. However, duplicate analysis has been removed where possible.

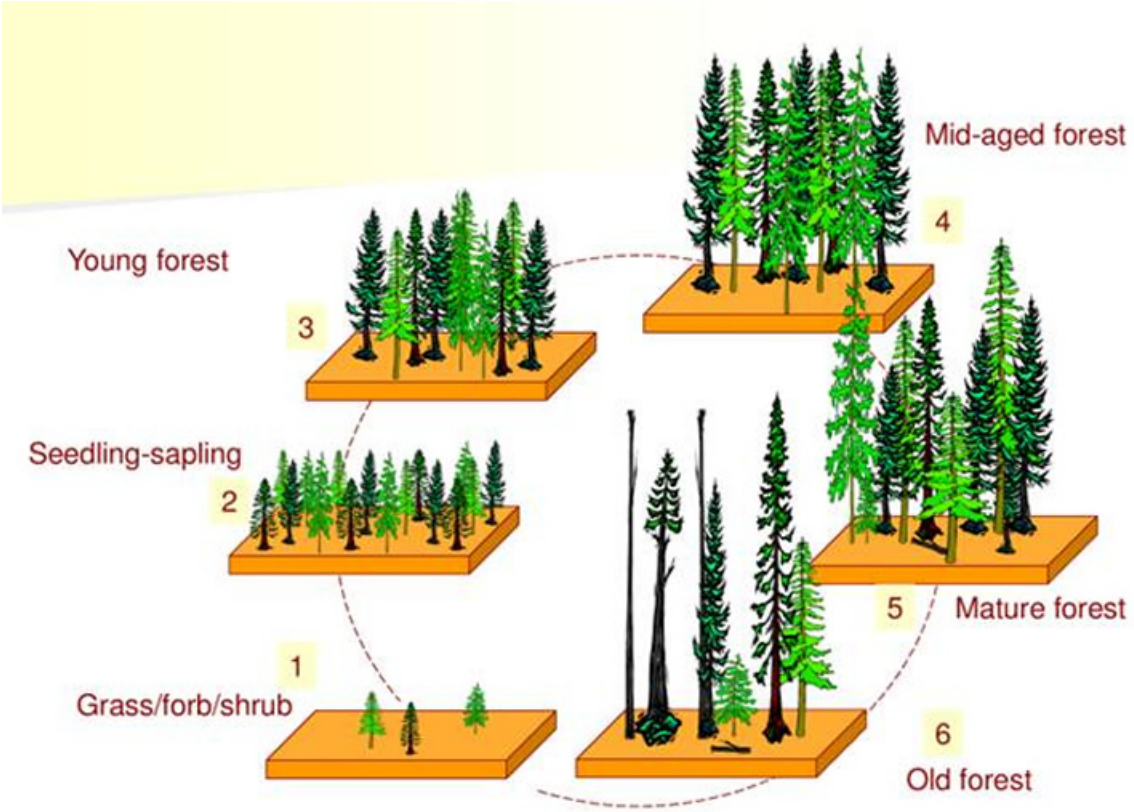

Figure 12. Stand structure development

VSS Classification of Forest Structure

The forest structure of wildlife habitat can determine whether some species will be present or absent. Vegetation structure stages (VSS) (Reynolds et al., 1992) present within the project area range from VSS 1 to VSS 6 (table 30). VSS 1 is the youngest forest structure, consisting primarily of grasses, forbs, shrubs, and seedlings and saplings less than 1 inch in diameter. VSS 6 stands, at the opposite end of the spectrum, are mature forests consisting largely of trees greater than 24 inches in diameter. Stands categorized in any one VSS class include other sized class trees included within the class. Habitat containing a variety of VSS classes is preferred by many wildlife species. Approximately 89 percent of the Rim Lakes Project area is currently in VSS 3 and 4. The desired condition, as defined by the forest plan is to have a more balanced distribution of habitat.

Treatments proposed to MSO habitat are shown in table 31. Treatments to northern goshawk habitat are shown in table 32. Other treatments are shown in table 33.

Table 30. Distribution of existing stand VSS acres in the Rim Lakes Project area

Vegetative Structure Stage (VSS)	Tree Diameter (d.b.h.)	Percent of Existing Condition	Percent of Forest Plan Desired Condition*	Difference
1 – Grass–forb–shrubs	0–1”	2	10	-8
2 – Seedling/sapling	1–5"	2	10	-8
3 – Young forest	5–12”	47	20	+27
4 – Mid-age forest	12–18"	42	20	+22
5 – Mature forest	18–24"	6	20	-14
6 – Old forest	24" +	1	20	-19
Totals			100	100

* Apache-Sitgreaves National Forests Land and Resource Management Plan (USDA 1987, as amended 2009)

Table 31. Proposed alternatives in MSO habitat

Vegetation Type	Habitat Type	Proposed Treatment	Alt. A	Alt. B	Alt. C
Dry Mixed Conifer	MSO Protected Habitat	Precommercial thin to 9"	0	341	341
		Burn only acres	0	875	875
		No treatment acres	1,417	201	201
		Total MSO protected acres	1,417	1,417	1,417
	MSO Restricted Habitat	Selective cut to 24"	0	4,188	0
		Selective cut to 16"	0	0	4,188
		Burn only acres	0	843	843
		No treatment acres	5,037	6	6
		Total MSO restricted acres	5,037	5,037	5,037
	MSO Target Threshold	Selective cut to 24"	0	568	0
		Selective cut to 16"	0	0	568
		Burn only acres	0	900	900
		No treatment acres	1,470	2	2
		Total target threshold acres	1,470	1,470	1,470
	MSO Threshold	Intermediate thin to 24"	0	112	0
		Intermediate thin to 16"	0	0	112
		Burn only	0	97	97
		No treatment acres	209	0	0
		Total threshold acres	209	209	209
Ponderosa Pine - Gambel Oak	MSO Restricted Habitat	Selective cut to 24"	0	1,330	0
		Selective cut to 16"	0	0	1,330
		Burn only acres	0	975	975
		No treatment acres	2,305	0	0
		Total MSO restricted acres	2,305	2,305	2,305
	MSO Target Threshold	Selective cut to 24"	0	85	0
		Selective cut to 16"	0	0	85
		Burn only acres	0	180	180
		No treatment acres	265	0	0
		Total target threshold acres	265	265	265

Table 32. Proposed alternatives in northern goshawk habitat

Vegetation Type	Habitat Type	Proposed Treatment	Alt. A	Alt. B	Alt. C
Ponderosa Pine	MSO Protected Habitat within PAC	Precommercial thin to 9"	0	18	18
		Burn only	0	542	542
		No treatment acres	578	18	18
		Total PAC acres	578	578	578
	Northern Goshawk PFA/Nest	Harvest	0	620	0
		Selective cut to 16"	0	0	620
		Burn only	0	375	375
		No treatment acres	995	0	0
		Total PFA/nest acres	995	995	995
	Northern Goshawk Foraging with >40% Slopes	Harvest	0	16,216	0
		Harvest to 16"	0	0	16,216
		Burn only	0	4,468	4,468
		No treatment acres	20,684	0	0
		Total foraging acres	20,684	20,684	20,684

Table 33. Proposed Alternatives in other habitat

Vegetation Type	Habitat Type	Proposed Treatment	Alt. A	Alt. B	Alt. C
Other Vegetation	Meadows and grasslands	Tree removal	0	176	0
		Tree removal to 16"	0	0	176
		Burn only	0	56	56
		Grassland no treatment	240	8	8
		Total meadow/grass acres	240	240	240
	Other acres (private, wetlands or nonvegetated) no treatment		348	348	348

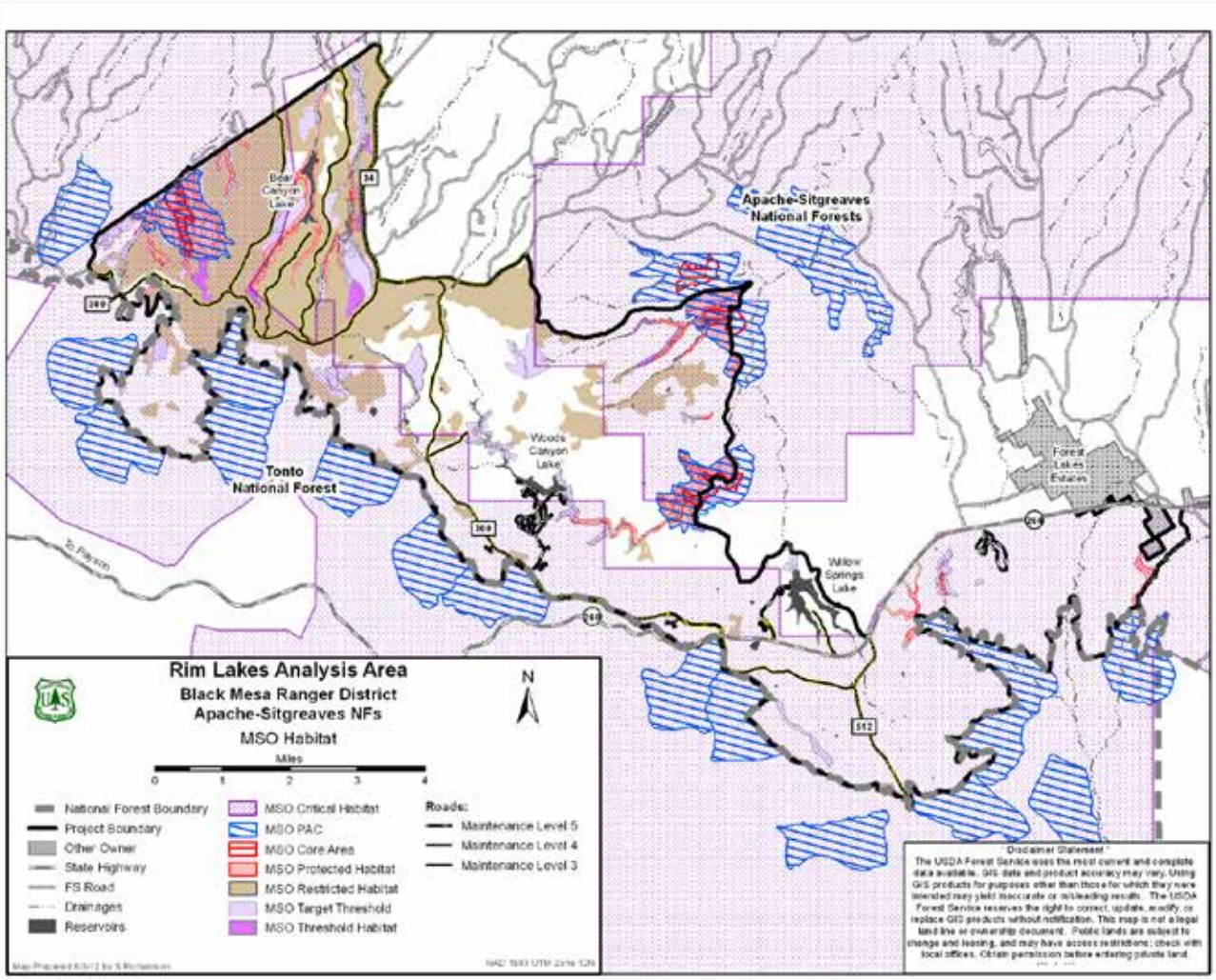

Figure 13. MSO habitat including critical habitat designation

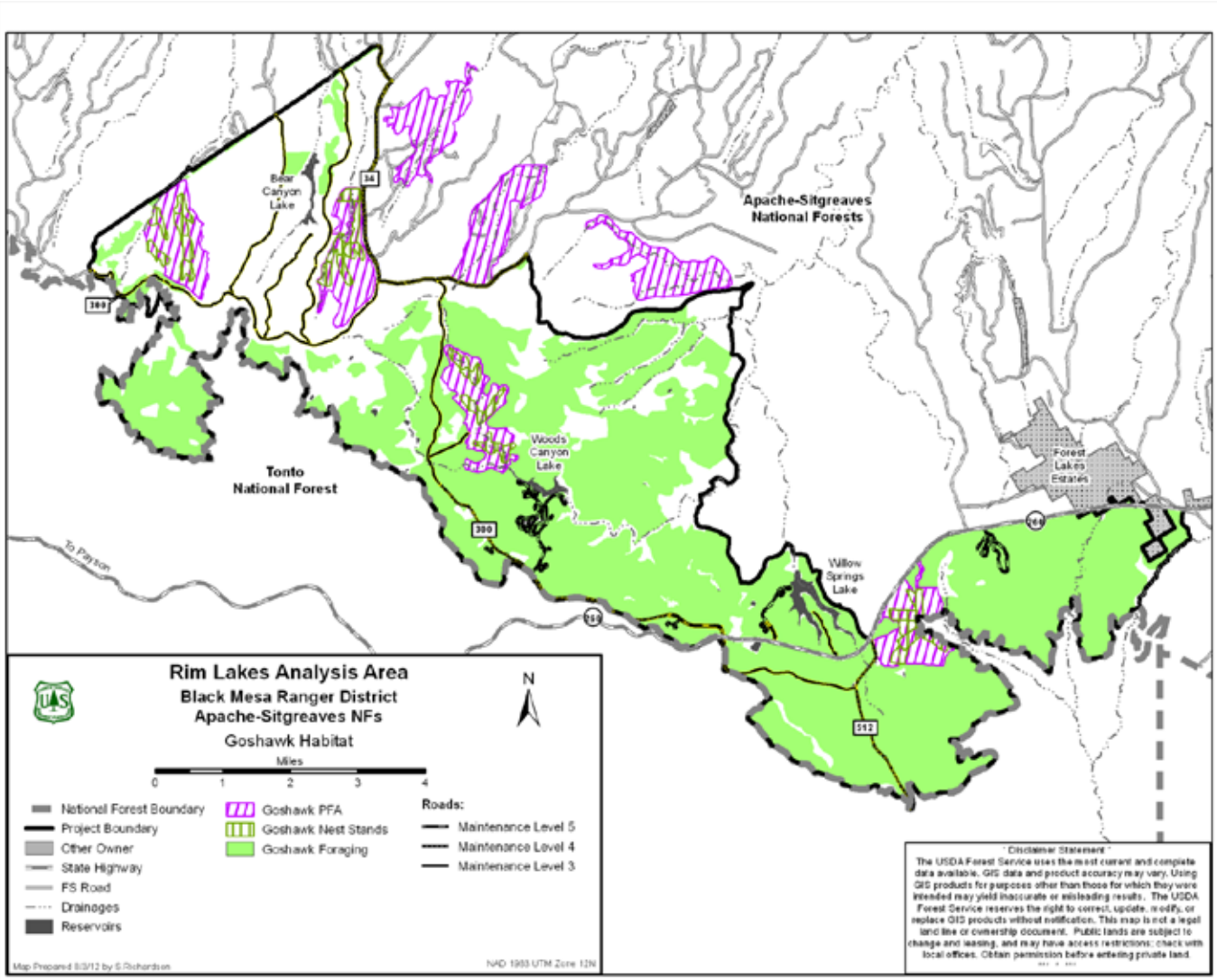

Figure 14. Goshawk habitat in analysis area

Federally Listed Terrestrial Species

Summary

As shown in table 34, all the action alternatives may affect, but are not likely to adversely affect any federally listed species. Minor short-term effects are expected to critical habitat of spotted owl, which would result in long-term benefits to the habitat.

Table 34. Summary of affects to federally listed species

Species	Alternative A	Alternative B	Alternative C
Mexican spotted owl (MSO)	No effect to the species or its critical habitat.	May affect, not likely to adversely affect the Mexican spotted owl.	
MSO critical habitat	No effect.	May affect, not likely to adversely affect. Mechanical and broadcast burning treatments are expected to have a short-term insignificant impact with a long-term benefit.	Similar to alternative B, except prey base habitat component would become shaded out following canopy closure and decline in condition sooner (15 years) than alternative B (30 years).
New Mexico jumping mouse	No impact.	May impact individual New Mexico jumping mouse, but is not likely to result in a trend toward Federal listing or loss of viability.	
Little Colorado spindace	No effect to species or its critical habitat.	May affect, but is not likely to adversely affect. No effect to designated critical habitat.	
Chiricahua leopard frog	No effect to species or its critical habitat.	May affect, but is not likely to adversely affect. No effect to designated critical habitat.	

Details

Species considered were reviewed using district files as well as the Apache-Sitgreaves National Forests. In addition, the U.S. Fish and Wildlife Service threatened and endangered species concurrence list dated June 20, 2008 (Brown 2011, appendix B), was referenced for development of species that may occur or have suitable habitat within the project area. For the purpose of including these species for effects analysis, species that are known or have potential to occur within the project area are further analyzed, and species that are not present or do not have potential habitat in the project area are dismissed from further analysis (table 35).

The “Aquatics Species” section (page 171) and aquatic species specialist report (McMillan 2011) addresses aquatic species and their habitats. One terrestrial threatened species with critical habitat, Mexican spotted owl, and one proposed species, New Mexico jumping mouse, have the potential to occur in the project area.

Table 35. Federally listed terrestrial species dismissed from further analysis

Common Name	Scientific Name	Known to Occur?	Potential to Occur?	Federal Status	Rationale
Mexican gray wolf	*Canis lupus baileyi*	No	Yes, random incident	Experimental/ Nonessential	Only the Clifton, Alpine, and Springerville Ranger Districts are approved for wolf release/introduction sites. Black Mesa RD is not included within existing home ranges of known packs, but does occur within the experimental population area boundary that includes the entire Apache-Sitgreaves National Forests.
Southwestern willow flycatcher	*Empidonax traillii extimus*	No	No	Endangered	Minimal cottonwood/willow vegetation communities along creeks and streams; previous surveys in target areas on district had no detections.
Yellow-billed cuckoo	*Coccyzus americanus occidentalis*	No	No	Candidate	Minimal cottonwood/willow vegetation communities along creeks and streams; previous surveys in target areas on district had no detections.

Table 36. Federally listed terrestrial species analyzed in detail

Common Name	Scientific Name	Known to Occur?	Potential to Occur?	Federal Status	Critical Habitat
Mexican spotted owl	*Strix occidentalis lucida*	Yes	Yes	Threatened	Yes
New Mexico jumping mouse	*Zapus hudsonius luteus*	No	Yes	Candidate	NA

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Mexican Spotted Owl

The Southwestern Region of the U.S. Forest Service incorporated guidelines from the "Mexican Spotted Owl Recovery Plan" into all forest plans in 1996 (USDA 1996).

The "Mexican Spotted Owl Recovery Plan" defines MSO habitat as follows:

- Protected activity centers (PACs) are categorized as protected habitat as well as all areas in mixed conifer and pine/oak habitat types with slopes greater than 40 percent where timber harvest has not occurred in the past 20 years (USDI 1995). The project area contains approximately 1,996 acres of MSO protected habitat, of which 1,303 acres are within designated PACs that are considered occupied.
- Restricted habitat is defined as unoccupied mixed conifer forests, pine/oak forests, and riparian areas on slopes less than 40 percent (USDI 1995). Approximately 9,281 acres of MSO restricted habitat exists within the project area, of which 6,710 acres are mixed conifer forest, and 2,571 acres are pine/oak forest.

- Current forest plan direction and the "Mexican Spotted Owl Recovery Plan" (USDI 1995) require that threshold and target threshold areas be designated within MSO restricted habitat. These areas consists of 10 percent of pine-oak and 25 percent of mixed conifer. The intent of designating these areas is to protect high quality MSO nesting habitat where it exists and to develop needed nesting structure elsewhere.
- The project area currently has 209 acres of restricted habitat that meet threshold criteria and 1,470 acres of restricted habitat have been designated target threshold as part of this analysis (Brown et al., 2011).

In addition, as a requirement of the Endangered Species Act, Mexican spotted owl critical habitat was designated by the U.S. Fish and Wildlife Service in 2004. Critical habitat is defined as either protected or restricted, which contain the primary constituent elements (PCEs) necessary for conservation of the species within the designated critical habitat units. Although approximately 22,788 acres of the project area fall within the critical habitat boundary, most of this area lies in ponderosa pine vegetation and does not have the potential to manage for PCEs for the spotted owl. Nonetheless, reducing risk of crown fire in ponderosa pine critical habitat benefits the protected and restricted habitats by reducing the risk to them as well.

The project area has approximately 3,886 acres of critical habitat that meet the definition of MSO protected or restricted habitat. Where possible, areas within designated critical habitat must be managed to maintain or enhance primary constituent habitat elements. These elements include criteria associated with the range of tree and plant species, canopy closure, snags, downed logs, and residual plant cover (USDI 2004). This requirement applies to the 3,886 acres of critical habitat that meet the MSO definition.

MSO Monitoring

Completed surveys specific to this project analysis were conducted in 2006 and 2007, with complete monitoring history of the four PACs within the project area (table 37).

Table 37. Monitoring summaries of MSO PACs within the project area

Survey Year	Ridge PAC	Palamino PAC	Deer Lake Canyon PAC	Woods Canyon PAC
2006	Pair occupancy	Single male	Single male	New PAC, pair occupancy
2007	Single male	Pair occupancy	No response	Single male
2008	Pair – 1 young	No response	No response	No response
2009	Single male	Not monitored	No response	No response
2010	No response	Not monitored	Not monitored	Not monitored

Table 38. Mexican spotted owl (MSO) protected habitat (1,995 acres)

	Mixed Conifer	Pine-Oak [1]	Other (acres) [1]	Total
Protected activity center (PAC)	725	0	578	1303
Protected habitat > 40% slope	692	0	0	692
Reserved lands [1]	0	0	0	0
Total	1417	0	578	1995

[1] 100 percent of the area could be allocated for old growth structure.
[2] Mixed conifer restricted habitat allocation varies by recovery unit (MSO recovery plan).

Table 39. Mexican spotted owl (MSO) restricted habitat (9,281 acres)

	Mixed Conifer	Pine-Oak	Other	Total
Restricted habitat "other" (90% of pine-oak and 75% of the mixed conifer in the project area)	5,031	2,304	0	7,335
Restricted habitat threshold [1]	209	0	0	209
Restricted habitat target threshold [1]	1,470	267		1,737
Total	6,710	2,571	0	9,281

[1] 100% of the area could be allocated for old growth structure.
[2] Mixed conifer restricted habitat allocation varies by recovery unit (MSO recovery plan).

Protected Habitat: MSO PACs

Mexican spotted owl surveys have been conducted in protected and restricted habitat within the project area and within a half mile of the project area boundary. Surveys dating back to the late 1980s have occurred in various parts of the project area. Four MSO PACs have been established that exist entirely or partly within the analysis area. Only the Ridge PAC occurs entirely within the project area, while the Woods Canyon and Palamino PACs and nest core area occurs partially in the project area (table 40).

The Deer Lake Canyon PAC mostly occurs outside the project area and does not have any nest core habitat within the project area. In addition to the 4 PACs within the project area, 14 other PACs fall within the one-quarter mile buffer area around the project area (Brown et al., 2011).

Table 40. MSO PACs, nest core habitat, critical habitat, and habitat type in the project area

MSO PACs	PAC Acres within the Project Area	Nest Core Acres within the Project Area	Critical Habitat within the PACs	Forest Habitat Type Acres within Each PAC	
Ridge	601	119	601	Mixed conifer	576
				Ponderosa pine	18
				Grassland	7
Woods Canyon*	371	40	238	Mixed conifer	75
				Ponderosa pine	297
Palamino*	262	59	262	Mixed conifer	74
				Ponderosa pine	188
Deer Lake Canyon*	75	0	75	Ponderosa pine	75

*PACs located partially within the project area boundary.

Forest Structure and Stand Density in MSO Restricted Habitat "Other"

For the purpose of the analysis, forested habitat analysis has primarily focused effects from forest structure and stand density for MSO with approximately 34 percent of the project area (11,000 acres) being stratified as MSO habitats.

Based on existing conditions, MSO restricted habitats within the project area currently provide for the desired distribution of tree sizes specified in the recovery plan and forest plan, except for trees in the largest d.b.h. class, which are currently slightly below desired representation. There is an excess of trees in the lowest d.b.h. class (12–18 inches d.b.h.), which are the primary size class of trees that would be treated. The desired condition, as defined by the forest plan and recovery plan guidelines, is to have a sustained level of MSO nest/roost habitat well distributed across the landscape while reducing potential for stand-replacing wildfires through MSO habitats. MSO restricted habitats would be managed from current condition toward desired long-term management of stand density index stand structure.

MSO—Existing and Desired Forest Structure

MSO forest habitats within the project area currently provide for the desired distribution of tree sizes specified in the forest plan, except for trees in the 24 inches and larger d.b.h. class, which are currently slightly below desired levels. Based upon growth projections, the desired representation for this class would be achieved within the next decade (Richardson et al., 2012). Table 41 and figure 15 display the percent of the maximum SDI by size class compared to the desired percent of the maximum SDI by size class for MSO mixed conifer and pine-oak habitat from the MSO recovery plan and forest plan guidelines.

Table 41. MSO restricted percent of total existing SDI, by d.b.h. class (2010)

Percent of Maximum SDI by d.b.h.	Existing Condition Mixed Conifer	Desired Condition*	Existing Condition Pine-oak	Desired Condition
SDI % 12–18"	31	10 +	34	15 +
SDI % 18–24"	12	10 +	13	15 +

Percent of Maximum SDI by d.b.h.	Existing Condition Mixed Conifer	Desired Condition*	Existing Condition Pine-oak	Desired Condition
SDI % 24"+	8	10 +	10	15 +

* Based on the forest plan, desired minimum percentage of trees by size class.

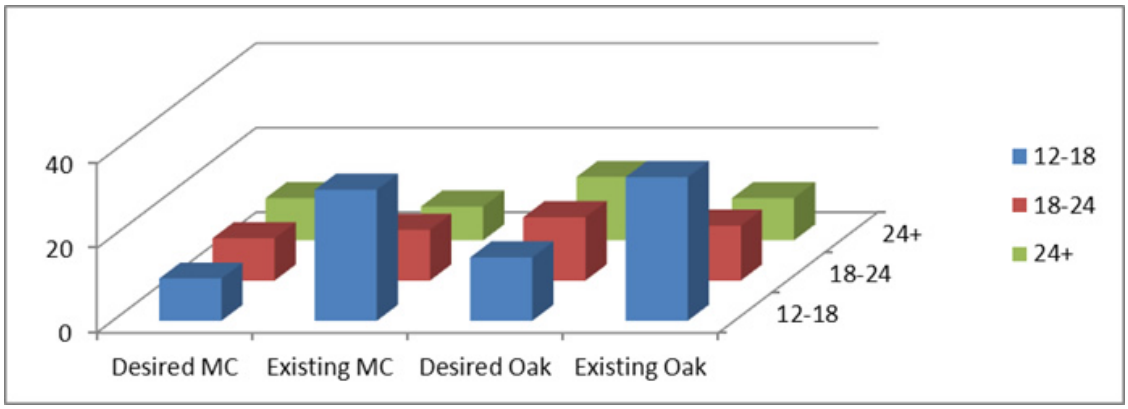

Figure 15. Percent of maximum stand density index in MSO habitat by tree diameter

Existing and Desired Forest Density and Snags in MSO

Stand density index (SDI) and basal area (BA) are discussed in detail within the "Vegetation" section (page 25). Existing percent maximum SDI and BA for the forested area within the project area are shown in table 42. The lower stand densities are concentrated in areas of recent timber sales on the west and south side of the project area, power line corridors, and the Rodeo-Chediski Fire on the east side.

Currently, 97 percent of the area is considered high density (zone 3). The low to moderate density (zones 1 and 2) stands resulted from retaining trees 16 inches d.b.h. and larger, from a previous hazardous fuels reduction project adjacent to the project area.

Forest plan guidelines require BA minimum for protected, target, and target threshold habitats. This requirement does not allow the flexibility to manage for age class distributions.

For the following two tables, the silviculture specialist report, appendix C (Richardson et al., 2012) describes stand density index calculations and the basis for desired density conditions related to the forest plan vegetation standards and guidelines and project purpose and need.

The desired condition density ranges represent the zone where attainment of both forest health objectives and uneven-aged forest development and maintenance objectives are biologically feasible.

Road Systems and the MSO

Two types of road systems totaling 13.96 miles occur within MSO PACs and MSO protected habitat in the project area as described in the engineering specialist report (Johnson, 2011) and shown in figure 23 (page 235). Level 1 roads are closed roads and level 2 roads are managed for high-clearance vehicles (table 44). Level 1 roads used during the project would be returned to

closed status after project completion. No haul routes would occur in the 14 PACS outside the project area.

Table 42. MSO mixed conifer existing and desired forest density and snags by stratum

	Protected Habitat (including PACs)	Restricted: Threshold/ Target Threshold	Restricted: Other
Acres (not all are proposed for treatment)	1,417	1,679	5,031
Desired BA	NA	150–170	70–90
BA existing average	111	111	111
BA existing range	30–235	30–235	30–235
Desired SDI*	NA	NA	25–40
Existing SDI	52	52	52
Deisred snags	2.0+	2.0+	2.0+
Existing snags	2.5	2.5	2.5

*Within stand matrix (not including regeneration group openings).

Table 43. MSO oak-pine forest cover type

	Protected Habitat (including PACs)	Restricted: Threshold/ Target Threshold	Restricted: Other
Acres (not all are proposed for treatment)	578	267	2,304
Desired BA	NA	150–170	70–90
BA existing average	99	99	99
BA existing range	37–323	37–323	37–323
Desired SDI	NA	NA	25–40
Existing SDI*	48	48	48
Deisred snags	2.0+	2.0+	2.0+
Existing snags	1.2	1.2	1.2

* Within stand matrix (not including regeneration group openings).

Critical Habitat

Total designated MSO critical habitat within the project area is 22,788 acres. Approximately 17,212 acres would receive mechanical treatment under either alternative B or alternative C. Of the 17,212 acres, approximately 3,886 acres meet the definition of MSO protected or restricted (table 45 and table 46, figure 13).

Approximately 22,507 acres of MSO critical habitat would receive low severity prescribed burning under either alternative B or alternative C (MSO nest core habitats would not be treated). Acres not treated by mechanical or prescribed fire include MSO nest core habitat and other non-MSO habitats (reservoir and private lands).

Table 44. Road level and use in MSO PACs and protected habitat

Road Levels	Habitat Type	Road Use	Miles of Roads
Level 1 – Basic Custodial Care (Closed)	Protected Habitat Outside PAC		
		Haul Route	0.28
		Remain Closed	0.22
	Sum Total		0.50
	Protected Habitat within PAC		
		Haul Route	0.96
		Prohibit Haul	1.38
		Remain Closed	3.59
	Sum Total		5.93
Level 2 – High-Clearance Vehicles	Protected Habitat Outside PAC		
		Haul Route	0.25
		Not Used	0.20
	Sum Total		0.45
	Protected Habitat within PAC		
		Haul Route	5.31
		Not Used	1.76
	Sum Total		7.07
	Grand Total of Roads		13.95

Table 45. MSO critical habitat with proposed mechanical treatment type and acres

MSO Critical Habitat Treatment Type	Alt. B and Alt. C Acres in Critical/Restricted Owl Habitat	Alt. B and C in Critical Habitat Outside Protected/Restricted	No Mechanical Treatment in MSO Critical Habitat
MSO protected	288		
MSO restricted	3,290		
MSO target threshold	240		
MSO threshold	68		
NOGO – foraging habitat		12,856	
NOGO – nest/PFA		345	
Meadow enhancement		125	
Total 23,670	3,886	13,326	6,458

Table 46. MSO critical habitat with proposed prescribed burning

Treatment Type	Acres
Low severity prescribed burning	22,507
No prescribed burning (MSO nest core and other)	281

Environmental Effects to MSO

Alternative A

This alternative would not have mechanical thinning or low severity broadcast burning in MSO protected or restricted habitat. There would be no increase in human-related activities within or adjacent to the MSO habitat. Therefore, no change in foraging, nesting, and roosting habitat would occur. This alternative would not reduce the risk of high severity canopy wildland fire, which is identified as one of two highest threats to MSO recovery in the recovery plan (USDI 1995).

As noted in the "Fuels and Fire" section (page 63), the effect of canopy openings and distribution of tree groups and clumps on potential fire behavior was estimated using FlamMap. Alternative A demonstrates much of the north and central portions of the project area exhibiting active crown fire and passive crown fire above levels of both alternatives B and C.

In terms of FRCC, alternative A also represents current conditions for this landscape with all MSO habitats remaining in FRCC 3, at high risk of active crown fire. No mechanical thinning or low severity broadcast burning to reduce fuel loading would be performed, the project area remains at a high risk of stand-replacing wildfire. If a high severity active canopy wildfire were to occur, it would alter habitat suitability for MSO. Managing the project area toward forest plan guidelines and MSO recovery would not occur.

Alternative B—Direct/Indirect Effects

One of the four PACs in the project area would be treated mechanically (see table 47). The Ridge PAC would be mechanically treated on 281 acres, with 119 acres of nest core habitat buffer not receiving treatment. With treating within the Ridge PAC, 22 percent of the total PAC acres within the project area would be mechanically treated. Protected habitat would be treated on 77 acres, 11 percent of the available protected habitat within the project area.

Table 47. Mechanical treatment in MSO habitat

MSO Habitat	Treated Acres	Total Stratified Habitat Acres	Percent Treated
Protected habitat	358	1,995	18
Restricted target threshold	653	1,737	38
Restricted threshold	112	209	54
Restricted "other"	5,518	7,335	75
Grand Total	6,641	11,267	59

Low severity burning would occur in each of the four PACs within the project area (table 48). Only the Ridge PAC would be thinned from below, then treated by low severity broadcast fire. Habitat in the other three PACs would receive low severity broadcast burning without mechanical

treatments due to the areas being within established inventoried roadless areas where no mechanical treatments are proposed. All activities would avoid the PAC nest core buffers where it occurs in the project area.

Mechanical thinning and low severity prescribed burning would result in the forest understory to be more open within the Ridge PAC.

Low severity prescribed burning in the other three PACs and protected habitat would not alter forest structure. Low severity prescribed burning would primarily reduce surface fuels—such as duff and litter—and reduce only a minor component of young age class trees. This would increase understory vegetation following recovery that is desirable for the MSO prey base and future maintenance treatments. Prey base habitat would be temporarily disturbed over the short term with mechanical and prescribed fire treatments, but enhanced following forest understory vegetative recovery. By phasing the project activities, not all MSO habitats would be treated simultaneously, thus lessening the impacts.

Table 48. Low severity burning in MSO PACs

PACs	PAC Acres in the Project Area	Acres Treated in the Project Area	Acres Excluded from Treatment in the Project Area	Percentage of Treated Acres in the PACs*
Woods Canyon	371	330	41	55
Deer Canyon Lake	75	75	0	13
Palamino	262	203	59	34.5
Ridge**	601	431	170	72
Total	1,309	1,039	218	79

*PAC area designation is a minimum of 600 acres.
**Ridge PAC is the only PAC that occurs entirely within the project area.

Table 49. Low severity broadcast burning on MSO stratified habitat

MSO Habitats	Acres
Protected habitat	1,952
Restricted other habitat	7,330
Restricted target threshold	1,735
Restricted threshold	209
Total acres of low severity burning	11,226

Table 50. No burn MSO areas, including nest core

MSO Habitats	Acres
Protected habitat outside PAC	4
Protected habitat within PAC	271
Restricted “other”	6
Restricted target threshold	2
Total acres of no treatment	283

Under alternative B, MSO PACs and protected habitat diameter limits along with high density BA requirements in threshold and target threshold would limit achieving the objective to reduce canopy fuel continuity or for understory vegetation to respond to treatment. Consequently, areas in protected, threshold, and target threshold habitat would remain as FRCC 3 or move to FRCC 2 in situations where some canopy can be affected without losing the desired BA.

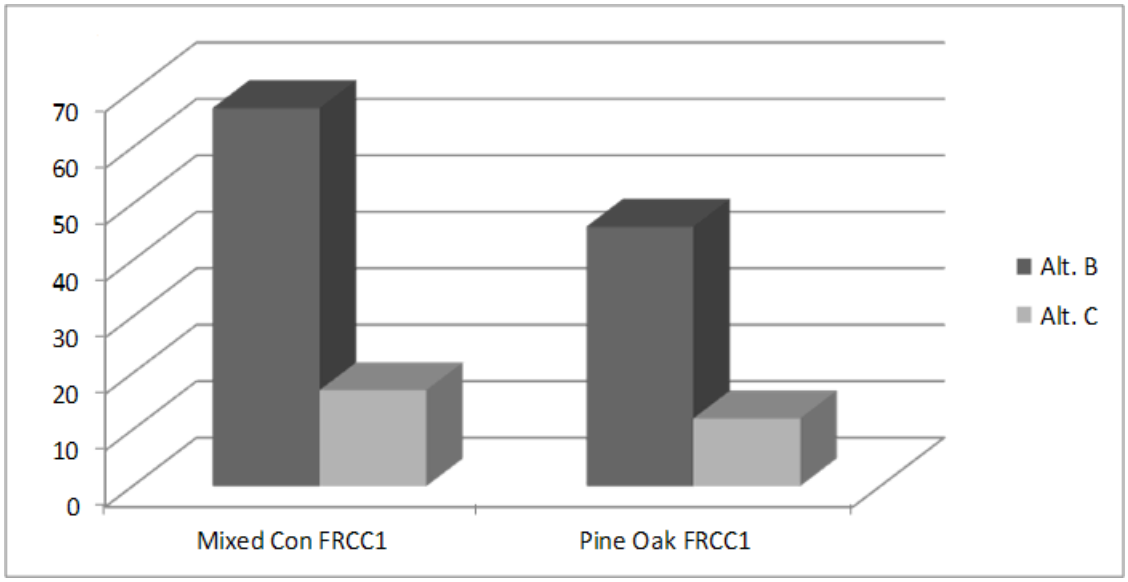

Figure 16. Percent of habitat restored to FRCC 1 by alternative

In alternative B, restricted "other" habitat (MC) can be restored to an FRCC 1 where the species composition, structure, and function of these stands would be in concert with a surface fire regime at 67 percent of this habitat. Alternative C would restore about 17 percent. Alternative B would restore about 46 percent of restricted habitat (pine/oak), whereas alternative C would restore about 12 percent.

FlamMap analysis of fire type potential for alternative B shows a marked reduction in passive and active crown fire in protected, restricted, target, and target threshold habitats over alternative A (page 63).

Active crown fire between alternative B and C is not significantly different. However, there are marked differences between the passive crown fire between alternative B and C for restricted and threshold, target threshold habitats. Alternative B has minimized the canopy fire behavior due to the creation of tree canopy openings and tree stand distribution of groups and clumps resulting in reducing the potential for active and passive crown fire within MSO restricted "other" habitats. This alternative has reduced the risk of high severity canopy fire in restricted, threshold, target threshold, and old growth significantly more than alternative A, and also provides for a longer effective timeline for meeting project objectives compared with alternative C.

Mechanical treatment for PACs, protected, restricted threshold, and restricted target threshold habitats would retain tree canopy and meet/move toward BA objectives by reducing tree competition.

Treatments in restricted habitat "other"—outside threshold and target threshold areas—would provide for more canopy cover diversity, spatial arrangement for groups, and clumps of stands with openings less than 2 acres to increase the understory vegetation component. Canopy cover would change slightly in restricted other habitat with development of uneven-aged stand management with retention of a range of 25–40 percent SDI (a reduction from 52 percent) which equates to a range of 40–70 percent canopy coverage. The excess of 12- to 18-inch d.b.h. trees would be treated to move toward desired conditions. The desired condition, as defined by the forest plan and recovery plan guidelines is to have a sustained level of MSO nest/roost habitat well distributed across the landscape while reducing potential for stand replacing wildland fires through MSO habitats.

Smoke from prescribed burning may temporarily disturb MSO within and adjacent to the project area, but this is short term and would not adversely affect MSO due to the low severity prescription. Prevailing southwest winds and the topography of the area typically cause smoke to carry north and east. Wind may carry smoke to PACs, but it is expected to be short term and transitory in nature.

Burning proximate to PAC(s) during the breeding season (March 1–August 31) would be conducted in such a manner that limited smoke occurrence within a PAC(s) and smoke would not settle in PAC(s) for long durations, having an negligible indirect effect to MSO.

Smoke from prescribed burning would comply with Arizona Department of Environmental Quality (ADEQ) requirements. ADEQ considers the cumulative effects of smoke emissions from multiple jurisdictions prior to approving daily prescribed burning activities. This mitigates the potential for severe smoke effects from multiple prescribed fire projects to the entire analysis area.

Snags and logs would be retained at or managed toward meeting forest plan guidelines. Data collected from 2006 to 2007 showed an average snag density of 1.8 per acre and an average of 4.2 logs (12 inches at midline and 8 feet long) per acre in the project area. Current snag densities are below forest plan standards of 2–3 per acre. Current log densities fall within the forest plan standard of 3–5 per acre. Future snag recruitment is expected through existing insect infections and low severity broadcast burning on unhealthy trees. Potential snags would be tallied and left to meet the minimum forest plan standards of 2–3 per acre during mechanical treatments.

Alternative B would retain current old growth habitat and develop old growth components in newly allocated stands within MSO stratified habitat. About 3,940 acres would be allocated to be managed for old growth structure.

All treatments, including product hauling and road maintenance within a quarter mile of PAC boundaries within and adjacent to the project area, would be subject to established breeding season restrictions (DEIS appendix B). Approximately 0.96 mile available as level 1 roads would be temporarily opened within PACs and 5.31 miles of available level 2 high-clearance roads would be used within PACs (table 51). Approximately 6.73 miles of roads within PACs would remain closed, prohibit hauling, or not be used. By selecting to use a majority of the available level 2 roads within PACs, noise and disturbance to previously nondisturbed areas of closed level 1 roads are minimized. Approximately 16 percent of the closed roads within PACs would be opened to support project activities then reclosed. Additionally, 1.38 miles of level 2 roads within

the PACs would not be used for haul roads. For all PACs, approximately 52 percent of the available roads would not be utilized.

Table 51. Road level and use in MSO PACs

Project Area Road Levels and Classification	Total Miles of Roads	Percentage of Miles of Road Used/Not Used in PACs
1 – Basic Custodial Care (Closed)		
Area within PAC		
Haul route	0.96	16% used
Prohibit haul	1.38	84% not used
Remain closed	3.59	
Sum Total	5.93	
2 – High-Clearance Vehicles		
Area within PAC		
Haul route	5.31	75% used
Not used	1.76	25% not used
Sum Total	7.07	
Sum Total of Used Roads	13	

Early morning and late evening activities and noise associated with mechanical thinning, logging, and chipper trucks, and road use and maintenance operations may disturb foraging Mexican spotted owls. Any roads located within one-quarter mile of PACs that are identified for project-related use would be subject to breeding season timing restrictions (Brown et al., 2011). No product hauling or maintenance would occur on these roads from March 1 through August 31.

Alternative C—Direct/Indirect Effects

Mechanical treatment and broadcast burning treatments would occur in the same stands as alternative B, except that no trees greater than 16 inches in diameter would be cut. Effects analysis of alternative C is similar to alternative B.

With alternative C, 75 percent of MSO restricted other habitat forest types (by area) are projected to meet desired maximum density conditions post treatment. Overall differences in stand density are slight relative to alternative B; however, the forest vegetation spatial arrangement would be different under this alternative than under alternative B. The posttreatment tree distribution would be more uniform under alternative C without the clumpy and groupy stand arrangement, and so there would be less opportunity to create openings. This forest structure and stand arrangement leads to more rapid canopy closure (estimated at 15 years) of the forest as it develops post treatment (Richardson et al., 2012). This rapid canopy closure has significant implications for high severity wildland fire risk with both crown fire and FRCC, along with understory herbaceous and shrub community development. Restricted other habitat would be managed for clumpy and groupy stand arrangement with openings less than 2 acres, where constraints do not limit achievement of objectives. This alternative would reduce the risk of high severity canopy fire in restricted, threshold, and target threshold more than alternative A but less than alternative B.

Because of the diameter limit in alternative C, canopy cover would be slightly different than alternative B in restricted habitat with development of an even-aged stand with retention of a range of 25–40 percent SDI (a reduction from 52 percent) which equates to a range of 40–70 percent canopy coverage.

The excess of 12- to 16-inch d.b.h. trees would be treated to move toward desired conditions. Treatment resulting in even-aged stands would continue to be at a higher risk for active crown fire over alternative B.

Alternative C has similar effects as alternative B for MSO high density BA requirements in threshold and target threshold habitats. Alternative C would reduce the ability to reduce canopy fuel continuity or for understory vegetation to respond to treatment. Areas in protected, threshold, and target threshold habitat would remain as FRCC 3 or move to FRCC 2 in situations where some canopy can be affected without losing the desired BA.

In alternative C, restricted habitat (MC) would be restored to an FRCC 1 less than alternative B (figure 11 above). Implementing alternative C would manage for less of an improved FRCC within MSO restricted habitat post treatment for up to 20 years (Nicolet 2011). Potential crown fire would be higher than alternative B, with the ability to manage wildland fire for resource benefit and maintenance treatments in the future less than alternative B. High severity crown fire was identified as one of two primary threats to the MSO when it was listed as threatened in 1995 (USDI 1995a). High severity crown fire continues to be a primary threat today.

Prey base habitat would be enhanced following forest understory vegetative recovery, but for a shorter period of time than alternative B due to increased canopy coverage over time.

MSO ESA Determination Effect

Alternative A

Based on the above discussion, alternative A has no effect to Mexican spotted owl or its critical habitat. This alternative would not reduce the threat of high severity active canopy fire, which is a major concern for recovery of this species. This alternative does not manage toward forest plan or recovery plan objectives of MSO.

Alternative B

The determination of effects for the Mexican spotted owl habitats is based on design criteria, mitigation, and conclusions based on the above effects discussion. Alternative B may affect, not likely to adversely affect the Mexican spotted owl.

This alternative would meet forest plan and recovery plan guidelines for MSO. MSO stratified habitat would provide for a mosaic of desired stand structure conditions, allowing for wildlife habitat and vegetative diversity. This mosaic would allow for a diversity of fire effects, thereby increasing opportunities for the maintenance of forest structure and function using natural and broadcast fire in the long-term future (up to 30 years). This alternative would improve the conditions in the project area to reduce the risk of high severity crown fire within treated acres for 30 years by reducing FRCC in restricted habitats and surrounding northern goshawk stratified habitats that are adjacent to MSO protected, threshold, and target threshold habitats. FRCC would largely remain unchanged in protected, target, and threshold target habitats (fuels specialist report). This alternative would move vegetation toward protected and restricted habitat recovery

plan and forest plan objectives for MSO and would manage adjacent northern goshawk habitats objectives for an estimated 30 years with opportunities for maintenance treatments or wildland fire use.

Alternative B would provide long-term nesting and roosting benefits while reducing potential risk of high severity wildland fire. To mitigate adverse effects associated with treatments within protected habitat, no activities would occur within the nest core buffer with approved activities occurring outside the breeding season. Low severity prescribed fire within MSO stratified habitat would retain forest stand structure and provide for understory grass–forb–shrub release to improve habitat components following vegetative recovery for MSO prey base.

Alternative C

Alternative C, determination of effects for MSO is based on the above discussions and pertinent alternative C discussions and determinations carried forward. Alternative C may affect, not likely to adversely affect the Mexican spotted owl.

Alternative C would provide long-term nesting and roosting benefits while having an increased risk of high severity wildland fire compared with alternative B. To mitigate adverse effects associated with treatments within protected habitat, no activities would occur within the nest core buffer with approved activities occurring outside the breeding season.

Cumulative Effects to MSO

Alternative A

Activities identified in cumulative effects background in this chapter (page 39) add to the cumulative effects to this species by disturbance-related activities. No direct cumulative effects would occur to MSO because there are no direct effects from this project. Alternative A does not manage toward recovery objectives for MSO.

Alternatives B and C

In addition to the vegetation management listed at the beginning of this chapter, development of private lands in Forest Lakes Estates is expected to continue. Forest Lakes Estates only contains MSO foraging habitat. Although development of these properties would likely make vegetation less suitable for foraging, this would not affect the species because these activities would not affect MSO protected, restricted, or critical habitat.

Private land development is likely to increase human occupancy and attract more forest user days to this area. Activities associated with an increase in nighttime human activity associated with occupancy may cause some displacement to foraging spotted owls adjacent to the Rancho Allegre property. Human occupancy and associated activity effects in this area are not significant to Mexican spotted owl as the nearest PAC is greater than a mile away.

Effects Analysis for MSO Critical Habitat

Approximately 3,886 acres of designated critical habitat in the project area has potential to provide PCEs. To maintain forest structure PCEs to levels consistent with the forest plan and recovery plan, this protected and restricted habitat would be mechanically treated in the project area. Treatment activities retain forest structure and prey base, and so would have minimal effects

on critical habitat. The Ridge PAC MSO nest core habitat would not be treated by mechanical or prescribed fire on 119 acres.

Approximately 22,507 acres of designated critical habitat would receive low severity prescribed burn treatments incrementally during the 15-year implementation schedule. This low severity prescribed burn treatment would result in some temporary effects on prey base habitat elements, but these effects should not result in adverse effects and would result with improved habitat conditions for prey base following vegetative recovery. It is expected that burning would positively affect prey base by allowing for understory vegetative species to be released after mechanical thinning and low severity prescribed fire that would provide additional cover and food resources.

Canyon habitats would not be treated and so would not be affected. They would, however, benefit as surrounding lands become less susceptible to uncharacteristically severe wildfire.

Alternative B

Following is the effects analysis of alternative B on the primary constituent elements.

Forest Structure

1. Restricted habitat (other) - within the tree species (mixed conifer, pine-oak): implementation would take the 80 percent of 5-inch to 18-inch d.b.h. structure and create variable younger age class stands. Treatments would provide new openings up to 2 acres, but majority would result in 0.25–0.75 acre openings in mixed conifer and 1–2 acres in pine-oak. Uneven-aged stand management with regeneration openings would be managed toward meeting forest plan guidelines.
2. Ridge PAC and protected habitat would receive precommercial thinning that removed trees greater than 9 inches d.b.h. on 281 acres and 77 acres respectively that would remove finer fuels and slightly reduce the BA and low level canopy; however, any canopy or BA lost would be short term as individual trees that remain would increase in canopy and BA with reduced competition. Restricted target and target threshold treatments would have similar structure effects with the exception that select trees may be harvested up to 24 inches d.b.h..
3. Low level canopy cover would be reduced within protected habitat and restricted target/target threshold habitats due to thinning small trees, but still retain these levels to forest plan standards in protected and target threshold habitats and move target threshold toward threshold standards. Any canopy or BA lost would be short term as individual trees that remain would increase in canopy and BA with reduced competition. Canopy cover would change slightly in restricted habitat with development of uneven-aged stand management with retention of a range of 25–40 percent SDI, which equates to 40–70 percent canopy coverage.
4. Broadcast burning may reduce the number of large, dead trees (snags), but by using low severity broadcast burning with adequate fuel moistures, it is expected that most existing snags would be retained. Selection and management for snag retention and creation would be employed to meet forest plan guidelines during mechanical treatments. Landings in MSO critical habitat would be located in existing openings or in areas where snags would be minimally impacted. Mechanically thinning and broadcast burning treatments are not expected to adversely affect this primary constituent element.

Pretreatment and posttreatment monitoring would be conducted according to current Forest Service protocol to evaluate snag retention effectiveness. Logs are currently meeting forest plan guidelines and would be maintained at guideline levels.

Prey Species

1. Broadcast burning would reduce the amount of fallen trees and other woody debris across treated areas in order to decrease high fuel loads. This moves toward desired levels similar to historic conditions that allow for future maintenance and reduce the risk of high severity wildland fire over time. Burning techniques would be used to retain most large existing downed logs (12 inches or greater at the midpoint and at least 8 feet long). This would be accomplished by burning in adequate fuel moistures and with ignition techniques that reduce the risk of log consumption. Landings would be located in existing openings or in areas where logs would be minimally impacted when available. Not all critical habitat would be treated at once because of the requirement for phased implementation (appendix B). The prey base habitat elements would receive some temporary effects within burned areas. However, it is expected that low severity broadcast fire would not consume all ground fuels and would leave unburned areas. The prey base numbers may be temporarily impacted and rebound following vegetative recovery, but prey base populations are not expected to be adversely affected by these treatments. Not all MSO habitats would have impacts to prey base habitats, additionally, the phased implementation allows for not all MSO prey base habitats to be impacted at once, and providing untreated or recovered habitats within foraging habitat range. Posttreatment monitoring would be conducted according to current Forest Service protocol to evaluate log retention effectiveness.
2. Treatments are not expected to reduce desired tree and plant species composition, including Gambel oak. No oak trees would be thinned or harvested, but some may be lost to low severity broadcast fire. Overall, shade-intolerant Gambel oak would greatly benefit from these proposed treatments because of the release of large oak from overstory tree competitors. Fire may stimulate regeneration of oak in areas with high duff layers. Benefits from implementing the treatments would be realized with opening of the overstory canopy that provides opportunities for understory vegetative species to be released providing cover and food resources for prey base.
3. Adequate levels of residual plant cover to maintain a mosaic of unburned habitat patches containing fruits and seeds, and allow plant regeneration for the needs of MSO prey species would be maintained with a low severity broadcast fire due to an expected burned, partially burned, and unburned duff layers. New herbaceous plant growth would occur in areas where thick layers of dead plant material has accumulated over time and prevented herbaceous growth. Treatments are expected to have a short-term impact of 1 to 2 years until forest understory recovery, but are not expected to adversely affect this primary constituent element.

Design criteria and mitigation would be implemented to be compliant with forest plan and recovery plan guidelines. Activities associated with mechanical thinning and broadcast burning would be implemented to minimize effects to MSO within PACs by avoiding treatments in the nest buffer and only treating 281 acres within the Ridge PAC.

The protected habitat, restricted threshold, and restricted target threshold habitats would be managed toward forest plan and recovery plan guidelines and would develop future nesting habitat.

Restricted other habitat would be managed for age class structure development and move toward forest plan guidelines. A short-term impact with mechanical thinning and broadcast burning activities would provide for long-term future benefits for MSO habitats being managed toward forest plan and recovery plan guidelines.

Other effects to critical habitat are described previously in the "Effects" portion of this section.

The desired condition, as defined by the forest plan and recovery plan guidelines, is to have a sustained level of MSO nest/roost habitat well distributed across the landscape while reducing potential for stand replacing wildland fires through MSO habitats. The forest plan also described uneven-aged forest structure as the desired condition for restricted (other) habitat areas. Prey base habitat would be enhanced following forest understory vegetative recovery. Roads and access that would be temporarily opened during activity implementation would be closed and rehabilitated upon project completion. The forest plan amendment proposed as part of this alternative would not directly change these conditions because it provides for achieving northern goshawk habitat objectives, which indirectly benefit MSO critical habitat by providing landscape level condition class changes.

Alternative C

As with alternative B, approximately 3,886 acres of critical habitat meeting the definition of protected habitat or restricted habitat would be treated in the project area to maintain or enhance primary constituent habitat elements for forest structure and prey base. Canyon habitats would not be affected.

Mechanical treatment and broadcast burning treatments would occur in the same stands as alternative B, except that no trees greater than 16 inches in diameter would be cut. Effects analysis to MSO protected, restricted threshold, restricted target threshold, and restricted "other" are described above. The direct, indirect, and cumulative effects for alternative B are applicable to alternative C. The amendment proposed for alternative C would allow for stands in northern goshawk habitat to move toward even-aged conditions and away from the uneven-aged conditions that most benefit goshawk. Although this moves stands toward a condition that provides nest/roost sites well distributed, it does not reduce the long potential for stand-replacing wildfires in MSO habitats.

Cumulative Effects to Critical Habitat—Alternatives B and C

Development of private lands in Forest Lakes Estates and the Rancho Alegre private land parcel is expected to continue. Rancho Allegre is a meadow not within designated critical habitat but is bordered by National Forest System lands containing restricted habitat. Continued development of these properties may make them less suitable for MSO foraging. Restricted habitat adjacent to the Rancho Alegre property may become less suitable for nesting or roosting. The loss of habitat in these parcels is negligible when compared to the amount of available habitat on surrounding national forest lands.

Private land development is likely to attract more forest users to this area. Activities associated with an increase in nighttime recreation may cause some displacement to foraging spotted owls adjacent to the Rancho Allegre property. Recreation in this area is not believed to have notable effects to Mexican spotted owl behavior.

Table 52. Comparison of alternatives on MSO habitat

Summary Evaluation Criteria	Alternative A	Alternative B	Alternative C
Biological diversity, restricted habitat (other) (excluding MSO protected, threshold, target threshold)	Low: shaded out understory, stands dominated by 5–18" class trees, aspen and oak restricted.	High: clumpy/groupy stand distribution with regeneration openings; understory release of herbaceous/browse is high; increased stand age class distribution; future maintenance to complement regeneration openings and understory composition and production.	Moderate: even-aged stand with minimal regeneration openings; understory release less than desirable with canopy closure expected in 15 years.
Forest understory vegetation development (MSO prey base, ungulates)	Low potential: shaded out, degrading over time (i.e. not sustainable).	High potential: stand developed with groups and clumps and regeneration openings; long-term maintenance (30 year longevity).	Moderate potential: short-term gain until canopy closes (15 year longevity).
Forest understory vegetation - surface fire potential (percent of stratified habitat)	MSO Restricted = 26% MSO Threshold/Target = 28%	MSO Restricted = 73% MSO Threshold/Target = 87%	MSO Restricted = 50% MSO Threshold/Target = 72%
Forest structure – restricted habitat (other)	Low: dominated by 5–18" class trees, lack of age class diversity.	High: initial mechanical treatment with groups, clumps, and regeneration openings provide most diversity. Class development would occur over time; periodic broadcast burn maintenance planned for developing regeneration openings.	Moderate: initial mechanical treatment with cap limits spatial distribution, less diversity. Class development than alternative B; no broadcast burn maintenance planned; no future regeneration openings.
Posttreatment passive crown fire potential – MSO threshold/target threshold	High risk of adverse habitat alteration modeled at 63%.	Low risk of adverse habitat alteration modeled at 8%.	Moderate risk of adverse habitat alteration modeled at 23%.
Posttreatment passive crown fire potential – MSO restricted	High risk of adverse habitat alteration modeled at 54%.	Low risk of adverse habitat alteration modeled at 27%.	Moderate risk of adverse habitat alteration modeled at 27%.
Posttreatment passive crown fire potential – MSO protected	High risk of adverse habitat alteration modeled at 60%.	Low risk of adverse habitat alteration modeled at 8%.	Moderate risk of adverse habitat alteration modeled at 28%.

Determination of Effects for MSO Critical Habitat

Alternative B

The determination of effects for the Mexican spotted owl critical habitats is based on design criteria, mitigation, and conclusions based on the above effects discussion. Alternative B may affect, not likely to adversely affect the Mexican spotted owl critical habitat for forest structure and prey base PCEs. It is recognized that treatments (mechanical and broadcast burning) are expected to have a short term insignificant impact with a long-term benefit.

This alternative with future maintenance for restoration and fuel reduction treatments provide for a long-term maintenance of primary constituent elements. Developing a mosaic of stand conditions throughout the critical habitat would allow for a diversity of fire effects, thereby increasing opportunities for the maintenance of forest structure and function using natural and broadcast fire in the long-term future (up to 30 years). This alternative would improve the conditions in the project area to reduce high severity crown fire within treated acres for 30 years by reducing FRCC in restricted other habitats and surrounding northern goshawk. FRCC would largely remain unchanged in protected, target, and threshold target habitats (Nicolet 2011). This alternative has moved toward protected and restricted habitat recovery objectives for MSO and would manage adjacent northern goshawk habitats objectives for an estimated 30 years with opportunities for maintenance treatments or wildland fire for resource benefit.

Alternative C

Alternative C may affect, not likely to adversely affect the Mexican spotted owl critical habitat for forest structure and prey base PCEs. It is recognized that treatments (mechanical and broadcast burning) are expected to have a short term insignificant impact with a long-term benefit.

This alternative for restoration and fuel reduction treatments provide for medium-term maintenance of primary constituent elements. Developing even-aged stand conditions throughout the critical habitat would allow for less diversity of fire affects than alternative B. This alternative would improve the conditions in the project area to reduce high severity crown fire within treated acres for 15 years until canopy closure occurs. FRCC would largely remain unchanged in protected, target, and threshold target habitats (Nicolet, 2011).

This alternative would move toward recovery objectives for MSO for protected and restricted target and target threshold habitat. Prey base habitats would initially be adversely affected, with long-term gains following vegetative recovery.

The prey base habitat component would become shaded out following canopy closure and decline in condition sooner than alternative B.

Consistency With MSO Biological Opinion (2012)

This section describes how alternatives relate to the “Eleven Forest Biological Opinion for Mexican Spotted Owl Reasonable and Prudent Measures Terms and Conditions and Conservation Measures.”

The USDA Forest Service consulted with the USDI Fish and Wildlife Service (FWS) on the 11 land and resource management plans (LRMP) for all national forests and grasslands in the

Southwestern Region. A final biological and conference opinion (LRMP BO) was issued for "The Continued Implementation of the LRMP for the Apache-Sitgreaves National Forests of the Southwestern Region" USDA Forest Service on April 30, 2012. Section 7(d) of the Endangered Species Act of 1973, as amended, requires that Federal agencies "shall not make any irreversible or irretrievable commitment of resources with respect to the agency action which has the effect of foreclosing the formulation or implementation of any reasonable and prudent alternative which would not violate subsection (a)(2)." It is the current direction of the Southwestern Region to conduct a consistency check to determine whether an amendment to a LRMP is necessary to be consistent with the requirements of the LRMP BO for an action alternative.

An LRMP amendment is considered to be consistent with the LRMP BO if:

- It results in effects (to species and/or designated critical habitat) that were analyzed in the BO;
- It does not result in exceeding the amount of take issued in the BO;
- It meets the assumptions stated in the BO; and,
- It would result in continuing to implement the terms and conditions of the BO.

The FWS in its opinion included reasonable and prudent measures in order to minimize incidental take of MSOs:

1. Minimize or eliminate adverse effects to MSOs on the Apache-Sitgreaves NFs (see terms and conditions 1.1, 1.2, and 1.3)
2. Minimize or eliminate adverse effects to MSO habitat on the Apache-Sitgreaves NFs (see terms and conditions 2.1 and 2.2)
3. Monitor the impacts of site-specific projects on the MSO (see terms and conditions 3.1 and 3.2).

In addition to the "Reasonable and Prudent Measures Terms and Conditions," section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or CH, to help implement recovery plans, or to develop information.

Table 53 identifies each alternative on consistency with the 11 forest BO for Mexican spotted owl. Although there is no difference with consistency between alternatives B and C, there are significant differences between longevity or benefits of project activities (30 years vs. 15 years) as it directly relates to forest canopy closure and wildland fire risk as well as fire regime condition class. Alternative B is superior to alternative C with reducing the potential for high severity canopy wildland fire, which is one of the top two risks to MSO recovery.

Table 53. Consistency of alternatives with Mexican spotted owl ESA requirements

Terms and Conditions	No Action	Alt. B	Alt. C
1.1 Where feasible, the Apache-Sitgreaves NFs shall avoid activities within 0.25 mile of PACs during the MSO breeding season (March 1 to August 31) that could result in disturbance to MSOs.	NA	Consistent, with long-term benefit.	Consistent, with short-term benefit.
1.2 MSO surveys shall occur within the Wallow Fire perimeter to determine the status and distribution of MSOs impacted by the fire. (Note: As we have stated earlier in this document, there is much uncertainty in regards to the status of the MSO within the Wallow Fire and we do not know how many MSOs would be able to use a portion of the fire area (approximately 22,267 acres of previously identified nesting/roosting habitat) for activities other than foraging into the future. There is currently no science that allows us to say exactly how many MSOs may be able to continue to conduct roosting and/or nesting behaviors within the fire perimeter. However, we are using our knowledge of MSO behavior following other large, high-severity fires and the existing status of the species within the UGM EMU to estimate the number of PACs we believe must still be present before reinitiation of this consultation should occur.) Surveys shall be conducted according to protocol unless other factors (e.g., human health and safety) result in needed modifications. Surveys should be coordinated with the FWS prior to implementation of any projects. Surveys should focus on potential habitat within the fire perimeter.	NA	Consistent	Consistent
1.3 On site-specific projects, the USFS will work with FWS staff to identify and implement additional reasonable and prudent measures and terms and conditions specific to the project, to minimize effects to MSOs.	Consistent	Consistent	Consistent
2.1 Where feasible, vegetation management treatments (which could include activities such as fuels reduction, utility line maintenance, etc.) will maintain adequate amounts of important habitat features or MSOs (such as large trees, large snags, and large logs).	NA	Consistent	Consistent
2.2 On site-specific projects, the USFS will work with FWS staff to identify and implement additional reasonable measures, specific to the project, to minimize effects to MSO habitat.	NA	Consistent	Consistent
3.1 The Apache-Sitgreaves NFs shall monitor incidental take resulting from the proposed action and report their findings to the FWS. Incidental take (implementation) monitoring shall include information such as when or if the project was implemented, whether the project was implemented as analyzed in the site-specific BO (including CMs and best management practices (BMPs)), breeding season(s) over which the project occurred, relevant MSO survey information, and any other pertinent information as described in the site-specific BO about the project's effects on the species.	Consistent	Consistent	Consistent
3.2 Annual reports, which will include this species, shall be sent to the appropriate local FWS Ecological Services field office by March 1st of each year.	Consistent	Consistent	Consistent

Conservation Recommendations	No Action	Alternative B	Alternative C
1. We recommend that the USFS work with the FWS to conduct MSO surveys over the next several years to attempt to determine how MSOs modify their territories in response to the Wallow Fire and other wildland fires. This information will aid us in understanding the short- and long-term impacts of fire on the MSO, and its subsequent effect on the status of the species in the UGM EMU.	NA	Consistent	Consistent
2. We recommend that the USFS work with the FWS to design forest restoration treatments across the Apache-Sitgreaves NFs that protects existing nest/roost habitat from high severity, stand-replacing fire and enhances existing or potential habitat to aid in sustaining MSO habitat across the landscape. PACs can be afforded substantial protection from wildland fire by emphasizing fuels reduction and forest restoration in surrounding areas outside of PACs and nest/roost habitat.	NA	Consistent	Consistent

Consistency Finding: Based on a review of the LRMP BO and information discussed in the above effects analysis, it is determined that implementation of any of the action alternatives would be consistent with the "Apache-Sitgreaves National Forests Programmatic LRMP Biological Opinion" and a forest plan amendment is not necessary.

New Mexico Jumping Mouse

This species has been documented in the White Mountains of southern Apache and northern Greenlee Counties (Hoffmeister 1986). The nearest known site occurs on the north fork of the White River. No surveys have been completed in the analysis area for this species, but riparian habitat does occur within the project area. The Mexican jumping mouse nests in dry soils, but uses moist, streamside, riparian soils to hunt in at night, making the range long and narrow (often as long as 150 m) along permanent running water. The project area has grassy and meadow habitats adjacent to perennial water that may provide suitable habitat for this species. Nonforested cover types (wetland, reservoir, grassland) totaling approximately 551 acres combined with 32.2 miles of riparian areas is considered for effects analysis.

Effects

Alternative A

Alternative A would not result in an immediate change to the quantity or quality of habitat used by New Mexico jumping mouse. Forested habitat would continue to be overstocked and shade out the understory. Meadow habitats would continue to receive conifer encroachment over time. The forested habitat within the project area would be at a higher risk of stand replacing crown fire (fire specialist report).

There would be no cumulative effects associated with this alternative because there is no effect from this project.

Alternative B

Proposed activities adjacent to wet meadows and riparian corridors could negatively affect New Mexico jumping mouse individuals. Tree thinning, broadcast burning, opening level 1 roads, use of approved routes, and maintenance of existing roads could result in injury or mortality of individuals. Most meadows and riparian corridors would be either undisturbed or lightly disturbed by tree thinning and associated vehicle traffic simply because there are few trees in these areas. Mice could be injured or killed by falling trees or vehicles running over them. Skidders and other equipment could collapse burrows or tunnels, causing harm or disturbance to individual active or hibernating mice.

Benefits from treatments would include management toward VSS class distribution objectives and increased understory herbaceous and browse species that would benefit this species.

This alternative would improve the conditions in the project area to reduce high severity crown fire within treated acres up to 30 years by creation of uneven-aged stand management with tree stands arranged in groups and clumps with regeneration openings. Additionally, the species would benefit from this alternative's changing the FRCC rating from FRCC 3 to FRCC 1 in MSO restricted other habitats and surrounding northern goshawk up to 20 years.

Alternative C

The effects analysis from alternative B applies under this alternative with a few exceptions. Differences in the effects analysis result from VSS class distribution objectives. This means that in alternative C, with less canopy opening, less development of the understory herbaceous and browse species would occur, and so the benefit would be less to the New Mexico jumping mouse. Alternative C has a shorter duration before the crowns close as well, so that herbaceous species would be maintained. As the FRCC returns to FRCC 3, the benefits to the mouse would be reduced as the risk of high severity canopy wildland fire increases.

This alternative has improved the conditions in the project area to reduce high severity crown fire within treated acres up to 15 years for northern goshawk habitats and MSO restricted other habitats by even-aged stand management and resulting FRCC. FRCC would largely remain unchanged in protected, target, and threshold target habitats (see "Fuels" section).

Benefits from treatments would include management toward VSS class distribution objectives and increased understory herbaceous and browse species that would benefit New Mexico jumping mouse until canopy closure occurs (15 years) and desirable understory becomes shaded out.

This alternative has improved the conditions in the project area to reduce high severity crown fire within treated acres for up to 15 years by reducing FRCC in restricted other habitats and surrounding northern goshawk. FRCC would largely remain unchanged in protected, target, and threshold target habitats (see "Fuels" section).

Determination of Effect

Alternative A: Based on the above discussion, alternative A would have no impact to New Mexico jumping mouse. With not treating within the project area, it would remain mostly at the FRCC 3 level and would be susceptible to a high severity, stand-replacing crown fire.

Alternative B or C: The determination of effects for the New Mexico jumping mouse and its habitat (193 acres of meadow and riparian) are based on conclusions on the above discussion. Based on the above discussion, alternative B or alternative C may impact individual New Mexico jumping mouse, but is not likely to result in a trend toward Federal listing or loss of viability.

Forest Service Sensitive Terrestrial Species

Summary

The analysis identifies sensitive species that might be affected by this project. In includes mammals (four), birds (five), reptiles (one), and plants (five). Also, sensitive species of fish (four) and amphibians (two) are included in the analysis (in the "Aquatics Species" section starting at page 171).

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))."

Both action alternatives may impact individual sensitive species, but these alternatives are not likely to result in a trend toward Federal listing or loss of viability. The difference between the action alternatives is that alternative B would maintain its beneficial habitat effects for at least 30 years, while alternative C is expected to maintain that benefit for 15 years or less.

Details

The Black Mesa Ranger District utilized the "Region 3 Regional Foresters Sensitive Species List" dated September 21, 2007, to assist with development of species that may occur or have suitable habitat within the project area for effects analysis or are not analyzed in detail based upon species occurrence or habitat in the project area (table 54). Details about the northern goshawk follow, but readers should see the wildlife specialist report (Brown 2011) for details on other species.

Table 54. Sensitive species reviewed for effects analysis in the project area

USFS Sensitive Species (*Scientific Name*)	Species or Habitat Occur in Project Area
Following Species Analyzed in Detail with Rationale	
Mammals	
Merriam's shrew *(Sorex merriami leucogenys)*	Species may occur; habitat present in project area. Merriam's shrews have not been recently captured in the project area. Surveys specific to this species have not been conducted in or near the project area. DeRosier and Ward (1994) documented anatomical parts of this species from Mexican spotted owl pellets collected on the Black Mesa Ranger District. The project area has grassy and meadow habitats adjacent to perennial water scattered across the project area that likely provides suitable habitat for this species. Nonforested cover types (wetland, reservoir, grassland) scattered across the project area totaling approximately 551 acres combined with 32.2 miles of riparian areas is considered for effects analysis.
Long-tailed vole (*Microtus longicaudus*)	Species may occur; habitat present in project area. Long-tailed voles have not been recently captured in the project area and site-

USFS Sensitive Species (*Scientific Name*)	Species or Habitat Occur in Project Area
	specific surveys for this species have not been performed in the project area. DeRosier and Ward (1994) documented anatomical parts of this species from Mexican spotted owl pellets collected on the Black Mesa Ranger District. The project area has grassy and meadow habitats surrounded by coniferous forests that likely provide suitable habitat for this species. Nonforested cover types (wetland, reservoir, grassland) scattered across the project area totaling approximately 551 acres combined with 32.2 miles of riparian areas is considered for effects analysis.
New Mexico jumping mouse *(Zapus hudsonius luteus)*	Species may occur; habitat present in project area (described in detail in the federally listed section above).
Allen's lappet-browed bat *(Idionycteris phyllotis)*	Species documented on district; habitat present in project area. Bat surveys have not been conducted recently in the project area. Allen's lappet-browed bat has been documented at several sites on the Black Mesa Ranger District, including areas within a few miles east, west, and north of the project area (Petryszyn and Sidner 1994). One individual of the species was netted in 2003 at Bruno Tank, within .25 mile of the project area boundary. The project area has several thousand snags that could be used by Allen's lappet-browed bat for roosting, as they are known for using tree roosts on the Coconino and Apache-Sitgreaves National Forests in Arizona (AZGF 2001). The Mogollon Rim and several canyons in and near the project area also provide suitable roosting habitat for this species, water in the form of lakes, cienegas, stock tanks, and streams is also readily available. All forested and nonforested habitats totaling approximately 33,548 acres in the project area is considered for effects analysis for foraging, while forested habitats are considered for roosting.
Birds	
Bald eagle (Haliaeetus leucocephalus)	Species and habitat present in project area. The bald eagle south of the 40th parallel was listed as endangered under the Endangered Species Preservation Act of 1966, and was reclassified to threatened status on July 12, 1995 (USDI 1995). Bald eagles were delisted from the Endangered Species Act throughout most of Arizona and the United States in July 2007 (USDI 2007). The Sonoran Desert population continues to be protected under ESA as a threatened species (USDI 2008). Bald eagles that occur within the project area remain protected by the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act, with both acts prohibiting the "take" of bald eagles. Bald eagles have been detected at Woods Canyon and Willow Springs Lakes during the summer months with an active nest located at Woods Canyon Lake. Wintering bald eagles have been observed at Bear Canyon, Woods Canyon, and Willow Springs Lakes. There are no known roost sites in or near the project area. Existing reservoirs totaling approximately 286 acres and adjacent coniferous forest is considered for effects analysis.
Northern goshawk *(Accipiter gentilis)*	Species and habitat present in project area (see below).
Common black-hawk *(Buteogallus anthracinus*	Species and habitat present in project area. No formal surveys for common black-hawks have been conducted on the Black Mesa district, but some overlap in suitable habitat has occurred during northern goshawk surveys. To date, no black-hawk nests have been discovered during goshawk surveys although black-hawks have been observed in Chevelon, Woods, and Slim Jim Canyons which contain suitable nesting habitat. The Black Mesa district provides suitable nesting habitat in Woods and Chevelon Canyons where pools containing black-hawk prey persist throughout the year. Chevelon Creek is perennial above Chevelon Lake and intermittent below the lake. The portion of Willow Creek within the project area has perennial pools which may provide suitable black-hawk foraging habitat. The project area contains limited suitable nesting habitat for common black-hawks. Common black-hawks have been observed in Woods Canyon adjacent to the

USFS Sensitive Species (*Scientific Name*)	Species or Habitat Occur in Project Area
	project area and farther north in Chevelon Canyon area. Effects analysis addresses potential habitats along the 32.2 miles of riparian areas and adjacent forested areas scattered across the project area.
American peregrine falcon *(Falco peregrinus anatum)*	Species and habitat present in project area. The American peregrine falcon was removed from the Endangered Species Act's threatened and endangered species list in 1999 (USDI 1999). It is now classified as a Region 3 forest sensitive species. Surveys for peregrine falcons have been conducted along much of the Mogollon Rim adjacent to the Rim Lakes Project area and in portions of canyons north of the project area. There are three known eyries along the Mogollon Rim on the Tonto National Forest adjacent to the project area. All three were monitored and occupied in 2007. The project area borders the Mogollon Rim along its entire length. While the project area itself contains no suitable nesting habitat, the cliffs along the rim directly below the project area are excellent habitat. The project area is likely used by peregrine falcons as foraging habitat. Forest Service policy provides for protection of peregrine falcon eyries and restrictions on activities during the nesting season. All forested and nonforested habitats totaling approximately 33,548 acres in the project area are considered for effects analysis as foraging habitat and known nest sites for nesting habitat.
Zone-tailed hawk *(Buteo albonotatus)*	Species and habitat present in project area. *Although adapted to a variety of habitats, the Zone-tailed is uncommon and patchily distributed, occurring in diverse lowland and higher elevation habitats, the species ranges from riparian woodland and humid forests to semiarid open country and montane highlands (Johnson et al., 2000).* A zone-tailed nest is also known from Hart Canyon, north of the project area. No zone-tailed hawk nests were located in suitable habitat during formal northern goshawk surveys within the project area. Zone-tailed hawks have been observed along the Mogollon Rim and could be nesting below the rim and foraging in the project area. All forested and nonforested habitats totaling approximately 33,548 acres in the project area are considered for effects analysis as foraging habitat.
Reptiles	
Narrow-headed garter snake *(Thamnophis rufipuctatus)*	Species not known to occur; habitat present in project area. No formal surveys for narrow-headed garter snakes have been conducted on the Black Mesa district, however snakes and other aquatic species were documented during recent leopard frog surveys which occurred in suitable narrow-headed garter snake habitat within and adjacent to the project area. No narrow-headed garter snakes were detected during these surveys. A narrowed-headed garter snake was detected at the Vincent Ranch in Hart Canyon in a 1991 USFWS report. The element occurrence card from this sighting lacks verifiable information (no photograph) and the individual was found with two wandering garter snakes. The report is the only reported occurrence of this species from the Little Colorado River watershed, which is outside the project area. Nonforested cover types (wetland, reservoir, grassland) scattered across the project area totaling approximately 551 acres combined with 32.2 miles of riparian areas are considered for effects analysis.
Plants	
Arizona sneezeweed (Helenium arizonicum)	Species and habitat present in project area. This plant is endemic to north-central Arizona in Coconino, Gila, Apache, and Navajo Counties. It occurs around wet places such as ponds, lakes, and roadside ditches. It can be abundant in its habitat and does not appear to be grazed even though its habitat can have heavy grazing impacts. It is vulnerable to drainage or drying of wetlands. Arizona sneezeweed has been documented at several locations within the project area along the Mogollon Rim. Effects analysis addresses this species in proximity to reservoirs and wetlands (310 acres).

USFS Sensitive Species (*Scientific Name*)	Species or Habitat Occur in Project Area
Eastwood alum root *(Heuchera eastwoodiae)*	Unconfirmed reports of species in project area; habitat present in project area. Surveys for Eastwood alum-root have not been conducted on the Black Mesa Ranger District. The species has not been documented as occurring within the project area. Suitable habitat for this species exists in the major canyons scattered throughout the project area; effects analysis addresses forested habitat totaling approximately 32,596 acres within these major drainages.
Arizona sunflower *(Helianthus arizonensis)*	Species not documented; habitat may exist in project area. Surveys for Arizona sunflower have not occurred within the project area. It is unknown whether this species exists within the project area. Effects analysis addresses all forested and nonforested habitats totaling approximately 33,548 acres in the project area as potential habitat.
Blumer's dock *(Rumex orthoneurus)*	Species and habitat present in project area. Blumer's dock has been documented in Woods and Willow Canyons within the project area and found elsewhere in the Black Mesa Ranger District outside the project area. Nonforested cover types (wetland, reservoir, grassland) scattered across the project area totaling approximately 551 acres combined with 32.2 miles of riparian areas are considered for effects analysis.
Bebb's Willow *(Salix bebbiana)*	Species and habitat present in project area. Bebb's willow occurs at a few locations within and near the project area. Surveys for this species were completed by Granfelt (2001) with several relic Bebb's willows found in the project area. Effects analysis addresses the headwaters of Woods and Willow Canyons and wet meadows (24 acres).

Table 55 lists species and/or habitat determined to not be present in the project area and/or have no impact under the action alternatives.

Table 55. Sensitive species not analyzed

Following Species Not Analyzed in Detail with Rationale	
Common Name	**Scientific Name**
Birds	
Baird's sparrow	*Ammodramus bairdii*
Gray catbird	*Dumetella carolinensis*
Abert's towhee	*Pipilo aberti*
Burrowing owl (Western)	*Athene cunicularia hypugaea*
Arizona bell's vireo	*Vireo bellii arizonae*
Gray vireo	*Vireo vicinior*
Mammals	
Dwarf shrew	*Sorex nanus*
Water shrew	*Sorex palustris navigator*
Western red bat	*Lasiurus blossevillii*
Spotted bat	*Euderma maculatum*
Pale Townsend's big-eared bat	*Corynorhinus townsendii pallescens*
Greater Western mastiff bat	*Eumops perotis californicus*
White Mountains chipmunk	*Tamias minimus arizonensis*
White Mountains ground squirrel	*Spermophilus tridecemlineatus monticola*

Following Species Not Analyzed in Detail with Rationale	
Common Name	**Scientific Name**
Arizona gray squirrel	*Sciurus arizonensis arizonensis*
Springerville silky pocket mouse	*Perognathus flavus goodpasteri*
Southern red-backed vole	*Clethrionomys gapperi*
Arizona montane vole	*Microtus montanus arizonensis*
Navajo Mogollon vole	*Microtus mogollonensis navaho*
Reptiles	
Mexican gartersnake	*Thamnophis eques megalops*
Orange giant skipper	*Agathymus neumoegeni*
Plants	
Arizona alum root	*Heuchera glomerulata*
Maguire's beardtongue	*Penstemon linarioides* ssp. *maguirei*
Davidson's cliff carrot	*Pteryxia davidsonii*
Goodding's onion	*Allium gooddingii*
Greene milkweed	*Asclepias uncialis* ssp. *uncialis*
Villous groundcover milkvetch	*Astragalus humistatus* var. *crispulus*
White Mountains paintbrush	*Castilleja mogollonica*
Gila thistle	*Cirsium gilense*
Yellow ladys-slipper	*Cypripedium parviflorum* var. *pubescens (=C. calceolus* var. *pubesens, C. pubescens)*
Heathleaf wild buckwheat	*Eriogonum ericifolium* var. *ericifolium*
Wislizeni gentian	*Gentianella wislizeni*
Arizona alum root	*Heuchera glomerulata*
Mogollon hawkweed	*Hieracium brevipilum (=H. fendleri* var. *mogollense)*
Heartleaf groundsel	*Packera cardamine (=Senecio cardamine)*
Maguire's beardtongue	*Penstemon linarioides* ssp. *Maguirei*
Davidson's cliff carrot	*Pteryxia davidsonii*
Parish's alkali grass	*Pucinellia parishii*
Arizona willow	*Salix arizonica*
Mogollon clover	*Trigolium longipes* ssp. *Neurophyllum (=T. neurophyllum)*

Northern Goshawk

The project area has four goshawk post-fledgling family areas (PFAs) (figure 14). Surveys have documented no activity in two PFAs for at least 5 years; one was burned severely during the Rodeo-Chediski Fire and the other has not been active since the mid-1990s. No goshawk nests were located outside established PFAs.

Table 56. Northern goshawk habitat—ponderosa pine forests

Nest Habitat	257 acres

Post-Fledgling Family Areas (PFA) Habitat	
Uneven-aged	441 acres
Even-aged	298 acres
slopes > 40% [1]	0
Total inside PFAs	739 acres
Areas Outside of PFAs	
Uneven-aged	8,776 acres
Even-aged (Foraging)	11,685 acres
slopes > 40% [1]	223 acres
Total outside PFAs	20,684 acres
Total Acres in Planning Area	21,680 acres

[1] 100 percent of the area could be allocated to be managed for old growth structure. Uneven-aged stands would be managed toward 40 percent large tree structure.

Northern Goshawk Scale Analysis

Distribution of habitat structures (tree size and age classes, tree groups, density, snags, dead and down woody material, etc.) were evaluated at three scales: the small (site) scale; the mid-scale (stand), and at the project area scale:

- Small scale evaluation used plot data.
- The mid-scale evaluation used aggregated plot data divided into two categories; one for inside goshawk PFA/nest areas, and a second for habitat outside of PFA/nest areas.
- The project area scale evaluation used plot average data aggregated for all northern goshawk habitats in the planning area for each alternative.

Size and age class are described by using vegetation structural stage (VSS) classifications in this evaluation.

Basal area is provided as the best available density measure for this habitat type. Basal area data were collected at the plot level and aggregated to the stand level, and these data were aggregated to the mid-scale and project area scale.

There are two data sets for the snags and logs: (1) inventory conducted during northern goshawk surveys, and (2) stand exams. The inventory points for the northern goshawk surveys were strategically located for calling points. They provide the best available data for snags and logs within northern goshawk habitat for this project area.

Canopy Coverage: Forest plan minimum canopy cover guidelines apply only to VSS 4–6; therefore, a stand-level measurement of canopy cover is not applicable, and a point-level measurement may or may not be applicable (depending upon point location within tree group/patch).

Examples of treatment prescription results are found in the wildlife specialist report (Brown 2011).

Structure at the Small (Site) Scale

The plot data are the scale at which data is collected. Each plot was evaluated in FSVEG and assigned to a given VSS classification based on dominant BA. These data can be found in the silviculture specialist report, (Richardson 2011, appendix A). Display of all plot data by VSS classification in this evaluation would depict an array of VSS categories from VSS 1 to VSS 6. This array would be predominantly VSS 3 and 4 with lesser amounts approaching VSS 6. A similar relationship exists approaching VSS 1. However, VSS 2 appears to be the smallest class of VSS representation.

These attributes of existing VSS conditions were evaluated, and then action alternatives features were used to address changes to these existing attributes.

Mid-Scale and Project-Scale Evaluation for Structure (VSS)

The mid-scale habitat evaluation aggregated inventory plot data in two strata. One is outside of PFA/nest area stratum from all stands (95 percent of total goshawk habitat in project area), and the other is inside PFA/nest areas, the remaining 5 percent. Project scale evaluation includes all stands whether PFA/nest or foraging areas (FAs).

Table 57 shows the desired conditions as defined in the forest plan and the current condition at two scales of analysis. Although the table shows apparent surplus amounts of VSS 3 mid-scale outside PFA and project scale, only about one-third of the VSS 3 class evaluated has the vigor to move toward larger VSS classes (VSS 4, VSS 5, VSS 6). Approximately two-thirds does not have the vigor judged necessary to be managed forward.

Table 57. Mid-scale and project area stand structures

VSS	Forest Plan Desired Percent of VSS	Alt. A (Current) Percent of VSS Mid-scale Outside PFA/Nest	Alt. A (Current) Percent of VSS Mid-Scale within PFA/Nest	Alt. A (Current) Percent of VSS Project Scale
1	10	7	4	7
2	10	4	2	4
3	20	28	15	27
4	20	38	42	38
5	20	17	24	17
6	20	6	15	6

Three Scale Basal Area Evaluation

Basal area was examined as a measure of tree density at three scales. Aspects of density that could not be accurately reflected in these data that are necessary for forest plan consistency have been built into project design features common to both action alternatives (B and C). For example, the forest plan refers the reader to RMRS 217 for guidance on how to manage nest areas, and that document further identifies that 120 BA is desired. This nest area BA would be met as part of the design requirements for both action alternatives. If nest areas are not at this 120 BA, they would not receive any treatment that would lower the BA.

As with the three scales evaluation for structure, the site-scale evaluation used inventory plot data. The mid-scale aggregated inventory plot data by two strata: PFA/nest area stratum, all stands (5 percent of total goshawk habitat in project area) and areas outside PFA/nest areas (table 58).

At the project area scale, this evaluation shows all northern goshawk habitat in the planning area using plot average data. A comparison of basal area as a measure of density shows alternative A currently at 88 square feet per acre at the project area scale of evaluation (table 58). Alternative A has BA values that are above historic conditions and does not address the problem of reducing and arranging fuels to reduce large scale, high-intensity fires and effects that are not desired.

Table 58. Mid-scale/project area BA analysis: all stand structures

VSS	Alt. A (Current) Mid-BA Outside PFA/Nest	*Alt. A (Current) Mid-BA Inside PFA/Nest	Alt. A (Current) BA Project Scale
1	0	0	0
2	6	2	6
3	37	24	36
4	28	32	28
5	12	16	12
6	5	5	5
Total BA	88	79	88

Snags

Forest plan guidelines require two snags per acre, which is currently above existing conditions (table 59).

Table 59. Existing and desired forest density and snags by goshawk habitat

Stratified Habitat	Existing Acres*	Existing Snags per Acre	Desired Snags per Acre
PFA/nest	996	0.7	2.0+
Out of PFA/nest	20,684	0.8	2.0
Project area	21,680	0.8	2.0

* Not all acres are proposed for treatment.

Table 60. Northern goshawk inventory plots for logs/acre, data from area larger than project area

Survey Area (1,665 plots)	Acres	Average Dead/Down Logs per Acre
Rim East	3,289	3.22
Rim Lakes	16,414	4.92
Rim Promontory	4,744	5.08
Rim R/C Area	5,299	2.44
Rim West	10,332	4.23
	Acres 40,078	Project Area Average 3.98

Logs were recorded at approximately 1,665 plots during northern goshawk surveys in 2005 and 2006 covering 40,078 acres and included the majority of stratified habitat areas within the project area (table 59) and habitat outside the project area (table 60). Log data is not available for the mid-scale level at the same aggregates as the VSS evaluation. Plot data were aggregated to nonoverlapping survey areas, and those areas were aggregated to the project area scale. These data displays the dead/down log average conditions within the survey areas and project area. An average of logs throughout the inventoried areas was 3.98 large downed logs per acre, which exceeds the forest guidelines for ponderosa pine of at least three downed logs per acre, and 5–7 tons of woody debris per acre. Both action alternatives contain design criteria to retain at least 3 downed logs per acre, and 5–7 tons of woody debris per acre.

Northern Goshawk—Effects

Alternative A—No Action

Conditions would not change from current, meaning that goshawk habitat would be less effective and resistant to fire effects.

Alternative B—Direct/Indirect Effects

To decrease the risk of losing northern goshawk habitat to high-severity wildfire, PFAs and nest stands would be treated either mechanically and/or with low severity broadcast fire following forest plan guidelines, including those in the proposed forest plan amendment to provide for openness. Thinning within PFAs is expected to result in a clumpy distribution of all-aged trees, which would create more open conditions while still providing sufficient cover to fledgling goshawks, and follow canopy coverage guidelines. Northern goshawks and habitats would have direct and indirect disturbance impacts to both mechanical thinning and broadcast fire treatments.

Existing nest stands have a high canopy cover of mature to old age trees and these conditions would be maintained. Except for the situations noted in the forest plan amendment (for public safety or stand development reasons), no VSS 6 tree groups would be thinned. Mechanical and low severity broadcast burning treatments would alter northern goshawk habitat by thinning tree densities and reducing existing tree canopies dominated by VSS 3 and 4 classes toward meeting forest plan guidelines of uneven-aged stands (silviculture specialist report).

In nest/PFAs and foraging areas, group selection would be used to regenerate ponderosa pine, white pine, and Douglas-fir in openings (.25–4 acres in size). Openings would be developed within excess VSS classes and/or diseased patches (generally within VSS 3 and 4 areas). If present, leave a minimum of 3–5 mature and old, live trees per acre in groups or stringers with interlocking crowns. Tree groups would be maintained by VSS class, ranging from a quarter acre to 1 acre in size and generally in groups of 4–20 trees (0.1 acre basis). Treatments would strive to distribute percentages according to desired VSS percentages in the forest plan. Residual stand density would vary, but would average 50–70 square feet of basal area per acre in foraging areas, and would average 70–80 square feet in PFA. Where stand structures are predominantly even-aged, the stand would be thinned in an irregular-density fashion, striving to create groups and clumps of residual trees. Desirable dominant and codominant white pine and ponderosa pine would be left as single trees or groups throughout the area.

Alternative B would preserve current old growth habitat and develop old growth components in designated stands within northern goshawk stratified habitats (figure 14) on 223 acres that would

be allocated to be managed for old growth structure. Old growth wildlife habitat would increase as designated stands increase in maturity over time.

Where severe dwarf mistletoe infection centers are located, focus on removal of infected trees to establish new regeneration groups (VSS 1) or to favor existing regeneration. Where regeneration groups are not to be established, focus on reduction of severely-infected trees within the leave tree groups (Richardson et al., 2011 and Richardson et al., 2012).

Small inclusions of aspen remnants within portions of ponderosa pine would be regenerated by removing all conifers in the immediate area, .5–1 chain (33–66 feet) from the clone, with some removal of aspen or site-disturbing activity such as ripping of aspen roots adjacent to large aspen clone. Where aspen is present in mixed conifer, it may be promoted through group selection described above with removal of all conifers .5–1 chain from the aspen clone.

Desired condition for average posttreatment canopy cover for PFAs is 50–60 percent on VSS 4 and 50 percent in VSS 5 and VSS 6; and average canopy cover at 40 percent in VSS 4, VSS 5, and VSS 6 (Richardson et al., 2011 and Richardson et al., 2012). Small and medium sized trees are also important habitat components in goshawk PFAs and nest stands. These canopy cover ranges would provide for northern goshawk foraging habitats and improve prey base habitats with the development of openings and uneven-aged vegetation structure. The posttreatment canopy cover moves toward the forest plan standards for northern goshawk in both PFAs and nest stands.

Broadcast burning would occur throughout the foraging and PFA/nest habitat. In addition, low severity maintenance burning would occur once on ponderosa pine forest types, so impacts associated with the initial broadcast burn treatments would reoccur. A fall and winter burning period would reduce any impact to nesting and fledgling goshawks from broadcast burning activities and smoke, as burning would only occur outside the sensitive reproductive season. Smoke may settle in the PFAs during the breeding season, but would be transitory and short term in nature. Resident goshawks would be able to move beyond smoky areas during the fall burning season and still be in or near their respective PFAs. Broadcast fire is recommended in ponderosa pine and mixed-species forests to perpetuate northern goshawk habitat and to reduce fuel loading (Reynolds et al., 1992).

Small openings would be created within the forested areas to provide more sunlight to the forest floor, thereby increasing grasses, forbs, and shrubs. Low severity broadcast fire would result in a mosaic of burned, partially burned, and unburned duff layers. An increase in herbaceous plant growth would increase in areas where a thick layer of dead plant material has accumulated over time and is burned off during treatments. The increase in herbaceous plants and shrubs should result in additional forage and cover for goshawk prey species such as cottontails, golden mantled ground squirrels, and mourning doves.

The existing road system within the analysis area would receive higher vehicle use than currently occurs. Existing roads would be used for transporting crews to and from worksites, hauling materials from worksites, and as control lines for broadcast burning. Activities could occur during any time of the year but would not affect the entire project area all at once. Projects would be implemented in stages, affecting different areas at different times. Higher use of the road system could result in higher levels of noise, visual, and dust disturbance to goshawks although Grubb et al. (1998) found that logging trucks passing within 413 m of an active goshawk nest did not elicit any behavioral response from a brooding female goshawk. Timing restrictions in PFAs and nest

stands would reduce the effects of road use in breeding areas during the breeding season. Foraging habitat outside of PFAs could be affected yearlong and could cause goshawks to avoid foraging in areas where vehicle traffic associated with treatment activities is high. Approximately 2,766 acres of foraging areas would not be mechanically treated, which would provide areas for undisturbed foraging.

Short-term disturbance to goshawk by treatment activities would temporarily displace or alter foraging and roosting areas. Timing restrictions for treatment activities within northern goshawk PFAs would not disturb goshawks during the breeding season. The project area would be treated in phases over time and would not occur over the project area at the same time. Northern goshawk would only experience activity-related disturbance in portions of the project area at one time.

Fire and smoke effects from broadcast burning may disturb individual birds, but this should be a short-term impact and would not adversely affect goshawks due to implementing a low-severity prescription. Timing restrictions within PFAs would prevent burning in PFAs during the breeding season and reduce any impacts from breeding season burning outside of PFAs.

The forest plan includes direction to establish dispersal PFAs at a 2 to 2.5-mile spacing across the landscape where active goshawk territories are absent. Two dispersal PFAs have been established in the project area; these areas would be managed according to the forest plan.

With approximately 102 goshawk PFAs established on the Apache-Sitgreaves National Forests, a potential impact to the reproduction success of two active PFAs associated with the project area would not cause a measurable change to the forestwide goshawk population trend. The quality of habitat across the project area would improve within the project area and work toward improving habitat quality forestwide.

Understory herbaceous and browse component would have more diversity and production under this alternative compared to alternative C due to the spatial arrangement (groupy and clumpy) of trees and regeneration openings. Alternative B provides for a closed canopy at 30 years post treatment resulting in a shading effect on understory herbaceous and browse that prey species depend upon. Maintenance low severity broadcast burning would occur once on ponderosa pine forest types, so impacts associated with the initial broadcast burn treatments would reoccur. Benefits from maintenance treatments would include management toward VSS class distribution objectives and increased understory herbaceous and browse species that would benefit forest health.

If no followup treatments occur after the maintenance burn included in alternative B, canopy closure is anticipated to provide vegetation structure for a high severity canopy wildland fire in 30 years (Richardson et al., 2012). The effect of canopy openings and distribution of tree groups and clumps on potential fire behavior can be seen in table 61. For northern goshawk PFA/nest stand habitats, the fire specialist report (Nicolet 2011) identifies that posttreatment conditions would provide moderate potential for crown fire across 18 percent of PFA/nest stand habitats and a low potential for crown fire across 15 percent of the northern goshawk foraging habitat. Alternative A percentages are 36 and 39 percent, respectively.

For FRCC, alternative B shows a favorable difference between PFA/nest and foraging FRCC following year 1 out to year 20 for keeping 50 percent or better of the area in FRCC 1 while alternative C is dominated by FRCC 2 at year 1. Alternative B retains less than 23 percent of the

area or less FRCC 3 for PFA/nest and foraging habitat at year 20, while alternative C is 58 percent for PFA/nest and 64 percent foraging habitat at FRCC 3.

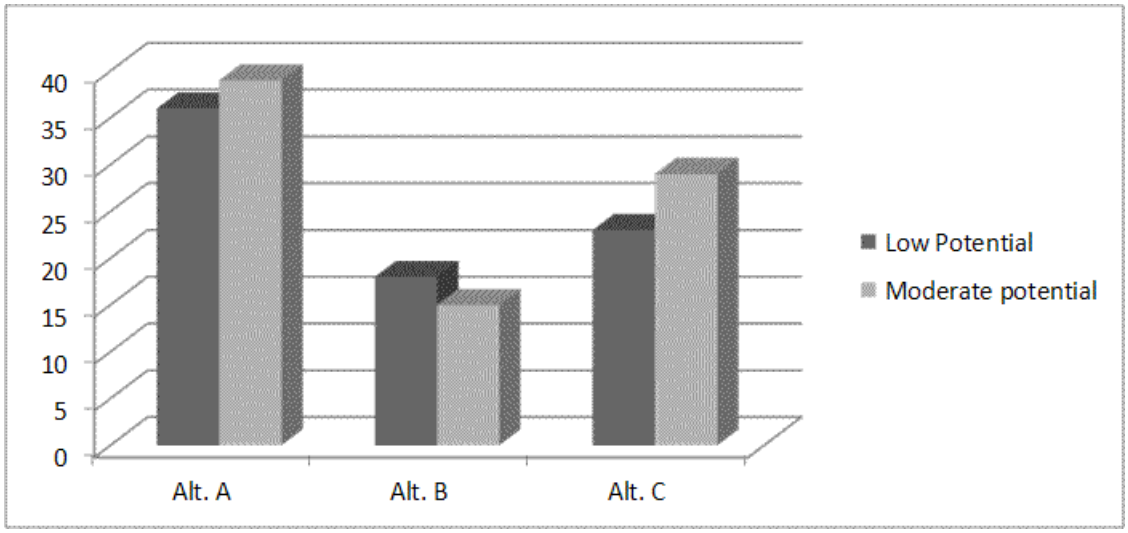

Figure 17. Percent of project area in low and moderate crown fire potential by alternative

Table 61. Northern goshawk potential fire type comparison of alternatives

Habitat Type	Potential Fire Type	Alt. A	Alt. B	Alt. C
Goshawk PFA/Nest	Surface fire	50	72	61
	Passive crown fire	36	18	28
	Active crown fire	14	10	1
Goshawk Foraging	Surface fire	35	65	50
	Passive crown fire	39	15	29
	Active crown fire	26	20	21
Old Growth	Surface fire	40	79	64
	Passive crown fire	46	11	25
	Active crown fire	14	10	11

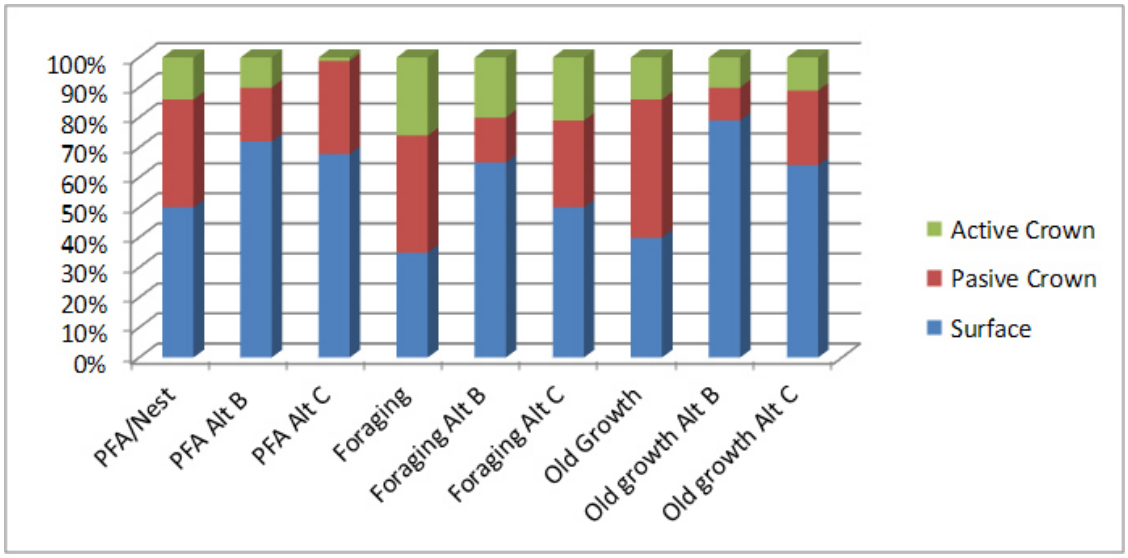

Figure 18. Goshawk habitat and fire type compared by alternative

This alternative has improved the conditions in the project area to reduce high severity crown fire within treated acres for 30 years by reducing FRCC surrounding northern goshawk habitat (PFA/nest, foraging) as compared to alternative C discussed below. If a high severity canopy fire occurred, it would destroy perching, nesting, and foraging habitat in the project area.

Alternative C—Direct/Indirect Effects

The effects analysis from alternative B applies under this alternative with a few exceptions involving spatial distribution of trees, openings of trees, understory herbaceous and browse species, canopy closure as it relates to fire potential, and long-term FRCC that results in potential high severity canopy fire conditions.

Mechanical treatments within northern goshawk stratified habitats with a 16-inch-diameter constraint would be a thin from below application that would not allow the flexibility for spatial arrangement of leave tree groups or clumps with openings. Openings would only be available in stands that have all trees less than the diameter constraint.

Understory herbaceous and browse component would have less diversity and production under this alternative compared to alternative B due to the lack of interspatial openings between trees. Alternative C provides for a closed canopy at 15 years post treatment resulting in a shading effect on understory herbaceous and browse that prey species depend upon.

Based upon mechanical thinning limitations (16-inch-diameter constraint), the spatial arrangement of trees and stands are limited due to existing conditions of the project area dominated by VSS classes 3 and 4. Canopy closure is anticipated to provide vegetation structure for a high severity canopy wildland fire in 15 years (Richardson et al., 2011). For northern goshawk PFA/nest stand habitats, the fire specialist report (Nicolet 2011) identifies that posttreatment conditions would provide for moderate potential for passive crown fire across 23 percent of the area for alternative C, a lower potential for crown fire across 18 percent of PFA/nest stand habitats for alternative B, and a high crown fire potential across 36 percent for alternative A. Active crown fire between alternative B and C is nearly identical, the differences

between action alternative is the passive crown fire modeling. For northern goshawk foraging habitats, the fire specialist report models identifies that posttreatment conditions would provide for moderate potential for crown fire across 29 percent of the area for alternative C, a low potential for crown fire across 15 percent for alternative B and a high crown fire potential across 39 percent for alternative A.

This alternative has improved the conditions in the project area to reduce high severity crown fire within treated acres for 15 years in surrounding northern goshawk. If a high severity canopy fire occurred, it would adversely modify northern goshawk habitat in the project area.

Effects Evaluation at Three Sales

Comparison of Alternative B and Alternative C

A few differences between alternatives B and C that affect canopy coverage are worth discussion:

- Alternative B would not thin any VSS 6 group, with a few exceptions.
- Alternative C would not thin any VSS 5 or VSS 6 tree due to d.b.h. limitations.

Alternative B has a greater ability to thin down to desired BA to meet spatial and groupy/clumpy distribution over alternative C. Alternative C has a 16-inch d.b.h. limitation as a design feature for implementation and may not allow for obtaining desired BA needed to meet fuels objectives resulting from higher canopy values and tree crown spacing. Additionally, higher canopy values or retention of 16 inch or greater over the top of VSS 2 or VSS 3 sized trees can suppress those smaller trees and preclude recruitment of larger size trees needed for canopy cover in the future.

Due to spatial arrangement of tree groups and clumps, alternative B shows a marked reduction in passive crown fire than alternative C for both PFA/nest and foraging habitat. It can also be seen that areas with active and passive crown fire are interspersed with surface fire. Alternative C also exhibits a reduction in crown fire over alternative A but continues to have larger areas with potential for passive crown fire than alternative B.

The scaled analyses for northern goshawk in this section have compared the effects of alternative B and alternative C.

Mid-scale analysis aggregated plot data by two strata: Outside of PFA/nest area stratum, which is 95 percent of total goshawk habitat in the project area; and inside PFA/nest areas, which is about 5 percent of the project area (table 62).

Table 62. Mid-scale: outside and inside PFA/nest (all stand structures)

VSS	Forest Plan Desired Percent of VSS	Alt. A Outside PFA	Alt. B Outside PFA	Alt. C Percent of VSS	Alt. A Inside PFA/Nest	Alt. B Inside PFA	Alt. C Inside PFA
1	10	7	10	7	4	10	5
2	10	4	10	5	2	10	5
3	20	8	10	10	15	15	5
4	20	38	27	30	42	26	31
5	20	17	28	33	24	24	36
6	20	6	15	15	15	15	18

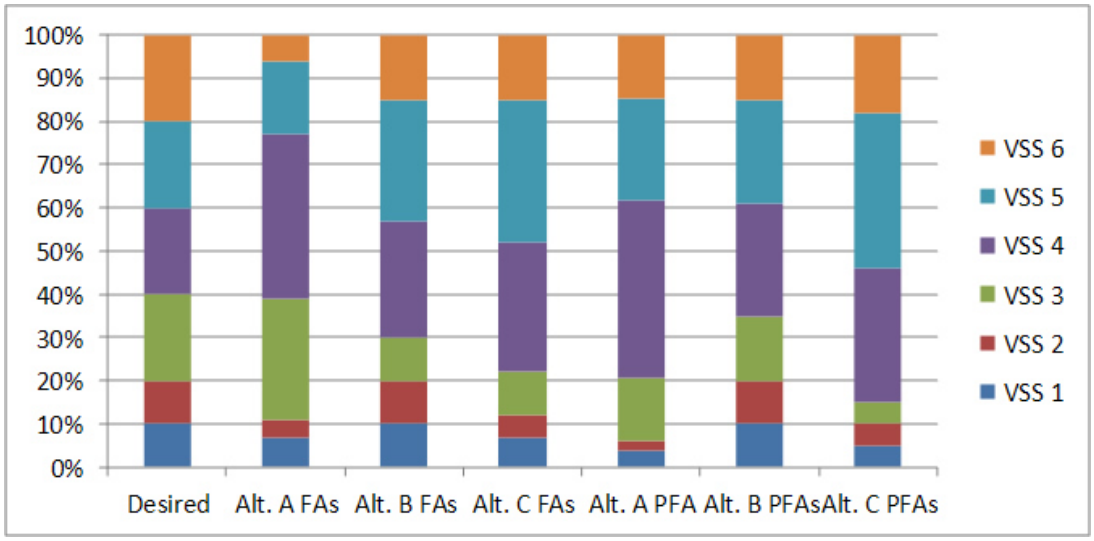

Figure 19. VSS distribution in foraging areas (FAs) and PFAs

Mid-Scale Outside of PFA/Nest Area Stratum

Alternative B

Alternative B, mid-scale outside of PFA/nest area stratum contains approximately 4,623 acres that are predominantly low density and would not require mechanical treatments. Implementing alternative B would move existing stands toward a VSS distributions in a more balanced distribution of age classes by favoring larger age classes, creating more VSS 1 regeneration openings, and developing VSS 2 seedlings and saplings.

Figure 19 displays the changes to structure among the three alternatives at the middle scale. Each alternative shows VSS distribution in foraging areas outside PFA/nest (e.g. alternative A FAs), and VSS distribution inside PFA/nest (e.g. alternative A PFAs).

The change from current age classes occurs as VSS 3 and VSS 4 are moved toward VSS 1, VSS 2, VSS 5, and VSS 6. The reduction of VSS 3 is due in part to the fact that only approximately one third of the VSS 3 class in the project area has the vigor to be manageable for growth into later VSS classes (VSS 4, VSS 5, and VSS 6). Approximately two-thirds do not have the vigor judged necessary to be managed forward.

Alternative A (current condition) shows a VSS classification that is a higher amount of VSS 3 because the VSS classification model uses the dominant size class (determined by basal area of that size class) and so by removing VSS 3 size classes, a mixed stand can move toward VSS 4 or VSS 5 by making those size classes dominant (Richardson 2011). After treatment, these VSS 3 stands would shift in classification to VSS 5 or VSS 6 because of removal of subdominant trees.

Alternative B's basal area changes are also influenced by favoring VSS 2 groups that would release and grow into manageable groups or by placing regeneration openings, both of which are improved in alternative B. The shift in VSS 4 is 11 percent less but is a shift toward a desired balance (20 percent) in this structural size class.

Alternative B shows an increase of 11 percent in the VSS 5 class. This shift exceeds the desired proportion of 20 percent by 8 percent to carry more VSS 5 to become VSS 6 which after

treatment is 5 percent deficit of the desired 20 percent. Alternative B moves all treated even-aged stands toward uneven-aged stands, thus increasing structural diversity, and moves all treated uneven-aged stands toward a desired distribution of balanced VSS structural classes.

Alternative C

As with alternative B, alternative C mid-scale evaluation outside of PFA/nest area stratum indicates that approximately 4,623 acres are predominantly low density and would not require treatments.

As shown in figure 19, implementing alternative C would move existing stand VSS distributions toward VSS classes representing older aged structural stages, especially VSS 4 and VSS 5.

This alternative was designed to retain all trees greater than 16 inches, and this diameter limit threshold lies within the upper range of VSS 4 (12–18 inches). This alternative does not change VSS 1 from current and shows only a 1 percent increase in VSS 2 because of the limitation to create openings resulting from the diameter limit.

Size class reductions in basal area come predominantly by taking from the VSS 3 and VSS 4 category with gains in VSS 5 and VSS 6. By reducing VSS 3 to such a low amount (5 percent when the desired is 20 percent), alternative C moves many existing uneven-aged stands toward even-aged stands, thus simplifying within stand and structural diversity.

Alternative B/C, Mid-Scale Inside PFA/Nest

Implementing alternative B would move existing stand VSS distributions toward a more balanced distribution of age classes. Alternative B moves all even-aged stands toward uneven-aged stands, thus increasing structural diversity within the stands.

Implementing alternative C would move existing stand VSS distributions toward VSS 5 and VSS 6 with these two classes comprising 54 percent of the age class distribution. The VSS 1 and 2 classes would remain almost unchanged. Short term the VSS 3 and VSS 4 stages would decline while VSS 5 and 6 would increase.

Alternative C was designed to retain all trees greater than 16 inches. This diameter lies within the upper range of VSS 4. Size class reductions from current are predominantly taken from the VSS 3 and VSS 4 categories with 10 percent and 11 percent reductions, respectively. These reductions are primarily shifted to gains of 12 percent in VSS 5 and 3 percent in VSS 6 classifications.

As is found in habitat outside PFA/nest areas, alternative C moves many uneven-aged stands toward even-aged stand conditions, thus simplifying within stand structural diversity.

Both action alternatives constitute approximately 5 percent of goshawk habitat in the project analysis area identified as PFA/nest area stratum.

Only occasional VSS 6 groups would be treated in alternative B consistent with the forest plan amendment. No VSS 5 or VSS 6 would be treated in alternative C. Currently all PFA/nest area stands are classified as even aged in both action alternatives.

As noted in table 63, comparison of alternative B and alternative C VSS classes in PFA/nest area stratum shows alternative B moves toward a wider distribution of age classes while alternative C

moves toward a more even-aged stand, dominated by larger trees that have a more continuous canopy, which is more susceptible to loss as a result of uncharacteristic severe wildfire.

Project Area Scale
(All Northern Goshawk Habitat in the Planning Area)

Table 63 shows all northern goshawk habitat in project area.

Table 63. Project area-scale: all northern goshawk habitat (all stand structures)

VSS	FLRMP Desired Percent of VSS	Alt. A (Current) Percent of VSS	Alt. B Percent of VSS	Alt. C Percent of VSS
1	10	7	9	7
2	10	4	9	5
3	20	27	14	14
4	20	38	29	32
5	20	17	25	30
6	20	6	13	13

Alternative B—Project Area Scale

Implementing alternative B would move existing stand VSS distributions toward a more balanced distribution of age classes as defined above. This improvement toward a VSS structural size class balance over current conditions (alternative A) is easily seen for VSS 1, VSS 2, VSS 4, and VSS 6. As was also indicated in the mid-scale evaluation of VSS, the reduction in VSS 3 is due in part to the fact that only approximately one-third of the VSS 3 class in the project area has the vigor to be manageable for growth into later VSS classes (VSS 4, VSS 5, and VSS 6). Approximately two-thirds do not have the vigor judged necessary to be managed forward.

After treatment, VSS 3 would shift to VSS 5 or VSS 6 because of removal of subdominant trees. The alternative B basal area is also influenced by favoring VSS 2 groups that would release and grow into a manageable group or by placing regeneration openings, both of which are improved in alternative B.

The VSS 3 can be considered slightly improved. The significant reduction in VSS 3 largely reflects favoring older aged structural attributes found in VSS 5 and VSS 6, such as no treatment in existing VSS 6 group conditions and using VSS 3 to move toward desired VSS 1 and VSS 2 proportions in the desired balance of size class. Alternative B moves all even-aged stands toward uneven-aged stands, thus increasing structural diversity.

Alternative C—Project Area Scale

Alternative C would move existing stand VSS distributions toward older aged structural stages. This alternative was designed to retain all trees greater than 16 inches, and this diameter limit threshold lies within the upper range of VSS 4. This alternative does not change VSS 1 from current and only a slight change in VSS 2. It decreases the percentage of VSS 3 and VSS 4 as it increases the percentage in VSS 5 and VSS 6.

The decline in VSS 3 reflects favoring larger size classes (VSS 5 and VSS 6) because of the 16-inch-diameter threshold for retention. The increases in VSS 5 and VSS 6 are also because of the 16-inch-diameter threshold for retention. Alternative C moves all uneven-aged stands toward even-aged conditions.

Mid-Scale Basal Area Analysis for Density

As with the VSS classifications, mid-scale basal area analysis aggregates inventory plot data by two strata: outside PFA/nest areas and inside PFA/nest areas. Density represents averages; including stand openings.

It is important to note in table 64 that these BA averages are density representations at the stand level and include regeneration gaps and other stand level openings at the mid-scale for both strata and at the project area scale. Posttreatment density represents stand-level averages (60 square feet BA in stand matrix); including regeneration gaps and other stand openings.

It is also important to note that to achieve fuel treatment effectiveness, the BA must be reduced but more importantly, the spatial arrangement of residual trees influences the fuel reduction effectiveness. With an appropriate special arrangement, a stand may have a higher BA but be more resistant to crown fire.

Table 64. Mid-Scale: basal area outside and inside PFA/NA (all stand structures)

VSS	Alt. A (Current)	Alt. B Outside PFA	Alt. C Outside PFA	Alt. A Inside PFA	Alt. B Inside PFA	Alt. C Inside PFA
1	0	0	0	0	0	0
2	6	1	1	2	0	0
3	37	10	10	24	8	9
4	28	17	19	32	27	34
5	12	10	12	16	16	25
6	5	5	5	5	5	5
Total BA	88	43	47	79	56	83

Alternative B is designed to provide a spatial arrangement of groups and clumps of residual trees with interspaces that separate tree crowns between groups and clumps. This provides reduced probability of crown fires at large scales and provides more years of protection than alternative C.

Alternative C provides improvement in fuels conditions, but the effectiveness is lost in approximately one-half the time that alternative B provides.

A comparison of basal area as a measure of density shows alternative A currently at 88 square feet per acre for the area outside of PFA/nest area stratum. Alternative B reduces this as does alternative C, but alternative C treatments carry more BA than alternative B in part because alternative B has more VSS 1 which is openings, for regeneration purposes, that alternative C does not have. The basal area for stands outside of PFA/nest area treatment is identified as 60 square feet per acre for both alternatives B and C.

A comparison of basal area as a measure of density shows alternative B and alternative C reduce density. Alternative B treatments carry less BA density in part due to this alternative managing for more VSS 1 and VSS 2. The PFA/nest area treatment in the stand matrix is identified as 70 square feet per acre for both alternatives B and C.

Project Area Scale Basal Area Analysis

Project area scale basal area analysis for all northern goshawk habitat in the planning area used plot average data (table 65).

Table 65. Project area scale: basal area all northern goshawk habitat (all stand structures)

VSS	Alt. A (Current)	Alt. B	Alt. C
1	0	0	0
2	6	2	2
3	36	16	15
4	28	20	21
5	12	11	12
6	5	5	5
Total BA	**88**	**53**	**56**

Alternative B and C Basal Area

A comparison of basal area as a measure of density shows alternative B and alternative C reduce density similarly. As is found at the mid-scale, alternative C treatments carry more BA because of the removal of trees less than 16 inches in diameter, with the remaining BA in larger sized trees, 16 inches or greater, and fewer regeneration canopy gaps for VSS 1 and VSS 2.

Both action alternatives have lower BA values than alternative A because both alternatives remove significant amounts of BA to achieve project objectives. However, they distribute that BA differently.

Alternative B has a project area BA of 53 square feet per acre. Alternative C has project area BA of 56 percent. As noted in the mid-scale evaluation, alternative B leaves stands outside of PFA/nest area BA value of 43 square feet per acre and PFA/nest area value of 56 square feet per acre. Alternative C leaves stands outside of PFA/nest area BA value of 47 square feet per acre and PFA/nest area value of 63 square feet per acre.

Both action alternatives reduce the tree density. Alternative A has BA values that are above historic conditions and does not address the problem of reducing and arranging fuels to reduce large scale, high-intensity fires and effects that are not desired.

Snags

Forest plan guidelines require two snags per acre, which is currently above the existing conditions (table 66). According to stand exam data, snag densities are currently below forest plan guidelines throughout the stratified habitat. There are minimal differences between the PFA/nest area and out of PFA/nest area (mid-scale) strata. This data does not display any difference between mid-scale

and project area (landscape-scale) snag densities. Project design features have been identified to address the shortage of snags at desired levels for both action alternatives.

Table 66. Existing and desired forest density and snags by northern goshawk stratum

Stratified Habitat	Existing Acres*	Existing Snags per Acre	Desired Snags per Acre
PFA/nest	996	0.7	2.0+
Out of PFA/nest	20,684	0.8	2.0
Project area	21,680	0.8	2.0

* Not all acres are proposed for treatment.

Dead/Down Logs

Logs were recorded at approximately 1,665 plots during northern goshawk surveys in 2005 and 2006 covering 40,078 acres and included the majority of stratified habitat areas within the project area and habitat outside the project area (table 67). Log data is not available for the mid-scale level at the same aggregates as the VSS evaluation. Plot data were aggregated to nonoverlapping survey areas, and those areas were aggregated to the project area scale. These data displays the dead/down log average conditions within the survey areas and the project area. An average of logs throughout the inventoried areas was 3.98 large downed logs per acre, which exceeds the forest guidelines for ponderosa pine of at least 3 downed logs per acre and 5–7 tons of woody debris per acre. Both action alternatives contain design criteria to retain at least 3 downed logs per acre and 5–7 tons of woody debris per acre.

Table 67. Northern goshawk inventory plots for logs/acre, data from area larger than project area

Survey Area (1,665 plots)	Acres	Average Dead/Down Logs per Acre
Rim East	3,289	3.22
Rim Lakes	16,414	4.92
Rim Promontory	4,744	5.08
Rim R/C Area	5,299	2.44
Rim West	10,332	4.23
	Acres 40,078	Project Area Average 3.98

Effects Determination

Alternatives B and C

The determination of effects for this species is based on the following:

1. There are four established northern goshawk PFAs present in the project area out of 102 across the Apache-Sitgreaves National Forests. Impacts to nesting success to 4 PFAs within the project area would have negligible impacts to forestwide population trends of the 102 PFAs across the forest.
2. Mechanical and broadcast burn treatments in PFAs (including nest stands) and foraging habitat would not increase the quantity of habitat but would improve the quality of habitat across the project area and work toward improving habitat quality forestwide.

3. Mechanical tree thinning and broadcast burning would be limited to seasonal restrictions within the four PFAs.
4. Smoke may settle in the PFAs but would be transitory and short term in nature.
5. One broadcast burn maintenance treatment within the ponderosa pine forest type would provide for the same short-term effects as the first entry.
6. For alternative B, VSS class distribution would be managed for moving toward forest plan requirements with a groupy, clumpy spatial arrangement.
7. In alternative C, VSS class distribution would be managed for moving toward forest plan requirements where possible, but would lack the groupy and clumpy tree group spatial arrangement of alternative B. Under this alternative, much of the area would remain as it is—even-aged—or move toward even-aged structure.
8. In alternative C, a reduction in snags and logs within log landings may reduce foraging and nesting habitat for some small mammals and birds, which are northern goshawk prey; however, these areas are limited in size, and snags and logs would be managed at or above forest plan guidelines outside these areas.
9. Logs per acre at each scale (nest/PFA, foraging, and all stratified habitats) would meet forest plan guidelines, with the exception of areas of landings.
10. Snags per acre at each scale (nest/PFA, foraging, and all stratified habitats) would remain below forest plan guidelines with the potential for increased numbers of snags per acre in the future. During mechanical treatments, identification of and development of future snags would occur in goshawk stratified habitats. Additional potential for snag recruitment would result from broadcast burning. In alternative c, snags per acre at each scale (nest/PFA, foraging, and all stratified habitats) would remain below forest plan guidelines with the potential for increased numbers of snags per acre in the future. During mechanical treatments, identification and development of future snags would occur in goshawk foraging, PFA, and nest stands (silviculture specialist report).
11. In alternative B, an increase in herbaceous and shrub understory would result from treatments and provide more forage and cover for northern goshawk prey species post treatment. Alternative C would not see the same level of herbaceous understory recovery.
12. Treatments within the project area would be incremental and generally not exceed 6,000 acres per year. Thus not disturbing all PFAs in one year and provide foraging habitat areas without treatment disturbance.
13. Reduction of fuels would reduce the potential for high severity canopy wildfire for 30 years that could destroy perching, nesting, and foraging habitat in the project area.
14. In alternative B, 50 percent of the PFA/nest habitat and 63 percent of the foraging habitat is within FRCC 1 under this alternative. In alternative C, 12 percent of the PFA/nest area habitat and 16 percent of the foraging habitat is maintained to FRCC 1 out to 20 years under this alternative.

Based on the above discussion, alternative B (proposed action) for the project area may impact individuals of northern goshawk but would not result in a trend toward listing or loss of viability. Additionally, this alternative would meet the northern goshawk recommendations and would move the stratified habitat toward the desirable clumpy and groupy tree stand arrangement with potential for more even distribution of VSS classes over time. Alternative B provides for sustainability with maintenance treatments that would create regeneration openings and improve the primary prey base habitat structure improving the quality of habitat.

Based on the above discussion, alternative C may impact individuals of northern goshawk but would not result in a trend toward listing or loss of viability. This alternative would not meet the northern goshawk standard for uneven-aged management, as it would not move the stratified habitat toward a more even distribution of VSS classes over time (Richardson 2012). In addition, the spacing of trees remaining due to diameter cap limitations provide for rapid canopy closure within 15 years to increase the risk of high severity canopy fire. Alternative C would meet short-term sustainability out to 15 years, while alternative B provides for long-term sustainability out to 30 years.

Environmental Effects—All Other Sensitive Species

Alternative A - Impacts Common to All Forest Sensitive Species

The effects described for alternative A apply to all sensitive species as if no treatments are being implemented. The following effects analysis for alternative A applies to each sensitive species being analyzed in table 67.

Alternative A—Direct/Indirect/Cumulative Effects

Alternative A would not result in an immediate change to the quantity or quality of habitat used by any of the sensitive species. Forested habitat (32,956 acres) would continue to be overstocked and shade out understory. Meadow habitats would continue to receive conifer encroachment over time. The forested habitat within the project area would be at a higher risk of stand replacing crown wildfire (Nicolet 2011).

There would be no cumulative effects associated with this alternative because there is no effect from this project.

Alternative A would have no impact to sensitive species as identified in table 67 as being analyzed. With no treatments within the project area, it would remain mostly at the FRCC 3 level and would be susceptible to a high severity, stand replacing crown wildfire.

Alternatives B and C

Effects determinations for sensitive species analyzed are in table 68, except for effects to northern goshawk which follow the table.

Table 68. Sensitive species effects determination for alternatives B and C

USFS Sensitive Species	Effects Determination
Mammals	
Merriam's shrew	Alternative B or C may impact individual Merriam's shrews, but are not likely to result in a trend toward Federal listing or loss of viability. Merriam's shrews have not been recently detected on the Black Mesa Ranger District. Anatomical parts of this species were found in Mexican spotted owl pellets collected on the district in the early 1990s. Suitable habitat exists within the project area. Thinning and broadcast burning activities may impact individual Merriam's shrews, if they are present in the project area. Meadows that would support Merriam's shrews would be undisturbed during treatments. One broadcast burn maintenance treatment within the ponderosa pine forest type would provide for the same effects as the first entry.

USFS Sensitive Species	Effects Determination
	Treatments within the project area would be incremental and generally not exceed 6,000 acres per year, thus not disturbing all potential habitats in any one single year. Alternative B would reduce high severity wildland fire for 30 years and alternative C for 15 years.
Long-tailed vole	Alternative B or C may impact individual long-tailed vole, but are not likely to result in a trend toward Federal listing or loss of viability. Anatomical parts of this species were found in Mexican spotted owl pellets collected on the district; suitable habitat exists within the project area. Thinning and broadcast burning activities may impact individual voles, if they are present in the project area. Minimal mechanical treatments would occur in meadow habitat, while the majority of the habitat would not be mechanically treated and remain undisturbed. One broadcast burn maintenance treatment within the ponderosa pine forest type would provide for the same effects as the first entry. Understory herbaceous and browse response with treatments would improve habitat. Alternative B would reduce high severity wildland fire for 30 years and alternative C for 15 years.
New Mexico jumping mouse*	See analysis above in federally listed section.
Allen's lappet-browed bat	Alternative B or C may impact individual Allen's lappet-browed bats, but are not likely to result in a trend toward Federal listing or loss of viability. Allen's lappet-browed bats were captured on the Black Mesa Ranger District during bat surveys conducted in the 1990s. Suitable habitat exists for this species within the project area. Thinning and broadcast burning activities may impact individuals by altering foraging and roosting habitats to Allen's lappet-browed bats if they are present in the project area. Snag densities would be reduced within log landings, but managed for forest plan guidelines throughout other areas in the project area. One broadcast burn maintenance treatment within the ponderosa pine forest type would provide for the same effects as the first entry. Mechanical treatments would identify and retain snags at the forest plan requirement.
Birds	
Bald eagle	Alternative B or C may impact individual bald eagles, but are not likely to result in a trend toward Federal listing or loss of viability. There is one known bald eagle nest site within the analysis area that would continue to have a seasonal forest closure during nesting season. There are no known winter roost sites adjacent to or within the project area. Nest and roost sites would be protected during thinning and broadcast burning. Mechanical treatments would identify and retain desired snags per acre. The treatment activities (broadcast burning and mechanical thinning) may cause short-term displacement to foraging and perching bald eagles. One broadcast burn maintenance treatment within the ponderosa pine forest type would provide for the same short-term effects as the first entry. Some large snags that could be used for perching could be removed within landings or burned during broadcast burning treatments; however, the remainder of the project area would be managed for forest plan snag guidelines. Smoke may be present in the project and analysis areas when bald eagles are present, but it is expect to be short term and transitory in nature. Alternative B's reduction of fuels would reduce the potential for high severity canopy wildfire for 30 years, and alternative C for 15 years; that could destroy perching and foraging winter habitat for bald eagles in the project area.

USFS Sensitive Species	Effects Determination
Northern goshawk	Alternative B or C may impact individuals of northern goshawk but would not result in a trend toward listing or loss of viability (see above for details).
Common black-hawk	Alternative B or C may impact individuals of the common black-hawk but would not result in a trend toward listing or loss of viability. There are no known black-hawk nests on the Black Mesa district although black-hawks have been sighted in Woods and Chevelon Canyons. Suitable nesting habitat exists within perennial stream segments of Woods and Chevelon Canyons, which has areas included in the streamside management zones and buffered from treatment activities. Conservation measures and BMPs should minimize the amount of sediment and ash on downstream riparian habitat and the effects on common black-hawk prey. Thinning trees would improve watershed conditions, which may result in increased water quality and quantity for black-hawk prey. Smoke may be present in the project area but it is likely to be short term and transitory in nature. One broadcast burn maintenance treatment within the ponderosa pine forest type would provide for the same short-term effects as the first entry. Treatments within the project area would be incremental and generally not exceed 6,000 acres per year. Thus not disturbing all potential habitats in any one single year. Alternative B's reduction of fuels would reduce the potential for high severity canopy wildfire for 30 years, and alternative C for 15 years; that could destroy perching, nesting, and foraging habitat in the project area.
American peregrine falcon	**Alternative B or C may impact individuals of the American peregrine falcon but would not result in a trend toward listing or loss of viability.** There are no known peregrine falcon eyries present in the project area. No suitable nesting cliff habitat is present. Three active eyries exist adjacent to the project area along the Mogollon Rim. Treatment activities within the primary management zone and line-of-sight of active eyries would not occur during the breeding season. The posttreatment distribution of VSS classes would provide a variety of foraging habitat and cover for peregrine falcon prey. Snags and logs within log landings would likely be removed, but other areas within the project area would be managed for forest plan guidelines. One broadcast burn maintenance treatment within the ponderosa pine forest type would provide for the same short-term effects as the first entry. Treatments within the project area would be incremental and generally not exceed 6,000 acres per year. Thus not disturbing all potential habitats in any one single year. Alternative B's reduction of fuels would reduce the potential for high severity canopy wildfire for 30 years and 15 for alternative C; that could destroy foraging habitat in the project area.
Zone-tailed hawk	Alternative B or C may impact individuals of the zone-tailed hawk but would not result in a trend toward listing or loss of viability. There are no known zone-tailed hawk nests in the project area. The nearest known nest is 5–6 miles north of the project area. Zone-tailed hawks have been documented soaring within the project area. Potential nesting habitat, similar to MSO protected habitat, would be managed for forest plan guidelines and would remain suitable nesting habitat following treatments. Zone-tailed hawk prey abundance may increase as a result of proposed treatments. One broadcast burn maintenance treatment within the ponderosa pine forest type would provide for the same short-term effects as the first entry. Treatments within the project area would be incremental and generally not exceed 6,000 acres per year. Thus not disturbing all potential habitats in any one single year.

USFS Sensitive Species	Effects Determination
	Alternative B's reduction of fuels would reduce the potential for high severity canopy wildfire for 30 years and alternative C for 15 years; that could destroy foraging habitat in the project area.
Reptiles	
Narrow-headed garter snake	Alternative B or C may impact individuals of the narrow-headed garter snake but would not result in a trend toward Federal listing or loss of viability. One record of a narrow-headed garter snake occurrence on the Black Mesa district exists from 1991 from Vincent Ranch in Hart Canyon. This is the only report of this species in the Little Colorado River drainage. The Black Mesa district is considered to be at the periphery of this species' range. Conservation measures and BMPs should minimize the amount of sediment and ash (water quality) to downstream aquatic and riparian habitat and its effects to narrow-headed garter snake prey species. One broadcast burn maintenance treatment within the ponderosa pine forest type would provide for the same short-term effects as the first entry. Streamside management zones provide for buffers along riparian corridors. Treatments within the project area would be incremental and generally not exceed 6,000 acres per year. Thus not disturbing all potential habitats in any one single year. Alternative B's reduction of fuels would reduce the potential for high severity canopy wildfire for 30 years and alternative C for 15 years; that could adversely modify habitat in the project area.
Plants	
Arizona sneezeweed	**Alternative B or C may impact individuals of the Arizona sneezeweed but would not result in a trend toward Federal listing or loss of viability.** Arizona sneezeweed has been observed at several wetland depression locations within the project area. Mechanical or low severity broadcast fire treatments within riparian habitats are limited and would employ BMP. One broadcast burn maintenance treatment within the ponderosa pine forest type would provide for the same short-term effects as the first entry. Treatments could cause damage or mortality to individual plants if they were present. Potential habitat (wet meadows, reservoirs) would be protected during mechanical treatments with BMPs. Alternative B's reduction of fuels would reduce the potential for high severity canopy wildfire for 30 years and alternative C for 15 years; that could adversely modify habitat in the project area.
Eastwood alum root	Alternative B or C may impact individuals of the Eastwood alum-root but would not result in a trend toward Federal listing or loss of viability. Eastwood alum-root plants have been documented on the Black Mesa district along Chevelon Canyon and near Black Canyon Lake. Forest Service personnel have not conducted surveys of suitable habitat in the project area to determine presence or absence of the species. Suitable moist habitat can be found on the steeper slopes of the headwaters of Woods, Willow Springs, Willow, and Beaver Canyons in the project area. Treatments could cause mortality to individual plants. One broadcast burn maintenance treatment within the ponderosa pine forest type would provide for the same short-term effects as the first entry. Treatments within the project area would be incremental and generally not exceed 6,000 acres per year, thus not disturbing all potential habitats in any one single year. Alternative B's reduction of fuels would reduce the potential for high severity canopy wildfire for 30 years and alternative C for 15 years; that could adversely modify habitat in the project area.

USFS Sensitive Species	Effects Determination
Arizona sunflower	Alternative B or C may impact individuals of the Arizona sunflower but would not result in a trend toward Federal listing or loss of viability. Arizona sunflower is not known to exist within the project area. One account exists from the Sitgreaves National Forest with no specific location given. Treatments could cause damage or mortality to individual plants, if they are present. Drainages, which may provide habitat for Arizona sunflower, would be protected during mechanical treatments. One broadcast burn maintenance treatment within the ponderosa pine forest type would provide for the same short-term effects as the first entry. Treatments within the project area would be incremental and generally not exceed 6,000 acres per year, thus not disturbing all potential habitats in any one single year. Alternative B's reduction of fuels would reduce the potential for high severity canopy wildfire for 30 years and alternative C for 15 years; that could adversely modify habitat in the project area.
Blumer's dock	Alternative B or C may impact individuals of Blumer's dock but would not result in a trend toward Federal listing or loss of viability. Blumer's dock plants have been detected within the project area in Woods and Willow Canyons. Suitable Blumer's dock habitat can also be found in other headwater drainages and wet meadows. Treatments could cause damage or mortality to individual plants. BMPs would be employed to protect Blumer's dock habitat during mechanical and broadcast burn treatments. Wet meadows and ephemeral drainages would be protected during mechanical treatments and a filter strip would be retained in riparian areas. One broadcast burn maintenance treatment within the ponderosa pine forest type would provide for the same short-term effects as the first entry. Mechanical treatments would open the canopy around some wet meadows, which could increase the amount of habitat available for Blumer's dock. Reduction of fuels would reduce the potential for high severity canopy wildfire for 30 years and alternative C for 15 years; that could adversely modify habitat in the project area.
Bebb's willow	Alternative B or C may impact individuals of Bebb's willow but would not result in a trend toward Federal listing or loss of viability. Bebb's willows have been detected within the project area in Woods and Willow Canyons. Suitable Bebb's willow habitat can also be found in other headwater drainages and wet meadows in the analysis area. Treatments have the potential to cause damage or mortality to individual plants, however, (1) BMPs (buffer) and other protective measures would be employed to protect Bebb's willows and habitat (wet meadows and ephemeral drainages) during mechanical and broadcast burn treatments, and (2) crown sprouting of willows would be expected if individuals were burned with a low-severity fire. A buffer strip would be retained in all riparian areas. Mechanical treatment would open the canopy around some wet meadows. This could increase the amount of habitat available for Bebb's willow. Mechanical maintenance treatments would be done on meadows to reduce conifer encroachment. Alternative B's reduction of fuels would reduce the potential for high severity canopy wildfire for 30 years and alternative C for 15 years; that could adversely modify habitat in the project area.

Management Indicator Species

Management Indicator Species—Summary

The analysis identifies 11 management indicator species, as well as aquatic macroinvertebrates (several species). After considering the effects on MIS populations forestwide after 2011 Wallow

Fire, neither action alternative would affect forestwide trends, whether upward trends that are established for many species, or negative trends established for mule deer and macroinvertabrates.

The difference between the action alternatives is that alternative B would maintain its beneficial habitat effects for at least 30 years, while alternative C is expected to maintain that benefit for 15 years or less. The addendum to the wildlife specialist report (Brown 2012) includes more detailed analysis regarding the current habitat conditions and population trends.

The amount of habitat for the forest MIS is small—less than 5 percent (table 69)—and so changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Table 69. MIS species, habitat components, forest trends, and acres analyzed

MIS Species by Forest Management Area	Habitat Component Indicated*	Forestwide Habitat Trend*	Forestwide Population Trend*	Acres of Habitat Forestwide	Acres Analyzed in Project Area (Percent of Habitat)
Mexican Spotted Owl Stratified Habitat MA-01	Late Succession	Declining	Declining	649,069	11,276 (1.7%)
Northern Goshawk Stratified Habitat MA-01	Late Succession (ponderosa pine)	Stable to Declining	Declining	1,682,492	21,680 (1.3%)
Rocky Mountain Elk MA-01	Early Succession	Increasing	Stable to Declining	1,690,439	33,221 (2%)
Mule Deer MA-01	Early Succession	Increasing	Stable to Increasing	1,769,299	33,221 (1.9%)
Hairy Woodpecker MA-01	Snags (all types)	Upward	Stable	712,366	32,956 (4.6%)
Red-naped Sapsucker (area with small inclusions of aspen) MA-01	Snags (aspen)	Stable	Stable	800,000	30,385 (3.8%)
Merriam's Turkey MA-01	Late Succession	Stable	Stable	936,663	33,221 (3.5%)
Pygmy Nuthatch MA-01	Late Succession (ponderosa pine)	Declining	Stable	569,890	32,956 (4%)
Abert's Squirrel MA-01	Early Succession (ponderosa pine)	Stable to Declining	Stable	746,902	24,829 (3.3%)
Red Squirrel MA-01	Late Succession (spruce/mixed conifer)	Declining	Stable to Declining	203,347	8,127 (4%)

MIS Species by Forest Management Area	Habitat Component Indicated*	Forestwide Habitat Trend*	Forestwide Population Trend*	Acres of Habitat Forestwide	Acres Analyzed in Project Area (Percent of Habitat)
Yellow-breasted Chat MA-03	Low to Mid Elevation Riparian	Stable	Stable	10,101	<100 (1%)
Cinnamon Teal MA-11	Wetlands	Upward	Stable	29,430	310 (1.1%)

* USDA Forest Service. 2006 (unpublished document). Management indicator species assessment: Apache-Sitgreaves National Forests. USDA Forest Service, Springerville, AZ.

** There are no pure stands of cottonwood/willow riparian habitat in the project area. The density of conifer trees causes all streamside stands to be classified as conifer stands. Therefore, acres of yellow-breasted chat riparian habitat are estimated to be <100 acres.

For each MIS with potential to occur in the project area, the "Apache-Sitgreaves National Forests MIS Assessment" (USDA 2006) was utilized for habitat condition and trend of their representative habitat component and population trend across the forest (table 69 and table 70). This analysis was updated in 2012 following the Wallow Fire, which burned substantial portions of the forest east of the project area.

MIS species occurring within Woodland (MA-2) and Grassland (MA-4) are not analyzed because these habitat types do not occur within the project area and no changes in habitat trend, quality, or quantity are expected to occur as a result of this project. Lucy's warbler, a low elevation (4,000 feet and below) riparian habitat indicator, and Lincoln's sparrow, a high elevation riparian habitat indicator, were not considered in the analysis for this project because the habitat types they inhabit do not occur within the project area, and neither species has been detected during 5 years of songbird surveys on the Black Mesa Ranger District.

The amount of MIS habitat forestwide is compared to the representative habitat within the project area. The amount for each species is shown by percentages of appropriate forest cover types (see table 70). No forest habitat cover type would be converted to another forest habitat cover type for any MIS under any alternative. The percentages of forest wide habitat in the project area are lowest for the northern goshawk at 1.2 percent and highest with the pygmy nuthatch at 5.8 percent. Table 70 provides a basis for reviewing each MIS quantity of habitats that would be treated in the project area to the forest plan identified habitats (USDA 2006).

Table 70. Comparison of MIS habitat forestwide and within the project area

MIS Species	Current Forestwide Species Habitat (acres)	Representative Habitat within Project Area (acres)	Percent of Forestwide Habitat in Project Area
Mexican spotted owl	649,069	11,276*	1.7
Northern goshawk	1,682,492	21,680*	1.2
Elk	1,690,439	33,221	2.0
Mule deer	1,769,299	33,221	1.9
Hairy woodpecker	712,366	32,956	4.6

MIS Species	Current Forestwide Species Habitat (acres)	Representative Habitat within Project Area (acres)	Percent of Forestwide Habitat in Project Area
Red-naped sapsucker	800,000	30,385	3.8
Merriam's turkey	936,663	33,221	3.5
Pygmy nuthatch	569,890	32,956	5.8
Abert's squirrel	746,902	24,829	3.3
Red squirrel	203,347	8,127	4.0
Yellow-breasted chat	10,101	<100	< 0.9
Cinnamon teal	29,430	310	< 0.1

*Acres of northern goshawk and Mexican spotted owl in the project area are derived from the habitat stratification in figures 9 and 10.

Mexican Spotted Owl

Effects to Mexican spotted owls and their habitat are addressed in more detail for each alternative in the section above, additional discussion regarding MIS follows.

Forestwide Habitat Trends

The Mexican spotted owl is a management indicator species for late succession forest habitat in the Apache-Sitgreaves National Forests (ASNFs). Both timber harvest and wildfires have affected mixed conifer and ponderosa pine forests. Records indicate that there have been 1,890 acres of timber harvests that removed large diameter trees (seed cuts, clearcuts, and overstory removals) since 1996 for an average of about 371 acres per year. Records also show that these timber harvesting practice have ceased on the forest since 2001 (i.e., zero acres harvested using these techniques). Because of this, it is not likely that habitat suitability for Mexican spotted owls has been reduced since 2001 due to timber harvest.

Catastrophic fires can cause landscape-wide modifications to the habitat capability of the forest for spotted owls. Over the last 11 years, the ASNFs have been subject to several large wildfires. The Wallow Fire of 2011 was the largest recorded fire in Arizona history and burned over 500,000 acres of the ASNFs.

During containment, the forest initiated a burned area evaluation and restoration (BAER) group to identify values at risk and initiate emergency protection of these values. Based on the risk assessment conducted by the BAER wildlife resource team, risk to Mexican spotted owls was found to be very high. A large number of nest sites (PACs) were impacted by the fire in relation to the total number of PACs occurring on the ASNFs. A total of 76 Mexican spotted owl PACs, accounting for 58 percent of the PACS on the forest occur within the burn perimeter of the Wallow Fire. Of these, 30 are considered to be at high risk of loss and another 23 PACs are considered to be at moderately high risk (unpublished USFS report "Rapid Assessment Team Wildlife Report").

Given the extent of loss, management and restoration actions are being taken to prevent further deterioration and to enhance recovery rates. Pheromone treatments have been implemented to reduce the risk of beetle induced tree mortality within the fire perimeter, and seeding and heli-mulching has occurred over large areas encompassing all or portions of many of the PACs. Reforestation activities are also proposed for implementation within these PACs (unpublished

USFS report "Rapid Assessment Team Wildlife Report"). The full impact of the Wallow Fire on the owl population on the ASNFs would probably not be known for several years.

The Wallow Fire caused considerable loss of mixed conifer and ponderosa pine forest types and had severe impacts to some PACs. Therefore, available habitat quality for the Mexican spotted owl is low on the Apache-Sitgreaves National Forests. Habitat on unburned portions of the forest is likely improving due to protection of existing and potential old growth areas, decreasing harvest levels, and high net annual growth rate. However, actual improvements in the quality of late succession management areas would take many decades. The improvement in habitat for Mexican spotted owl would be slow. Therefore, habitat trends forestwide are considered to be declining.

Forestwide Population Trends

Monitoring of known Mexican spotted owl territories was conducted by Forest Service personnel from 2006 to 2011 within all three of the ranger districts on the ASNFs. The Mexican spotted owl territories monitored on the Black Mesa Ranger District show a high proportion of territories to be unoccupied annually (33–69 percent). In general, the percentage of nesting territories was relatively stable from 2006 to 2011 as was the percentage of territories occupied by single birds only.

During the 6-year period, the number of territories monitored per year on the Alpine/Clifton and Springerville/Lakeside Ranger Districts ranged from 0 to 17. During most years, monitored territories numbered 5 or less. These sparse datasets make it difficult to reliably infer population trends on these two ranger districts. In general, however, results suggest a declining trend in the percentage of territories occupied and show a high proportion of territories to be unoccupied annually (24–67 percent). Direct effects of the large-scale Wallow Fire on known territories in these two ranger districts cannot be inferred since monitoring was not conducted in 2011 due to restrictions. It is known, however, that a large number of nest sites (PACs) were impacted by the fire in relation to the total number of PACs occurring on the ASNFs. A total of 76 Mexican spotted owl PACs, accounting for 58 percent of the PACS on the forest occur within the burn perimeter of the Wallow Fire. Of these, 30 are considered to be at high risk of loss and another 23 PACs are considered to be at moderately high risk (unpublished USFS report "Rapid Assessment Team Wildlife Report").

Given the considerable loss of forest vegetation due to recent large scale forest fires (i.e., Wallow Fire), Mexican spotted owl populations on the ASNFs would likely decline due to decreased habitat capability. Additional monitoring of Mexican spotted owl territories would give a better picture of population trend, however, the effects of the fire would likely not be known for several years.

The Mexican spotted owl is considered a rare, permanent resident of the ASNFs (USDA 1996). Available information from the 2006 assessment of management indicator species report showed that Mexican spotted owls were fairly well distributed in forested habitats on the Apaches-Sitgreaves National Forests and populations in the forest were considered to be stable, but likely lower than potential. Given the considerable loss of forest vegetation and severe impacts to PACs resulting from the Wallow Fire in 2011 and other wildfires since 2006, Mexican spotted owl abundance is considered to be declining due to decreased habitat capability to support the species.

Alternative A

Implementation of this alternative would not allow for management actions that are supported by forest plan goals and objectives for this species and their associated habitat types. Alternative A would not likely change the "declining" forestwide habitat trend or the "declining" forestwide population trends.

Alternative B

Alternative B would move MSO habitats toward forest plan guidelines. The treatments in MSO restricted threshold habitat and restricted target threshold (objective to achieve 150–170 BA where available) would be managed for nest and roost characteristics. Implementing treatments would reduce the potential for stand replacing, high severity, crown fire throughout the project area. MSO habitats moving toward forest plan guidelines would support the "declining" forestwide habitat trend and not alter the "declining" forestwide population trend.

Due to only 1.7 percent of the available forestwide habitat occurring within the project area, changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Alternative C

Overall differences in stand density are slight relative to alternative B. However, the forest vegetation spatial patterns would be different under this alternative than under alternative B in "restricted other" habitats. The posttreatment tree distribution would be more uniform under alternative C, leading to more rapid canopy closure (15 years) and increased risk of high severity wildland canopy fire, which would be detrimental to MSO habitats. MSO habitats moving toward forest plan guidelines would support the "declining" forestwide habitat trend and "declining" forestwide population trend. Due to only 1.7 percent of the available forestwide habitat occuring within the project area, changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Northern Goshawk

Forestwide Habitat Trend

Habitat conditions for the northern goshawk have declined over the past 100 years. However, forest management activities are being enacted to improve goshawk habitat across the Apache-Sitgreaves National Forests. Thinning and prescribed natural fires would improve on habitat conditions favoring goshawk flight maneuverability, prey species, snags, and down woody material with increased vegetation diversity. Nest sites are protected and foraging habitat is managed for improvement. Recent drought conditions, landscape-scale wildfires, and tree insect outbreaks across Southwestern forests have lead to the loss of some forest habitat and have depressed the populations of many northern goshawk prey species.

The U.S. Fish and Wildlife Service finds that despite forest management activities across the western United States, the goshawk continues to be well distributed throughout its historic range. The service also finds no evidence that lack of habitat is limiting the overall population, causing extirpation, or curtailing species from its range.

Low reproductive performance on the ASNFs may reflect the fact that the forest is on the southern edge of the range of *A. g. atricapillus*. Population density tends to be greatest near the center of the range and lower toward the boundaries, because resources are often scarce and/or environmental conditions approach tolerance limits at a species' geographic fringe. Also, direct and indirect effects of climate often seem to be important in the persistence of marginal populations, especially important given that environmental factors may affect demographic rates of northern goshawk populations.

Based on the information above, habitat trend is considered to be stable to declining on the ASNFs. The "Sensitive Species" section above discusses effects for each alternative to northern goshawk.

Forestwide Population Trend

During the last 6 years (2006–2011) only 3 northern goshawk territories were monitoried on the Alpine/Clifton Ranger Districts out of 24 named territories: 1 was occupied on the Clifton RD in 2006 and 2007 and another additional territory was occupied in 2007; and 1 northern goshawk territory was occupied on the Alpine RD in 2007 (ASNFs, unpublished data). In additon, the sparse monitoring data for northern goshawk territory activity on the Springerville and Lakeside Ranger Districts show a high percentage of territories monitoried to be unoccupied.

The northern goshawk territories monitored on the Black Mesa Ranger District show a high proportion of territories monitored to be unoccupied annually (62–82 percent). The high percentage of territories unoccupied within the ASNFs is most likely a combined result of the lack of intensive monitoring (i.e., results from small sample sizes) and the recent large scale, forest stand-changing fires and the resulting poor forest conditons for nesting goshawks. The recent Wallow Fire (2011) on the Springerville and Alpine Ranger Districts has impacted 30 goshawk territories, with an additional 3 territories impacted by forest fires on the Black Mesa Ranger District. Given past drought conditions and recent large scale forest fires (i.e., Rodeo-Chediski and Wallow Fires), the existing habitat conditions on the ASNFs have lead to northern goshawk populations to be in decline. However, there are several areas of potential habitat that have rarely been surveyed (e.g. Chevelon Canyon, Leonard Canyon) where additional goshawk nesting territories may still be located.

Alternative A

Alternative A would not alter the "stable to declining" forestwide northern goshawk habitat trend or the "declining" forestwide population trend. Implementation of this alternative would not be consistent with forest plan goals and objectives for this species and their associated habitat types.

Alternative B

Alternative B would move northern goshawk habitats (nest stands/PFAs, foraging habitats, and project area) toward improvement in quality of habitat and meeting forest plan guidelines, including those descriptions found in the forest plan amendment (page 25).

The development of uneven-aged stands in groupy, clumpy arrangements with regeneration openings within PFAs, nest stands, and foraging habitats would release understory herbaceous/shrub communities that provide habitat for prey of the northern goshawk. This alternative would reduce the potential for stand replacing, high severity crown fire. More forested

stands within the project area would be managed for the stand structure goshawks prefer. Maintenance, low severity prescribed burning would occur once on ponderosa pine forest types, so that impacts associated with the initial prescribed burn treatments would reoccur. Thirty-three goshawk PFAs have been impacted by fire (30 on the Alpine/Springerville RDs by the Wallow Fire and 3 on the Black Mesa RD). Although the Rim Lakes Project has a potential disturbance in reproductive success in two active PFAs, a measurable change to the forestwide goshawk population trend is not expected because of mitigation measures that would control the timing of any disturbance if the PFAs were active.

Improving the quality of habitat for northern goshawk in the project area (1.2 percent of the forestwide acres) would contribute toward improving the overall quality on the ASNFs for this species and would improve the "stable to declining" forestwide habitat trend and not contribute further to a "declining" forestwide population trend. Only 1.2 percent of the available forestwide habitat occurs within the project area, so changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

During public comment for this project, one line of research was mentioned that raised concerns about the effectiveness of the northern spotted owl recommendations in reproductive success (Beier 2008 and Beier 2012). This research conducted a test of the recommendations and concluded that reproduction of goshawks declined as forest structures in their breeding areas became increasingly similar to those described in the recommendations. These concerns have been evaluated in a response (Reynolds et al. 2012), which found the methods used by Beier to reach his conclusion were flawed. For example, Reynolds found the methods used to determine similarity to the structural conditions described in the recommendations resulted in inappropriate measures of similarity. Reynolds also concluded that insufficient monitoring and other factors contributed to Beier's conclusions.

Alternative C

Alternative C would improve northern goshawk habitats in the short term; and make progress toward, but not attain, forest plan guidelines due to even-aged management.

The development of even-aged stands within PFAs and foraging habitats would improve site conditions for majority of prey species following treatments, but would lack the clumpy and groupy stand arrangement with numerous regeneration openings. Following 15 years post treatment, the forest canopy would provide for a potential for stand replacing, high severity crown fire. This alternative provides a short-term (up to 15 years) benefit compared to alternative B that provides a long-term benefit (up to 30 years).

Alternative C would move habitats toward forest plan guidelines at a lesser extent than alternative B, especially in terms of creating uneven-aged structure, but it would support an improvement to the "stable to declining" forestwide habitat trend and "declining" forestwide population trend with implementation of this alternative.

Due to only 1.2 percent of the available forestwide habitat occurring within the project area, changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Implementation of this alternative would make progress toward, but not attain, forest plan guidelines due to even-aged management objectives for this species and their associated habitat types.

Elk and Mule Deer

Forestwide Habitat Trend

In the ASNFs, elk (*Cervus elaphus canadensis*) are used as an indicator species for early succession forested habitats (USDA 1987a). Fire serves as the main disturbance regime influencing the age structure and successional stage of the forests within the ASNFs. Since 2005, approximately 650,000 acres have burned with the most recent Wallow Fire affecting 540,979 acres. The Wallow Fire consumed five times more of the forest than all other wildfire events since 2005. In contrast, forest treatments such as salvage operations, group selection, seed cuts, etc., that favor early successional development have decreased since 1985.

Compared with forest management prescriptions, wildfire has much greater potential to create early-succession habitat, although catastrophic fires do not appear to result in immediate improvements for Rocky Mountain elk habitat. For example, the Rodeo-Chediski Fire of 2002 burned over 173,000 acres and converted approximately 55 percent of the burn to early-succession habitat. However, forage and security cover for big game species such as Rocky Mountain elk declined after the fire. As a result, the forage capacity for elk declined in the short term relative to prefire conditions. In contrast, areas that experienced a moderate- or low-intensity burn, resulted in grass and forb enhancement and created a juxtaposition of food and cover that benefited Rocky Mountain elk habitat. In summary, low intensity wildfires provide a more immediate improvement than high intensity wildfires.

On most forested ranges, fire enhances grazing resources such as grasses, sedges, aster, goosefoot, bear grass, eriogonums, lupines, and other early successional and understory montane plants. Browse items such as serviceberry, mountain mahogany, sagebrush, rabbitbrush, acorns, and leaves of oaks, snowberry, and willows may also be favored by low intensity wildfires. Thus, low-intensity fire is considered desirable for Rocky Mountain elk habitat. Most (54 percent) of the moderate to high density Rocky Mountain elk habitat in the Rodeo-Chediski Fire area burned under low intensity fire, thus benefiting the species. Based on these considerations, there is an increasing trend in the creation of early-successional habitat that could benefit Rocky Mountain elk given the large spatial scale of recent wildfire activity. The important determinant would be the juxtaposition of this habitat with security cover—a factor that is best predicted by data regarding fire severity. Targeted restoration efforts to promote the establishment of new growth would ultimately benefit Rocky Mountain elk in moderate and high intensity burned areas.

For mule deer, maintaining an interspersion of quality browse and sufficient cover to support population persistence is a primary management goal for mule deer management in Arizona where mule deer serve as a management indicator species (MIS) for the ASNFs.

Fire serves as the main disturbance regime influencing the age structure and successional stage of the forests within the ASNFs. Since 2005, approximately 650,000 acres have burned with the most recent Wallow Fire affecting over 500,000 acres. In contrast, forest treatments such as salvage operations, group selection, seed cuts, etc., that favor early successional development have decreased since 1985.

Compared with forest management prescriptions, wildfire has much greater potential to create early-succession habitat, although catastrophic fires do not appear to result in immediate improvements for mule deer habitat. For example, the Rodeo-Chediski Fire of 2002 burned over 173,000 acres and converted approximately 55 percent of the burn to early-succession habitat.

However, forage and security cover for big game species such as mule deer declined after the fire. As a result, the forage capacity for mule deer declined in the short term relative to prefire conditions. In contrast, areas that experienced a moderate- or low-intensity burn, resulted in grass and forb enhancement and created a juxtaposition of food and cover that benefited mule deer habitat.

On most forested ranges, fire enhances grass/forb growth and shrubs such as *Ceanthus* spp., mountain mahogany, and other hardwood species. Thus, low-intensity fire is considered desirable for mule deer habitat. Deer would use areas closer to cover. Most (54 percent) of the moderate to high density deer habitat in the Rodeo-Chediski Fire area burned under low-intensity fire benefiting mule deer. The remaining 46 percent of the high-density big game habitat burned under moderate- to high-severity conditions. Habitat that burned under moderate to high severity would have little or no habitat value in the short term (1–5 years) because grass and forbs are very sparse. Thus, in the long term these areas could provide high quality forage for mule deer.

Based on these considerations there is an increasing trend in the creation of early-successional habitat that could benefit mule deer given the large spatial scale of recent wildfire activity.

Forestwide Population Trend

The ASNFs encompass seven game management units (GMUs) managed by the Arizona Game and Fish Department. The Arizona Game and Fish Department has provided aerial survey data for Rocky Mountain elk collected between 2001 and 2011 for four GMUs. In unit 27, the Rocky Mountain elk annual population estimates averaged 3,370 and varied from a low of 2,988 in 2003 to a high of 3,730 in 2010. In contrast, the combined population estimates for units 3A and 3C suggest that the Rocky Mountain elk populations in this unit are in decline. Population estimates for unit 1 are fairly stable, averaging 5,870 and varying from a low of 5,411 in 2006 to a high of 6,953 in 2001.

Over the last 5 years (2006–2011) Rocky Mountain elk populations on the Apache-Sitgreaves National Forests have either been relatively stable (GMU 27 and 1) or declining (GMU 3A and 3C). Wildfire activity over the past decade would likely improve habitat conditions by creating early-successional habitats that benefit browse production. Although large scale, high-intensity fires—such as the Wallow Fire in 2011 that burned over 540,000 acres—may not result in the landscape heterogeneity required to support robust Rocky Mountain elk populations in the short term, natural succession combined with active forest restoration designed to create a mosaic of uneven-aged stands would ultimately benefit the resident Rocky Mountain elk populations.

Rocky Mountain elk populations on the ASNFs are in good condition with a stable population growth trend.

Elk using the project area are managed by the Arizona Game and Fish Department in Game Management Unit (GMU) 4A. Deer are managed in this area as part of combined GMU 4A/4B. Nearly all of the project area is considered suitable habitat for elk and mule deer (33,221 acres).

The elk population in 4A has been reduced approximately 50 percent over the past 10 years due to Arizona Game and Fish Department management actions, with the estimated population at 2,200 adults.

The mule deer population is in a long term downward decline in GMUs 4A/4B due to a reduction in quality forage habitats. There is no estimated population total for these units. An average of 60 adults has been observed post harvest during helicopter surveys from 1999 to 2004. The average annual harvest for 1998–2003 is around 50 deer.

The current forage-to-cover ratio in the project area is approximately 45:55 (table 70). The forest plan (USDA 1987, as amended) recommends, "Within diversity units where no conflicts occur with TES species needs, as a guideline manage forage to cover ratios between 40:60 and 70:30." Annual forage use monitoring conducted by Forest Service and AGFD personnel shows that ungulates (domestic livestock, elk, and deer) are overutilizing herbaceous forage in many meadows. Visual observations indicate that ungulates are underutilizing upland forage, likely due to the fact that upland grasses are less palatable than meadow grasses. Twenty-five to 30 percent forage utilization by large ungulates is desired in this area. Table 70 displays the forage needs of elk and mule deer within the project area. Domestic livestock are allowed to graze 37 percent (about 12,470 acres) of the project area.

Furthermore, the quality of herbaceous forage is less than desired due to forested habitats shading out many palatable herbaceous and woody species. Slopes, aspects, and type of habitat stratified (MSO vs. northern goshawk) would influence future forage (forest understory vegetation) and cover ratios within treated areas. There is a need to improve forage quality and quantity by reducing the density of trees by mechanical thinning and prescribed burning to allow release of desirable understory herbaceous and browse species.

Fire serves as the main disturbance regime influencing the age structure and successional stage of the forests within the ASNFs. Since 2005, approximately 650,000 acres have burned with the most recent Wallow Fire affecting 540,979 acres. The Wallow Fire consumed five times the area of forest than all other wildfire events since 2005. In contrast, forest treatments such as salvage operations, group selection, seed cuts, etc., that favor early successional development have decreased since 1985.

Compared with forest management prescriptions, wildfire has much greater potential to create early-succession habitat although catastrophic fires do not appear to result in immediate improvements for Rocky Mountain elk habitat. For example, the Rodeo-Chediski Fire of 2002 burned over 173,000 acres and converted approximately 55 percent of the burn to early-succession habitat. However, forage and security cover for big game species such as Rocky Mountain elk declined after the fire. As a result, the forage capacity for elk declined in the short term relative to prefire conditions. In contrast, areas that experienced a moderate- or low-intensity burn, resulted in grass and forb enhancement and created a juxtaposition of food and cover that benefited Rocky Mountain elk habitat. In summary, low-intensity wildfires provide a more immediate improvement than high-intensity wildfires.

On most forested ranges, fire enhances grazing resources such as grasses, sedges, aster, goosefoot, bear grass, eriogonums, lupines, and other early successional and understory montane plants. Browse items such as serviceberry, mountain mahogany, sagebrush, rabbitbrush, acorns, and leaves of oaks, snowberry, and willows may also be favored by low-intensity wildfires. Thus, low-intensity fire is considered desirable for Rocky Mountain elk habitat. Most (54 percent) of the moderate to high density Rocky Mountain elk habitat in the Rodeo-Chediski Fire area burned under low-intensity fire, thus benefiting the species. Based on these considerations, there is an increasing trend in the creation of early-successional habitat that could benefit Rocky Mountain

elk given the large spatial scale of recent wildfire activity. The important determinant would be the juxtaposition of this habitat with security cover—a factor that is best predicted by data regarding fire severity. Targeted restoration efforts to promote the establishment of new growth would ultimately benefit Rocky Mountain elk in moderate and high intensity burned areas.

Forestwide Population Trend

The ASNFs encompass seven game management units (GMUs) managed by the Arizona Game and Fish Department. The Arizona Game and Fish Department has provided aerial survey data for Rocky Mountain elk collected between 2001 and 2011 for four GMUs. In unit 27, the Rocky mountain elk annual population estimates averaged 3,370 and varied from a low of 2,988 in 2003 to a high of 3,730 in 2010. In contrast, the combined population estimates for units 3A and 3C suggest that Rocky Mountain elk populations in this unit are in decline. Population estimates for unit 1 are fairly stable, averaging 5,870 and varying from a low of 5,411 in 2006 to a high of 6,953 in 2001.

Table 71. Estimated herbaceous summer forage needs for elk and mule deer in the project area, based on 2003 big game density estimates by AGFD*

Species	Density Category	Animal Density (Animals/mi.^{2})	Area (mi.^{2})	Number of Animals (Density x Area)	Herbaceous Forage Needs (lb./animal/ season)	Total Herbaceous Forage Needs (lbs.)
Elk Summer	Very High	12.5	4.6	57.5	1,555	89,413
	High	8.0	34.0	272		422,960
	Moderate	4.5	13.7	61.7		95,866
Mule Deer Summer	Moderate	7.5	0.9	6.8	225	1,519
	Low	3.0	18.5	55.5		12,488
	Sparse	0.5	32.9	16.5		3,701
Total						625,947

*Big game density information was based on 2003 population estimates and validated at the game management unit level. Utilizing this data at the scale of a single allotment or analysis area may reduce the reliability of the population estimates and, therefore, the forage needs calculations. Source: Dave Dorum, Arizona Game and Fish Department, 11/03/2006.

Alternative A

The forage-to-cover ratio for elk and mule deer would grow to 45:55 under the no action alternative. Cover acreage would increase and forage would decrease as stand tree densities increase. Meadows and other small openings used for forage would probably receive more elk and deer use if populations remain stable. There would be no treatment related disturbance under this alternative.

This alternative would not reduce the potential for stand replacing, high severity crown fire in the project area that currently posed a threat to elk and mule deer habitat.

Alternative A would not likely change the mule deer “upward” forestwide habitat trend or the “stable to increasing” forestwide population trend. Alternative would not likely change the elk “upward” forestwide habitat trend or the “stable to declining” forestwide population trend.

Implementation of this alternative would not be consistent with forest plan goals and objectives for this species and their associated habitat types.

Under alternative A, foraging areas such as forest openings and meadows would decline over time due to tree encroachment in the project area. Forage to cover ratios in alternative A would not be maintained to meet forest plan guidelines. Ungulate forage use areas would continue to target meadows and riparian areas. Herbaceous and browse understory forage species would remain at or near existing conditions until a wildland fire occurred that would open up the canopy and release forest understory vegetation.

Alternative B

Thinning forest stands followed by low severity broadcast burning would result in more foraging habitat (70 percent) than cover habitat (30 percent), or the forage-to-cover ratio is 70:30, which is still within forest plan guidelines. Hiding cover would be retained along at least 40 percent of arterial and collector roads. It is expected that hiding cover would be better dispersed within this alternative due to the uneven stand VSS classes and the retention of clumps of small to medium sized trees. Because of this uneven structure, wildlife hiding and thermal cover within treated stands would likely be more effective in this alternative.

Substantially more upland herbaceous, forb, and browse forage would be available to elk and mule deer following treatments and recovery, which may reduce current forage use pressure on existing meadows and wetlands.

Short-term disturbance to elk and mule deer by treatment activities would temporarily displace and alter foraging, resting, and traditionally used areas. Timing restrictions for treatment activities within MSO PACs and northern goshawk PFAs would not disturb elk or mule deer during the calving and fawning seasons. The project area would be treated in phases over time and would not occur over the project area at the same time. Elk and mule deer would only experience activity-related disturbance in portions of the project area at one time.

Smoke effects from broadcast burning may disturb individuals but this should be a short-term impact and would not adversely affect elk or mule deer. Timing restrictions within PFAs and MSO PACs would prevent burning in these areas during the calving and fawning seasons.

This alternative would reduce the potential for stand replacing, high severity crown fire in the project area that currently posed a threat to elk and mule deer habitat. Maintenance, low severity prescribed burning would occur once on ponderosa pine forest types, so impacts associated with the initial prescribed burn treatments would reoccur.

Alternative B would likely support the mule deer “upward” forestwide habitat trend but not affect the “stable to increasing” forestwide population trend. Similarly, alternative B would likely support the elk “upward” forestwide habitat trend but not affect the “stable to declining” forestwide population trend. Due to only 2 percent of the available forestwide habitat occuring within the project area for both mule deer and elk, changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Herbaceous understory vegetation response would be greater post treatment with alternative B and productive out to 30 years. Alternative C would expcet to see a productive herbacous understory 15 years post treatment due to canopy closure and shading effect. Implementation of alternative B would be consistent with forest plan goals and objectives for elk/deer and their associated habitat types.

Alternative B would meet minimum forest plan big game cover guidelines with a ratio of 70:30 (table 72). Big game would have more forage habitat available following treatments with long-term maintenance of understory with broadcast burning. Maintenance, low severity prescribed burning would occur once on ponderosa pine forest types that would develop interspersed regeneration openings with groupy and clumpy stands remaining. Life expectancy for this alternative is up to 30 years.

Because the project area supports the highest elk densities on the district, the AGFD and forest personnel have identified this area as needing more upland herbaceous and browse forage to support big game needs. With the release of understory herbaceous and browse species following treatment, big game use areas would expand and the meadows and riparian areas may receive less utilization. Browsing on aspen, cottonwood, and oaks might also be reduced by increasing forage availability in the uplands.

Table 72. Changes in forage-to-cover ratios by alternative throughout the project area

Alternative	Forage:Cover Ratio
Alternative A (no action)	45:55
Alternative B	70:30
Alternative C	63:37

Forested hiding and escape cover would be reduced from current conditions; however, with the release of understory herbaceous and browse species (forage) would be a benefit. Alternative B would provide an effective big game escape cover across the landscape with uneven-aged stand management. The clumpy, uneven-aged objective in this alternative would result in lesser sight line distances due to the retention of clumps of small to medium diameter trees. Forested cover would be retained along 40 percent of arterial and collector roads and around dirt tanks and cienegas according to forest plan guidelines. MSO protected, target, target threshold habitats, and areas with steep slopes (>40 percent) would also retain forested cover. Herbaceous cover needed by small mammals, insects, ground-nesting birds, and reptiles would become more abundant under this alternative as tree densities are reduced and understory herbaceous and browse species are released.

Alternative C

Since the same stands would be treated mechanically and with prescribed burning in alternative C as in alternative B, most of the effects described in alternative B would apply to alternative C.

The forage-to-cover ratio would be 63:37 under this alternative, which is within forest plan guidelines. Although more stands would have higher canopy closure—which is a measure of wildlife cover—treated stands would likely have more open understories and less escape cover compared to alternative B because fewer small to medium sized trees would be retained. Substantially more forage would be available to elk and mule deer after treatments are completed, which may reduce forage use pressure on existing meadows and wetlands. Foraging habitat would not improve quite as much under this alternative as compared to alternative B due to somewhat higher tree and crown densities post treatment that would not favor understory species.

Diameter limits in the Nagel and Little Springs Project areas have resulted in stands with very little big game cover where more cover could have been retained without a diameter limit. Wildlife species richness and diversity are higher in uneven-aged stands with a variety of tree size classes and habitat components (Patton 1992). Inevitably, diameter limits do not allow for the reestablishment of groupy and clumpy tree arrangements that are typical of natural ponderosa pine stand configurations, because trees would be retained in the openings/interspaces that would otherwise enhance the restored stand condition.

Alternative C would likely support the mule deer "upward" forestwide habitat trend but not affect the "stable to increasing" forestwide population trend. Similarly, alternative C would likely support the elk "upward" forestwide habitat trend but not affect the "stable to declining" forestwide population trend. Due to only 2 percent of the available forestwide habitat occuring within the project area for both mule deer and elk, changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Herbaceous understory production and duration of functionng is less in alternative C due to spatial arrangement of trees and stands that allow for canopy closure within 15 years post treatment and have a shading effect on desirable understory species. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Alternative C would create more foraging habitat than current conditions but less than alternative B over the long term. Forage-to-cover ratios in alternative C would be 63:37 and within forest plan guidelines (table 71). Forage availability would improve by approximately 18 percent under this scenario and would remove some pressure from meadows, riparian areas, and deciduous tree species. Forested cover would decline by 18 percent from existing conditions but would still meet forest plan guidelines. In order to meet stand density objectives, alternative C removes more of the smaller trees, less than 16 inches, which would increase sight line distances and increase big game vulnerability to hunters and other predators. Cover would also be retained along roads and water sources in this alternative similar to alternative B. Herbaceous and browse forage would improve across the project area, which could result in an increase in wildlife species needing this habitat component.

With the release of understory herbaceous and browse species following treatment, big game use areas would expand and the meadows and riparian areas may receive less utilization. Browsing on aspen, cottonwood, and oaks might also be reduced by increasing forage availability in the uplands.

Big game forage habitat available following treatments would occur at acceptable levels until canopy closure occurs, which is expected to be in 15 years. Maintenance, low severity prescribed burning would occur once on ponderosa pine forest types. Understory herbaceous and browse species would become shaded out over the long term; 15 years in alternative C compared to 30 years in alternative B.

Other MIS Environmental Effects

With the forested cover type consisting of 98.2 percent of the project area, the species that inhabit forested habitats have the potential to be most affected, both positively and negatively, by alternatives B and C.

Hairy Woodpecker

Forestwide Habitat Trend

The "Habitat Quality Index Model" (HQI; version 18) was used to evaluate the present habitat capability of the Apache-Sitgreaves National Forests for hairy woodpeckers. Based on the FIA dataset, the model recognized 712,366 acres of year-round habitat that provide at least some value to the species (AGFD 2012).

Catastrophic fires, such as the Rodeo-Chediski Fires of 2002, and the Wallow Fire of 2011 may cause landscape-wide modifications to the habitat capability of the forests for hairy woodpeckers. During the Rodeo-Chediski Fires, a total of about 18,960 acres of mid-aged, mature, and late-succession forests burned at high or moderate severity, reducing or eliminating the forest value to hairy woodpeckers. However, increases in snag density in proximity to lightly burned or unburned stands within the fire perimeter likely increases the habitat value of those stands for this species. The Rodeo-Chediski Fire Salvage analysis indicated that habitat capability for hairy woodpeckers did not change substantially due to the fire (USDA Forest Service 2003b). Recent research conducted in burned forests in the Apache-Sitgreaves National Forests (ASNFs) from 2000 to 2003 indicates that hairy woodpecker populations increased dramatically following wildfire but declined as burned areas aged (Covert 2003).

Hairy woodpeckers use snags for both nesting and foraging, and use down logs for foraging. The 1996 FIA for the Apache-Sitgreaves NFs estimated there were about 44 million standing dead trees (snags) greater than 1 inch in diameter, averaging 25 snags per acre. Over half of the snags occurred in the ponderosa habitat type. About 24 percent of these snags were between 5 and 10.9 inches in diameter. These snags provided foraging habitat for many species of insectivorous birds. However, most cavity-nesting birds prefer even larger diameter snags for nesting purposes. The FIA data indicates that there were about 3.5 snags per acre that are 11 inches in diameter or greater at the time of the inventory and 1.4 snags per acre that are 17 inches or greater. There were about 8.1 aspen snags per acre greater than 12 inches in diameter available in aspen stands with other large diameter aspen snags scattered in other forest types (e.g. Douglas-fir and white fir).

The Rodeo-Chediski and Wallow Fires created large numbers of snags in the burned area. Prior to these fires, large snags (≥18" d.b.h.) numbered about 0.4 snag per acre in ponderosa pine habitats and about 1.2 snags per acre in mixed conifer habitats (USDA Forest Service 2003b). After the fires, large snags were substantially increased across the burned area. There are still pockets of low severity burned and unburned stands with low snag numbers. Snag densities in these areas are expected to be increasing due to increased insect activity (USDA Forest Service 2003b). Snags are expected to fall over in the next 2–20 years depending on tree species and size.

Forestwide Population Trend

Bird surveys conducted within the ASNFs by Forest Service personnel since 2007 have detected this species on forest treatments within ponderosa pine and pine-oak plots, and sparingly in pinyon-juniper plots. These surveys determined that this species is well distributed across the ASNFs and relatively evenly distributed throughout representative vegetation associations. Based on the information, available habitat quality for the hairy woodpecker is fair with an upward trend due to increases in snags, ongoing forest growth, and declining timber harvest. However, conditions are likely still below potential.

The project area provides snag numbers across the project area slightly below those described in forest plan guidelines, but above the 0.72 snag per acre suggested by Thomas et al. (1979b) to maintain at least 40 percent of the maximum potential population of hairy woodpeckers. The project area contains 32,956 acres of potential habitat for hairy woodpecker.

Alternative A

Alternative A would not result in an immediate change to the quantity or quality of habitat used by the hairy woodpecker. Improvement in quality would occur over time because tree densities would remain high and mortality of trees would be greater under this alternative. Snag recruitment would result in a minor improvement to hairy woodpecker habitat quality. By not thinning out high-density stands, tree growth rates would be lower than compared to alternatives B and C. Hairy woodpecker habitat would remain mostly at the FRCC 3 level and would be susceptible to a high severity, stand replacing crown wildfire.

Alternative A would not change the “upward” forestwide hairy woodpecker habitat trend or “stable” forestwide population trend. Changes in hairy woodpecker quality habitat acreage would be accomplished by maintaining dense stands over time with trees susceptible to higher rates of mortality. Implementation of this alternative would be consistent with forest plan goals and objectives for hairy woodpeckers and their associated habitat types.

Alternative B

The amount of quality habitat would experience an increase over current conditions with managing for diversity of VSS classes over time. Despite the removal of large trees from the project area under this alternative, thinning VSS class 3 and 4 trees and leaving the majority of large diameter trees would provide for increased growth rates that would allow the stands to achieve higher VSS class values over time moving toward forest plan guidelines.

Large trees are an important habitat component for hairy woodpeckers. Large trees often have dead limbs and sometimes dead tops which are used by this species for foraging and, occasionally, nesting. Large live trees also are the source of large snags, which are necessary for the existence of hairy woodpeckers in forested environments.

Both even and uneven stand VSS class percentages have increased distribution over alternative A by moving toward desired conditions.

Prescribed burning is likely to create new foraging and nesting habitat for hairy woodpeckers, as burning often causes scattered or small groups of tree mortality. Burning related tree mortality can cause short-term increases in bark beetle and woodborer densities, which often results in higher hairy woodpecker abundance. Some existing snags currently used as hairy woodpecker nesting habitat in the project area are likely to be consumed by broadcast burning, but also new snags are created by tree mortality resulting from the prescribed burning. Monitoring has documented increases in snag densities, including large snags, following prescribed fire in the Southwest. Hairy woodpecker abundance is highest in areas that have burned within 2–3 years (Saab et al., 2007). Prescribed burning is expected to occur in various areas of the project area for at least 10 years and would provide quality hairy woodpecker foraging habitat and recruit new nesting habitat throughout this time period. Maintenance, low severity prescribed burning would occur once on ponderosa pine forest types, so impacts associated with the initial prescribed burn treatments would reoccur.

Short-term disturbance to hairy woodpeckers by treatment activities would temporarily displace and alter foraging, loafing, roosting, nesting habitat, and territory. Timing restrictions for treatment activities within MSO PACs and northern goshawk PFAs would not disturb hairy woodpeckers during the breeding season. The project area would be treated in phases over time and would not occur over the project area at the same time. Hairy woodpeckers would only experience activity-related disturbance in portions of the project area at one time.

This alternative would result in improved quality habitat (forest structure) into the future by improving forest stand structure, spatial distribution of openings, and reducing the potential for stand replacing, high severity crown fire. This alternative would support the "upward" forestwide habitat trend and the "stable" forestwide population trend. Due to only 4.6 percent of the available forestwide habitat occuring within the project area, changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Alternative C

Alternative C would implement thinning and burning across the same areas of the project area as alternative B, but would not authorize the harvest of trees over 16 inches in diameter. Hairy woodpecker habitat would experience many of the direct and indirect effects as described in alternative B.

More large trees would remain on the landscape than in alternative B, providing a larger source for future snags.

Average VSS class values would be similar to alternative B (silviculture specialist report). Posttreatment habitat under this alternative would likely provide a denser, interlocked overstory canopy combined with a more open understory due to removal of smaller than 16 inch trees.

This alternative would result in improved quality habitat (forest structure) into the future. The proposed project would provide long-term benefits to hairy woodpecker following implementation by improving forest stand structure and snag recruitment. Based on spatial distribution, their still exists the potential for stand replacing, high severity crown fire. This alternative would support the "upward" forestwide habitat trend and would not affect the "stable" forestwide population trend. Due to only 4.6 percent of the available forestwide habitat occuring within the project area, changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

This forest structure would provide less understory herbaceous and shrub component and would have a higher risk or potential for stand replacing, high severity crown fire 15 years post treatment.

Red-naped Sapsucker

Forestwide Habitat Trend

The key habitat feature for which this species was selected as a management indicator species was aspen snags. The "Habitat Quality Index (HQI) Model" (version 18), developed by the Southwestern Region, was used to evaluate the present habitat capability of the forests for the

red-naped sapsucker. Based on the 1996 FIA data and habitat coefficients in the HQI model, there is approximately 800,000 acres of suitable and potential red-naped sapsucker habitat. This habitat currently has an overall habitat quality rating of 0.4 (i.e., the habitat would support 40 percent of maximum potential populations). The foraging habitat quality rating is 0.6, while the cover habitat quality rating is 0.3 for the red-naped sapsucker.

In the forest, mid- to late-seral stage aspen are declining, due to both natural causes and management actions to regenerate stands. Some early-seral stage stands are being created through wildfire and management activities, but recruitment is limited primarily due to grazing by animals. FIA data indicates that gross annual growth in aspen far exceeds mortality. A comparison of estimated acres of aspen in the forests based on information in the forest plan EIS, 1996 FIA data, and current GIS vegetation data indicates that there has been some increase in the amount of aspen across the forests during the life of the plan.

Records of harvest levels for the forest (Beal 2005) indicate that there have been only 829 acres of timber harvests that could encourage the regeneration of aspen in aspen stands or mixed conifer stands since 1996. Trees are growing in other parts of the forest and habitat conditions there are gradually declining as aspen is out-competed by later succession conifer species.

The Rodeo-Chediski Fire burned approximately 176,000 acres on the Sitgreaves National Forest in 2002, of which approximately 25,000 acres could potentially produce aspen regeneration. In 2011, the Wallow Fire burned approximately 541,000 acres in the Sitgreaves National Forest having a similar impact on aspen stands. Early postfire monitoring suggests that wild ungulates may be having a negative effect on the recruitment and growth of aspen sprouts. Given the wide distribution of red-naped sapsuckers across the forests, the continued recurrence of wildfires is likely to maintain or improve the abundance and distribution, and improve the overall habitat capability of red-naped sapsuckers in the forests.

The second level of habitat that needs to be considered in assessing forestwide habitat trend for the red-naped sapsucker is the abundance of dead and down wood. Red-naped sapsuckers use snags for nesting. The 1996 FIA for the ASNFs estimated there were about 44 million standing dead trees (snags) greater than 1 inch in diameter, averaging 25 snags per acre. Over half of the snags occurred in the ponderosa habitat type. However, not all of these snags have much value for wildlife. About 24 percent of these snags were between 5 and 10.9 inches in diameter. These snags provided foraging habitat for many species of insectivorous birds. However, most cavity-nesting birds prefer even larger diameter snags for nesting purposes. Sapsuckers prefer snags or decayed live trees 6 inches or greater in diameter with the average size of nest trees in one central Arizona study being >14 inches in diameter (Li and Martin 1991).

The FIA data indicates that there were about 8.1 aspen snags per acre greater than 12 inches in diameter available in aspen stands with other large diameter aspen snags scattered in other forest types (e.g. Douglas-fir and white fir). However, the vast majority of aspen snags are less than 5 inches in diameter. Personal use firewood gathering may have contributed to loss of larger aspen snags. In other areas of the forests, snags are being recruited as older patches of aspen die out. A small 10-year study of aspen decline has found that trees are rapidly becoming snags, but the rate has remained steady (Martin 2002).

Snags are not long lived. Snag fall-down rates vary by species, diameter, and cause of mortality. Snag fall-down rates for the ASNFs have not been estimated, but fall-down rates for other forests

with similar habitat types indicate that most ponderosa pine snags persist for 2–20 years (Bull et al., 1997). Thus, the persistence of snags across the landscape is dependent on continuing tree mortality. Mortality in the ASNFs was estimated based on 1996 FIA data (USDA Forest Service 2003a) at about 13 percent of gross annual growth. Forty-five percent of this mortality was caused by disease, 28 percent by fire, and 15 percent by insects. The remaining 12 percent was attributed to weather, suppression, and animal damage, in respective order of prominence.

Postfire management has attempted to mitigate impacts from the Rodeo-Chediski and Wallow Fires. It is not currently known how much impact the Wallow Fire had on red-naped sapsuckers in the White Mountains; however, these actions have helped improve riparian conditions in some areas of the forests.

As this species is a very uncommon and local breeder within the ASNFs, trend information has not changed since 2006.

Forestwide Population Trend

The Arizona Game and Fish Department surveyed a portion (i.e. 1/6th) of each of the 7.5" USGS quadrangles that include lands managed by the ASNFs. Of these, 65 sectors occurred on ASNFs lands. Breeding red-naped sapsuckers were detected, from 1993 to 2000, at least once in 19 of these sectors distributed across the forest. This trend information should be interpreted with caution due to a very small sample sizes on each route (Sauer et al., 2004). However, the information for each route is relevant to documenting the general distribution and persistence of the species in the forests. Five breeding bird survey routes are located in the forest. Most of these routes have been surveyed annually since 1992. Red-naped sapsuckers were detected on only one of the five routes (Sprucedale route). Recent MIS monitoring efforts in the Black Mesa Ranger District (unpublished data) conducted from 2001 to 2005 included observations of red-naped sapsuckers (n=0, 0, 2, 1, 1).

Dr. Tom Martin of the USGS Biological Survey, Cooperative Wildlife Research Unit, has conducted 15 years of bird productivity studies in snowmelt drainages on the Mogollon Rim on the west end of the forest. The Breeding Biology Research and Monitoring Database (BBIRD) study compiled the number of red-naped sapsucker nests identified in snowmelt drainages on the Mogollon Rim over the past 10 years. Numbers of nests has varied, starting with 28 nests in 1991, and ending with 25 nests in 2000. The greatest number of nests was located in 1998, followed by a low of 21 nests in 1999 (Martin, 2002 unpubl. data). The BBIRD dataset indicates that red-naped sapsucker populations are stable on the extreme western portion of the Apache-Sitgreaves National Forests. The populations fluctuate over time, but show no indication of increasing or decreasing.

Taking into account the continuing occurrence of red-naped sapsuckers across the forest in suitable habitats, stable habitat trends for aspen, mixed conifer, and snag habitat in the forest, documented nesting in the forest, and the overall population trend across its breeding range, it appears that the forest supports well distributed reproducing populations of this species. Currently, red-naped sapsucker populations in the ASNFs are considered to be stable, but likely lower than potential due to fire suppression.

The project area contains 30,384 acres of small habitat inclusions for potential habitat for red-naped sapsucker.

Alternative A

The project area lacks pure stands of aspen or cottonwood and, thus, provides less than optimal habitat for red-naped sapsuckers and only occurs in dispersed patches across the project area (acreage not delineated from forested habitat). Alternative A would not implement thinning or burn treatments that might otherwise stimulate aspen and cottonwood regeneration. Alternative A would not provide the improvement in habitat needed by red-naped sapsuckers.

Alternative A would not affect forestwide trends for red-naped sapsucker populations or habitat. Changes in the amount of habitat and quality habitat would not be large enough to alter forestwide trends.

A decrease in red-naped sapsucker quality habitat would occur over time with maintaining dense stands and desirable species out-competed by conifers. This alternative would not affect the "stable" forestwide habitat trend nor the "stable" forestwide population trend due to the small portion of aspen inclusion habitat in the project area verses the total forests management areas. Implementation of this alternative would not be consistent with forest plan goals and objectives for this species and their associated habitat types.

Alternative B

Alternative B would implement thinning and burning treatments that could improve habitat for red-naped sapsuckers with aspen regeneration, which is expected to have the greatest potential under this alternative. Despite the potential for aspen recruitment under this alternative, there would continue to be no pure aspen stands within the project area. Alternative B includes a proposal to fence aspen to facilitate regeneration and exclude large ungulates where it is deemed necessary. Regeneration of aspen stands would benefit red-naped sapsuckers by allowing aspen to become more abundant in some areas.

Short-term disturbance to birds by treatment activities would temporarily displace and alter foraging, loafing, roosting, nesting habitat, and territory. Timing restrictions for treatment activities within MSO PACs and northern goshawk PFAs would not disturb red-napped sapsuckers during the breeding season. The project area would be treated in phases over time and would not occur over the project area at the same time. Red-naped sapsuckers would only experience activity-related disturbance in portions of the project area at one time.

Maintenance, low severity prescribed burning would occur once on ponderosa pine forest types, so impacts associated with the initial prescribed burn treatments would reoccur.

Alternative B would likely have improvement in available aspen habitat but not at levels that would alter the "stable" forestwide trends for red-naped sapsucker populations or the "stable" forestwide trend for habitat. Due to only 3.8 percent of the available forestwide habitat occuring within the project area, changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Alternative C

Alternative C would implement thinning and burning across the same areas of the project area as alternative B. Red-naped sapsuckers habitat would experience many of the direct and indirect effects as described in alternative B.

The potential to regenerate aspen would be less than alternative B because the diameter limit on harvesting large trees results in more conifer competition in aspen clones.

This forest structure would provide less understory herbaceous and shrub component and would have a higher risk or potential for stand replacing, high severity crown fire 15 years post treatment. No maintenance treatments would be accomplished.

Alternative C would likely have improvement in available aspen habitat (less than alternative B), but not at levels that would change the "stable" forestwide habitat trend or change the "stable" forestwide population trend for red-naped sapsucker. Due to only 3.8 percent of the available forestwide habitat occuring within the project area, changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Merriam's Turkey

Forestwide Habitat Trend

In the ASNFs, the turkey is an indicator species for late-succession habitat (USDA 1987) which provides important areas for roosting, nesting, brooding, and loafing. Wildfires have been the main disturbance regime influencing the age structure and successional stage of the forests within the ASNFs. Since 2005, approximately 650,000 acres have burned with the most recent Wallow Fire affecting over 500,000 acres. In contrast, forest treatments such as salvage operations, group selection, and seed cuts over the past 3 decades account for approximately 300,000 acres.

The ASNFs encompass seven game management units (GMUs) managed by the Arizona Game and Fish Department. Current forest conditions based on GIS data provided by the ASNFs indicate that primary cover types required for nesting, brood rearing, and roosting have persisted despite landscape-scale disturbance within the forest (i.e., Wallow Fire). Approximately 428,344 acres of ponderosa pine/Gambel oak have been mapped and should continue to support turkey populations into the future.

Based on the information, habitat trends for late succession habitat are considered to be stable.

Forestwide Population Trend

Taking into account the continuing occurrence of the turkey across the forest in suitable habitat, the abundance and wide distribution of suitable habitats across the forest, stable habitat trends for late succession habitat in the forest, and the presence of a harvestable surplus in the turkey population, it appears that the forest supports a well distributed reproducing population of this species. Currently, outside of the areas impacted by the 2011 Wallow Fire, turkey populations in the ASNFs are considered to be stable, and likely near potential.

Wild turkey is a game species managed by the Arizona Game and Fish Department in combined Units 4A/4B. The average annual harvest from 1998 to 2004 was 90 birds. Nearly all of the project area is considered suitable habitat for Merriam's turkey (32,956 acres). The high stand densities along with being dominated by stands in the VSS 3 and 4 classes, the amount of understory forage, and cover habitat has a reduced quality of habitat available for this species.

Harvest data obtained from the Arizona Game and Fish Department for GMUs within the ASNFs suggests that turkey populations are stable.

Alternative A

Merriam's turkeys are a generalist species that use nearly all types of habitat present in the project area. They use forested areas and meadows to satisfy a variety of needs. Within the project area, the quantity of turkey habitat would not improve and would be reduced over time with increased stand density, reduced understory herbaceous, and conifer encroachment into wetlands.

Improvement in Merriam's turkey habitat within the project area would require the creation of more openings in the forest to promote the growth of grasses and forbs for rearing habitat. Conifer trees are currently encroaching into the openings and meadows turkeys use as foraging habitat. Merriam's turkey foraging habitat would continue to decline, but roosting and nesting habitat would remain relatively unchanged.

Alternative A would not alter the "stable" forestwide trend for turkey habitat trend or "stable" forestwide population trend. Implementation of this alternative would not be consistent with forest plan goals and objectives for this species and their associated habitat types.

Alternative B

Thinning and prescribed burning treatments would result in considerable improvements to turkey foraging habitat. Encroaching conifer trees would be removed from meadows, new openings would be created in forested stands, and grass and forb growth would be stimulated by broadcast burning and the increase in sunlight to the forest floor. These actions would be expected to increase the abundance of insects important to the summer diet of turkey poults.

The implementation of uneven-aged management would retain tree clumps of various age and size classes which would provide cover and roosting habitat within stands. Cover stands that occur across the project area in MSO stratified habitats would be treated to obtain a higher tree density to provide cover to wildlife species, including turkeys. Northern goshawk stratified habitat would also provide groupy and clumpy stands that would improve roost habitats.

Smoke effects from broadcast burning may disturb individual birds but this should be a short-term impact. Timing restrictions within MSO PACs and PFAs would prevent burning during the breeding season in these areas. Maintenance, low severity prescribed burning would occur once on ponderosa pine forest types, so impacts associated with the initial prescribed burn treatments would reoccur.

Short-term disturbance to turkeys by treatment activities would temporarily displace and alter foraging, loafing, roosting, and some nesting areas. Timing restrictions for treatment activities within MSO PACs and northern goshawk PFAs would not disturb turkeys during the breeding season. The project area would be treated in phases over time and would not occur over the project area at the same time. Turkeys would only experience activity-related disturbance in portions of the project area at one time. Maintenance, low severity prescribed burning would occur once on ponderosa pine forest types, so impacts associated with the initial prescribed burn treatments would reoccur.

Alternative B would improve the quality of habitat for turkey and support the "stable" forestwide habitat trend, and contribute to the "stable" forestwide population trend which would remain unchanged. Due to only 3.5 percent of the available forestwide habitat occuring within the project area, changes in the quantity or quality of habitat would not be large enough to alter forestwide

trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Alternative C

Since the same stands would be treated similarly in alternative C as in alternative B, most of the effects described in alternative B above would be the same. The difference is that no trees over 16 inches in diameter would be mechanically cut and the spatial arrangement of trees in groups, clumps with regeneration openings.

Turkey habitat would improve slightly under this alternative when compared to alternative A. Acres of quality habitat would increase over what currently exists. However, because alternative C would lack groups and clumps for roost sites, it would not provide as quality habitat.

Short-term disturbance to turkeys by treatment activities would be the same as under alternative B. The project area would be treated in phases and not all at the same time. Turkeys would experience activity-related disturbance in portions of the project area at one time.

Alternative C would further support the "stable" forestwide habitat trend with the "stable" forestwide population trend remaining unchanged. Due to only 3.5 percent of the available forestwide habitat occuring within the project area, changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Pygmy Nuthatch

Forestwide Habitat Trend

In the ASNFs, the pygmy nuthatch is used as an indicator species for late succession ponderosa pine habitat (USDA 1987a). Over the last 11 years, the ASNFs has been subject to several large fires and two of the State's largest fires, the Rodeo-Chediski and Wallow Fires. It was reported in the forest plan that 746,902 acres of ponderosa pine habitat occur within the ASNFs, but over 651,504 acres have been affected by fire from 2005 to 2011 including the Wallow Fire. Postfire management activities have attempted to mitigate impacts to the forest. The recent Wallow Fire—which affected 538,209 acres—has not been completely assessed for all forest species (unpublished USFS Rapid Assessment Team Report). The severity of the Wallow Fire varied across its footprint, therefore, determining the extent of mature and late succession ponderosa pine tree stands would aid in determining the remaining habitat for the pygmy nuthatch. Complete loss of mature ponderosa trees could have a significant impact on resident pygmy nuthatches in areas impacted by the fire. The conversion of late successional forest habitats to early-successional habitats by large scale, high-intensity fires such as the Wallow Fire would likely impact pygmy nuthatch populations negatively. However, fire intensities that were low enough in other areas to produce additional nesting structures (snags or dead limbs on live trees) could have a short term positive effect for pygmy nuthatches.

The ASNFs encompass seven game management units managed by the Arizona Game and Fish Department. Current forest conditions based on GIS data provided by the Apache-Sitgreaves National Forests indicate that primary cover types required for pygmy nuthatch viability have persisted despite landscape-scale disturbance within the forest (i.e., Wallow Fire). Approximately 282,030 acres of ponderosa pine forest have been mapped and should continue to support pygmy

nuthatch populations into the future if managed to maintain interlocking canopies and old-growth conditions.

Postfire management has attempted to mitigate impacts from the Rodeo-Chediski and Wallow Fires on pygmy nuthatch habitat in the ASNFs. However, there is significant lag time between catastrophic wildfires and the recovery of late-seral stage forests. It is likely that the broad-scale loss of these late-seral stage forests would negatively impact pygmy nuthatch populations in the fire affected areas.

Forestwide Population Trend

Bird surveys conducted from 2008 to 2011 within the ASNFs by Forest Service personnel on forest treatments detected this species in highest numbers within ponderosa pine plots and lowest numbers in pinyon-juniper and pine-oak plots. Surveys detected pygmy nuthatch at 100 percent of the ponderosa pine plots surveyed in 2008 and approximately 80 percent of ponderosa pine plots surveyed in 2009, 2010, and 2011. Pygmy nuthatch were detected at lower percentages of pinyon-juniper and pine-oak plots (pinyon-juniper range = 30–40 percent; pine-oak range = 43–100 percent). These surveys illustrate the close association the pygmy nuthatch has with mature ponderosa pine forests and the importance of properly managing this forest type for the persistence of pygmy nuthatch populations on the ASNFs. Survey totals for pygmy nuthatch pooled across the entire Apache-Sitgreaves National Forests were 105, 79, 75, and 24 for surveys conducted in 2008, 2009, 2010, and 2011, respectively. This declining trend in number of detections, especially from 2010 to 2011, demonstrates the negative effect that fire (i.e., Wallow Fire) can have on pygmy nuthatch habitat and populations.

Monitoring information from the North American Breeding Bird Surveys in Arizona indicates that pygmy nuthatch populations are stable. Summaries of pygmy nuthatch BBS data for Arizona (Sauer et al., 2011) show a slight negative trend of 1.1 percent between 1968 and 2010 (CI-3.7, 1.3). This trend estimate is a summary of the population change over the last 42 years, and does not provide information on other patterns of population change. Twenty survey routes were used in this analysis, and the relative abundance of hairy woodpeckers observed per route was 27.1.

The pygmy nuthatch is common throughout forested areas of Arizona and is considered a common permanent resident of the ASNFs (USDA 1996). Currently, pygmy nuthatch populations in the Apache-Sitgreaves National Forests are considered to be stable but lower than potential. Pygmy nuthatch habitat on the Apache-Sitgreaves National Forests was in good condition and stable prior to the large and severe wildfires of 2011. These fires removed large tracks of habitat on the eastern half of the forest. This temporal habitat loss would likely lead to a short-term decrease in pygmy nuthatch population densities within the fire affected areas on the ASNFs. Outside of the fire effect areas, pygmy nuthatch habitat appears to be supporting stable populations. Recolonization of the fire affected areas can be expected as the habitat progresses back toward a climax seral stage. Overall, the forest is maintaining and/or increasing in older seral stage habitats, thus increasing habitat diversity as well as old growth that the pygmy nuthatch are associated with. Future implementation of prescribed burning and thinning would only continue to improve the species' habitat. Additional catastrophic wildfire in the mixed conifer would threaten local pygmy nuthatch populations, however, current emphasis on reducing fuels in ponderosa pine would reduce the risk. Restoration prescriptions that reduce catastrophic fire risk and create ponderosa pine stands with large diameter trees and interlocking canopies may

increase pygmy nuthatch density and enhance the long-term persistence of this species in the ASNFs.

Alternative A

Alternative A would not result in an immediate change to the quantity or quality of habitat used by the pygmy nuthatch. Improvement in quality would occur over time because tree densities would remain high and mortality of trees would be greater under this alternative. By not thinning out high-density stands, tree growth rates would decline as compared with alternative B or C. Pygmy nuthatch habitat would remain susceptible to a high risk of high severity, stand replacing crown wildfire under this alternative.

Alternative A would not likely change the “declining” forestwide habitat trend or the “stable” forestwide population trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Alternative B

Alternative B would provide essentially the same quantity of pygmy nuthatch habitat as currently exists, but the quality habitat would increase due to thinning small and medium sized trees and retaining most large trees. This would contribute to the upward forestwide habitat trend discussed in the forestwide MIS report.

Large trees are an important habitat component for pygmy nuthatches as they often have dead limbs and/or dead tops which are used for foraging and occasionally nesting.

Prescribed burning is likely to create new nesting habitat for pygmy nuthatches, as burning often causes scattered or small groups of tree mortality. Burning related tree mortality can cause short-term increases in bark beetle densities, which may enhance foraging opportunities. Some existing snags currently used as pygmy nuthatch nesting habitat in the project area are likely to be consumed by broadcast burning, thereby eliminating established habitat, yet new snags are created by prescribed burning (Saab et al., 2007, Saab and Block 2006, Randall-Parker and Miller 2002). Saab et al. (2007) documented increases in snag densities, including large snags, following prescribed fire in the Southwest. Pygmy nuthatches have been documented as having a negative response to prescribed fire the year of burning, but a neutral response one or more years after burning (Saab et al., 2007). Prescribed burning would occur in various areas of the project area for at least 10 years.

Short-term disturbance to pygmy nuthatches by treatment activities would temporarily displace and alter foraging, loafing, roosting, nesting habitat, and territory. Timing restrictions for treatment activities within MSO PACs and northern goshawk PFAs would not disturb hairy nuthatches during the breeding season. The project area would be treated in phases over time and would not occur over the project area at the same time. Pygmy nuthatches would only experience activity-related disturbance in portions of the project area at one time. Maintenance low severity prescribed burning would occur once on ponderosa pine forest types, so impacts associated with the initial prescribed burn treatments would reoccur.

Alternative B would further support the “declining” forestwide habitat trend but the “stable” forestwide population trend would remain unchanged. Due to only 5.8 percent of the available forestwide habitat occuring within the project area, changes in the quantity or quality of habitat

would not be large enough to alter forestwide trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Alternative C

Since the same stands would be treated mechanically and with prescribed burning in alternative C as in alternative B, most of the effects described in alternative B above would be the same with the exception of that no trees over 16 inches in diameter would be mechanically cut. No maintenance treatments would occur.

More large trees would remain on the landscape than in alternative B, providing more of the individual habitat components that are important to this species. Posttreatment habitat under this alternative would likely provide a denser overstory and more open understory.

Alternative C would further support the "declining" forestwide habitat trend with the "stable" forestwide population trend remaining unchanged. Due to only 5.8 percent of the available forestwide habitat occuring within the project area, changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Abert's Squirrel

Forestwide Habitat Trend

In the ASNFs, Abert's squirrel are used as an indicator species for "mid-successional" forests of ponderosa pine (USDA 1987a). Based on the information currently available, there appears to be an overall upward trend in late succession and mature ponderosa pine habitat.

Wildfires have been the main disturbance regime influencing the age structure and successional stage of forests within the ASNFs since 2005. Since that time, approximately 650,000 acres have burned with the most recent Wallow Fire affecting over 500,000 acres. In contrast, forest treatments such as salvage operations, group selection, and seed cuts over the past 3 decades account for approximately 300,000 acres.

Current forest conditions based on GIS data provided by the ASNFs indicate that primary cover types required for squirrel viability have persisted despite landscape-scale disturbance within the forest (i.e., Wallow Fire). Approximately 282,030 acres of ponderosa pine forest have been mapped and are expected to continue to support squirrel populations into the future if managed to maintain interlocking canopies and old growth conditions across 24–42 percent of the landscape.

Although there is a general lack of consistent monitoring data for Abert's squirrels across the ASNFs, it appears that recent large-scale wildfires that impacted interlocking canopies and old growth conditions, relatively low densities of squirrels, and an overall upward trend in late succession and mature ponderosa pine habitat in areas outside the Wallow Fire indicate that habitat trends forestwide are fairly stable.

Forestwide Population Trend

Partridge and Ingraldi (2007) examined Abert's squirrel density between 2004 and 2007 using feed sign indices (Dodd et al., 1998) from three sites within the ASNFs' Lakeside Ranger District. Abert's squirrel density was low across sites (range: 0.01–0.21 squirrels/ha). While mean density

varied among the three sites, overall low density estimates precluded the detection of a population trend. These population estimates on the Lakeside Ranger District are substantially lower than those from other sites in Arizona (Dodd et al., 2006). In the Coconino National Forest (1999–2002), for example, Dodd et al. (2006) obtained estimates of 0.42 (±0.02) squirrels/ha on high-quality plots and 0.16 (±0.01) squirrels/ha on low-quality plots.

Populations seem to fluctuate widely over time, caused by the amount of overwinter mortality, which is likely related to that fall's cone crop. Brown (1984) reported densities of 15–30 per square mile (about 2 to 5 per 100 acres). Hoffmeister (1986) reported density ranged from a low of 1–2 per 100 acres in 1954 up to 12 per 100 acres in 1941 in an area near Flagstaff. Currently, Abert's squirrel populations in the forests are considered to be stable and likely somewhat below potential (ASNFs 2012).

The project area contains approximately 24,829 of suitable Abert's squirrel habitat. Acres of VSS 3 and VSS 4 exceed desired levels while the percentages of VSS 5 and VSS 6 are below desired levels.

Alternative A

Alternative A would not result in an immediate change to the quantity or quality of habitat used by Abert's squirrel. By not thinning out high-density stands, tree growth rates would decline compared with alternatives B or C. Creation of uneven-aged stands would not occur. The desirable large tree groupings in high VSS classes (>20 VSS 5 and VSS 6 trees per acre) with interlocking crown would not be attained under this alternative. This alternative would not reduce the potential for stand replacing, high severity crown fire in the project area that currently poses a threat to Abert's squirrel habitat.

Alternative A would not alter Abert's squirrel "stable to decling" forestwide habitat trend or the "stable" forestwide population trend. Implementation of this alternative would not be consistent with forest plan goals and objectives for this species and their associated habitat types.

Alternative B

Abert's squirrel habitat would be improved as stand treatments develop better northern goshawk habitat. Reynolds et al. (1992) identified Abert's squirrel as an important goshawk prey species for northern goshawk and recommended large tree retention and management for interlocking crowns to improve habitat for this species. Applying these management principles to the project area is expected to improve the quality of Abert's squirrel habitat in the long term.

Disruption of normal behavioral patterns could occur to Abert's squirrels during thinning, piling, and burning activities. This could result in harm to squirrel nestlings but should be limited in scope, as the project area would be treated incrementally over a 10-year period. Proposed treatments may cause visual or auditory disturbance to individual squirrels, although these effects would be short term and limited in scope. Smoke effects from broadcast burning should be transitory in nature and short term. Maintenance, low severity prescribed burning would occur once on ponderosa pine forest types, so impacts associated with the initial prescribed burn treatments would reoccur.

Alternative B would not alter Abert's squirrel "stable to declining" forestwide habitat trend or the "stable" forestwide population trend. Due to only 3.3 percent of the available forestwide habitat

occuring within the project area, changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Alternative C

Since the same stands would be treated in alternative C as in alternative B, similar effects are expected as from alternative B. The main difference is that alternative C would leave trees greater than 16 inches, in an even-aged arrangement. Large tree retention is favored by Abert's squirrels for nesting and foraging, but the optimum habitat is relatively open stands of ponderosa pine in VSS 3 and VSS 4. Overmature ponderosa pine habitat has been described as poor for Abert's squirrels due to poor cone production.

Alternative C would not alter Abert's squirrel "stable to declining" forestwide habitat trend or the "stable" forestwide population trend. Due to only 3.3 percent of the available forestwide habitat occuring within the project area, changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Red Squirrel

Forestwide Habitat Trend

In the ASNFs, red squirrel are used as an indicator species for "late successional mixed conifer and spruce forests" (USDA 1987a). Less than 15 percent of the total land cover of the ASNFs consists of mixed conifer and spruce-fir (Rogers 2003). However, 42 percent of the forest consists of ponderosa pine forest which provides additional habitat when they share a habitat edge with mixed conifer (Rogers 2003). The dominant mid-seral conditions on the ASNFs primarily relate to cumulative effects of historical heavy logging such as the railroad logging early in the 20th century and long term fire suppression. Overstory removal prescriptions also contributed to the trend toward smaller diameter stands. Over the past 15–20 years, most of the vegetation treatments in red squirrel habitat have shifted away from sawtimber and more toward wildlife habitat improvement. Vegetation treatments have been consistent with the forest plan, creating small openings and retaining large cone producing trees for red squirrel foraging opportunities. Trees with middens or other obvious signs of squirrel activity have been avoided during vegetation treatments even prior to the current forest plan. Older structured stands have been left alone in the areas of middens. The untreated stands continue to provide and maintain a closed canopy for fungi production and mesic conditions. As a result, the current habitat condition for this species is relatively good, with a stable trend.

Fire serves as the main disturbance regime influencing the age structure and successional stage of the forests within the ASNFs. Since 2005, approximately 650,000 acres have burned with the most recent Wallow Fire affecting 540,979 acres. The Wallow Fire consumed five times the area of forest than all other wildfire events since 2005. In contrast, forest treatments such as salvage operations, group selection, seed cuts, etc., that favor early successional development have decreased since 1985.

Compared with forest management prescriptions, wildfire has much greater potential to create early-successional habitats. For example, the Rodeo-Chediski Fire of 2002 burned over 173,000 acres and converted approximately 55 percent of the burn to early-succession habitat (USDA

2003). The large scale, high-intensity Wallow Fire is likely to have a similar impact on the conversion of late-successional habitats to early-successional habitats that do not favor red squirrel populations.

The current trend in management practices on the forest places more emphasis on thinning and prescribed burning, increasing the desired habitat in mixed conifer. Prescribed fire controls dense reproduction and improves prey base populations. Thinning in mixed conifer stands that are not maturing into large diameter trees would reduce intertree competition for moisture, nutrients, and light and stimulate growth of residual trees. Dense stands of trees are prone to catastrophic wildfire, which could completely remove red squirrel habitat, affecting local populations.

Forestwide Population Trend

The increasing conversion of late-successional habitats to early-successional habitats by fire would likely impact red squirrel populations negatively. Postfire management has attempted to mitigate impacts from the Rodeo-Chediski and Wallow Fires on red squirrel habitat in the ASNFs. However, there is significant lag time between catastrophic wildfires and the recovery of late-seral stage forests. It is likely that the broad-scale loss of these late-seral stage forests would negatively impact red squirrel population in the fire affected areas.

Surveys specific to the red squirrel have not been conducted on the ASNFs. Frequent observations and the extensive distribution and abundance of mixed conifer and spruce-fir forest are indicative the species continues to survive and reproduce successfully across the forest. There is no indication or documentation that red squirrels are declining on the Apache-Sitgreaves or in the Southwest. Red squirrel habitat on the ASNFs was in good condition and stable prior to the large and severe wildfires of 2011. These fires removed large tracks of red squirrel habitat on the eastern half of the forest. This temporal habitat loss would likely lead to a short-term decrease in red squirrel population densities within the fire affected areas on the ASNFs. Outside of the fire affected areas, red squirrel habitat appears to be supporting stable populations of red squirrel and viable populations are being sustained. Recolonization of the fire affected areas can be expected as the habitat progresses back toward a climax seral stage. Overall the forest is maintaining and/or increasing in older seral stage habitats, thus increasing habitat diversity as well as old growth that red squirrels are associated with. Future implementation of prescribed burning and thinning would only continue to improve the squirrel's habitat.

There are about 8,127 acres of mixed conifer habitat in the project area. The majority of this habitat is found in the western portion of the project area. Insect damage is reducing the large live tree component in the mixed conifer forest type but at the same time may be creating snags and large down logs needed by this species.

Alternative A

Alternative A would not result in an immediate change to the quantity or quality of habitat used by red squirrel. By not thinning out high-density stands, tree growth rates to decline as compared under alternative B and C and the uneven-aged stands would not occur. Denser stands would improve red squirrel habitats, but the desirable large tree groupings in high VSS classes (4, 5, and 6) would not be realized. This alternative would not reduce the potential for stand replacing, high severity crown fire in the project area that currently poses a threat to red squirrel habitat.

Alternative A would not alter Abert's squirrel "declining" forestwide habitat trend or the "stable to declining" forestwide population trend. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Alternative B

Treatment in red squirrel habitats would be performed under the MSO forest plan guidelines for protected and restricted habitats. The reduction in quality habitat would occur by mechanical thinning and broadcast burning of VSS 3 and VSS 4 trees to a more open condition. Canopy closures are being reduced in several VSS 3 and 4 mixed conifer stands to help meet the overall objective of reducing potential for stand replacing, high severity crown fire in the project area.

Managing for old growth and MSO forest plan guidelines would provide higher basal area, larger trees, and interlocked canopies that benefit red squirrel.

Disruption of normal behavioral patterns could occur to red squirrels during thinning, piling, and burning activities. This could result in harm to squirrel nestlings but should be limited in scope, as the project area would be treated incrementally over a 10-year period. Proposed treatments may cause visual or auditory disturbance to individual squirrels, although these effects would be short term and limited in scope. Smoke effects from broadcast burning should be transitory in nature and short term.

Broadcast burning may consume downed logs and snags. Snags are used by red squirrels as nesting habitat and both logs and snags are used to cache pine cones. These losses would likely cause affected squirrels to move out of established territories until the following year or expand the size of their territories to encompass needed resources. Some squirrel mortality could occur if food caches are burned. Koprowski et al. (2006) found that most squirrels did not abandon intact middens following wildfire. Those that did likely did so because the canopy above the midden was destroyed. It is highly unlikely that low severity broadcast burning would reduce significant canopy around existing middens. Maintenance, low severity prescribed burning would occur once on ponderosa pine forest types, so impacts associated with the initial prescribed burn treatments would reoccur. As needed to meet habitat capability, protect red squirrel caches at a density of one cache per 2 acres. Retain all trees within a 26-foot radius from the cache to maintain nest tree groupings.

Alternative B would not alter red squirrel "declining" forestwide habitat trend or the "stable to declining" forestwide population trend. Due to only 4 percent of the available forestwide habitat occuring within the project area, changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Alternative C

Since the same stands would be treated in alternative C as in alternative B, most of the effects described in alternative B would be expected in alternative C as well. Because trees greater than 16 inches in diameter would be retained in alternative C, fewer trees less than 16 inches would remain in red squirrel habitat following treatments in order to meet stand density objectives. This would not substantially change the value of the habitat to the squirrel.

Alternative C would not alter red squirrel "declining" forestwide habitat trend or the "stable to declining" forestwide population trend. Due to only 4 percent of the available forestwide habitat occuring within the project area, changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Yellow-breasted Chat

The project area contains only scattered cottonwood and box elder trees in Chevelon, Woods, and Willow Canyons. There are some areas in these canyons where alder is present as seedlings (0.1–0.9 inch d.b.h.) or saplings (1.0–4.9 inches d.b.h.). At the stand scale, the riparian trees, and shrub species do not comprise the basal area necessary to be identified as a riparian stand, therefore, are estimated to be <100 acres total.

No yellow-breasted chats have been documented on the survey route or within the project area. Breeding Bird Atlas surveyors recorded yellow-breasted chats in Chevelon Canyon and East Clear Creek several miles north of the Rim Lakes analysis area (Averrill-Murray and Corman 2005). Yellow-breasted chats have been recorded during district songbird surveys at Chevelon Crossing, which is approximately 15 miles north of the analysis area.

Forestwide Habitat Trend

In the ASNFs, yellow-breasted chat are used as an indicator species for "low elevation riparian" (USDA 1987a). The forest plan EIS lists a total of 10,101 acres of riparian habitat. In the late 1980s, grazing by livestock and elk negatively impacted riparian areas on the forest (USDA Forest Service 1987b). A total of 385 miles of stream were evaluated using the proper functioning condition (PFC) method since 1998. Samples of streams using the PFC methodology demonstrated that approximately 22 percent are in satisfactory hydrologic condition. About 22 percent of the streams currently are in satisfactory conditions compared to the estimated 28 percent at the time of the forest plan. Based on the information available, riparian habitat quality in higher elevation areas is currently fair to poor.

Since inception of the forest plan, actions have been taken to improve riparian conditions. The quantity of livestock animal unit months in the forest has been reduced significantly and several riparian areas have been excluded from grazing. Some ranger districts have entered into elk forage use agreements with the Arizona Game and Fish Department to reduce elk impacts to other wildlife habitat. These actions have helped improve riparian conditions in some areas of the forests.

The forest has been involved in a willow recovery program since 1989 in the Springerville Ranger District. This project has included fencing and monitoring of plant vigor and survival, especially with regard to Arizona willow (*Salix arizonica*) and Bebb's willow (*Salix bebbiana*). Willows in riparian areas, especially at higher elevations, show severe hedging and lack of regeneration due to heavy herbivory by both cattle and elk.

Postfire management has attempted to mitigate impacts from the Rodeo-Chediski and Wallow Fires. It is not currently known how much impact the Wallow Fire had on yellow-breasted chats in the White Mountains; however, these actions have helped improve riparian conditions in some areas of the forests. As this species is a riparian obligate breeder within the ASNFs, trend information is very limited. Bird surveys conducted within the forest by Forest Service personnel

since 2007 have not detected this species to date; however, these bird surveys were focused on forest treatments and were not conducted in known breeding locations for this species.

Forestwide Population Trend

Arizona BBS data indicate that yellow-breasted chat populations in the state experienced an overall slight increase in population levels of 0.31 percent (CI -.84, 1.55) between 1968 and 2010. This trend estimate is a summary of the population change over the last 44 years, and does not provide information on other patterns of population change. Sixteen survey routes were used in this analysis, and the relative abundance of yellow-breasted chat observed per route was 2.54.

Recent MIS monitoring efforts in the Black Mesa Ranger District conducted from 2001 to 2005 support the status of the yellow-breasted chat in the forest. Yellow-breasted chats were seen in riparian habitat or a station adjacent to riparian habitat. Observations of this species decreased noticeably from 2003 to 2004 in areas of high-burn severity in the Rodeo-Chediski Fire. Chats were also recorded recently along riparian areas associated with the Blue and San Francisco Rivers, as well as Eagle Creek in the Clifton RD during surveys for southwestern willow flycatchers in 2003.

The yellow-breasted chat is considered a rare summer resident in the Apache-Sitgreaves National Forest by the White Mountain Audubon Society. The Arizona Game and Fish Department conducted breeding bird surveys in support of the National Breeding Bird Atlas effort from 1994 to 2000. Five breeding bird survey routes are located in the forest. These routes have been surveyed annually since 1992. Chats have been recorded on two of these routes (Sprucedale and Forest Lakes). However, this trend information should be interpreted with caution due to a very small sample size.

Bird survey data from the forest's ranger districts did not detect this species during their surveys (2008–2011). However, considering the continuing occurrence of yellow-breasted chats throughout preferred habitats in the forest, habitat trends for low elevation riparian habitat in the forest, and the overall population trend across Arizona, it appears that the forest may support well distributed, reproducing populations of this species. Currently, yellow-breasted chat populations in the Apache-Sitgreaves National Forests are considered to be stable, but likely lower than potential.

Alternative A

Alternative A would not improve yellow-breasted chat habitat within the analysis area. No tree thinning would occur, and conifer densities in Woods and Willow Canyons would remain at current conditions or increase. Cottonwoods and willows would not regenerate and develop into the deciduous riparian gallery forest yellow-breasted chats prefer.

Alternative A would not likely change the "upward" forestwide habitat trend or "stable" forestwide population trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Alternative B

Thinning and burning treatments would result in fewer trees on upland areas, which would decrease overall transpiration and potentially release water resources into streams. Limited

thinning would occur in the headwaters of Woods and Willow Canyons, which may encourage cottonwood and willow regeneration in these areas. Riparian habitat would likely improve slightly but probably not enough to attract yellow-breasted chats to the project area. Other factors, such as stream gradient, may inhibit the development of suitable yellow-breasted chat habitat in the project area.

Short-term disturbance to yellow-breasted chat by treatment activities would temporarily displace and alter foraging, loafing, roosting, nesting habitat, and territory. Timing restrictions for treatment activities within MSO PACs and northern goshawk PFAs would not disturb yellow-breasted chat during the breeding season. The project area would be treated in phases over time and would not occur over the project area at the same time. Yellow-breasted chat would only experience activity-related disturbance in portions of the project area at one time. Maintenance, low severity prescribed burning would occur once on ponderosa pine forest types, so impacts associated with the initial prescribed burn treatments would reoccur.

Alternative B would not likely change the “stable” forestwide habitat trend or the “stable” forestwide population trends. Due to <0.9 percent of the available forestwide habitat occuring within the project area, changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Implementation of this alternative would be consistent with Forest Plan goals and objectives for this species and their associated habitat types.

Alternative C

Since the same stands would be treated in alternative C as in alternative B, similar effects would be expected as found with alternative B.

Alternative C would not likely change the “stable” forestwide habitat trend or the “stable” forestwide population trends. Due to <0.9 percent of the available forestwide habitat occuring within the project area, changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Cinnamon Teal

There are three lakes within the project area identified in the Forest Plan as “Water,” or MA-11. Bear Canyon, Woods, and Willow Springs Lakes provide approximately 286 acres of habitat to cinnamon teal. Several seasonal wetlands, or cienagas, permanent pools in some of the canyons, and developed earthen tanks are also available to cinnamon teal. Some of these areas may provide suitable nesting habitat, but most of the cienagas are dependent upon monsoons to provide for good brood-rearing habitat, therefore, 310 acres are considered potential habitat for cinnamon teal.

No cinnamon teal have been observed on the survey route but they have been seen on other areas of the Black Mesa Ranger District.

Forestwide Habitat Trend

In the ASNFs, cinnamon teal are used as an indicator species for “wetlands” (USDA 1987a). There are approximately 996 miles of perennial streams and about 3,771 acres of open water,

with an estimated 29,430 acres of riparian/wetland ecosystems associated with these surface waters.

Drought conditions exhibited on the forests during the past few years may result in the loss or reduction of wetland habitat at many of the spring-fed wetlands (e.g. Sierra Blanca Reservoir) or larger manmade lakes with broad, shallow wetland zones (e.g. Luna Lake or Nelson Reservoir). Many of the larger deep lakes (e.g., Willow Springs Lake, Black Canyon Lake, Chevelon Canyon Lake) on the forest generally lack the shallow wetland habitats conducive to cinnamon teal nesting, but do provide temporary habitat for migrating birds.

Breeding bird survey data for the cinnamon teal in Arizona show a nonsignificant declining population trend from 2000 to 2010. These analyses suffer from many significant deficiencies, not the least of which is low sample size (only nine routes detected statewide; Sauer et al., 2011).

The recent removal of livestock grazing on parts of the Alpine and Springerville Ranger Districts may have increased the wetland habitat capability for nesting teal. However, approximately 597 miles of perennial stream was impacted by the Wallow Fire since 2011. These effects include scouring and siltation of riparian vegetation (USFS 2011), thereby negating any livestock removal benefits to riparian habitat.

Forestwide Population Trend

Cinnamon teal are a harvested game species that is regulated by both the Arizona Game and Fish Department and the U.S. Fish and Wildlife Service. Harvest data trends can be used as a reflection in the overall population trends for a species. The harvest estimates for cinnamon teal (which is combined with the morphologically similar blue-winged teal) shows a decreasing trend from 2007 to 2010. With no standardized monitoring data of cinnamon teal on the forest to draw upon, and limited monitoring data available statewide, teal population trends on the forest are most likely reflecting the larger state trend; stable to potentially negative trend due to impacts of recent large scale forest fires, livestock grazing, recreation, and continued drought.

Alternative A

Wetlands and lakes used by cinnamon teal would change very little from current conditions. Acres and quality of habitat may experience only minor changes as forest succession progresses. Seasonal wetlands may dry up sooner if denser forests increase transpiration rates. This could affect cinnamon teal nesting success if wetlands dry before young are able to move to more permanent water.

Alternative A would not likely change the “upward” forestwide habitat trend or “stable” forestwide population trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Alternative B

Thinning and prescribed burning treatments proposed in alternative B would reduce the density of conifers around wetlands and lakes and remove most encroaching conifer trees from wetland perimeters. Fewer conifers could result in more water being available to supply wetland and lake habitat. In wetland habitat, this may extend the period suitable habitat is available to cinnamon teal. Some short-term disturbance by thinning and prescribed burning may cause cinnamon teal to

avoid certain areas until the activity is completed. Upland nesting conditions may improve in treated areas with increased herbaceous cover and vigor.

Short-term disturbance to cinnamon teal by treatment activities would temporarily displace and alter foraging, loafing, and nesting habitat. Timing restrictions for treatment activities within MSO PACs and northern goshawk PFAs would not disturb cinnamon teal (if present) during the breeding season. The project area would be treated in phases over time and would not occur over the project area at the same time. Cinnamon teal would only experience activity-related disturbance in portions of the project area at one time.

Alternative B would not likely change the "upward" forestwide habitat trend or "stable" forestwide population trends. Due to only 7.7 percent of the available forestwide habitat occuring within the project area, changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Alternative C

Since the same stands would be treated in alternative C as in alternative B, similar effects are expected. Since trees greater than 16 inches would not be removed under this alternative, more conifers could be retained around meadow perimeters that provide for a future seed source. Overall basal area values are similar to alternative B post treatment so potential water release is similar under alternative C.

Alternative C would not likely change the "upward" forestwide habitat trend or the "stable" forestwide population trends. Due to only 7.7 percent of the available forestwide habitat occuring within the project acrea, changes in the quantity or quality of habitat would not be large enough to alter forestwide trends. Implementation of this alternative would be consistent with forest plan goals and objectives for this species and their associated habitat types.

Cumulative Effects for MIS Species – Alternatives B and C

Development of private lands in Forest Lakes Estates is expected to continue. Both elk and mule deer may also alter their behavior and foraging area due to development and disturbance. Continued development of these properties may make them less suitable for MIS; however, the loss of habitat in these private land parcels is negligible when compared to the amount of available habitat on surrounding national forest lands.

Migratory Bird Treaty Act

Summary

The analysis identified species representing habitat types found in the planning area. For most of these species, the action alternatives expect short-term noise and smoke disturbance to occur during thinning and broadcast burning operations. Unintentional take of nestlings is possible during spring and summer thinning/piling and snag removal activities. No adverse affects are expected.

Details

Migratory Bird Treaty Act (as amended 1998) implements Conventions between the United States and four neighboring countries (Canada, Mexico, Japan, and Russia) for the protection of migratory birds and has specific provisions in the statute that includes: *Establishment of a Federal prohibition, unless permitted by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention . . . for the protection of migratory birds . . . or any part, nest, or egg of any such bird."* (16 U.S.C. 703).

Species of Concern

Arizona State Partners in Flight lists priority species of concern by vegetation type. Table 73 displays the species that may occur in or near the project area by vegetation type and the possible disturbance effects by mechanical treatments (see wildlife specialist report (Brown 2011) for those that do not occur).

Table 73. Migratory bird impacts and disturbance effects

Vegetation Type	Species	Habitat	Project Area Impacts	Disturbance Effects to Species under Alternatives B, C
Mixed conifer, ponderosa pine, ponderosa pine/gambel oak	Northern goshawk[1]	Addressed in sensitive species biological evaluation (BE)	Addressed in sensitive species BE and in TES section of wildlife specialist report.	Addressed in sensitive species BE and in TES section of wildlife specialist report.
Mixed conifer, ponderosa pine/gambel oak	Mexican spotted owl[1]	Addressed in T&E species biological assessment/ evaluation (BA/E)	Addressed in T&E species BAE and in TES section of wildlife specialist report.	Addressed in T&E species BAE and in TES section of wildlife specialist report.
Mixed conifer, ponderosa pine, piñon-juniper	Peregrine falcon [2]	Addressed in sensitive species BE	Addressed in sensitive species BE and in TES section of wildlife specialist report.	Addressed in sensitive species BE and in TES section of wildlife specialist report.
Mixed conifer, ponderosa pine, piñon-juniper, deserts, grasslands, tundra	Golden eagle [2]	Elevated nest sites in cliffs or large tree isolated from human disturbance.[4]	Suitable cliff habitat exists along the Mogollon Rim adjacent to the project area. No nests have been detected within the analysis area.	Short-term noise and smoke disturbance to foraging eagles possible during thinning and broadcast burning operations. No adverse affects expected.
Mixed conifer, ponderosa pine, piñon-juniper, deserts, prairies	Prairie falcon [2]	Cliffs[4]	Marginal cliff habitat or elevated areas within project area. Nearest suitable cliffs are 1½ miles from project boundary.	Short-term noise and smoke disturbance to foraging prairie falcons possible during thinning and prescribed burning operations. No adverse

Vegetation Type	Species	Habitat	Project Area Impacts	Disturbance Effects to Species under Alternatives B, C
				affects expected.
Ponderosa pine, Douglas-fir, maple, oak, aspen	Cordilleran flycatcher[1]	Dense canopy, mid- to late-succession forests, snags.[3]	No treatments of oak or maple trees. Ponderosa pine and Douglas-fir would be thinned according to the MSO forest plan guidelines. Snags and logs would be removed in landings, but snags would be retained and recruited within the project area at forest plan guidelines.	Short-term noise and smoke disturbance possible during thinning and broadcast burning operations. Unintentional take of nestlings possible during spring and summer thinning/piling and broadcast burning activities. Fewer snags would be available for nesting. No adverse affects expected.
Ponderosa pine	Purple martin[1]	Large snags in or near open areas usually near water. Species documented near WUI. [3]	Snags and logs would be removed in log landings. Trees won't be cut within a 100-foot buffer around stock tanks.	Short-term noise and smoke disturbance possible during thinning and broadcast burning operations. Unintentional take of nestlings possible during spring and summer thinning/piling and snag removal activities. No adverse affects expected.
Ponderosa pine, Douglas-fir, piñon-juniper	Flammulated owl[2]	Forests with some undergrowth or inter-mixture of oaks. Nests in aspen, oak, pine cavities. [4]	Live Gambel oaks would not be thinned and may increase when pine competition is removed. Snags and logs would be removed in log landings. Snags would be retained within the project area at forest plan guidelines.	Short-term noise and smoke disturbance possible. Live Gambel oak cavity nest trees would not be affected by proposed action. Unintentional take of nestlings possible if snag removal occurs during spring and summer. No adverse affects expected.
Ponderosa pine, burned stands of Douglas-fir, mixed conifer, piñon-juniper	Lewis' woodpecker[2]	Dead ponderosa pine or cottonwood trees or tall stumps for cavity nests. [4]	Snags and logs would be removed in log landings. Snags would be retained within the project area at forest plan guidelines. More open understory would promote insect prey.	Short-term noise and smoke disturbance possible. Unintentional take of nestlings possible if snag removal or broadcast burning occurs during spring and summer. No adverse affects expected.
Mixed conifer-hardwood forests including ponderosa pine, Douglas-fir, and aspen	Williamson's sapsucker[2]	Dead or live trees infected with Fomes fungus. [4]	Treatments to benefit aspen regeneration. Mixed conifer would be treated according to the MSO forest plan guidelines. Snags and logs would be removed in landings, but snags would be retained and recruited	Short-term noise and smoke disturbance possible. Unintentional take of nestlings possible during spring and summer thinning/piling and snag removal activities. No adverse affects expected.

Vegetation Type	Species	Habitat	Project Area Impacts	Disturbance Effects to Species under Alternatives B, C
			within the project area at forest plan guidelines.	
Aspen, mixed conifer (Douglas-fir, ponderosa pine)	Red-naped sapsucker[1]	Groups of large aspen, dead or live trees with heartrot.[3]	Addressed in MIS section of wildlife specialist report.	Addressed in MIS section of wildlife specialist report.
Ponderosa pine, piñon-juniper	Virginia's warbler[2]	Scrubby brush interspersed with piñon-juniper or ponderosa pine. Nests on ground. [4]	Thinning would promote growth of shrubby understory, but piling and burning could set back understory habitat in the short term.	Short-term noise disturbance possible. Unintentional take of nestlings possible during spring and summer broadcast burning and thinning/piling activities.
Ponderosa pine	Grace's warbler [2]	Pine forests approximately 7,000 feet in elevation. Nests in pine trees up to 60 feet above the ground.[4]	Thinning of ponderosa pine trees from approximately 24,829 acres.	Short-term noise disturbance possible. Unintentional take of nestlings possible during spring and summer thinning and broadcast burning activities.
Sycamore, cottonwood (mature)	Common black-hawk[1]	Gallery riparian tree for nesting.[3]	Some mature cottonwood present, no riparian galleries. Thinning of conifers adjacent to riparian areas with less than 40 percent slope.	Short-term noise and smoke disturbance to foraging black-hawks possible during thinning and prescribed burning operations. Minimal changes to common black-hawk habitat would occur. No adverse affects expected.
Box elder, tamarisk, willow, Russian olive, alder	Southwestern willow flycatcher[1]	Dense, midstory and understory. Almost always associated with surface water.[3]	Limited dense midstory habitat present in project area. Surface water is limited in areas with box elder and alder.	No adverse affects expected.
Ribes species, willow, Gambel oak, snowberry, and maple thickets	MacGillivrays warbler[1]	Prefers dense, moist, brushy habitat. Nests in dense shrubbery close to ground.[3]	Broadcast burning could set back understory habitat in the short term but may promote long-term production of Ribes species, Gambel oak, and maple.	Short-term noise disturbance possible. Unintentional take of nestlings possible during spring and summer thinning and broadcast burning activities.
Maple, oak, sycamore, willow (and associated conifers – Engelmann	Red-faced warbler[1]	Steep, sloping canyons. Ground nester. [3]	No treatments on slopes greater than 40 percent. Thinning of conifers adjacent to riparian areas with less	Short-term noise disturbance possible. Unintentional take of nestlings possible during spring and summer broadcast burning activities.

Vegetation Type	Species	Habitat	Project Area Impacts	Disturbance Effects to Species under Alternatives B, C
spruce, Douglas-fir, and ponderosa pine)			than 40 percent slope.	Minimal changes to red-faced warbler habitat would occur. No adverse effects expected.

[1] Priority bird species identified in Arizona Partners in Flight Bird Conservation Plan.

[2] Species on the "Birds of Conservation Concern – 2002" list for BCR 16 (Southern Rockies/Colorado Plateau), issued by the U.S. Fish and Wildlife Service.

[3] Habitat requirements taken from Arizona Partners in Flight Bird Conservation Plan.

[4] Habitat requirements taken from DeGraaf et al. 1991.

Big Game Forage to Cover Ratio

The big game habitat changes caused by the alternatives are found under the "Elk and Mule Deer" section (page 140).

Effects of the Forest Plan Amendments

As described in this section, the amendment proposed as part of alternative B would have beneficial effects to the long-term condition of the wildlife habitat in the project area.

Effects of alternative C, which allows for the even-aged emphasis, are also described in this section. In summary, this amendment would result in a less resilient forest that is more prone to insect/disease as well as uncharacteristic fire. Stands would be less open, providing less herbaceous ground cover for a shorter period of time. This places much of the project area's wildlife habitat at risk of the effects of fire within 10 to 15 years of treatment.

Aquatics Species

This section summarizes the key conclusions and effects from the aquatics specialist report (McMillan 2011) which is located in the project record and the forests' Web site. See the report for more information on law, regulation, policy, methodology, surveys, descriptions, etc.

For direct and indirect effects to aquatic species and habitats, the analysis includes all of the actual project area and 15 miles downstream from the project boundary, along project area drainages. For cumulative effects to species and habitats, the analysis area includes all 6th HUC watersheds (see the "Watershed, Water Quality, Soils, Riparian, Noxious Weeds" section page 192). The analysis area includes all areas where project-related effects to aquatic threatened, endangered, and sensitive (TES) species and aquatic management indicator species (MIS) or occupied/potential habitats could occur. Beyond this area, potential impacts from the proposed activities that could affect the species or its habitat would be unlikely and so are not considered.

A description of the affected environment is located in the "Watershed, Water Quality, Soils, Riparian, Noxious Weeds" section (page 192), as well as impacts expected to water quality, which is closely related to the effects to aquatic species impacts.

The following description of effects of alternatives applies to all aquatic species, with specific discussion for each species following.

General Aquatic Species Effects

Alternative A

For aquatic species being analyzed, indirect sedimentation effects to suitable and potential habitats would not occur under this alternative because the proposed actions would not take place so that these effects would be avoided. In the long term (5+ years after treatment), alternative A would not reduce fire hazard. An elevated risk to aquatic species would remain as the existing FRCC 3 remains for 100 percent of the project area. Retention of FRCC 3 maintains a high fire threat to the project area. Potential wildfire effects on aquatic habitats include altering water quality through short-term inputs of sediment and ash as surface runoff increases, post fire. Increased runoff can also affect stream morphology and habitat by unnaturally elevating peak runoffs that may excessively scour and disconnect channels from flood plains.

Retention of FRCC 3 keeps the fire hazard threat high in the project area. Wildfire effects on aquatic habitats include altering water quality through short-term inputs of sediment and ash as surface runoff increases, post fire. Increased runoff can also affect stream morphology by unnaturally elevating peak runoffs that may excessively scour and abruptly reshape channels.

Because attaining FRCC 1 ratings is desired for the ponderosa pine and mixed conifer vegetation types in the project area to maintain fire regimes within historical range and diminish fire severity, this alternative is the least desirable as compared to alternatives B and C, in limiting potential for unnaturally intense wildfire.

Alternative B

Indirect sediment effects to suitable and potential habitats, including Willow and Chevelon Creeks could occur but these effects should be minimal and primarily short term. Habitats may be indirectly affected by elevated sediment delivery from increased surface erosion generated by ground-disturbing activities such as road maintenance and reconstruction, mechanical harvesting activities, pile burning and broadcast burning throughout the Upper Willow Creek/Gentry and Chevelon Creek Headwaters watersheds. Mitigation measures including best management practices for road building and mechanical harvest are included in the alternative to minimize these impacts.

Without mitigation measures, these activities could indirectly affect aquatic habitat through increased sediment delivery, which would add to existing substrate embeddedness and increase stream temperatures. The majority of stream reaches sampled fall within the desired rating of less than 20 percent substrate embeddedness, although reaches immediately below the reservoirs are elevated at 52–60 percent. High embeddedness levels immediately below the lakes would be expected given the documented influence of reservoir dams on the diminished ability of streams to distribute their sediment load in a natural manner.

An important habitat component for aquatic species includes an ample food supply. Since many species are dependent upon aquatic macroinvertebrates for a major portion of their diet, potential effects are relevant to these habitats. Aquatic macroinvertebrates would be indirectly affected by project activities that result in increased sediment loading within their habitats. Increased sediment deposition would likely alter aquatic macroinvertebrate production, although not significantly.

Riparian condition—which includes streambank soil and vegetative stability—should not be significantly affected with implementation of the proposed action. Best management practices, including streamside management zone (SMZ) guidelines, would be implemented to retain the integrity of riparian habitats in the Willow and Chevelon Creek drainages as sediment buffer zones.

Since Willow Creek and Chevelon Creek and their tributaries have been given some of the most restrictive SMZ classifications in order to protect downstream aquatic habitat, sedimentation effects will be minimized to the greatest extent possible while still allowing the watersheds to be treated. The effectiveness of these buffer strips would be enhanced with the staging of timber treatments and prescribed burns in multiple year phases.

It is unlikely that changes in water quality, including temperature, would occur with the implementation of the proposed action. Available stream temperature data, taken from perennial streams such as Woods Canyon, Willow Springs Canyon, and Chevelon Canyon, indicate that stream temperatures appear to be within forest plan standards of ≤ 68 °F and less than the 88.7 ˚F maximum temperature tolerated by some species of concern (e.g. Chiricahua leopard frog embryos). Implementation of SMZ restrictions, designed to protect streams and provide for retention of existing riparian cover in perennial drainages, should prevent any measurable deterioration of water temperatures in the perennial systems.

There may be indirect short-term impacts from increased sediment movement into streams. However, many aquatic species adapted to the project area are tolerant to a variety of habitat conditions and these impacts would be of short duration (within 1–2 years after treatment completed) and are not likely to modify potential or suitable habitats to the degree that habitats are no longer suitable or potentially suitable.

Sedimentation effects are expected to occur for up to 2 years following mechanical treatments for each area treated and after prescribed burning treatments. Since project activities would likely take over a decade or more to complete, and the treatment areas would be spread out over the watersheds in smaller treatment blocks, the effects would be lessened as compared to all treatments occurring within a shorter time period.

Additionally, BMPs address retention of SMZs to act as filters for upland sediment and ash and should minimize impacts to aquatic habitat. Any short-term or long-term increases in sediment delivery to streams would not prevent future reintroduction of species such as the spinedace into Willow and Chevelon Creeks.

In the long term (5+ years after treatment), this project would be beneficial to aquatic species with the reduction in fire hazard, resulting in decreased risk to the species from unnatural fire effects in the watershed. This alternative moves the FRCC rating to 54 percent FRCC 1. Fuel reduction treatments which lower the FRCC rating to class 1 would benefit all aquatic species and their habitats in the analysis area, as the chances for severe wildfires are decreased in those areas.

Wildfire effects on aquatic habitats include altering water quality through short-term inputs of sediment and ash as surface runoff increases, post fire. Increased runoff can also affect stream morphology by unnaturally elevating peak runoffs that may excessively scour and abruptly reshape channels. Since attaining FRCC 1 ratings are desired for the ponderosa pine and mixed conifer vegetation types in the project area to maintain fire regimes within historical range and

diminish fire severity, this alternative is more desirable than alternatives A and C in limiting potential for unnaturally intense wildfire.

Alternative C

The direct and indirect effects to aquatic species described for alternative B are also applicable to Alternative C with one exception.

In the long term (5+ years after treatment), this project would be beneficial to aquatic species with the reduction in fire hazard, resulting in decreased risk to the species from unnatural fire effects in the watershed. This alternative moves the FRCC rating to 14 percent FRCC 1. This alternative is more desirable than alternative A in limiting potential for unnaturally intense wildfire, but less desirable than alternative B which moves the area to 54 percent FRCC class 1.

Cumulative Effects to Aquatic Species

Alternative A

Since there are no direct/indirect effects from alternative A, there would be no cumulative effects from this “no action” alternative.

Alternatives B/C

The EDA (see page 206) calculated in Upper Willow Creek is 10.5 percent post treatment (see “Watershed, Water Quality, Soils, Riparian, Noxious Weeds” section, page 192), which is below the level of concern of 15 percent. The Upper Chevelon Creek Headwaters post treatment EDA is 16.7 percent. The EDA effects analysis assumed that all treatments would occur in 1 year, and these percentages reflect that assumption. In actuality, treatments including thinning and burning and other associated disturbance activities such as road reconstruction would occur over a 10-year period, and EDA levels are expected to be less than described in the analysis.

Furthermore, the “Watershed, Water Quality, Soils, Riparian, Noxious Weeds” section indicates that site-specific BMPs, which include staging of treatments combined with treatment refinements, would result in an EDA below 15 percent for the Upper Chevelon Creek Headwaters.

Cumulative effects on aquatic species suitable habitats from increased sedimentation resulting from the proposed action when combined with the ongoing grazing and recreation activities combined with activities considered in the EDA analysis, are not likely to drastically diminish the suitability or potential suitability of habitats in the analysis area.

Most of the livestock allotments in the analysis area have been analyzed within the past 15 years, and necessary adjustments were made to meet management objectives as stated in the Apache-Sitgreaves forest plan including management concerns for TES species. Livestock numbers were reduced to allotment capacity, allowable use standards were implemented to meet the physiological needs of range plants, and range improvement structures were developed to better distribute livestock across the allotments. Current management of these allotments further reduces impacts to aquatic species and their habitats from previous management practices.

Cumulative effects are not likely to drastically diminish the suitability or potential suitability of habitats in the analysis area for aquatic species potential and suitable habitats. Greatest potential

is from increased sedimentation resulting from the proposed action when combined with the ongoing grazing and recreation activities combined with activities considered in the EDA analysis. Over both the short term (<5 years after treatment) and long term (5+ years after treatment), above natural levels of sedimentation would likely occur with implementation of the proposed action or alternatives. Ongoing ground-disturbing actions would continue, as well as those additional past and future foreseeable activities evaluated in the EDA analysis. However, as mitigated, these combined actions would not result in losses of species or habitats for species as described in the following sections.

Federally Listed Aquatic Species

A list of endangered, threatened, and proposed species was compiled by the Apache-Sitgreaves National Forests with concurrence by the Phoenix Endangered Species Office of the U.S. Fish and Wildlife Service. The USFWS approved species list for the Apache-Sitgreaves National Forests was reviewed for endangered, threatened, and proposed aquatic species and their critical habitat that may occur in the Rim Lakes Forest Restoration Project area.

The threatened (T) aquatic species described below in table 74 may occur or have potential habitat within the analysis area. None of the species described below are known to occur in the project area.

Table 74. Aquatic species designated as threatened

Common Name	Scientific	Status	Critical Habitat Designated?	Critical Habitat in AA?	Species Known to Occur Historically?	Species Known to Occur Currently?	Suitable or Potential Habitat in AA?
Little Colorado spinedace	*Lepidomeda vittata*	T[1]	Yes	No	Yes	No	Yes
Chiricahua leopard frog	*Lithobates chiricahuensis*	T	No[2]	No	Yes	No	Yes

[1]Based on a 5-year review by the U.S. Fish and Wildlife Service, Little Colorado spinedace is recommended for reclassifying to endangered status primarily due to dewatering of habitat and interactions with nonnative fish and crayfish (U.S. Fish and Wildlife Service 2008).

[2] The USFWS proposed critical habitat designation for the Chiricahua leopard frog on March 15, 2011 (U.S. Fish and Wildlife Service 2011).

Little Colorado Spinedace

This species is not present in the project area but may be present in downstream habitats. Potential/suitable habitat is present in the analysis area.

The Little Colorado spinedace historically occurred throughout the upper portions of the Little Colorado River drainage, but is now found only in portions of East Clear, Chevelon, Silver, and Nutrioso Creeks and the Little Colorado River in Coconino, Navajo, and Apache Counties, Arizona. The closest spinedace population is in Chevelon Creek, below Chevelon Canyon Lake, 68 river miles from the project boundary, near the confluence of Rock Tank Canyon (Lopez et al., 1998b). Critical habitat has been designated in East Clear Creek, Chevelon Creek, and Nutrioso Creek. The nearest critical habitat is in Chevelon Creek, approximately 74 miles from the project

boundary beginning in the section of stream at Bell Cow Canyon confluence, downstream to the confluence with the Little Colorado River. Lands in this area are privately owned, with the exception of a small portion, which is owned by Arizona Game and Fish Department (U.S. Fish and Wildlife Service 1987).

Within the analysis area, the species was historically found in Willow Creek, approximately 2.5 miles downstream from the project area. For the purposes of this analysis, it would be assumed that the likelihood of species presence in its historic habitat within Willow Creek is low given the lack of documentation since the 1960s, and Willow Creek will be considered to be suitable or potential habitat.

With the goal of protecting existing spinedace populations, the "Little Colorado Spinedace Recovery Plan" (U.S. Fish and Wildlife Service 1998) identifies upper Chevelon Creek, above Chevelon Canyon Lake, as a refugia site to be considered for spinedace recovery. The section of Chevelon Creek described above as a possible refugia site for spinedace occurs approximately 15 miles below the project boundary and is considered to be suitable or potential habitat.

Environmental Effects

Alternative A

There would be no direct effects to the species with implementation of this alternative since the species is not present in the project area.

The forest plan directs that the forest improve habitats for listed threatened, endangered, or sensitive species of plants and animals, and to work toward the recovery and declassification of species. This alternative does not increase fire resiliency of watersheds containing Little Colorado spinedace suitable and potential habitat, leaving these habitats vulnerable to degradation from potential wildfire effects.

Alternatives B/C

There would be no direct effects to the species with implementation of either alternative since the species is not present in the project area.

Effects are described in the "General Aquatic Species Effects" section, page 171.

Cumulative Effects to Potential and Suitable Habitats

With alternative A, since there are no direct/indirect effects from alternative A, there would be no cumulative effects from this "no action" alternative. For alternatives B and C, although the species is likely not present in the analysis area, Willow Creek is a likely reintroduction site for spinedace, 12 miles below the project boundary. Arizona Game and Fish Department is planning for Willow Creek spinedace reintroduction within the next few years (Mike Lopez, AGFD, personal communication 2011).

Potential or suitable habitats for Little Colorado spinedace are present in the analysis area and are affected by past, present or future foreseeable management activities or natural events that have occurred, or are currently occurring in the analysis area. Watersheds in the project area that encompass stream habitats identified as possible future reintroduction sites include Upper Willow Creek and Chevelon Creek Headwaters.

Timing of treatments would serve to keep the EDA within levels to avoid concerns.

Cumulative effects are the same for Little Colorado spinedace as described in the "General Aquatic Species Effects" section, page 171.

Spinedace, if reintroduced in the next few years, should be able to utilize the habitats in the analysis area. Most of the livestock allotments in the analysis area have been analyzed within the past 15 years and necessary adjustments were made to meet management objectives as stated in the Apache-Sitgreaves forest plan including management concerns for TES species. Livestock numbers were reduced to allotment capacity, allowable use standards were implemented to meet the physiological needs of range plants, and range improvement structures were developed to better distribute livestock across the allotments. Current management of these allotments further reduces impacts to aquatic species and their habitats from previous management practices.

Determination of Effects

Alternative A

Based on the above discussion, lack of occupied habitat in the project area and considering past, present, and future foreseeable impacts, alternative A would not affect Little Colorado spinedace. There would be no effect to designated critical habitat.

Alternatives B/C

Based on the above discussion, alternative B or C may affect, but are not likely to adversely affect Little Colorado Spinedace. There would be no effect to designated critical habitat.

Chiricahua Leopard Frog

This species is not present in the analysis area but potential/suitable habitat is present. Critical habitat has been proposed.

The Chiricahua leopard frog is considered to have been extirpated from the Little Colorado River watershed (U.S. Fish and Wildlife Service 2002) but at one time existed in Chevelon, Leonard, and Clear Creeks. All three historic locations are outside the analysis area for this project. All of the extant populations described in the specialist report are not in the analysis area and are in 6th HUC watersheds not affected by Rim Lakes Forest Restoration Project, although the historic habitat in Tonto Creek is in the analysis area.

The closest proposed critical habitat also occurs in Cherry, Crouch, and Ellison Creeks and the Buckskin Hills area. All of the extant populations and proposed critical habitats described above are not in the analysis area.

Based upon the criteria described in the specialist report, the surveys conducted to date, the stocking of nonnative sport fish, and the observed crayfish numbers, the lake habitat that occurs in the project area is not likely to be occupied.

Direct and Indirect Effects

Alternative A

There would be no direct effects to the species with implementation of this alternative since the species is not present in the project area. Indirect sediment effects to suitable and potential habitats would not occur under this alternative.

The forest plan directs that we improve habitats for listed threatened, endangered, or sensitive species of plants and animals, and to work toward the recovery and declassification of species. This alternative does not increase fire resiliency of watersheds containing Chiricahua leopard frog suitable and potential habitat, leaving these habitats vulnerable to degradation from potential wildfire effects.

Alternatives B/C

There would be no direct effects to the species with implementation of either alternative since the species is likely not present in the project area. Based upon known distribution and survey information, Chiricahua leopard frogs are not present in the project area and likely not present in the analysis area.

Suitable or potential habitats, primarily occurring in Upper Willow Creek/Gentry and Chevelon Creek Headwaters watersheds where most of the perennial habitats occur, may be impacted from sediment as described in the "General Aquatic Species Effects" section page 171.

Cumulative Effects

Alternative A

There would be no cumulative effects from this "no action" alternative. The species is likely not present in the analysis area, therefore, there are no past, present, or reasonably foreseeable future actions by Federal, State, or tribal agencies or private groups or individuals identified within the analysis area that would affect current populations of Chiricahua leopard frogs. Potential or suitable habitats for Chiricahua leopard frog are present in the analysis area and are affected by past and present management activities or natural events that have occurred, or are currently occurring in the analysis area.

Alternatives B/C

Direct and indirect cumulative effects on Chiricahua leopard frog potential and suitable habitats are similar to those described in the "General Aquatic Species Effects" section.

Dredging of potential and suitable stock pond habitats would improve habitat quality by increasing the ability of ponds to hold more water for longer periods, which would benefit currently unoccupied potential or suitable leopard frog habitats.

Determination of Effects

Alternative A

Based on the above discussion, it is my determination that the proposed would not affect Chiricahua leopard frog. The proposed action would have no effect on proposed critical habitat.

Alternatives B/C

Based on the above discussion, it is my determination that the action alternatives may affect, but are not likely to adversely affect Chiricahua leopard frog. Alternative B or alternative C would have no effect on proposed critical habitat.

Table 75. Sensitive aquatic species in the analysis area

Common Name (Scientific)	Status	Species Known to Occur Historically?	Species Known to Occur Currently?	Suitable or Potential Habitat in Alt. A?	Effects Determination Alt. B or C
Little Colorado sucker (*Catostomus* sp. 3)	S	Yes	Yes	Yes	Individuals may be impacted but these impacts would not result in a trend toward listing or loss of viability.
Bluehead sucker (*Catostomus discobolus discobolus*)	S	Yes	Yes	Yes	
Roundtail chub (*Gila robusta*)	S, C	Yes	Yes	Yes	
California floater (*Anodonta californiensis)*	S	Yes	No	Yes	
Northern leopard frog (*Rana pipiens*)	S	Yes	No	Yes	
Southwestern toad (*Bufo microscaphus Microscaphus*)	S	Yes	Yes	Yes	

Forest Service Sensitive Species—Aquatic

The Region 3 Regional Forester's Sensitive Species List, dated September 21, 2007, was utilized to identify aquatic species which occur or could occur in the Rim Lakes Forest Restoration Project area. Sensitive species (S) described in table 75 may occur or have potential habitat in the analysis area.

Environmental Effects to Sensitive Species

Alternative A – All Sensitive Aquatic Species

Species to which this applies includes: Little Colorado sucker, bluehead sucker, roundtail chub, southwestern toad, northern leopard frog, and California floater. Sensitive aquatic species known to be present in the analysis area include the Little Colorado sucker, bluehead sucker, roundtail chub, and southwestern toad. Potential habitats for sensitive species such as California floater and northern leopard frog also occur in the analysis area drainages, tanks, and reservoirs.

Effects are described in "General Aquatic Species Effects" section on page 171.

Little Colorado Sucker

The species does not occur in the project area, but is known to occur in the Little Colorado River, near St. Johns. Little Colorado sucker are also found in other major tributaries to the Little Colorado River including the Clear Creek drainage, Chevelon Creek, and Silver Creek. Additionally, the species has been introduced into the Salt River watershed.

Within Willow Creek, tributary to Clear Creek, the species was visually observed in upper reaches in 1994 (Young et al., 2001) and may still occur. Both upper Willow Creek and Woods

Canyon Creek are within the analysis area. Willow Creek is likely occupied habitat and Woods Canyon is suitable or potential habitat for the species.

Bluehead Sucker

The species is not present in the project area, but has recently been found in Willow Creek, beginning approximately 6 miles below the project boundary at the Willow Creek and Gentry Creek confluence downstream to Wiggins Crossing (Arizona Department of Game and Fish 2006). Potential and suitable habitat occurs within all perennial streams in the project area, including Woods Canyon and Chevelon Creek.

Effects: Little Colorado Sucker/Bluehead Sucker

No direct effects to these suckers would occur with implementation of the proposed action since these species are not present in the project area.

Indirect effects to Little Colorado sucker and bluehead sucker could occur since the bluehead has been confirmed in Willow Creek (2006) while the Little Colorado sucker is likely present based on distribution in the 1990s. Suitable or potential habitat occurs in Woods Canyon and Chevelon Creeks.

Short-term effects to potential and suitable habitat are the same as described for aquatic species (page 171). Measureable water quality declines are unlikely. Any short-term increases in sediment levels would not impact species viability.

In the long term (5+ years after treatment), this project would be beneficial to Little Colorado and bluehead suckers with the reduction in fire hazard.

The effects described for alternative C are the same as alternative B, except the benefits of alternative C do not last as long as those from alternative B.

Cumulative Effects

Occupied habitats and potential/suitable habitats for Little Colorado and bluehead suckers are present in the analysis area and are affected by past, present, or future foreseeable management activities or natural events that have occurred, or are currently occurring in the analysis area. Watersheds in the project area that encompass stream habitats identified as occupied or possible future reintroduction sites include Upper Willow Creek and Chevelon Creek Headwaters. As disclosed in the “Cumulative Watershed Effects Analysis,” past and future foreseeable disturbances include timber harvest activities, road and trail construction/maintenance, and areas affected by wildfire.

As noted in the “General Aquatic Species Effects” section, the EDA concerns would be mitigated by dispersing treatments across several watersheds. Other aquatic effects are described in that section.

Continued water impoundment within the analysis area drainages would likely continue to affect the suitability of habitats in the analysis area by diminishing the amount of habitat that is available for the species and altering flow patterns downstream. With the exception of continued water impoundment, there are no State, tribal or private actions known that would affect the analysis area.

Determination of Effects

Based on the above discussion, alternative A would have no impact on Little Colorado sucker, bluehead sucker, roundtail chub, southwestern toad, northern leopard frog, and California floater.

Based upon the above discussion, for either alternative B or alternative C individuals may be impacted, but the anticipated impacts would not result in a trend toward Federal listing or loss of viability of the Little Colorado and bluehead suckers.

Roundtail Chub

The species is not present in the project area. Occupied habitat occurs in Gordon Creek, Tonto Creek (Voeltz 2002), Haigler Creek, and Marsh Creeks (Arizona Game and Fish Department 1992), Tonto National Forest. Headwaters of these drainages are present in the project area but they are limited to less than 5 miles in total length. Roundtail chub were historically present in Canyon Creek off of the forest, with the last documented occurrence in 1967, so may no longer occur in this drainage. Approximately 15 miles of headwater tributaries to Canyon Creek occur in the project area. All of the drainages mentioned above including Gordon Creek, Tonto Creek, Canyon Creek, and upper Chevelon Canyon Creek occur within the analysis area.

Alternative B or C

No direct effects to roundtail chub would occur with implementation of the proposed action since the species is not present in the project area. Indirect effects to roundtail chub could occur since the species is likely present in several drainages on the Tonto National Forest. Indirect effects to potential reintroduction sites—such as Chevelon Creek—could also occur. These are described in the “General Aquatic Species Effects” section (page 171).

Alternative B or C Cumulative Effects to Roundtail Chub

Occupied habitats and potential/suitable habitats for roundtail chub are present in the analysis area and are affected by past, present, or future foreseeable management activities or natural events that have occurred, or are currently occurring in the analysis area. Watersheds in the project area that encompass stream habitats identified as occupied or possible future reintroduction sites include Upper Willow Creek and Chevelon Creek Headwaters.

As disclosed in the “General Aquatic Species Effects” section, the proposed action when combined with non-EDA activities described in the analysis and combined with activities considered in the EDA analysis, are not likely to drastically diminish the suitability or potential suitability of habitats in the analysis area. Continued water impoundment within the analysis area drainages would likely continue to affect the suitability of habitats in the analysis area, but not to a measureable amount.

In the Tonto Creek drainage, the project area only contains 737 acres or 4 percent of the total 6th HUC watershed and was not modeled. The EDA calculated in Gordon/Haigler is 11.6 percent, post treatment, which is below the threshold of 15 percent.

Based upon the above discussion, for either alternative B or alternative C, individuals may be impacted, but the anticipated impacts would not result in a trend toward Federal listing or loss of viability of the roundtail chub.

California Floater

This species is not present in the analysis area. Hulen (1988) indicates the presence of California floater in Chevelon Creek based upon surveys by Landye in 1988 as well as other surveys conducted in 1956 and 1970. Both Hulen (1988) and AGFD (1994) indicate that a population may still be extant in this drainage. Lopez et al. (1998) indicates the species is documented below Chevelon Canyon Lake during surveys conducted in 1996. Based upon available information collected by Lopez et al. (1998), extant populations are present below Chevelon Canyon Lake over 15 miles downstream and outside of the analysis area. Potential habitat may occur in Chevelon Creek above the reservoir.

Alternative B or C

No direct effects to California floater would occur with implementation of the proposed action since the species is not present in the project area.

There is a potential to affect suitable or potential habitat as described in the "General Aquatic Habitat Effects" section.

Since there is low likelihood that California floater is present in the analysis area, this species has a low likelihood of being affected, although the proposed treatments would likely alter instream habitat in the short term through increases in suspended sediment.

Alternatives B/C Cumulative Effects

Potential/suitable habitats for California floaters are present in the analysis area and are affected by past, present, or future foreseeable management activities or natural events that have occurred, or are currently occurring in the analysis area. Watersheds in the project area that encompass stream habitats identified as potential habitats include Chevelon Creek Headwaters.

As described in the "General Aquatic Species Effects" section, the proposed action when combined with activities considered in the EDA analysis, are not likely to drastically diminish the suitability or potential suitability of habitats in the analysis area.

Based upon the above discussion, for either alternative B or alternative C, individuals may be impacted, but the anticipated impacts would not result in a trend toward Federal listing or loss of viability of the California floater.

Northern Leopard Frog

Species may be present in the project area. District records indicate that northern leopard frogs were historically documented in Clear Creek, several miles northwest and outside of the analysis area. They have also been documented in the project area within both Woods Canyon Lake (1968) and Willow Springs Lake (1996). The species has not been detected in recent surveys in either lake, and currently these lakes contains nonnative trout that are stocked annually, and appear to have such large crayfish populations that ranid frogs may be precluded from utilizing these habitats. These lakes likely provide potential habitat for the species. Although this species has not been recently documented in the analysis area, it is assumed that aquatic environments with dense riparian and emergent vegetation provide habitat for this species.

In 2007, approximately 8.5 miles (13,750 meters) of streams, 6.4 miles (10,290 meters) of three lakes, two cienegas and six tanks were surveyed in the Rim Lakes analysis area. Both Woods

Canyon and Willow Springs Lake were included in the 2007 survey sites. No ranid frogs were observed. Surveyors found that many of streams and all of the lakes were heavily infested with crayfish.

Alternatives B/C

Direct and indirect effects to the species are possible since there is a likelihood that the species is present in the analysis area. Although direct effects to the species are unlikely in perennial streams that are buffered by SMZs, they could occur in wetlands and stock tanks, as described in the "General Aquatic Species Effects" section (page 171).

Although there may be indirect short-term impacts from increased sediment movement into streams, ranid frogs are known to be tolerant to a variety of habitat conditions and these sediment impacts would be of short duration (within 1–2 years after treatment completed) in lotic systems and are not likely to modify lotic or lentic habitats to the degree that they are no longer suitable or potentially suitable.

Alternatives B/C Cumulative Effects

The cumulative effects analysis for northern leopard frog is similar to the analysis for Chiricahua leopard frog. Both species are members of the Rana genus and have similar habitat requirements.

Also as described in the "General Aquatic Species Effects" section, the proposed action when combined with activities considered in the EDA analysis, are not likely to drastically diminish the suitability or potential suitability of habitats in the analysis area. Continued water impoundment within the analysis area drainages would likely continue to affect the suitability of habitats in the analysis area. Both short-term and long-term impacts would affect both ranid frogs similarly.

Determination of Effects

Based upon the above discussion, for either alternative B or alternative C individuals may be impacted, but the anticipated impacts would not result in a trend toward Federal listing or loss of viability of the northern leopard frog.

Southwestern Toad

This species is not present in the project area, but has been documented in the action area. Southwestern toads have historically occupied sites in the Little Colorado River drainage and Gila and Salt River drainages on the Apache-Sitgreaves National Forests. Distribution on the forest within these drainages includes East Clear Creek, Bonita Creek, Eagle Creek, Blue River, Black River, and Luna Lake (Sullivan 1991).

Surveys of suitable habitats conducted in 2007 within the project area did not detect Southwestern toads but the species has been detected in previous USFS surveys, approximately 3 miles north of the project area in West Chevelon Creek in 2004. Also, based upon AGFD (1994) southwestern toads were historically documented in Tonto Creek approximately 2 miles south of the project area, on the Tonto National Forest near the Hwy. 260 crossing at Kohls Ranch in 1970.

Alternatives B/C

No direct effects to Southwestern toad would occur with implementation of the proposed action since the species is not present in the project area. Indirect effects to the species could occur since

the species is present in the analysis area. These effects are described in the "General Aquatic Species Effects" section (page 171).

Occupied habitat in the Upper West Chevelon Canyon watershed and historic habitat occuring in the Tonto Creek Headwaters watershed may be indirectly impacted from increased sediment loading into streams or lakes, but these impacts would be of short duration and are not likely to adversely modify habitats in the long term. Habitats should retain enough characteristics to support Southwestern toad in the long term.

Although there may be indirect short-term impacts from increased sediment movement into streams, ranid frogs are known to be tolerant to a variety of habitat conditions and these sediment impacts would be of short duration (within 1–2 years after treatment completed) in lotic systems and are not likely to modify lotic or lentic habitats to the degree that they are no longer suitable or potentially suitable.

Cumulative Effects Alternatives B/C

The cumulative effects analysis for Southwestern toad is similar to that described in the "General Aquatic Species Effects" section. Occupied habitats are found in the Chevelon Creek and Tonto Creek watersheds. In the Tonto Creek drainage, the project area only contains 737 acres or 4 percent of the total 6th HUC watershed and was not modeled. Otherwise, the EDA calculated values and effects are described in the "General Aquatic Species Effects" section. The proposed action when combined with activities considered in the EDA analysis, are not likely to drastically diminish the suitability or potential suitability of habitats in the action area. Continued water impoundment within the action area drainages would likely continue to affect the suitability of habitats in the action area. Both short-term and long-term impacts would affect both ranid frogs similarly.

Determination of Effects

Based upon the above discussion, for either alternative B or alternative C, individuals may be impacted, but the anticipated impacts would not result in a trend toward Federal listing or loss of viability of the Southwestern toad.

Management Indicator Species (Aquatic)

Aquatic Macroinvertebrates (Various Species)

The forest plan standards and guidelines for aquatic macroinvertebrates are to manage for and maintain at least an 80 percent biotic condition index (BCI) on all perennial streams (Forest Level Macroinvertebrate Status Summary 2005). The BCI score indicates as a percentage how close an aquatic ecosystem is to its own potential. The "Fisheries and Riparian Habitat Improvement for the Apache-Sitgreaves National Forests Implementation Plan" (forest riparian plan) provides the rationale and methods to be used and is discussed in the 2005 macroinvertebrate summary.

Forest level trends in aquatic macroinvertebrate populations and habitats are *estimated* to be downward on 70 percent of the cold water streams on the forests (Forest Level Macroinvertebrate Status Summary (2005)).

Within the action area of the Rim Lakes Project, there were six macroinvertebrate samples collected from Willow Springs Creek and six samples collected from Woods Canyon Creek. No

other streams in the action area have been sampled. The results from these surveys are summarized in table 76.

Table 76. Macroinvertebrate data collected in the Rim Lakes Action Area

Stream	Sample ID	Sampling Date	BCI/Rating
Willow Springs Creek	Site 316	12/95	60/Poor
Willow Springs Creek	Site 317	12/95	61/Poor
Willow Springs Creek	Site 318	12/95	60/Poor
Willow Springs Creek	Site 319	12/95	Not Calculated
Willow Springs Creek	Site 320	12/95	Not Calculated
Willow Springs Creek	Site 321	12/95	Not Calculated
Woods Canyon Creek	Site 322	12/95	73/Fair
Woods Canyon Creek	Site 323	12/95	65/Poor
Woods Canyon Creek	Site 324	12/95	79/Fair
Woods Canyon Creek	Site 325	12/95	69/Poor
Woods Canyon Creek	Site 326	12/95	76/Fair
Woods Canyon Creek	Site 327	12/95	75/Fair

None of the samples analyzed within the project area in the 2005 report meet the forest plan standard for BCI indices (80 percent). If these samples were taken immediately below their respective reservoirs, the substrate embeddedness in these reaches was also noted as high and could explain the low baseline BCI scores.

Aquatic Habitats

The concern for aquatic species is to maintain high quality habitat. Indicators of aquatic habitat quality considered for this project include riparian condition, stream temperature, streambank stability, and fine sediment.

Sediment would be used as the measure of project effects on aquatic habitat and species.

All vegetation and soil disturbing land uses that reduce water infiltration rates or remove vegetative cover from sites can increase runoff and sediment from storm events. The amount and type of sediment within a stream system influences aquatic habitat quality and species diversity. For example, fine sediment accumulation in a gravel bed stream can affect ranid egg survival (U.S. Fish and Wildlife Seevice 2002) and decrease the production of aquatic macroinvertebrates (Zwartjes et al., 2005). Relyea (2007) indicates that loss of refugia in the substrate is one of the most important mechanisms behind macroinvertebrate intolerance to fine sediment. Potential fine sediment sources may originate from treatments that disturb soils and from existing and new temporary roads.

Forest plan standards and guidelines (S&Gs) indicate that the forests would manage for or maintain at least 60 percent of potential habitat capability (HCI) for Apache trout, rainbow trout, brook trout, brown trout, loach minnow, and Little Colorado spinedace. Previous surveys indicate that Willow Creek, Woods Canyon Creek, Chevelon Creek, and Willow Springs Creek streams contain trout, and that both Willow and Chevelon Creeks contain habitat emphasized in other

plans for Little Colorado spinedace as refugia or reintroduction sites. A desired HCI index of 60 percent is relevant for these drainages.

The forest plan also identifies Willow Creek, Woods Canyon Creek, Chevelon Creek, and Willow Springs Creek as priority streams in management area 3 with the following standards and guidelines:

1. Prevent siltation not to exceed 20 percent (85mm) in riffle areas.
2. Maintain 80 percent of the spawning gravel surface free of inorganic sediment.
3. Manage for stream temperatures not to exceed 68 °F, unless not technically feasible.
4. Manage and maintain or improve riparian areas to satisfactory riparian condition.
5. Manage for and maintain at least 80 percent of streambank total linear distances in stable condition**.**

Woods Canyon Creek

Woods Canyon Creek is a north-flowing tributary to Chevelon Creek in southeast Coconino County. It flows through ASNFs administered lands at elevations ranging from 7,800 feet at the upper headwaters to 7,000 feet at the confluence with Willow Springs Canyon. Below the confluence of Woods Canyon Creek and Willow Springs Canyon Creek is the beginning of Chevelon Creek. Woods Canyon Creek is a second order stream approximately 16 miles in length that originates in the northwest portion of the project area.

Approximately 11 miles of ephemeral/intermittent drainage occurs above Woods Canyon Lake and 6 miles of predominately perennial stream occurs below Woods Canyon Dam. Surface flow is dependent upon seasonal spills over Woods Canyon Dam and year-round dam seepage to provide for streamflow. The stream's watershed contains primarily mixed conifer forest type and is approximately 16 square miles in size.

A search of district survey records indicate that the perennial reaches of Woods Canyon Creek were surveyed in 1995 by Lopez et al. (1998) utilizing GAWS survey methodologies. Fish population surveys were also conducted as part of the general aquatic wildlife survey (GAWS) protocol in 1995 and water quality monitoring was completed from 1995 to 1996. All of the surveyed reach miles are below Woods Canyon Dam and are within the action area. *An estimated 3 miles of surveyed reaches occur within the project boundary. This area includes all of reach 1 and a portion of reach 2. All of the reaches occur within the action area.*

Willow Springs Canyon

Willow Springs Canyon is a north-flowing tributary to Chevelon Creek in southeast Coconino County. It flows through ASNFs administered lands at elevations ranging from 7,600 feet at the upper headwaters to 7,000 feet at the confluence with Woods Canyon Creek. Below the confluence of Willow Springs Canyon and Woods Canyon Creek is the beginning of Chevelon Creek. Willow Springs Canyon is a second order stream approximately 8 miles in length that originates in the southern portion of the project area. Approximately 5 miles of intermittent drainage occurs above Willow Springs Lake and 3 miles of interrupted perennial stream occurs below Willow Springs Dam. Surface flow is dependent upon seasonal spills over Willow Springs Lake Dam and year-round dam seepage to provide for streamflow. The stream's watershed contains primarily mixed conifer forest type and is approximately 8.9 square miles in size.

A search of district survey records indicate that the perennial reaches of Willow Springs Creek were surveyed in 1995 by Lopez et al. (1998a) utilizing GAWS survey methodologies. Fish population surveys were also conducted as part of the GAWS protocol in 1995 and water quality monitoring was completed from 1995 to 1996. *All of the survey reaches are below Willow Springs Dam and within the action area. Less than 0.5 mile of surveyed reaches occurs within the project area. This area includes the uppermost portion of reach 1.*

Chevelon Creek

Chevelon Creek is a north-flowing tributary to the Little Colorado River in southeast Coconino County. It flows through ASNFs administered lands in the action area at elevations ranging from 7,000 feet at the upper limit to 6,400 feet at Chevelon Canyon Lake. Chevelon Creek is a seventh order stream approximately 79 miles in length that originates at the confluence of Woods Canyon and Willow Springs Canyon, north of the project area. The stream's watershed is approximately 371 mi^2 in size and contains primarily mixed conifer forest type in the higher elevations and ponderosa pine/piñyon-juniper and grasslands at the lower elevations.

A search of district survey records indicate that the section of Chevelon Creek found in the action area was surveyed in 1996 by Lopez et al. (1998b) utilizing GAWS survey methodologies. Fish population surveys were also conducted as part of the GAWS protocol in 1996 and water quality monitoring was completed from 1995 to 1996. Several reaches were surveyed, with only the uppermost reach included in the Rim Lakes action area. Reach 7, which originates at the confluence of Woods Canyon and Willow Springs Canyon and continues downstream for 11 miles to Chevelon Canyon Lake, would be described below as part of the action area. *No part of Chevelon Creek occurs within the project area, but the upper 13 miles of the drainage occurs in the action area.*

Willow Creek

Willow Creek is a north-flowing tributary to Clear Creek in southeast Coconino County. It flows primarily through ASNFs administered lands, with some private inclusions (<5 percent of total), at elevations ranging from 7,655 feet at the upper headwaters to 6,010 feet at the confluence with Clear Creek. Willow Creek is a fourth order tributary to Clear Creek that is approximately 31 miles in length and originates in the northwest portion of the project area. The stream's watershed contains primarily mixed conifer forest type in the higher elevations and ponderosa pine/piñyon-juniper at the lower elevations and is approximately 90 square miles in size.

A search of district survey records indicate that Willow Creek was visually surveyed in 1997 by Lopez et al. (1999). Five reaches were visually surveyed from June to September. Approximately 4 miles of upper Willow Creek occur within the project area. Reaches in the project area include: upper 0.25 mile of reach 3 and all of reaches 4 and 5. These sections of stream area predominately dry with isolated pools. Reaches also included in the analysis area include reach 3 and the upper section of reach 2 (to include the uppermost section of reach 2 downstream to 3 miles below Wiggins Crossing).

Bear Canyon Creek

No habitat surveys are available for the approximate 4 total miles of this drainage. In February 2006, the Springerville Ranger District fisheries biologist conducted a field review of this drainage within the project area from Bear Canyon Lake Dam downstream to the project

boundary. The upper portion of this drainage was perennial due to dam seepage. Surface flow is dependent upon seasonal spills over Bear Canyon Lake Dam and year-round dam seepage to provide for streamflow. Vegetative bank cover was noted as insufficient to protect banks in sections of this reach. The channel was notably incised with little to no flood plain below the dam. The road on the west side of the channel below the dam was bermed and appeared to be unused. The road continued across the drainage and up the dam face and was channelizing flow off of the dam face directly into the creek. This section of stream adjacent to the road had raw banks that appeared to be recovering. Immediately below the dam was some PVC pipe litter strewn about the channel, likely from a dam maintenance project that was not completed at time of survey.

Species documented since 1991 include: Little Colorado sucker, cutthroat trout, rainbow trout, brook trout, speckled dace, arctic grayling, and bluehead sucker. AGFD management emphasis for this drainage is for native species and the desired fish species assemblage includes: speckled dace, bluehead sucker, and Little Colorado sucker (Young et al., 2001).

Canyon Creek and Tributaries

An estimated 15 miles of upper headwater drainages to the Canyon Creek system occurs within the project area. Tributaries include Mule Creek, East Fork Canyon Creek, and other unnamed tributaries to the Canyon Creek drainage. Within the anticipated analysis area, the sections of Canyon Creek off of the forest occur on the Tonto National Forest and Fort Apache Indian Reservation. Canyon Creek and its tributary, Mule Creek, are the only perennial drainages in the upper Canyon Creek watershed; other drainages are intermittent. It should be noted that this watershed was affected by extreme wildfire during the Rodeo-Chediski Wildfire in 2002. Burn severity ranged from unburned to severely burned areas.

Upper Canyon Creek watershed was severely impacted with approximately 84 percent of steep slopes at the upper end of Canyon Creek and Mule Creek burned at moderate (27 percent) or high (57 percent) severity levels (USFS 2003). Both drainages had severe sedimentation and debris flows during the subsequent monsoon season following the fire and are likely still experiencing high sedimentation levels. No habitat surveys are available for these drainages in the analysis area.

Upper Tonto Creek and Tributaries

This drainage includes headwater drainages to these systems on southern portion of the project area just above the rim: Christopher Creek, Hunter Creek, and Gordon Canyon. These drainages are tributaries to Tonto Creek on the Tonto National Forest. Less than 5 miles of upper headwater drainages to this system occurs within the project area. No habitat surveys are available for these drainages in the analysis area.

Chevelon Canyon Lake

This lake is not in the project area, but does occur in analysis area. This 200-acre cold water reservoir receives relatively high angler use and is managed by AGFD as a Blue Ribbon Fishery for rainbow trout and also as a wild brown trout fishery. Stocking regime includes stocking of 50,000 to 100,000 rainbow trout fingerlings annually. Other species currently present include Little Colorado sucker AGFD management emphasis for this lake is for sportfish and the desired

fish species assemblage includes: rainbow trout, brown trout, and Little Colorado sucker (Young et al., 2001).

Bear Canyon Lake

This lake is in the project area. Species detected since 1991 include cutthroat trout, brown trout, arctic grayling, and rainbow trout (Young et al., 2001). Current species assemblage is thought to be limited to rainbow trout and fathead minnow (Mike Lopez, AGFD, personal communication 2006). AGFD management emphasis for this lake is for sportfish and the desired fish species assemblage includes: rainbow trout and arctic grayling (Young et al., 2001).

Woods Canyon Lake

This lake is in the project area. This 52-acre cold water reservoir receives relatively high angler use and is managed by AGFD as a rainbow trout fishery. Stocking regime includes annual stocking of 75,000 rainbow trout. Other species currently present include both brook and brown trout, possibly golden shiner (Young et al., 2001), and fathead minnows (Mike Lopez, AGFD, personal communication 2006). AGFD management emphasis for this lake is for sportfish and the desired fish species assemblage includes rainbow trout (Young et al., 2001).

Willow Springs Lake

This lake is in the project area. This 158-acre cold water reservoir receives relatively high angler use and is managed by AGFD as a rainbow trout fishery. Stocking regime includes annual stocking of 50,000 to 100,000+ catchable and subcatchable rainbow trout. Other species currently present include largemouth bass, brook trout, brown trout (Young et al., 2001), smallmouth bass, green sunfish, and fathead minnow (Mike Lopez, AGFD, personal communication 2006). AGFD management emphasis for this lake is for sportfish and the desired fish species assemblage includes: rainbow trout (Young et al., 2001).

Method Used to Perform Cumulative Effects Analysis for Aquatic Species

The spatial and temporal bounds utilized for disclosing cumulative effects are described in the “Watershed, Water Quality, Soils, Riparian, Noxious Weeds” section.

Environmental Effects

Alternative A

In the long term (5+ years after treatment), this project would not reduce fire hazard. An elevated risk to aquatic MIS species would remain from unnatural fire effects in the watershed. This alternative does not change the FRCC rating from 100 percent FRCC 3 existing condition. Retention of FRCC 3 keeps the fire hazard threat high in the project area. Wildfire effects on aquatic habitats include altering water quality through short-term inputs of sediment and ash as surface runoff increases post fire. Increased runoff can also affect stream morphology by unnaturally elevating peak runoffs that may excessively scour and abruptly reshape channels. Since attaining class 1 ratings are desired for the ponderosa pine and mixed conifer vegetation types in the project area to maintain fire regimes within historical range and diminish fire severity, this alternative is the least desirable as compared to alternatives B and C, in limiting potential for unnaturally intense wildfire.

Alternative B

Riparian condition, which includes streambank (or lakeside) soil and vegetative stability should not be significantly affected with implementation of the proposed action. Of the 105 miles of streams in the project area, less than 10 miles are perennial. These perennial stream segments and lake perimeters have the most restrictive BMPs, which generally allow for no mechanical treatments and a low intensity prescribed fire prescription.

Any potential effects to riparian vegetation would be short term, allowing for sufficient vegetative recovery by the next growing season, and provide for streambank protection and cover in the long term. Best management practices, including SMZ guidelines, would be implemented to retain the integrity of riparian habitats in all perennial drainages within the project area.

Any potential changes to riparian habitats at the project level are not expected to be significant either in quantity or quality, and should not alter forestwide riparian habitat trends which were estimated to be downward. Any potential effects to riparian vegetation would be short term and not measureable in its affects across the landscape. Of the 1,000 perennial stream miles found forestwide, less than 10 miles are found in the project area. Of the 25 lakes across the forest, the Rim Lakes Project area contains 3. That represents <1 percent of perennial streams and 12 percent of perennial lakes on the forests.

In the long term (5+ years after treatment), this project would be beneficial to riparian habitats with the reduction in fire hazard, resulting in decreased risk to MIS from unnatural fire effects in the watershed.

Alternative C is similar except the effectiveness and duration of the benefits of vegetation treatments would be smaller.

Cumulative Effects to Aquatic Macroinvertebrates

Alternative A

There would be no cumulative effects from this “no action” alternative.

Alternatives B/C

Occupied habitats and potential/suitable habitats for aquatic macroinvertebrates are present in the analysis area and are affected by past, present, or future foreseeable management activities or natural events that have occurred, or are currently occurring in the analysis area. All watersheds in the analysis area may have some perennial habitats within them, but Upper Willow Creek and Chevelon Creek Headwaters contain the most. As disclosed in the “General Aquatic Species Effects” section, past and future foreseeable disturbances include timber harvest activities, road and trail construction/maintenance, and areas affected by wildfire. As also disclosed, the EDAs calculated range from 10.5 percent to 17.8 percent post treatment. Canyon Creek Headwaters (15.5 percent, Chevelon Creek Headwaters (16.7 percent) and Christopher Creek (17.8 percent) all rate above the 15 percent threshold. However, the assumption within the EDA effects analysis was that all treatments would occur in 1 year and these percentages reflect that assumption. In actuality, treatments including thinning and burning and other associated disturbance activities such as road reconstruction would occur over a 10-year period, and EDA levels are expected to be less than disclosed in the analysis.

Furthermore, site-specific BMPs, which include staging of treatments combined with treatment refinements would result in an EDA below 15 percent for the three watersheds of concern.

Over both short-term (<5 years after treatment) and long-term (5+ years after treatment) timeframes, maintenance of above natural levels of sedimentation would likely occur with implementation of the proposed action, continuation of the ongoing ground-disturbing actions not considered in the EDA analysis, as well as those additional past and future foreseeable activities evaluated in the EDA analysis.

Cumulatively, the described actions can indirectly affect aquatic macroinvertebrates by reducing available habitat and by contributing to substrate embeddedness. Continual sediment inputs from ongoing activities would persist, but sedimentation effects are not expected to be at a level to extensively affect the suitability of habitats for continued occupancy. Flow storage in area reservoirs would continue to limit the total available habitat downstream and alter the natural hydrograph of each affected stream. Reservoir impoundments would continue to measurably affect the total amount of available habitat downstream and alter how each system distributes its sediment load.

Determination of Effects

Alternative A: Forestwide trends in macroinvertebrate populations are estimated to be downward on 70 percent of the cold water streams on the forests. Based upon the "no action" project effects to the forestwide trend for riparian habitat, implementation of alternative A would contribute no effect to the forestwide aquatic macroinvertebrate population trend, although an elevated risk for wildfire impacts to riparian habitats would continue.

Alternative B: Based upon the anticipated project effect to the forestwide trend for riparian habitat, implementation of alternative B would contribute no effect to the forestwide aquatic macroinvertebrate population trend, although this alternative is more desirable than alternatives A and C, in limiting potential for unnaturally intense wildfire.

Alternative C: Based upon the anticipated project effect to the forestwide trend for riparian habitat, implementation of alternative C would contribute no effect to the forestwide aquatic macroinvertebrate population trend. Alterative C is more desirable than alternative A in limiting potential for unnaturally intense wildfire, but less desirable than alternative B which creates 54 percent FRCC class 1.

Consistency with the Apache-Sitgreaves National Forests Land and Resource Management Plan

The forest plan provides for specific goals, objectives, standards, and guidelines for management activities on the Apache-Sitgreaves National Forests. Based on a review of the forest plan and the proposed alternatives, implementation of any of the alternatives proposed would be consistent with the "Apache-Sitgreaves National Forests Land and Resource Management Plan" regarding aquatic species requirements.

Wildlife Effects of the Forest Plan Amendments

The effects to wildlife of the amendment proposed in alternative B are described in the "Wildlife" sections above. As noted, this amendment would result in more openness as well as "groupy-

clumpy" habitat that favors the northern goshawk and its prey, many of which are also management indicator species for the forest. Similarly, effects of the amendment proposed in alternative C are described with the effects descriptions of alternative C. Favoring even-aged management would mean a benefit to some wildlife species that is shorter lived than that allowed with uneven-aged management systems. Species such as goshawk would be impacted long term by the loss of structural stage development because this alternative would remove much of the young trees in order to achieve density objectives.

Watershed, Water Quality, Soils, Riparian, Noxious Weeds

This section is a summary of the key effects and conclusions from the watershed specialist report (Nelson 2011) located in the project record. The report includes best management practices and mitigation measures designed to protect water quality and watershed values (appendix B of this EIS).

Analysis Area

The project area is contained within hydrologic units of varying orders of size as defined by the United States Geological Survey and delineated by Federal agencies including the U.S. Forest Service. These hydrologic units (HUCs) have been assigned code numbers ranging from two to eight digits reflecting the intensity of delineation. A "1st code" hydrologic unit is the broadest delineation and employs a two digit HUC. First code HUCs are progressively subdivided into "second," "third," and "fourth code" hydrologic units.

The Rim Lakes Forest Restoration Project (Rim Lakes Project) is within four Fifth Code watersheds and eleven 6th HUC watersheds. The project is approximately 33,548 acres in size. See table 78 for a summary of watershed acreage within the Rim Lakes Forest Restoration Project. There are 24 acres within this project area that are privately owned.

Table 77. Summary of soil and water effect by alternative

Resource	Alternative A	Alternative B	Alternative C
Upland Soils	No change – soil condition satisfactory except in riparian areas.	Satisfactory soil condition maintained and may improve in riparian areas.	
		Some short term soil loss and soil compaction expected. Monitor SDC during treatment to ensure soil impacts stay within soil condition guidelines.	
	Coarse woody debris meets soil quality guidelines.		
Riparian Area and Stream Channel Condition	No riparian enhancement.	Reduces canopy in riparian areas to allow for improved vegetation condition	
Riparian Area and Stream Channel Condition	Increased potential for uncharacteristic crown fire and accompanying increase in riparian and channel degradation.	Reduces potential for uncharacteristic crown fire and associated affects to riparian areas.	Reduces potential for uncharacteristic crown fire and associated affects to riparian areas. Shorter duration benefits.

Resource	Alternative A	Alternative B	Alternative C
		Mitigation of timing and treatments reduce risk of damaging streamflows caused by treatments in short term (CWE).	
Water Quality and Quantity	No change from current. Water quality and stream condition on slow upward trend from past activities (grazing, roads).	Creates a greater vegetative grass component than alternative A and alternative C, thereby improving retention, storage, and filtering functions. SMZs and BMPs provide protection from sediment to riparian and stream channels.	Similar to alternative B. however vegetative grass component transitions fewer acres and is shorter lived than B.
		Opportunity to increase long term water yield.	
Roads		Potential for improved road conditions within project area.	
Cumulative Effects (EDA)	No cumulative effects	No measureable cumulative effects as BMPs for timing and other mitigation are implemented.	
FRCC and Return to Stable Historic Conditions	Much of the area has low forage production due to 100 percent conifer needle litter layer.	Decreases in canopy closure and stand densities result in shift to herbaceous understory.	
		FRCC 1 on 54% of project area. Openings last for up to 30 years	FRCC 1 on up to 14% of project area for a more limited time (up to 15 years).

Table 78. Watershed classifications: fifth and sixth code watersheds

Fifth Code HUC Name	Sixth Code HUC	Watershed Acres	Project Area Acres	Proportional Extent (percent)
Canyon Creek		203,228	6,161	3
	Canyon Creek Headwaters	19,016	6,161	32
Haigler Creek-Tonto Creek		143,378	4,981	3
	Christopher Creek	18,773	2,057	11
	Concord Canyon/ Naegelin	14,630	106	1
	Haigler Creek/ Gordon	18,505	2,080	11
	Tonto Creek Headwaters	17,252	737	4
Upper Chevelon Canyon		173,901	15,895	9
	Alder Creek	15,629	233	1
	Chevelon Creek Headwaters	19,226	15,004	78
	Chevelon Creek/ Long Tom/ Horse Trap	18,695	436	2
	Upper West Chevelon Canyon	16,722	222	1
Upper Clear Creek		203,012	6,511	3
	Middle Willow Creek	20,154	2	<0.01

Fifth Code HUC Name	Sixth Code HUC	Watershed Acres	Project Area Acres	Proportional Extent (percent)
	Upper Willow Creek	21,993	6,509	30
Total			33,548	

Roads

Road mileage by watershed is given in table 79. Watersheds Upper Willow Creek/Gentry (232 miles) and Middle Willow Creek (155 miles) have the most road miles of watersheds analyzed. The least road miles amongst watersheds are found in Haigler Creek/Gordon (57 miles) and Tonto Creek Headwaters (53 miles).

Table 79. Road mileage by watershed and project area

Sixth Code Watershed	Watershed Road Miles	Project Area Road Miles	Proportional Extent (percent)
Alder Creek	89	2.0	2.2
Canyon Creek Headwaters	102	33.6	33.0
Chevelon Creek Headwaters/ Woods/Willow Springs	142	118.8	83.6
Chevelon Creek/Long Tom/ Horse Trap	103	4.8	4.7
Christopher Creek	80	23.9	29.8
Concord Canyon/Naegelin	68	1.4	2.0
Haigler Creek/Gordon	57	16.9	29.8
Middle Willow Creek	155	0.4	0.3
Tonto Creek Headwaters	53	7.4	14.0
Upper West Chevelon Canyon	88	2.9	3.3
Upper Willow Creek	232	71.0	30.7
Totals	1,010	283.2	28.0

Table 80. Roads and stream density (miles per square mile area) by watershed and project area

Sixth Code Watershed	Watershed Stream Density	Project Area Stream Density	Watershed Road Density	Project Area Road Density
Alder Creek	2.33	0.61	3.65	5.42
Canyon Creek Headwaters	1.81	1.30	3.42	3.49
Chevelon Creek Headwaters/ Woods/Willow Springs	2.57	2.62	4.73	5.07
Chevelon Creek/Long Tom/ Horse Trap	2.15	0	3.52	7.11
Christopher Creek	3.03	0.17	2.73	7.43
Concord Canyon/Naegelin	2.31	0	2.99	8.30

Sixth Code Watershed	Watershed Stream Density	Project Area Stream Density	Watershed Road Density	Project Area Road Density
Haigler Creek/Gordon	3.02	1.38	1.96	5.20
Middle Willow Creek	2.48	0	4.94	1.33
Tonto Creek Headwaters	2.19	0	1.96	6.39
Upper West Chevelon Canyon	2.31	2.60	3.36	8.39
Upper Willow Creek/Gentry	2.34	2.44	6.74	6.99
Totals	2.40	2.00	2.97	5.40

Stream density (miles per square mile) is a measure of drainage efficiency of a watershed. A watershed with a higher stream density more effectively drains water and sediment from headwater to higher order streams.

Road density is an indicator of existing watershed effects because it takes into account the size of a watershed when examining road miles. Table 80 displays a comparison of both stream and road density per watershed in the project area.

Christopher Creek and Haigler Creek/Gordon have the highest stream densities at 3.03 and 3.02, respectively. This suggests an ability to effectively transport sediments to higher order streams during rain and runoff events. Canyon Creek Headwaters and Chevelon Creek/Long Tom/Horse Trap have the lowest stream densities at 1.81 and 2.15, respectively.

The watersheds with the highest road densities are Upper Willow Creek/Gentry at 6.74 and Middle Willow Creek at 4.94. This means that Upper Willow Creek/Gentry has almost three times the length of road than naturally occurring stream channels. This suggests that the drainage network in Upper Willow Creek/Gentry has been extended as roads essentially act as stream channels, being conduits for sediment and capturing water from both snowmelt runoff and rain events. These roads additionally act as sediment sources in many of these watersheds.

The watersheds with the lowest road densities are Haigler Creek/Gordon and Tonto Creek Headwaters, both at 1.96. It should be noted that Christopher Creek, Haigler Creek/Gordon, and Tonto Creek Headwaters are the only watersheds with higher stream than road densities. The high road-to-stream density ratio in most of these watersheds suggests higher runoff rates and induced sediment inputs.

Project area road density for all watersheds is greater than watershed area road density. This suggests that roads are concentrated more heavily within the project area boundary than in the remainder of the watersheds. The project area has more roads because it contains proportionally fewer steep slopes.

Environmental Effects from Roads

No new system roads are proposed for construction in any alternative. Therefore, forestwide road density would not change. Alternatives B and C include opening and minor maintenance of about 186 miles of maintenance level 1 (ML1), which are closed roads. This amounts to about 64 percent of the miles of ML 1 roads that are available for use. All ML1 would be closed when the mechanical fuel treatment is completed. Construction of 2.6 miles of temporary roads are

proposed in both alternatives and they would be decommissioned after completion of treatments. The short-term impacts to water quality from sediment from roads opened during harvest operations are mitigated by best management practices (BMPs). BMP monitoring across the forests shows that BMPs are effective in preventing sediment from reaching streams when strictly followed.

Considering use of BMPs, water quality is not expected to change from existing conditions with implementation of alternative B or C from road impacts. Implications of road densities are included in the watershed cumulative effects section. Mitgation measures are found in appendix B and are based in part on road densities as calculated for equivalent disturbed area (EDA).

Soils

Soil condition is generally satisfactory throughout the planning area. Gully erosion and accelerated soil loss is occurring along a few open and closed roads where road drainage structures are not functioning or absent. Ground cover conditions are generally improving within these areas, but are still a source of sediment to streams. Existing soil and watershed conditions were assessed using the "Terrestrial Ecosystem Survey of the Apache-Sitgreaves National Forests" (TES) (Lainge et al., 1987) in conjunction with field observations taken in 2006 and 2009.

Region 3 Soil Condition Guidelines (FSH 2509.18) indicate when soil impairment begins. These are not standards, but indicators of where management change may need to occur. A qualitative analysis of the effects of implementing ground treatments would affect soil resources using the guidance shown in table 81.

Table 82 describes the terrestrial ecosystem unit inventory mapping units and selected interpretations.

Table 81. Soil condition guidelines for selected indicators of soil hydrologic function*

Index	Satisfactory	Impaired	Unsatisfactory
Bulk Density*	Slight Increase (1–5%)	Moderate Increase	
(5–15%)	Significant Increase (>15%)		
Infiltration*	Slight Decrease (1–10%)	Moderate Decrease	
(10–50%)	Significant Decrease		
(>50%)			
Penetration Resistance*	Slight Increase (1–10%)	Moderate Increase (10–50%)	Significant Increase (>50%)
Aerial Extent	Slight Disturbance		
(1–5 percent)	Moderate Disturbance		
(5–20 percent)	Significant Disturbance		
(>20 percent)			

*Excerpt from R3 Supplement FSH 2509.18

Table 82. Terrestrial ecosystem unit survey (TES), proportional extent, characteristics, and management implications*

TES Map Unit	Acres by Map Unit	Soil Classification (Family)	Vegetation Taxonomic Unit	MU Slope Class	Soil Condition Rating	Soil Erosion Hazard
192	896	Udic Haplustalfs, LSC 5, 0, fine, mixed, h. ppt. Udic Haplustalfs, clayey-skeletal, LSC 5, 0, mixed, h. ppt.	Pipos/Quga Pipos/Quga	16–40	Satisfactory Satisfactory	Severe Moderate
193	1,964	Udic Haplustalfs, LSC 5, 0, fine, mixed, h.ppt Lithic Haplustalfs, LSC 5, 0, clayey, mixed, h. ppt.	Pipos/Quga Pipos/Quga	0–15	Satisfactory Satisfactory	Slight Slight
196	151	Udic Haplustalfs, LSC 5, 0, fine, mixed, h. ppt	Pipos/Quga	0–15	Satisfactory	Slight
197	13,833	Udic Haplustalfs, LSC 5, 0, clayey-skeletal, mixed Lithic Haplustalfs, LSC 5, 0, clayey-skeletal, mixed	Pipos/Quga Pipos/Quga	0–15	Satisfactory Satisfactory	Slight Slight
199	374	Udic Haplustalfs, LSC 5, 0, fine, mixed	Pipos/Quga	16–40	Satisfactory	Severe
201	1,986	Typic Hapludalfs, LSC 6, 0, fine, mixed Typic Hapludalfs, LSC 6, 0, clayey-skeletal, mixed	Abco/Psmeg/Pipos /Pist Abco/Psmeg/Pipos/ Pist	0–15	Satisfactory Satisfactory	Slight Slight
202	333	Typic Hapludalfs, LSC 6, 0, fine, mixed Typic Hapludalfs, LSC 6, 0, clayey-skeletal, mixed	Abco/Psmeg/Pipos /Pist Abco/Psmeg/Pipos/ Pist	16–40	Satisfactory Satisfactory	Severe Severe
203	887	Typic Hapludalfs, LSC 6, 0, fine, mixed	Abco/Psmeg/Pipos /Pist	16–40	Satisfactory	Severe
206	1,001	Udic Ustochrepts LSC 6 Typic Ustochrepts, LSC 5	Abco/Psmeg/Pipos /Pist Pipos/Quga	41–120	Satisfactory Satisfactory	Severe Severe
207	841	Lithic Dystrochrepts, LSC 6, 0, loamy-skeletal, mixed, frigid Typic Hapludalfs, LSC 6, 0, loamy-skeletal mixed	Abco/Psmeg/Pipos /Pist Abco/Psmeg/Pipos/ Pist	0–15	Satisfactory Satisfactory	Slight Slight
208	166	Cumulic Udic Haplustolls,LSC 6,0, fine-loamy, mixed Cumulic Haplsutolls, LSC 5, 0, mixed	Popr Popr	0–5%	Impaired Impaired	Slight Slight

* From "Terrestrial Ecosystem Survey Report for the Apache-Sitgreaves National Forests" (1987)

Effects to Soils

Alternative A

The existing conditions and trends of upland soils would continue under this alternative. Organic soil carbon would accumulate at potential rates. Soil fertility would slowly improve commensurate with the accumulation of organic carbon. Where ground cover is well developed and intact, infiltration rates would be near potential as surface runoff is minimized. Erosion would remain a concern in those areas recovering from past disturbance, both natural and anthropogenic, but should reduce as ground cover is reestablished.

This alternative would not affect soil condition directly. However, because alternative A would retain the 100 percent of acreage in FRCC 3 land within the project area, conditions remain so a greater extent of area under ponderosa pine and mixed conifer stands would likely experience moderate to high soil burn severity in a wildfire. The loss of canopy cover, ground cover, and organic debris on the soil surface, together with the possible occurrence of hydrophobic soil layers in these areas and instances, would likely lead to dramatic increases in soil erosion and loss of soil organic matter and soil fertility. More erodible soils would likely reach soil erosion rates that result in loss of productivity.

Soils in grasslands would probably not be affected to the same degree since burn severities would likely be lower. Wildfire in these areas may also tend to stimulate more vigorous growth of grass and forb vegetation leading to overall improvements in ground cover.

Alternative B

Alternative B would not have long-term impacts to soil productivity with implementation and monitoring of mitigating BMPs as prescribed in appendix B. Short-term increases in soil loss are expected, but are minimized through prescribed BMPs for logging activities that have shown to be effective (ASNFs 2007, 2010).

A recent administrative study of soil disturbances by logging equipment implementing treatments similar to those proposed in alternative B (and C) (Sitko and Hurteau 2010) was initiated in 2007 to help the forest determine initial soil compaction or soil bulk density and resistance to penetration from fuel reduction treatments near Greer, Arizona.

Correlations between soil disturbance classes (SDC) as described in “Forest Soil Disturbance Monitoring Protocol” (Page-Dumroese, et al., 2009) and change in soil condition (R3 Supplement FSH 2509.18) due to compaction were established in this study. In the study, 81 percent of the area showed no reductions in soil condition class. However, 19 percent were either impaired or unsatisfactory. Based on this initial study, reductions in soil condition were detected in SDC 2 and 3, but no reductions in soil quality were detected in SDC 0 and 1. The Greer study showed that soil condition was impacted in severity class 2 and 3.

Table 83 shows an example of the visual indicators and management activities that may be found with the proposed thinning treatments. For more information, see the soil disturbance monitoring protocol in the project record.

Table 83. Example of soil visual indicators of soil disturbance and management activities*

Disturbance Type	Severity Class

	0	1	2	3
Past operation	None	Dispersed	Faint	Obvious
Wheel tracks or depressions	None	Faint wheel tracks or slight depressions evident (<5cm deep)	Wheel tracks or depressions are >5 cm deep.	Wheel tracks or depressions highly evident with a depth being >10 cm.
Equipment trails from more than 2 passes	None	Faintly evident	Evident, but not heavily trafficked.	Main trails that are heavily used.
Excavated and bladed trails	None	None	None	Present

* From Page-Dumroese, et al., 2009, "Forest Soil Disturbance Monitoring Protocol."

Other Western U.S. studies (Page-Dumroese, et al., 2006 and 2009) (ERI, 2003) also describe initial effects of thinning operations and report that once compacted, soil bulk density may take many years to recover to pretreatment conditions. Therefore, methods to limit initial compaction are most desirable and effective. BMPs prescribed in appendix B are effective in helping limit the extent and number of trips of the machinery or the compacting force, avoiding the times of year or soil moisture conditions that are more susceptible to compaction, and avoiding the soils most susceptible to damage provide the best defense to loss of soil productivity.

Where mechanical harvesting/thinning is practiced, short-term increases in erosion related to ground cover disturbance are minimized by BMPs (appendix B) that retain slash and limit disturbance and soil displacement. Subsequent slash disposal activities would extend the time of or temporarily reinitiate ground cover disturbance and its related erosion.

Finer textured soils and soils without high rock fragment content would have more potential for compaction. Implementation of BMPs that restrict mechanized treatment activities during periods of wet soil conditions would avoid serious compaction issues in most of the upland soils. In areas with extensive development of biotic soil crusts, mechanical harvesting would also cause a short-term increase in erosion as the soil crust is disturbed. This impact can be reduced to some extent by limiting mechanical entry to times when biotic soil crusts are least susceptible to disruption (such as very dry periods).

Long term positive effects would occur in areas where production of grass cover is stimulated by prescribed burning and by opening of the canopy cover through thinning operations. This effect would be most visible in grassland restoration treatments and in open areas where group selection cuts are made. Increases in ground cover where slash is lopped and scattered would also lead to positive impacts on soil fertility as well as a quick reduction of erosion from harvest activities.

An objective of the Rim Lakes Project is to reduce the occurrence of hazardous fuels—both standing and on the forest floor. Reducing these categories of hazardous fuels necessarily leads to a lower input of organic soil carbon to the soil layers. However, implementation of Region 3 guidelines to leave needed levels of large organic material on the forest floor, both in thinning and prescribed burning operations, should maintain current soil fertility levels in the long term. Prescribed fires can reduce the level of organic debris available for soil fertility maintenance, particularly where they reach moderate to high severity levels.

Although prescribed fires can limit the severity of the impact to soil resources, a complete elimination of potential impacts is not possible. Where both mechanical and prescribed fire occur on the same land, the activities must be coordinated such that the minimum levels of residual coarse woody debris identified in the BMPs would remain (except in areas where risk to human life and property from wildfire is high).

Since the severity of subsequent wildfires would likely be reduced by implementation of the proposed action, the area that would likely experience moderate to high soil burn severity in a wildfire is reduced significantly. With uncharacteristic wildfire, the loss of canopy cover, ground cover, and organic debris on the soil surface, together with the possible occurrence of hydrophobic soil layers in these areas and instances, would likely lead to dramatic increases in soil erosion and loss of soil organic matter and soil fertility.

No long-term effects to soil productivity are expected with implementation of this alternative with the implementation of soil and water conservation practices (or BMPs).

Alternative C

The effects of implementation for upland soils described above in alternative C are similar to the effects of implementation in alternative B. However, alternative C moves only 14 percent of the project area to FRCC 1.

Due to the small size of created openings and the current spacing of trees greater than 16 inches d.b.h., most treated areas under alternative C would eventually develop interlocking or nearly interlocking crowns within a relatively short timespan following this treatment (10 to 15 years), based on resulting density and average growth rates (Ronco et al., 1985) (Nicolet 2011).

Water Quality

The recent State of Arizona Department of Environmental Quality (ADEQ) biannual report on the status of surface water quality (ADEQ 2009) which lists impaired and nonattaining water bodies for the state along with management recommendations for improvements was used in assessing the potential impacts from proposed activities. ADEQ recently released the latest integrated 305(b) assessment and 303(d) listing report in conjunction with the EPA. This assessment on streams and lakes is categorized as meeting all designated uses, impaired, inconclusive, or attaining some uses (ADEQ, 2009). Examples of designated uses include aquatic and wildlife (cold), full body contact, drinking water standards, etc.

One water body in the examined area was listed in the current ADEQ report. Bear Canyon Lake is a 55-acre lake in the Upper Willow Creek watershed. This lake is listed as category 5 – impaired. The ADEQ has placed the lake on its planning list used to prioritize future monitoring due to low dissolved oxygen, chronic selenium exceedance, and missing core parameters: *Escherichia coli* and dissolved metals (copper, cadmium, and zinc). This lake is also listed on the 303(d) List by the EPA for exceedance on pH measurements. This implies a potential chronic sediment problem with Bear Canyon Lake, and measures for sediment reduction should take place when planning activities around the headwaters of Bear Canyon Lake.

Environmental Effects

Alternative A

This alternative is not anticipated to produce any changes to existing water quality trends in the streams, springs, and surface water bodies in or downstream of the project area. Open roads and any "closed" roads still being used for motorized travel would continue to discharge runoff and sediment to project area streams, especially where the roads are poorly located in stream bottoms, have inadequate drainage structures, and are hydrologically connected to the stream network.

This alternative would not provide for reduced vegetative conditions that are more resistant to uncharacteristic wildfire. This alternative would retain 100 percent of acres in FRCC 3 and move none of those acres toward a higher FRCC (1 or 2). Therefore, the likely effects to water quality and quantity in the case of wildfires resulting in high soil burn severity are well documented and result in heavy sediment and ash inputs to streams, as well as increased risk of damaging flows to streams, riparian areas, and downstream structures. It is likely that under any condition, a wildfire entering these untreated watersheds under alternative A would have considerably greater impacts to water quality and channel stability than wildfire occurring after implementation of alternative B or C.

This alternative would not improve—or improve slowly—water quality. Water quantity would continue to decline as overstory conditions close even more than current conditions.

Alternative B

Principal water quality impacts of the actions proposed in this alternative would include increased short-term inputs of ash and sediment to stream channels and impoundments in the project area and, to a lesser extent, downstream of the area. Implementation of BMPs (especially those that focus on streamside management zones or SMZs) would retain the filtering capacity of SMZs and so minimize this ash input to streams. SMZs combined with burn prescriptions that reduce severity of burns keep the input of ash to levels that cannot be measured.

The principal source of increased sediment to streams would likely be reopened or improved roads in the project area. Level 1 roads that are reopened would be closed again after the project objectives have been completed in the area. Thus, the sediment generated on their surfaces would likely decrease over time. However, it is likely that chronic sediment inputs to area streams would increase since it may be necessary to upgrade roads and increase the size and number of landings to accommodate chip vans or other equipment used for treatments.

A second source of increased sediment input to streams would be from areas where ground cover has been reduced or eliminated due to harvest, thinning, and prescribed fire activities. Skid trail locations are not generally designated prior to harvest and have the potential to compact and expose bare mineral soils to erosive agents.

The mechanical harvesting techniques proposed for some areas of this project, such as the use of feller-bunchers, can reduce the degree of soil gouging with positive benefits to preventing soil erosion. However, they still tend to disturb existing ground cover and expose bare mineral soils and do so over higher percentages of the treatment area than conventional logging activities.

BMPs would be implemented to maintain the sediment filtering capacity of streamside buffer strips. It is particularly important that the filtering capacity of the strips be maintained during the

periods when adjacent side slopes are in a disturbed situation (i.e., ground cover reduced by management activity). Specific BMPs for streamside management zones are included in appendix B. Implementation of BMPs designed to protect water quality is effective in preventing long-term deterioration of water quality from sediment.

Sediment is a potential source of further reducing the pH and could be derived from treatment and road activities within the Bear Canyon Lake watershed. Sediment delivery would be mitigated by implementation of project BMPs under alternative B or C. Streams within the watershed are designated on the streamside buffer map and are identified as needing site-specific restrictions. Further monitoring by the ADEQ has been identified as a need for characterizing water quality in Bear Canyon Lake. Until a total maximum daily load analysis has been completed, it is unknown whether the water quality standards that have not been met are a result of natural conditions or anthropogenic activities. The objective of the study is to determine the sources of impairment and to recommend remediation if necessary. BMPs would be implemented to prevent this project from contributing to that condition.

Fuel reduction treatments in forested watersheds would probably have long term detectable increases in water yields either onsite or downstream (Brewer 2008, Bosch and Hewlet 1982, Hornbeck and others 1997, Troendle and others 2003, 2007). Prescriptions that cover most of the project area are likely to remove greater than 20 percent of basal area that is needed to generate a detectable change in flow. Twenty percent of the treatments prescribed in alternative B are regeneration cuts with very small patches and groups, which allow more snow collection in openings, resulting in more potential onsite water storage and yield. The hydrologic effect would be that the area would provide longer periods of flow in intermittent streams within and downstream of the project area.

Bosch and Hewlet (1982) concluded and subsequent data (Hornbeck and others 1997) and modeling (Troendleand and others 2003, 2007) support that removing less than 20 percent of the basal area may also result in a change in flow, but this change would not be detectable. In cases where there is a detectable hydrologic response to fuel management treatments, the observed response would be greatest in wet years and smallest or nondetectable in dry years. Prescribed fires, when designed and used as a fuel reduction tool alone, are probably less likely to influence water yield than mechanical treatments or burning with mechanical treatments because of the smaller reduction in basal area and lack of ground disturbance by heavy machinery.

Measures taken to reduce the potential impact of increased peak flows and runoff are described in the following “Cumulative Watershed Effects Analysis” section.

Alternative B would have the highest herbaceous understory response and greatest understory plant diversity. This increase in a vegetative grass component would improve the ability of watershed to intercept and retain water inputs (precipitation and snowmelt).

Alternative C

The conditions and trends for water quality and quantity described under the existing conditions would continue under this alternative. Both alternative B and alternative C reduce canopy coverage and disturbed soil to an equivalent level. This alternative, however, is not expected to maintain open canopy cover conditions as long as alternative B. The effects of mechanical treatments would provide increases to water yield similar to alternative B, however, they would be much shorter lived, as forest canopies are expected to close much faster, as soon as 15 years

and only 14 percent of the area is expected to return to historic open conditions where periodic fire can maintain the open conditions. Regeneration cuts with small patches are not prescribed in alternative C and would probably result in less water yield increase as well.

Expected increases in forage production and basal area ground cover would diminish quickly over time. Alternative C would have less understory plant diversity than alternative B, but greater than alternative A. The diameter limit leaves more trees in the upper canopy resulting in a slightly lower production of herbaceous understory than alternative B. Understory production would be of short duration as the canopy would close in within 15 years.

Riparian/Stream Condition

A Hydro Science report (Haynes 1993) explored the conditions of the Upper Willow Creek and Middle Willow Creek watersheds. This report found the upland conditions to be acceptable, but stream reaches in the upper and middle portions of the Upper Willow Creek watershed as well as the main stem of Willow Creek were evaluated to have unacceptable conditions with active gully erosion. Hydro Science attributed the declining riparian area condition to historic overgrazing. They found that timber harvests have done little to degrade riparian areas.

Riparian areas were assessed in 1998 and 1999 within the project area using proper functioning condition (PFC) surveys (Pritchard et al., 1993). This survey technique is used throughout the Western United States by the U.S. Forest Service and Bureau of Land Management to assess conditions of riparian areas. The protocol for this qualitative survey technique requires professional judgment by a team of resource specialists on 17 items. The result of this survey is a riparian reach that is either in proper functioning condition (PFC), functioning at risk (FAR), or nonfunctional (NF).

A summary of these results by sixth code watershed is displayed in table 84. Of the 36.3 miles of stream surveyed, 5.9 miles were rated as proper functioning condition (satisfactory), 4.1 miles were determined to be nonriparian, and the remaining 26.3 miles were unsatisfactory, rated as either functional at risk (22.5 miles) or nonfunctional (3.8 miles).

Peak flows have increased in these watersheds over the last century due to impacts from heavy ungulate grazing and other actions, and have changed the ability to return to satisfactory conditions for a long time (Haynes 1993). Meadow areas in headwater reaches have lost riparian species and have been invaded by upland species due to incised streams and lowered water tables.

Table 84. Proper functioning condition ratings by 6th code watershed

Sixth Code Watershed	PFC Rating	Miles
Canyon Creek Headwaters	FAR	1.8
Chevelon Creek Headwaters/Woods/Willow Springs	FAR	12.7
Upper Willow Creek/Gentry	FAR	8.0
	FAR Total	22.5
Chevelon Creek Headwaters/Woods/Willow Springs	NF	2.3
Upper Willow Creek/Gentry	NF	1.5
	NF Total	3.8
Upper Willow Creek/Gentry	NR	4.1
	NR Total	4.1

Canyon Creek Headwaters	PFC	2.5
Chevelon Creek Headwaters/Woods/Willow Springs	PFC	3.3
	PFC Total	5.9
	Total Surveyed	36.3

PFC – Proper Functioning Condition – Satisfactory Riparian Condition
FAR – Functioning at Risk – Unsatisfactory Riparian Condition
NF – Non-Functional – Unsatisfactory Riparian Condition
NR – Non-Riparian

Table 85. Stream mileage by watershed and project area

Sixth Code Watershed	Watershed Stream Miles	Project Area Stream Miles	Proportional Extent (percent)
Alder Creek	57	0.2	0.4
Canyon Creek Headwaters	54	12.5	23.3
Chevelon Creek Headwaters/Woods/Willow Springs	77	61.4	79.6
Chevelon Creek/Long Tom/Horse Trap	63	0	0
Christopher Creek	89	0.5	0.6
Concord Canyon/Naegelin	53	0	0
Haigler Creek/Gordon	87	4.5	5.1
Middle Willow Creek	78	0	0
Tonto Creek Headwaters	59	0	0
Upper West Chevelon Canyon	60	0.9	1.5
Upper Willow Creek/Gentry	80	24.8	30.8
Totals	816	104.9	12.9

Stream mileage by watershed is given in table 85. The majority of streams are either intermittent or ephemeral within the project area. Chevelon Creek Headwaters (61.4 miles), Upper Willow Creek (24.8 miles), and Canyon Creek Headwaters (12.5 miles) have the most stream miles contained within the project area. These three watersheds, therefore, have the highest probability of management actions directly affecting stream channels. Four watersheds have no intermittent or perennial streams within the project area.

Environmental Effects

Alternative A

Under alternative A, current trends in condition of riparian areas within the Rim Lakes Project area would be expected to continue. Tree density and canopy closure within the riparian areas would increase. Current levels of large woody debris would be available to the stream channel both from the riparian and adjacent upland zones. Areas where deciduous woody riparian vegetation is being shaded out by invading conifers would remain in that condition.

Little changes to stream water temperatures would occur. Sedimentation from uplands would be expected to be lowest under alternative A as ground cover remains high and infiltration rates would remain unaltered. Most level 1 roads are currently stable and not contributing sediment. Channel and streambank conditions functioning at risk would be expected to remain in a slowly improving upward trend (ASNFs PFC Summaries 1999).

This alternative would allow riparian condition improvement at a slower rate than alternatives B or C, as there would be no direct reduction to conifer overstory to allow riparian vegetation to increase and improve riparian functions.

Alternative B

Under the proposed action alternative, thinning and burning operations can occur both on adjacent side slopes and within riparian/streamside zones. Site specific streamside management zones (SMZs) have been delineated for stream channels in the project area. The SMZs would also be managed under guidelines described in best management practices (BMPs) in appendix B.

The width of the SMZs, types of treatments allowed, and guidelines for implementation of those treatments vary depending on the aquatic resource values to be protected and the potential risks for deleterious impacts related to soil erosion (see ASNFs 2006a for description of SMZ guidelines). Treatments within the SMZs would be regulated both in space and time to achieve multiple resource management objectives. Treatments within SMZs, in combination with those on surrounding upland areas, should reduce the risk of significant damage to riparian communities and stream channel integrity due to the occurrence of any future wildfires in the project area.

The treatments would have beneficial impacts on riparian area vegetation composition and structure. This is particularly the case within the special riparian enhancement treatment areas in Woods Canyon, East Fork Woods Canyon, and Willow Springs Canyon. These treatments are specifically designed to reduce the conifer canopy cover in those riparian zones to stimulate the development of the underlying deciduous woody riparian vegetation (e.g., aspens, willows, and cottonwoods). This desired change in riparian vegetation would likely have a positive impact on stream channel stability and improve unsatisfactory riparian condition to properly functioning condition more quickly than alternative A.

Harvest/thinning operations that occur within the streamside management zones would reduce the canopy cover in riparian areas and would cause a potential short term warming effect on stream temperatures. However, as most stream channels within the project area are generally dry during May, June, and much of July, stream temperatures would not be influenced significantly by overstory thinning.

Prescribed fire treatments in the SMZs would likely have little potential to reduce canopy cover in riparian areas and would not result in further loss of shade. Proposed treatments across the entire project area would have the potential to cause a long-term reduction in the amount of large woody debris available for future input to stream channels. Since the majority of woody debris in the affected streams is generated within the streamside riparian zones, BMPs designed to provide for future large woody debris and other BMPs should limit the extent and severity of this potential impact and prevent loss of channel stability or structural diversity related to large wood. Strict application of BMPs designed to maintain ground cover and large woody materials on the soil surface within the riparian buffer zones would reduce the amount of sediment reaching the channels from harvested and burned upland slopes and prevent excessive levels of sedimentation in stream reaches.

This alternative would improve riparian condition at a faster rate than alternative A or C. FRCC 1 is the desired vegetation condition for optimum soil and water resources. It is a condition that allows for desired hydrologic condition and function. FRCC 2 and FRCC 3 are conditions that do

not allow for an upward or improving trend of hydrologic function. Currently, the entire project area is classified as being in FRCC class "3."

This alternative would decrease FRCC 3 to 13 percent by moving 54 percent of the project area toward FRCC 1 or historic conditions, and moving 32 percent to FRCC 2. Reductions in upland tree density and the long-term maintenance of open stands and forest openings should respond with increased streamflow and water yield (Brewer, 2008), which in turn would provide longer periods of intermittent streamflow. These increases are more prevalent in the project area as they are in some of the highest precipitation zones found for ponderosa pine and dry mixed conifer on the forests, a result of the orographic lifting effect of the Mogollon Rim.

Alternative C

To the extent possible, Rim Lakes would be managed to promote the spatial distribution of vegetation structural stages and canopy fuel heterogeneity while being restricted to not cutting any tree over 16 inches d.b.h.. Aspen and hard wood species would be promoted as much as possible. Activity slash and burning would be managed as in alternative B.

Effects of treatments in alternative C are similar to alternative B. However, there would be less opportunity for created openings and less long-term improvement in additional water yield to enhance streamflow and riparian conditions due to a more rapid canopy closure predicted.

Cumulative Watershed Effects Analysis

A cumulative watershed effects analysis is based upon an "equivalent disturbed area" model described in "Apache-Sitgreaves National Forests Cumulative Watershed Effects Analysis Procedure" (Lovely 1991, 2004). The model used in this analysis calculates the runoff inducement potential of various treatments and indexes them to the runoff potential of open roads. Thus, the EDA figure represents the percent of the watershed area which would have runoff related disturbance levels equivalent to that of being in a roaded condition.

When the cumulative EDA for past, present, and foreseeable future activities reaches 15 percent for a 6th code watershed, the situation raises a "red flag" that the total ground cover disturbing and runoff inducing activity in the watershed may be reaching levels that could signal potential deleterious impacts to watershed resources, particularly stream channel stability and water quality.

The application of this type of analysis has been a standard practice on the Apache-Sitgreaves National Forests since the early 1990s (Lovely, 1991). The ASNFs model was adapted to fit local conditions of cumulative watershed effects (CWE) models developed in Region 5 of the Forest Service. These types of CWE models are in common use in the western United States although some incorporate data on watershed, soils, and stream channel characteristics to develop threshold of concern values specific to a watershed.

The level of watershed data collection and analysis needed to perform that type of extension of the model is not yet available on the forests. Cumulative watershed impacts were analyzed using the EDA model which assumes all projects occur in 1 year even though they could not.[20]

[20] Probst, Jim. 2008. "Cumulative Watershed Effects Analysis: Rim Lakes Forest Health Project." Revised by Chris Nelson, 2010.

Although CEQ regulations for implementing NEPA do not require a "worst case" scenario, this method was selected in order to account for the widest range of possible implementation strategies.

Cumulative watershed effects were considered on a watershed basis (see table 85). The nature of the activities and anticipated impacts from this project are most appropriately analyzed at the 6th code watershed level. On the ASNFs, these watersheds are generally in the range of 10,000 to 20,000 acres in size.

An equivalent disturbed area (EDA) analysis was used to compare the impacts of past, current, proposed, and reasonably foreseeable future activities both on the forests and on private land within the five 6th code watersheds containing most of the project area. Most of the project area is within 6th code watersheds in the Little Colorado River basin above the Mogollon Rim. But enough acreage was contained in two 6th code watersheds below the rim (which are primarily on the Tonto National Forest) to indicate a need for modeling cumulative effects there.

For this project, an initial analysis was performed to determine if there is any potential to reach the threshold level under a "worst case" scenario. Under this scenario, the disturbances related to past, present, proposed, and foreseeable activities were calculated to the year 2013. It was assumed that both alternatives B and C were relatively equal in cumulative effects, therefore only comparisons between no action and action were completed.

The effects of past activities lessen or recover as time passes and are based on the severity and type of treatment implemented. The "worst case" analysis results (summarized in table 86 below) indicate that when the effects of past and present activities, combined with proposed and foreseeable future projects, are compressed in time to all occur in 2013, three of the five analyzed watersheds in the Rim Lakes Project area (Canyon Creek Headwaters, Chevelon Creek Headwaters/Woods/Willow Springs, and Christopher Creek) would be above the "red flag" threshold level of 15 percent equivalent disturbed area.

Further analysis of resulting equivalent disturbed areas under staging and treatment scenarios was used to develop project- and watershed-specific best management practices (BMPs) to alter, delay, or stage the elements of the proposed action alternative of the Rim Lakes Project so as to remain below the "red flag" threshold EDA level. By implementing the BMPs, it is unlikely that deleterious impacts to the watershed would occur due to the cumulative impacts of this project with those of past, present, and foreseeable future projects.

Table 86. EDA analysis results

6th Code Watershed	Canyon Creek Headwaters	Chevelon Creek Headwaters	Christopher Creek	Haigler Creek/ Gordon	Upper Willow Creek/Gentry
Total existing EDA (acres)	2,204	512.6	610.2	581.4	646.6
As percent of watershed	11.6	2.7	3.3	3.1	2.9
Total EDA in no action alternative (acres)	2,274.5	597.7	2,767.5	1,636	953
As percent of watershed (including TNF existing and projected treatments)	12.0	3.1	14.7	8.8	6.8

6th Code Watershed	Canyon Creek Headwaters	Chevelon Creek Headwaters	Christopher Creek	Haigler Creek/ Gordon	Upper Willow Creek/Gentry
Total EDA in action alternative (acres)	2,953	3,185.7	3,338.4	2,138.2	2,303.3
As percent of watershed	15.5	16.7	17.8	11.6	10.5
Watershed size (acres)	19,015	19,225	18,773	18,504	21,993

For the Canyon Creek watershed, it is estimated that hydrologic recovery from the Rodeo-Chedeski Fire and previous management activities allowed the watershed to fall below the 15 percent EDA threshold value in 2010. Only slight timing adjustments are needed to stay below that level as prescribed in the BMPs.

The Christopher Creek watershed would be slightly below the threshold EDA level (14.7 percent of watershed in 2013) without the proposed treatments. The Rim Lakes Project would treat only 11 percent of the watershed area. Combined with ongoing Tonto National Forest projects, delay of some treatments has been incorporated into the project as mitigation.

The Chevelon Creek Headwaters/Woods/Willow Springs watershed is currently well below the threshold EDA level (3.1 percent of watershed estimated at project implementation in 2013). If all treatments were implemented in year 1 of the project, the estimated EDA would exceed the ASNFs threshold level by 1.7 percent. Therefore, timing and staging as well as modification of fuels treatments were incorporated into the project through site-specific BMPs.

The worst case analyses for Upper Willow Creek/Gentry and Haigler/Gordon watersheds show that the threshold level for EDA would not be reached even if all proposed and foreseeable future activities were implemented in a single year. Timing and extent of the proposed and foreseeable projects in these two watersheds does not pose a cumulative effects threat to watershed resources.

It must be noted that the calculation of percent of watershed in EDA should not be considered an absolute indication that a watershed will or will not be negatively impacted by a proposed action. It is also unlikely that all treatments in any watershed would be implemented in a single year, therefore, the analysis has built in a conservative estimate of effects.

The resulting EDA figures require professional judgment for adequate interpretation. They are meant to assess the hazard of the scale and the duration dimensions of disturbance in a watershed. As such they indicate where changes in scale, duration, nature, or timing of project activities may require adjustment. They do not address the site-specific hazards of activities on various watershed functions.

Addressing these hazards would require strict adherence to BMPs developed for the project and, in some cases such as treatments in riparian zones, further onsite development of treatment prescriptions and mitigating measures by resource specialists before and during project implementation.

Noxious Weeds

Environmental Effects to Alternatives A, B, and C

Noxious weeds can pose a threat to forest and rangeland ecosystems. Identification, containment, and control of noxious weeds is important to prevent further spread. Prior to initiation of the Rim Lakes Project, there were no known populations of noxious weeds within the project area (list of prohibited, regulated, and restricted noxious weeds for the State of Arizona and Federal noxious weed list with Hughes 2011). After initiation of the project, a survey of the Rim Lakes Project area was conducted by the district noxious weed coordinator and no noxious weeds were found. Best management practices and mitigation measures have been developed for the project to identify, contain, and control noxious weeds should they be found and are located in the project record (Hughes 2011).

With no known noxious weed populations and no noxious weeds identified during surveys, along with the BMPs and mitigation measures developed for the project, the risk rating for any of the alternatives is low. If weed populations are found, treatments would be delayed until the weeds can be controlled or the area would be avoided, however, it is assumed that the area would be less than a quarter acre.

Therefore, there are no direct, indirect, or cumulative effects from noxious weeds expected from any alternative.

Watershed Effects of the Forest Plan Amendments

The effects to watersheds, water quality and soils of the amendment proposed in alternative B are described in the “Watershed” and “Soils” sections above. As noted, this amendment would result in more openness and diversity, thus benefiting the hydrologic condition. Because alternative B also reduces the risk of the effects of an uncharacteristic wildfire over a longer period, the benefits to watershed would be longer lasting. Effects of the amendment proposed in alternative C are described with the effects descriptions of alternative C. Favoring even-aged management would mean less watershed benefit over a shorter duration.

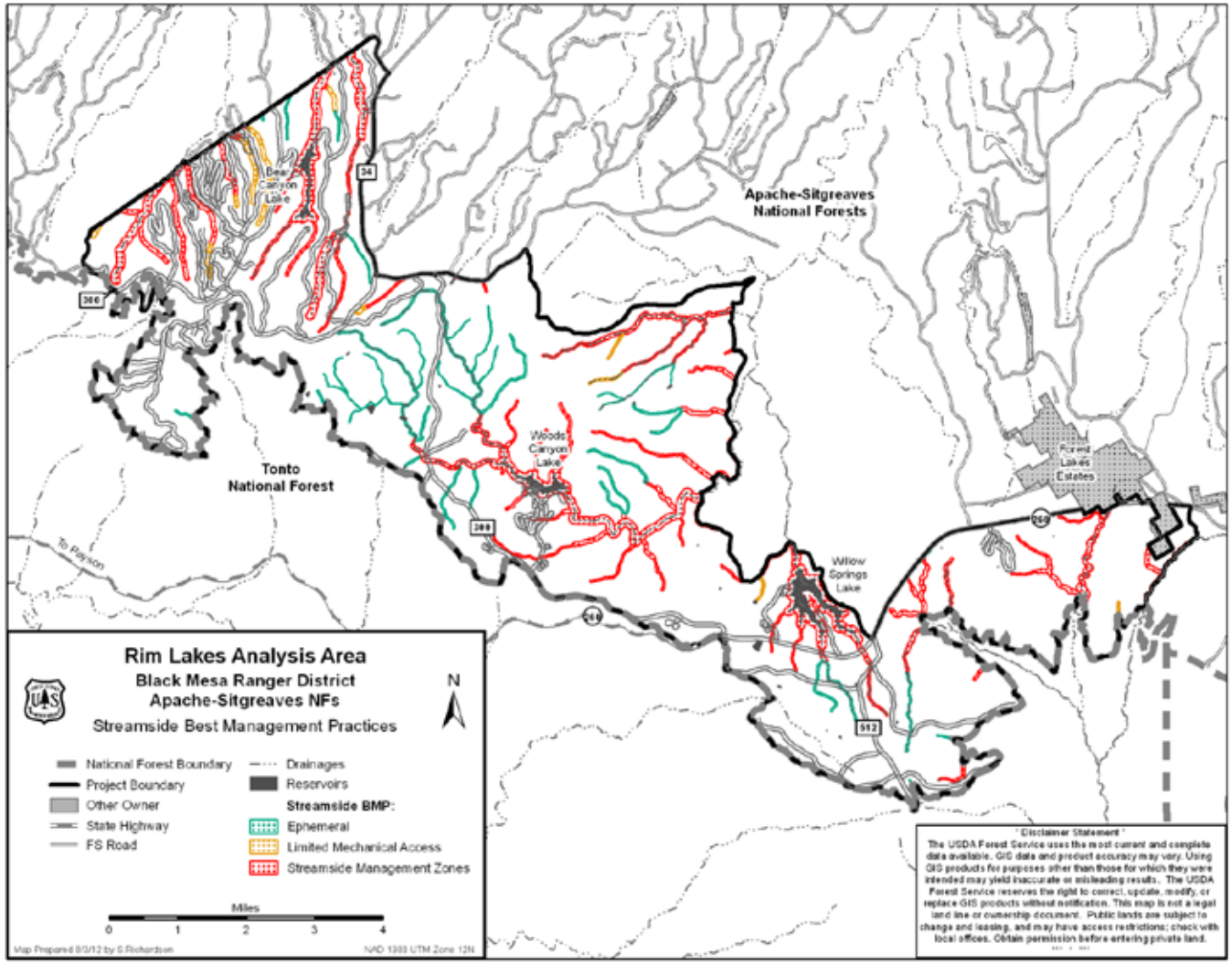

Figure 20. Streamside management zones and ephemeral streams

Recreation and Lands

This section describes key effects and conclusions from the recreation and lands specialist report (Dykstra 2011) located in the project record. Readers may refer to it for more information on law, regulation, policy, and more detailed descriptions of the activities and resources. The area of the analysis for recreation and lands resources is within the Rim Lakes Project area perimeter.

The White Mountains and Mogollon Rim are destinations for outdoor recreation and climatic relief from summer temperatures in the Phoenix and Tucson metropolitan areas. Popular recreational activities include hiking, mountain biking, off-highway vehicle (OHV) use, fishing, picnicking, camping, horseback riding, big game hunting, firewood gathering, wildlife and scenery viewing, and driving for pleasure. The White Mountains and Mogollon Rim provide some of the few winter sports opportunities in the State of Arizona. With adequate snowfall, snowmobiling and cross-country skiing are popular in the Forest Lakes area. Visitor use levels are moderate to high for most of the summer with peaks associated with the three summer holiday weekends and fall big game hunts. The majority of visitors are from the Phoenix metropolitan area (Dykstra 2011). The recreation and lands specialist report has a list of recreation facilities within the Rim Lakes Project area.

Forest Road 300 and State Highway 260 are corridors that provide for scenic viewing and access to developed and dispersed areas. Dispersed use can be found throughout the analysis area, including hiking, fishing, and "car camping." Although there are no congressionally designated wilderness areas within the analysis area, there are some primitive areas—such as the Palomino Lake area—where a person could stay for days without seeing another person. Developed use can be seen at the campgrounds, boating sites, and Mogollon Rim Visitor Center.

While there are several ROS classes in the classification system, there are four that apply to the Rim Lakes Project area (see figure 21).

Number of acres of each ROS class:

1. Rural: 2,170 acres (FR 105 corridor, rim edge from VC to WCL, Forest Lakes area)
2. Roaded Modified: 2,911 acres (FR 84, FR 208, area south of Forest Lakes)
3. Roaded Natural: 15,193 acres (Majority of project area)
4. Semiprimitive Motorized: 2,373 acres (northern boundary of project area from Willow Springs Lake to Woods Canyon Lake)

Several areas within the project area are popular for overflow from the Rim Lakes Recreation Area and for visitors that prefer less development and fewer regulations.

The Rim Lakes Recreation Area (RLRA) within the boundary of the Rim Lakes Project area includes the most developed recreation facilities and infrastructure on the Black Mesa Ranger District. Facilities include several lakes, day-use areas, developed campgrounds, hiking trails—including the General Crook National Recreation Trail—the Rim Visitor Center, boat ramps, and a marina with a privately-owned store.

The Rim Lakes are reservoirs, constructed by Arizona Department of Game and Fish in the early 1960s. The lakes were built to provide recreational boating and fishing opportunities. Woods Canyon Lake and Willow Springs Lake have small marinas that allow visitors to launch boats and

park their vehicles and trailers. The visitor use level at the Woods Canyon Lake marina area is very high during the summer months and parking becomes scarce throughout the weekends. Vehicle access to the Woods Canyon Lake complex is through National Forest System road (NFSR) 105 only. Traffic congestion in key areas such as NFSR 105, Woods Canyon Lake Store, NFSR 149, and Willow Springs boat ramp delay emergency response vehicles, and cause traffic backups and general agitation for forest visitors.

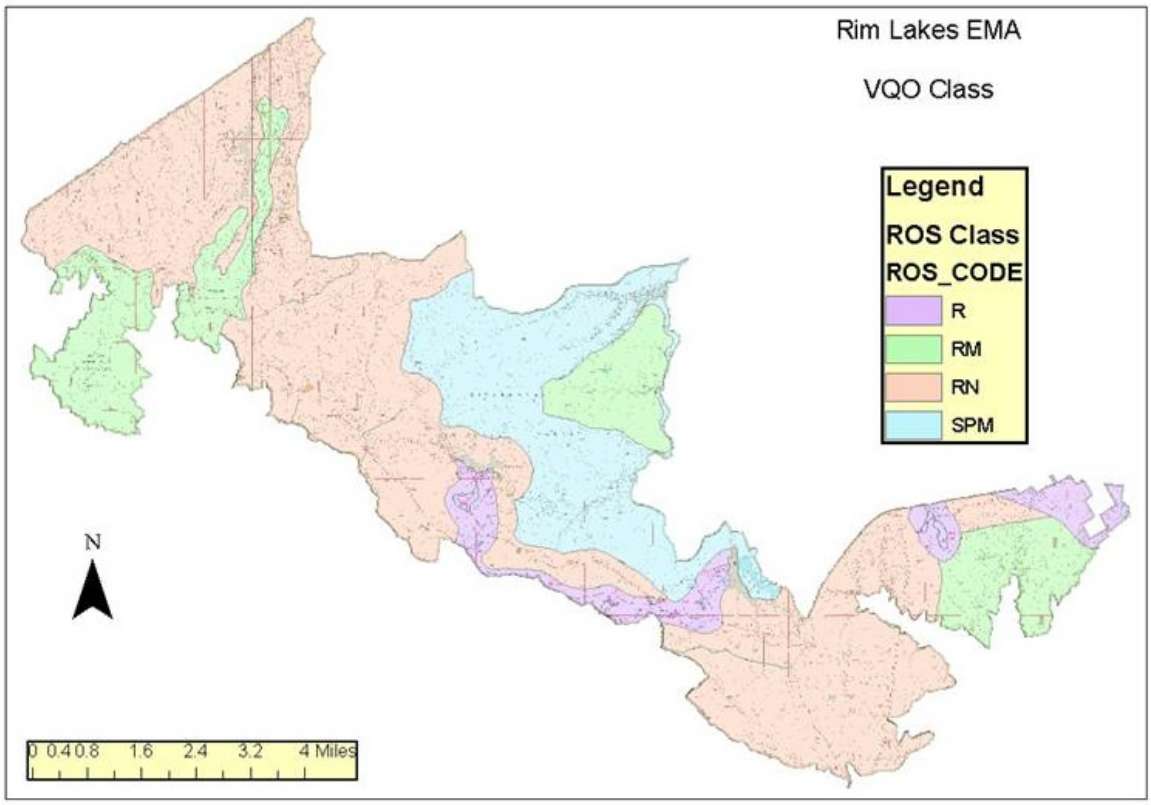

Figure 21. Project area ROS classifications

Black Mesa Ranger District manages five designated dispersed camping areas in the rim analysis area. The term “designated dispersed” is used by the Black Mesa Ranger District to describe camping sites in several popular areas. These sites are found along several National Forest System roads that are in close proximity to the Mogollon Rim and Woods Canyon Lake area.

There are 11 areas that the Black Mesa Ranger District identifies as “concentrated use areas” (CUAs). These areas, with no developed facilities, are traditionally used by large groups, typically a family reunion or civic organization, that camp overnight for several days. Groups provide their potable water and portable toilets. Group size can range from 75 to over 200.

The 1987 “Apache-Sitgreaves National Forests Land and Resource Management Plan” (LRMP) recommended the “scenic” classification for 29.9 miles of Chevelon Canyon from the confluence of Woods Canyon and Willow Canyon to the forest boundary. The two streams within the analysis area, Willow Springs Canyon and Woods Canyon, were found eligible and suitable for “wild” or “scenic” status under the Wild and Scenic Rivers Act. The “scenic” classification is defined as

"Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads" (Wild and Scenic Rivers Act).

In 2009, the forest supervisor signed an updated eligibility report for the National Wild and Scenic Rivers System (ASNFs 2009). The 2009 eligibility report found Willow Springs Canyon was no longer eligible because there were no outstanding remarkable values (ORVs) when compared to other rivers in the designated area of comparison (ASNFs 2009). Woods Canyon and Chevelon Creek were combined into one evaluation because they are within the same drainage basin and their values were found to be complementary and still retain eligible and suitable status.

Chevelon Creek itself does not lie within the project area, but portions of its quarter-mile management buffer lie within the project area boundary. This includes 4 miles of segment 1 and a portion of the 12.8 segment 2, recommended for "wild" classification (ASNFs 2009). Both of these segments are evaluated as "wild." The "wild" classification is defined as "Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America" (Wild and Scenic Rivers Act).

The corridor is a major drainage of the Mogollon Rim. Chevelon Creek cuts a scenic, steep, and twisting canyon through terrain covered with a mosaic of vegetation. Chevelon Canyon provides a canyon ecosystem relatively undistributed by human intrusion. It is a unique aquatic habitat in a relatively arid region with high semiprimitive recreation and wildlife values. Management guidelines for eligible or suitable rivers are described in Forest Service Handbook 1909.12 82.51, 9:

- **Wild.** Cutting of trees and other vegetation is not permitted except when needed in association with a primitive recreation experience such as to clear trails or to protect users or the environment, including wildfire suppression. Prescribed fire and wildland fire use may be used to restore or maintain habitat for threatened, endangered, or sensitive species and/or restore the historic range of variability.

A portion of Chevelon Canyon (225 acres) was identified as an inventoried roadless area (IRA) (Dykstra 2011, appendix H) in the November 2000 roadless area conservation FEIS. Protecting air and water quality, biodiversity, and opportunities for personal renewal are highly valued qualities of inventoried roadless areas. No roads are proposed for construction in the Chevelon IRA.

Off-highway vehicle (OHV) use is noticeably low in the project area in most of the Rim Lakes Recreation Area, but high adjacent to Bear Canyon Lake. Motorized travel is restricted to open, numbered roads, and cross-country motorized travel is prohibited. All open roads in the RLRA are level 3 or higher, so all vehicles and operators must be licensed.

Several areas within the project area are closed to motorized use. Special forest order number 01-402 is in effect for the Beaver Turkey Ridge Special Management Area (SMA) and the Willow Springs Horse Trap SMA. Carr Lake Wildlife Habitat Area (WHA) and Palomino/Deer Lake WHA, were effectively created by administrative road closures in the late 1980s (see table 87).

Table 87. Existing special management areas and wildlife habitat areas

	Beaver Turkey Ridge SMA	Willow Springs Horse Trap SMA	Carr Lake WHA	Palomino/Deer Lake WHA
Total number of acres	2,924	8,602	2,270	10,405
Number of acres within Rim Lakes Project area	220	602	2,270	7,714

There are no motorized trail systems authorized within the analysis area, with the exception of a designated snowmobile trail system. There are two informal snowplay areas near SR 260, and a cross-country ski trail system near Forest Lakes which are not maintained. Nonmotorized forest system trails and trail systems exist in the analysis area, including the General Crook National Recreation Trail, Carr Lake Trail system, and Rim Lakes Vista Trail 622. Rim Lakes Vista Trail 622 meanders along the Mogollon Rim for 3.5 miles and provides spectacular views overlooking the rim.

The General Crook National Recreation Trail was designated in 1979 and crosses through the analysis area east to west along the Mogollon Rim. The entire trail is 138 miles long, from Fort Verde to west of Cottonwood Wash and follows a route created by General George Crook in the 1870s. Original blazes can still be seen on the ponderosa pines lining the trail, as well as occasional traces of homesteads. Although the trail is nonmotorized, portions of the marked route follow or cross Forest System roads. The General Crook National Recreation Trail is also designated as an Arizona State Historic Trail.

AGFD game management units 3C, 4A, and 4B fall within the project area. Many big game and small game species are found within the analysis area. Hunting season increases use levels within the CUAs and general forest areas, but does little to increase use levels at developed recreation sites.

Land uses permitted under special uses authorizations within or immediately adjacent to the project area include an APS 345 KV transmission line, an SRP dual 500 KV transmission line, and a developed parcel of private land. The power transmission lines are critical utility corridors within the western United States power grid, primarily feeding the Phoenix metropolitan area, but also feeds locally to the Rim Lakes Recreation Area concessionaire and Woods Canyon Lake Store.

Rancho Allegre subdivision, also known as Homestead Entry Survey (HES) 185, is a 23.7-acre parcel of private land within the project area, surrounded on all sides by National Forest System lands. A decision notice and finding of no significant impact was signed in 2006 to issue a Federal Land Policy and Management Act (FLPMA) road easement for access to Rancho Allegre. The decision notice also provided for additional access points, emergency access, road construction, and decommissioning (Dykstra 2011, appendix H).

Environmental Effects

Alternative A

Implementation of Alternative A would have no short-term effects to recreation resources. Existing recreation opportunities would continue to be available. Number of acres in each ROS class would not change. Forest visitation would continue under this alternative. There would be no change in the status of the Chevelon Creek segments that are eligibility and suitability for wild

or scenic rivers and Chevelon Canyon segments identified as an inventory roadless area with the no action alternative. Motorized vehicle use would be maintained according to the existing restrictions described in the "Rim Lakes Management Plan."

Motorized vehicle use outside the Rim Lakes Recreation Area would be maintained according to current Forest Service and forestwide regulations, rules, and management objectives. Hiking and mountain biking use throughout the analysis area would be maintained as status quo. There would be no change in the status of the General Crook National Recreation Trail. There would be no change in the status of other nonmotorized trails. There would be no change in the authorization or administration of the APS and SRP utility corridors serving the Phoenix metropolitan area. Status of authorized access to private land within and adjacent to the project area would not change.

Long-term effects would be based on the forest health in the project area. Over time, the heavy fuels would accumulate (see "Fuels and Fire Potential" section page 63) in the project area and subject the existing facilities, infrastructure, and private land to a higher probability of uncharacteristically severe wildfire, including stand-replacing fires. Heavy fuel loading would continue to be within close proximity of areas with the highest visitor use which increases the likelihood of human-caused fire. Heavy fuel loading would continue to be adjacent to the APS and SRP utility corridors. Although both utility companies follow federally mandated standards for line clearing and vegetation removal, they are authorized and only held responsible for clearing within their permitted right-of-way.

Uncharacteristically severe wildfire, including stand-replacing fires, would result in changes to the landscape and its character, reduce or essentially eliminate the quality of recreational settings and experiences that are desirable in the Rim Lakes Project area. Loss of recreation facilities and infrastructure would result in closed or limited facilities, displacement of forest visitors, and loss of revenue to the local store owner and campground concessionaire operator.

Some impacts of an uncharacteristically severe wildfire would be temporary while others would be long term. Immediately after the Rodeo-Chediski Fire in 2002, the Black Mesa Ranger District closed areas to public entry for public health and safety. Many areas had hazardous trees, potential for flash flooding, and soils that had become highly erosive or sensitive to compaction.

Within 2 years, most hazards had been mitigated and the area closures were lifted. The district found immediately after the fire that the public did not camp or attempt to camp in traditionally used areas. Forest visitors moved to other places on the district, mostly outside of the area burned by the Rodeo-Chediski. Many maintenance level 1 roads (closed to motor vehicle use) within the Rodeo-Chediski burn area had previously been covered by vegetation, thus effectively closing the roads. Once the vegetation was consumed by the fire, many of the level 1 roads became apparent to the forest visitor and were used. Similar effects are anticipated to occur in the Rim Lakes area in the event of a stand-replacing fire.

Wild and scenic river eligibility and suitability for Chevelon Creek may be lessened or temporarily impacted by an uncharacteristically severe wildfire. The ORVs for Chevelon Creek are scenery, geology, fish, wildlife, and vegetation/ecology. Each of these ORVs may in some way be impacted by an uncharacteristically severe wildfire and/or the immediate suppression activity. Postfire hydrological changes, e.g., introduction of heavy sedimentation loading (watershed specialist report), may degrade the diversity of native fish species which include

roundtail chub, Little Colorado sucker, and bluehead sucker (fisheries specialist report) and terrestrial wildlife populations or habitat or a combination of these conditions (wildlife specialist report). The scenery ORV for Chevelon Creek is related to its exemplary example of sandstone/limestone canyon on the Sitgreaves portion of the ASNFs and the lush undergrowth and towering tree canopy. Vegetation consumption from an uncharacteristically severe wildfire may change the undergrowth and tree canopy.

Impacts to hiking trails, including the General Crook National Recreation Trail, would be temporary. Trails would be closed until hazards were mitigated. Some trails may be rerouted to lessen soil erosion where drainage flows were increased.

Impacts of an uncharacteristically severe wildfire to the APS and SRP utility lines would be immediate and temporary. These lines transmit electricity to the Phoenix metropolitan area. Line outages, however temporary, can impact customers during the hottest time of the year and endanger those customers reliant on electricity for health reasons, including air conditioning.

Alternatives B and Alternative C – Similarities

Both action alternatives reduce the likelihood of an uncharacteristically severe fire behavior immediately post treatment. Treatments would reduce the existing fuel loading and increase canopy openings allowing for more frequent surface fires rather than canopy fires (see "Fuels and Fire Potential" section page 63). Recreation facility investments, private land development and power line corridors, and forest visitors would be better protected from an uncharacteristically severe fire.

Number of acres in each ROS class would not change. During treatments, unnatural appearing slash piles would be near recreation sites temporarily. The piles would not be outside the ROS roaded natural objective, which would have no manmade facilities visible in the area.

In order to access treatment areas, 186 miles of currently closed forest roads would be opened and 2.6 miles of temporary haul roads would be built (see "Engineering and Transportation" section page 231). These roads would be closed after the project was completed. Maintenance would be required to restore the road for use during project implementation. The extent of maintenance needed would depend on the condition of the road, how long it was closed, and the extent of revegetation that had occurred. These roads would be open only for project implementation and considered open for administrative use, not public use.

Portions of the General Crook National Recreation Trail which coincide with Forest System Roads, 0.86 miles (where motorized vehicle use is allowed), would be used during project implementation.

With the initial reduction in the likelihood of an uncharacteristically severe fire, there would be no change in the status of the Chevelon Creek wild and scenic river eligibility and suitability or the inventoried roadless area. Recreation management and use would continue throughout the analysis area. There would be no change in the authorization or administration of the APS and SRP utility corridors. Status of authorized access to private land within and adjacent to the project area would not change.

In the short term, implementing either alternative B or C would not deter recreational activities throughout the entire project area at any one time. Effects of project implementation on recreation

use would be localized and coordinated to provide for the least conflict between visitors and treatment activities.

At times, planned maintenance burns would generate smoke that could pose health risks to the recreating public, but following Arizona Smoke Management procedures would minimize those impacts and keep them within appropriate standards.

Trail and dispersed camping area closures would only be in the immediate area and only for the duration of the treatment in close proximity. Temporary closure of trails and dispersed camping areas would displace forest users. Displaced forest visitors may impact other nearby forest areas that do not have the infrastructure to support public health and sanitation needs.

Treatment implementation would cause heavy commercial traffic, traffic delays, and reroutes. Traffic would also create dust during project activity on forest system roads. Rerouting traffic, restricting haul timing, and restricting haul routes would lessen the conflict between visitors and treatment activities, but affect traffic flow for forest visitors. Otherwise, motorized vehicle use would be according to the existing Forest Service and forestwide regulations, rules, and management objectives.

Alternative B and Alternative C – Differences

Both action alternatives reduce the likelihood of an uncharacteristically severe wildfire immediately post treatment. However, there is a distinct difference in the longevity of the treatment between alternatives B and C. Based upon proposed treatments in alternative B, the desirable forest conditions of mosaic patterns and open, uneven-aged forest character would persist for 30 years or longer following the initial treatment. Stand data outputs determined that 54 percent of the entire Rim Lakes area treated with uneven-aged management (alternative B) would move to fire regime condition class (FRCC) 1 where it could be maintained as such with prescribed fire for at least the next 20 years.

In alternative C, only 14 percent of the area would move toward FRCC 1. Treated areas in alternative C would quickly develop interlocking or nearly interlocking crowns within a relatively short timespan (less than 10 years). Model results support that alternative C provides a reduction in crown fire but continues to have large areas with potential for a passive crown fire (fire and fuels specialist report).

In the long term, under alternative C, fuels would accumulate in the Rim Lakes Project area and subject the existing facilities, infrastructure, and private land to a higher probability of uncharacteristically severe wildfire, including stand-replacing fires. The effects to resources and infrastructure would be close to the long-term effects discussed under alternative A.

Cumulative Effects Common to Both Action Alternatives

Past and present (ongoing) activities that have occurred over the last 10 years were evaluated within the Rim Lakes Project area (table 9). Activities that created the current conditions include: timber harvest; fire suppression; broadcast burning; improvements and maintenance to recreation facilities to meet the needs of the forest visitor and provide for public health and safety, and resource protection; maintenance of utility corridors; and improvements to private land inholdings. About 200 acres within the utility corridor have been cleared of vegetation in 2010 and 2011. Slash piles from hand thinning in the Woods Canyon Lake area were burned in the fall of 2010, so their effects no longer exist.

Reasonably foreseeable future actions include vegetation maintenance along utility corridors in the project area. This effect would be limited to the permitted easement. Similarly, hazard tree management along FR 300 and proposed construction upgrade to this road would be limited in scope. Changes to the Rancho Allegre subdivision would include construction of a new access road and decommissioning of an existing road (Dykstra 201). Further development or change in ownership of the private land subdivision surrounded by the project area is not within the control of the Forest Service; however, no changes are currently planned.

Currently the forest is in the process of analyzing changes to travel management in conformance with the Travel Management Rule (TMR), including prohibiting motor vehicle use off designated National Forest System roads, trails, and areas. However, a decision has not yet been made so it is too early to predict the changes that would occur from that decision. Because the TMR requires this prohibition (with exceptions), changes to recreation off-road driving can be expected.

The effects associated with this project combined with effects from past, present, and reasonably foreseeable future actions would not have a measurable cumulative effect on the recreation resources or lands activities. Effects associated with vegetation management activities in the power line corridor would be limited to the immediate area being treated and would not cumulatively affect the recreation resources or lands activities.

Recreation Effects of the Forest Plan Amendments

The effects to recreation resources of the amendment proposed in alternative B are described in the “Recreation” section above. As noted, this amendment would result in reduced likelihood of an uncharacteristically severe fire behavior immediately post treatment. Alternative B would maintain this condition longer. Treatments in alternative B would reduce the existing fuel loading, and increase canopy openings allowing for more frequent surface fires rather than canopy fires (see “Fuels and Fire Potential” section page 63). Recreation facility investments, private land development and power line corridors, and forest visitors would be better protected from an uncharacteristically severe fire. Effects of the amendment proposed in alternative C are described with the effects descriptions of alternative C. Favoring even-aged management would mean similar, but shorter duration benefits.

Scenic Resources

This section summarizes key conclusions and effects from the scenic resources specialist report (Doyle 2011) located in the project record. The report includes detail on law, regulation, and policy.

The project area lies within Management Areas (MA) 1, 3, and 16. Management emphases related to visuals include dispersed recreation (MA 1) and protecting high scenic values (MA 16). MA 11 is also included within the analysis area, but proposed treatments do not apply.

Currently, the scenery resources of the Apache-Sitgreaves National Forests (ASNFs) are managed through the application of the Visual Management System (VMS), adopted by the Forest Service in 1974. Under the VMS, visual quality objectives (VQOs) have been prescribed in the forest plan for all lands within the ASNFs. VQOs are measurable standards for the management of visual resources and refer to the degree of acceptable alterations of the characteristic landscape based on the importance of aesthetics. The characteristic landscape is the naturally established

landscape being viewed. The VQO classifications range from preservation, retention, partial retention, and modification to maximum modification.

To meet specific resource management objectives, the following visual quality objectives variations are allowed for a management area (forestwide S&Gs, p. 36):

- Preservation: no change
- Retention: +/-2 percent foreground, +/-5 percent background, middle ground.
- Partial Retention: +/-5 percent foreground, +10/- percent back and middle ground
- Modification/maximum modification: +10/- percent in all zones

One classification movement downward is all that would be allowed, although acceptable variations must be coordinated through the forest landscape architect to mitigate the variation when possible.

Distance zones are divisions of a particular landscape and are used to describe the part of a characteristic landscape that is being evaluated. The three distance zones are foreground, middle ground and background. The foreground is defined as the detailed landscape found within 0 to about a half mile from the observer. Middle ground is the area located from a half mile to 3–5 miles from the viewer. Background is the distant part of the landscape that provides harmony or contrast; it is located from 3 to 5 miles to as far as the viewer can see.

According to the forest plan, visual resource values on the ASNFs are to be maintained and enhanced by including VQOs in resource planning and management activities (USDA 1987). The prescribed VQOs for the project area include retention (approximately 31,400 acres) and partial retention (approximately 2,100 acres). Retention provides for management activities which are not visually evident. Partial retention includes activities that must remain visually subordinate to the characteristic landscape. Activities may repeat form, line, color, or texture common to the characteristic landscape, but changes in their qualities of size, amount, intensity, direction, pattern, etc., remain visually subordinate to the characteristic landscape.

The Rim Lakes Project area is a highly desirable year-round recreation destination, and scenic quality is important to visitors and residents alike (see “Recreation and Lands” section, page 211). People are drawn to the area for climatic relief afforded by the forested, high elevation slopes (7,200–7,900 feet above sea level) and cold water lakes. The major scenic attraction is the Mogollon Rim, which extends 200 miles from Flagstaff, Arizona, into western New Mexico. From the Mogollon Rim’s 7,600-foot elevation, numerous vista points and the Mogollon Rim Visitor Center provide spectacular views into the canyon and to lowlands to the south.

Primary scenic corridors in the project area include State Highway 260, National Forest System Roads (NFSRs) 300, 169, 100, 34, and the General George Crook National Recreation Trail. In addition to the Mogollon Rim, important and valued scenic elements within the project area include Woods Canyon, Willow Springs, and Bear Canyon Lakes. The project area also includes 225 acres of the Chevelon Canyon Inventoried Roadless Area (IRA) and 173 acres of the Woods Canyon/Chevelon Creek eligible wild and scenic river, which is eligible at “wild” status.

Scenery contributes indirectly to the local quality of life, tourism, and economic vitality and to the area’s sense of place. Results from the 2007 National Visitor Use Monitoring Survey (USDA

2009) for the ASNFs show that more than 80 percent of those who participated in the study identified recreation as the purpose of their visit.

The existing landscape character of the project area has been shaped by natural processes and human activities. The influences include beetle and mistletoe infestations, wildfires—in particular the 2002 Rodeo-Chediski Fire—as well as residential and recreation developments, grazing, fire suppression, and timber management.

As described in the "Vegetation" section (page 41), the project area includes heavily stocked, even-aged stands with closed canopy and suppressed understory to more open stands featuring some large trees (>24 inches in diameter), depending on slope, aspect, topography, previous fuel treatments and fire. Two power lines, operated under special use permit and defined by a 200- to 300-foot-wide corridor cleared of most vegetation, are located within the project area. The straight lines and hard edges of the corridor are a contrast with naturally occurring shapes in the landscape. They are potential focal points and detract from views along SH 260 and FR 300 but have a minor impact on the overall scenic quality of the project area.

The resulting landscape appears natural and unaltered to the casual forest observer and meets the VQOs of retention and partial retention. However, the existing condition falls short of the potential scenic quality inherent in the historic ponderosa pine and mixed conifer forests which exhibited more diversity of spatial distribution, size, and age class. In addition, the current forest conditions are at much higher risk of high intensity fire which could further degrade the scenic quality.

Environmental Effects

Alternative A

No vegetation management activities would be proposed under alternative A. There would be no impacts to the scenic resources associated with opening closed roads, burning, and mechanical treatments since these actions would not be implemented.

The VQOs of retention and partial retention would be met in the project area; however, the overall scenic quality of the project area would decline over time. The existing trend of even-aged stands of mixed conifers would continue, the canopy would continue to close, and visual diversity would decrease. Views into the project area from roads, trails, recreation sites, and residential areas would be reduced due to the overstocked condition of the stands, and the grass–forb–shrub understory component would continue to be crowded out.

Under this alternative, there would be no opportunities to enhance and improve scenic resources or achieve the desired condition described in chapter 1 since there would be no thinning or other treatments.

Because stands would not be thinned, the risk of stand-replacing fire would continue to be of concern to the Apache-Sitgreaves National Forests and residents of the surrounding communities. In the event of a high-severity wildfire—such as the Rodeo-Chediski Fire—the existing landscape character would be suddenly altered with little opportunity to slow or control the change. The VQOs in the project area would be met because fire is considered a natural part of the ecosystem; however, a high intensity, large-scale wildfire would redefine and reshape the existing landscape character. The appearance and character of the area would shift from densely forested to patchy

and open. The overstory component and green canopy would be absent or drastically reduced, depending on the severity of the fire. For several years the landscape would be dominated by blackened, dead standing trees; if allowed to come down on their own, the trees would likely fall in a dense, jack-straw pattern.

For two to three growing seasons, the blackened, exposed ground surfaces would be highly visible due to lack of vegetation. Sedimentation and erosion would increase, raveling soils that would take a long time to revegetate. Eventually these areas would be covered with scattered invasive plants and other spotty vegetation until native material became established. These changes would be visible throughout the project area in the foreground of forest roads and trails, and as middle ground and background views from Forest Lakes, Rancho Allegre, and developed recreation sites. If the fire were not contained within the project boundary, scenic quality of the Chevelon Canyon IRA and eligible Chevelon Creek WSR corridor would be at risk. The changes would contrast with the natural appearance of the landscape and degrade the scenic quality.

Initial public reaction to a large-scale fire tends to be negative, as many people do not consider extensive, blackened landscapes to be natural or beneficial (Ryan 2005). These effects are often perceived by local residents as devastating to their community and way of life; nonlocal forest visitors may regard the effects of a catastrophic fire as interesting and something “to be seen” but also as a degradation nonetheless of the scenic quality. In addition, emergency fire suppression actions such as fire lines and emergency postfire rehabilitation treatments could result in unnatural scars on the landscape.

With mitigation measures, the immediate impacts of the suppression and emergency treatments should not be evident to the casual forest visitor within 2 to 3 years of completion as grasses, wildflowers, shrubs, and forbs moved in, although effects from the fire itself would remain visible much longer. Within 5 years, the effects of the fire would begin to be viewed in a somewhat more positive light as the shrubby understory, seedlings, and saplings became more abundant. However, the presence of dead standing trees would remain a dominant and somewhat negative visual reminder for many years.

Alternative B

Effects from generalized prescriptions, treatment types, and associated actions described in chapter 2 (page 18 through 20) are discussed below.

Mexican Spotted Owl (MSO) Protected Habitat Areas (309 acres): This prescription would be implemented with the objective of reducing stand density and fire hazard. It would result in stands appearing slightly more open and more diverse over time when compared to the existing condition, although the difference may not be noticeable to the casual forest visitor, particularly when driving along roads.

MSO Restricted Habitat (5,512 acres): This prescription would move treated areas toward uneven-aged stands with a balance of age classes present. Small to moderate sized openings would be created over 20–40 percent of the area. This prescription would move treated areas toward uneven-aged stands with a balance of age classes present, which would increase visual diversity and enhance scenic quality. These stands would appear more open than the MSO protected habitat areas.

MSO Restricted Habitat – Threshold and Target Threshold (766 acres): Stands would appear quite dense, and no openings would be created. To the casual visitor, treated stands would appear essentially unchanged from existing conditions.

Goshawk Foraging and PFA Habitat Stands (16,835 acres): Stands treated under this prescription would be more open than in MSO habitat areas and would be managed for uneven-aged characteristics. Treated stands would appear more visually and spatially diverse when compared to existing conditions.

Grassland and Wetland Meadow Enhancement (193 acres): Natural meadows would be restored and are located in areas with a VQO of retention and most are located with the foreground and middle ground of trails and roads. This treatment would reintroduce a valued scenic element back into the landscape and sustain it over time.

Aspen Exclosures/Regeneration: There would be a slight, localized visual impact from the fence line that would be maintained to exclude elk from aspen and oak regeneration while it is in place. This impact would be offset by the restoration of the aspens, an important visual element particularly for fall foliage viewing.

Road Maintenance: Maintenance required to open 186 miles of roads could have slight to moderate effects on scenic quality that would last throughout the duration of the project until the roads were closed. If the closed road had not revegetated and needed very minor work to be functional, then impacts on the scenic quality would be a minimal change from the current condition. However, if the road had time to revegetate and needed more work to accommodate project activities, then impacts to the scenic quality would be more pronounced. The 2.6 miles of temporary road built to avoid the General Crook Trail would be decommissioned after the project is completed. The impacts would be similar to opening closed roads that require more maintenance to be functional. Effects would be very noticeable through the duration of the project in the immediate foreground and would diminish after the roads are decommissioned.

Mechanical Treatments: There would be a slight to moderate effect on scenic quality during and immediately following treatments. Contract specifications call for stumps to be left no more than 6 inches high, although typically stumps are cut flush unless prevented by rocks or other natural features.

The presence of skid trails, landings, and piled or scattered slash would also result in a moderate reduction of the scenic quality for the duration of the project. The effects in these areas would not be long term since skid trails would be rehabilitated, and activity generated slash would be removed within 1 year of project completion. The ground disturbance resulting from using machines to pile slash would be noticeable for up to 1 year after project completion, depending on how quickly the areas were rehabilitated and vegetation regenerated.

Broadcast Burning: Depending on fire severity, effects would include charred soil and vegetation immediately following meadow burning, charred bark up to 10 feet from the ground, needle and leaf scorch typically less than 20 feet from the ground, and loss of understory trees, trees with old scars, or trees with large accumulations of dead fuels at their base. This treatment method would likely result in short-term reduction in scenic quality. The presence of charred surface vegetation and red or black trees would present a contrast to the otherwise green surroundings. These contrasts would soften and become less noticeable within two or three growing seasons after project completion as the understory component (e.g., grass, aspen and oak

seedlings, etc.) moved in, as singed but not dead trees recovered and greened up, and as dead standing trees fell down.

The VQOs of retention and partial retention would be met under this alternative. Scenic quality would be enhanced to a greater extent and for a longer period than under alternatives A and C as the diversity of tree species, size, and spatial distribution increased. Throughout much of the project area, stand density would be reduced. The views along State Highway 260, Forest Road 300, and General Crook Trail in particular would be more diverse. Natural meadows would be restored and aspen stands regenerated, which would increase visual diversity and place more emphasis on these valued scenic features.

Alternative C

This alternative is similar to alternative B but would limit the cutting of trees up to 16 inches d.b.h.. Uneven-aged selection cutting, meadow restoration, and aspen regeneration would be implemented to the extent possible under the diameter limit constraints.

Effects related to Chevelon Canyon IRA and the eligible Chevelon Creek WSR, MSO protected habitat areas, MSO restricted habitat threshold and target threshold areas would be as described under alternative B, although target threshold areas may appear slightly more open under alternative B. Effects from associated project activities (road maintenance, etc.) would be as discussed under alternative B.

The difference between alternatives B and C would be most noticeable in goshawk foraging and PFA habitat stands. As a result of implementing the 16-inch-diameter limit, existing uneven-aged stands would become more homogenous. A greater number of smaller trees (<16 inches d.b.h.) would need to be removed to meet the basal area objectives so that only one or two age classes would be represented.

The VQOs of retention and partial retention would be met under this alternative. Overall, scenic quality would be enhanced to a greater extent under this alternative than under alternative A but less than under alternative B. The constraints imposed by the 16-inch-diameter limit would make it difficult to create breaks in the canopy and would limit the size and placement of openings; visitors traveling along SH 260, FR 300, and General Crook Trail would likely not notice any variation in the canopy.

Some stands would reflect even-aged management, and trees would be more uniformly spaced, with less grouping and clumping. The diameter limit would also restrict the ability to create openings of adequate size for aspen regeneration. Natural meadows and aspen stands would be restored when compared to alternative A, but the diameter cap would reduce the effectiveness and extent of restoration when compared to alternative B. The understory component would improve in number, diversity, and vigor but less than under alternative B. In addition, repeated entries to treat the same areas in relatively short intervals (+/- 10 years) would degrade the scenic quality because the treated areas would not have sufficient time to recover between treatment entries.

Cumulative Effects

The boundary for determining cumulative effects is the project area itself. Past and present activities that created the current conditions include grazing, the evolving forest management practices related to timber harvest and fire suppression, drought, disease and insect infestations,

developed and dispersed recreational use and associated developments, and private land inholdings.

Reasonably foreseeable future actions include 200 acres of vegetation maintenance along utility corridors in the project area. This effect would be limited to the permitted easement. Similarly, hazard tree management along FR 300 and proposed construction upgrade to this road would be limited in scope.

The effects associated with this project combined with effects from past, present, and reasonably foreseeable future actions would not have a measurable cumulative effect on scenic resources. The slash piles in Woods Canyon Lake Campground would be burned before any burning associated with this project would begin. Effects associated with vegetation management activities in the power line corridor would be limited to the immediate area being treated and would not cumulatively affect the visual resource.

Scenery Effects of the Forest Plan Amendments

The effects to scenery resources of the amendment proposed in alternative B and alternative C are described in the "Scenic Resources" section above. As noted, the amendment for alternative B would result in more openness and diversity in the stands. Alternative B would also maintain this condition longer. With alternative C. many stands would reflect even-aged management, and trees would be more uniformly spaced with less grouping and clumping. The diameter limit would also restrict the ability to create openings of adequate size for aspen regeneration, which would reduce diversity.

Cultural Resources

This section documents compliance with Section 106 of the National Historic Preservation Act for the Rim Lakes Forest Restoration Project. It is based on the cultural resources specialist report (Schroeder 2011) located in the project record. See the specialist's report for more information on law, regulation, policy, history, methodology, etc., regarding cultural resources management.

The Southwestern Region has established a programmatic agreement with the Advisory Council on Historic Preservation (ACHP) and State Historic Preservation Officers (SHPOs) that stipulates the Forest Service's responsibilities for complying with NHPA. The Southwestern Region has developed a standard consultation protocol for large scale hazardous fuels reduction, vegetation treatment, and habitat improvement projects: appendix J of the programmatic agreement. By following the procedures of the protocol, the ACHP and SHPOs have agreed that the Forest Service would satisfy legal requirements for the identification, evaluation, and treatment of historic properties. The ASNFs is complying with the protocol in lieu of standard consultation in the programmatic agreement and the council's regulations (36 CFR 800). In consultation with the SHPO, the terms of the protocol allow for the appropriate level of cultural resources surveys to be completed after the NEPA decision, but prior to implementation of the project activities.

Methodology Used for Data Collection and Analysis

The analysis used the ASNFs heritage site and survey GIS layers, Forest Service INFRA database, and review of existing site records stored at the supervisor's office. The most recent listings of the National Register of Historic Places were consulted. In addition to consulting

interested tribes, ethnographic documents and studies were reviewed to assist in identifying traditional cultural properties (TCPs) in the project area. Draft GIS maps were created to examine spatial information and to determine the site density per terrestrial ecosystem unit. Additional indepth archival record searches (i.e. GLO maps, land plats) may be conducted pursuant to appendix J of the programmatic agreement for each phase of the cultural resource inventory surveys.

The criteria used for establishing the area of potential effect (APE) for cultural resources was based on the boundaries of the proposed Rim Lakes Forest Restoration Project. Applicable maps were generated through geographic information system (GIS) analysis to determine the areas surveyed and sites within the APE. A total of 105 project surveys are represented in the GIS heritage survey database. A total of 21 archaeological resources have been located in the APE. Existing site records were reviewed to identify the current condition and any known previous impacts. In addition to archaeological resources, three sites that may be considered traditional cultural properties or important places were identified by the White Mountain Apache and Zuni through ethnographic studies (Krall and Randall 2009, Ferguson n.d.). Site types identified as being fire sensitive per appendix J may include—but are not limited to—rock art, prehistoric sites with flammable architectural elements and other flammable features or artifacts, dendrogylphs (aspen art), historic sites with standing or down wooden structures or other flammable features or combustible artifact materials. A total of six historic sites that are either combustible or contain combustible materials are known within the APE.

Since 1979, 107 cultural resource surveys were completed within the Rim Lakes Project area (Schroeder 2011, appendix A). Most of the surveys were conducted for timber sales implemented during the mid-1980s through 1990s. Seventy-seven of the projects were intensive pedestrian surveys (100 percent coverage). Approximately 3,000 acres or 10 percent of the entire project area has been intensively surveyed. Thirty of the surveys were sample-based, covering approximately 26,500 acres of the project area (approximately 80 percent of the project). The sample surveys consisted of intensively surveying 10 percent or 20 percent of the timber cutting unit using random transects and surveying all identified proposed roads and landings. A few of the sample inventories were conducted as reconnaissance surveys that do not meet professional standards and many others do not adequately cover the area to identify fire-sensitive sites and/or meet the requirements for inventory surveys for intensive ground-disturbing activities.

One hundred twenty-three terrestrial ecosystem map units were recognized on the ASNFs defined by differences of topography, soils, vegetation, precipitation, and frost-free days (USDA 1989). The project area encompasses 11 map units. Most of the project area is located within areas of low site density. Based on existing data from previous surveys conducted forestwide and terrestrial ecosystem units, approximately 19,966 acres of the project area has an estimated site density of 1 site per 591 acres and reaches a low of 1 site per 1,055 acres within an area of 1,550 acres (see table 88).

Results from previous cultural resource surveys within the project area identified a total of 21 archaeological resources (table 89). The Promontory Lookout Tower is listed on the National Register (AR-03-01-02-3591) and one site is designated as a state historic trail and as a national recreation trail (AR-03-01-02-835/AZ:P:9:1). Six sites are eligible for the NRHP and three sites were previously determined not eligible for the NRHP with SHPO concurrence. The eligibility status of 10 sites remains unevaluated. The majority of resources consist of historic sites, such as historic habitation structures, roads/trails, corrals, dendroglyphs, and fire lookouts. Additional

historic sites (corrals, dendroglyphs) have been noted but not recorded near Carr Lake, Lake One, and Hole in the Ground. Four sites date to the prehistoric period and/or protohistoric period.

Table 88. Potential site densities based*

Map Unit	Dominate Vegetation	Acres within Project Area	No. of Surveyed Acres per Site
0192	Ponderosa pine, Gambel oak	896.7	122
0193	Ponderosa pine, Gambel oak	1,964.1	68
0196	Ponderosa pine, Gambel oak	501.4	988
0197	Ponderosa pine, Gambel oak	19,966.5	591
0199	Ponderosa pine, Gambel oak	462.0	218
0201	White fir, Douglas-fir, ponderosa pine	3,390.4	601
0202	White fir, Douglas-fir, ponderosa pine	333.2	150
0203	White fir, Douglas-fir, ponderosa pine	1,550.9	1,055
0206	Ponderosa pine, Gambel oak	2,039.1	142
0207	White fir, Douglas-fir, ponderosa pine, Gambel oak	1,849.7	Unknown
0208	Kentucky blue grass	253.4	21

* Note total acres within project area will not match total project area acres. Acres comprised of water bodies were excluded.

Table 89. Previously recorded sites and their current NRHP status

FS Site No. AR-03-01-02-xxx	Site Type	Cultural or Archaeological Affilation	NRHP Eligibility
835	General Crook State Historic Trail	U.S. Government	Eligible/Listed on State
1121	Historic whiskey still	Euro-American	Unevaluated
1122	Masonry Spring Box 1930s	Euro-American	Unevaluated
1123	Historic aspen dendroglyphs	Euro-American	Unevaluated
1124	Multi-component artifact scatter	Anasazi/Hopi	Unevaluated
1125	Historic Rhoten/Zane Grey Cabin	Euro-American	Unevaluated
1126	Historic homestead foundation	Euro-American	Unevaluated
1309	Lithic scatter	Archaic	Eligible
1624	Lithic scatter	Unknown	Not eligible
2875	One room masonry structure	Anasazi	Eligible
2892	Cairn	Euro-American	Unevaluated
2954	Corral	Euro-American	Not eligible
3027	Fire lookout/lag tree	Euro-American	Eligible
3451	Telephone line	Euro-American	Unevaluated
3452	Willow Springs Ranger Station remains (about 1912)	U.S. Government	Eligible
3467	Historic trash dump	Euro-American	Unevaluated

FS Site No. AR-03-01-02-xxx	Site Type	Cultural or Archaeological Affilation	NRHP Eligibility
3493	Geological site fossils		NA
3591	Promontory lookout tower	U.S. Government	Listed
	Globe to Holbrook Road/Young to Heber Road Forest Highway (FH) 12	U.S.Government	Not eligible
	Old Rim Road F.H. 40/FR 300	U.S. Government	Unevaluated
	Heber-Reno Sheep Driveway District	Basque and Euro-American	Eligible

The best known historic site within the project area is the General George Crook Road/Trail, which runs 200 miles through the Apache-Sitgreaves, Coconino, and Prescott National Forests. Portions of the original trail have been converted into Forest Road 300. The area has been extensively logged in the past and continued to be through the 1990s. Many segments of the trail only retain integrity of location and association. Some associated features may retain integrity of association, location, and materials (blazed trees, rock piles). Past management activities have adversely impacted the trail's integrity of setting, feeling, and in some places location and materials.

Traditional Cultural Properties

Western Apache and Yavapai groups are known to have traditional ties to lands within the Rim Lakes Project area. A recent study of the Western Apache Homeland and Archaeology of the Mogollon Rim revealed several significant Apache sites in the project area: See Canyon Trail, Hole in the Ground, and an Apache Ceremonial ground (Krall and Randall 2009:8). Eva Watt, a White Mountain Apache elder, identified the location of the ceremonial ground south of the intersection of FR 512 Heber to Young Road and SR 260, on the northern side of the junction of FR 512 and FR 181, just south of the diaphanous Aspen Lake. Apaches camped and participated in social dances at this location. The See Canyon Trail that runs along the eastern side of Promontory Butte was used by Apache rebels to flee the U.S. Calvary and Apache scouts. The trail may have also been used as a route up over the rim to reach Hole in the Ground. The Hole in the Ground site is located approximately 1 mile from the head of See Canyon Trail route and research indicates that it may have been used as a trading point for Hopis and Apaches (Krall and Randall 2009:28).

A Zuni traditional plant collection area is documented within the project area in the vicinity of the Mogollon Rim and the head of Chevelon Canyon (Ferguson, no date). The Hopi are also known to traditionally collect resources on the ASNFs for religious purposes. The following tribes were consulted regarding the proposed action: White Mountain Apache Tribe, San Carlos Apache Tribe, Tonto Apache Tribe, Yavapai-Apache Nation, Yavapai-Prescott Tribe, Ft. McDowell Yavapai Indian Nation, Hopi Tribe, Navajo Nation, and Pueblo of Zuni. At present, no tribe has expressed concerns or identified that a TCP would be affected by project activities.

Environmental Effects

All Rim Lakes Project proposed treatments would be managed as having either "no effect" or "no adverse effect" to cultural resources. Under the regulations, an adverse effect is found when an

undertaking may alter, directly or indirectly, any of the characteristics of a cultural resource that qualify the property for inclusion in the National Register. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register.

The project treatments and associated activities would be conducted in compliance with applicable laws and regulations as outlined in the specialist report (Schroeder 2011). Forest plan standards and guidelines for cultural resources are stated under forestwide management areas. These guidelines are found on pages 39–40 (USDA 1987). Specific standards and guidelines for the General Crook Trail are found on pages 37–38. Below are standards for the General Crook Trail that apply to the Rim Lakes Forest Restoration Project.

- General Crook National Trail: Use of motorized vehicles on any portion of the route not specifically designated and designed for motorized vehicle travel is prohibited. Emphasize protection for the historic value of the trail route.
- Manage 200-foot-wide corridor to preserve evidences of historic roadway and landscape character, including related historic trees, markers, gravesites, and water holes.

Most of the lands within the forests are located in a fire-adapted ecosystem. Generally, low intensity fires have not adversely impacted prehistoric sites that are not fire sensitive or composed of combustible material. Conversely, most historic sites are either combustible or include combustible cultural material. Adverse impacts from fire may include but are not limited to historic sites completely burned down, prehistoric rock structures spalling apart from exposure to very high temperatures, the refiring of ceramic material, melting obsidian artifacts (caused by high-intensity fire), accelerated erosion of site features caused by hydrophobic soils (caused from high intensity and long duration fires), killed trees falling and uprooting the ground surface displacing or damaging cultural features and structures, creation of burned stump holes that result in erosion, and denuding of the ground surface exposing cultural materials to increased erosion and visibility that increases the potential for theft.

Alternative A

Under alternative A, no management actions would be taken to reduce the fuel loads in the project area. Failure to reduce accumulated fuel loads may increase the effects from high intensity and high severity wildfires, thereby increasing the potential for adverse effects to prehistoric and historic buildings, structures, and artifacts. The "no action" alternative would result in no direct effects to cultural resources, but may increase the potential of indirect effects from high intensity, high severity wildfires. This alternative would not affect traditional cultural properties.

Alternatives B and C

Removal of trees would reduce long term fuel continuity, fuel loading, and fire hazard which would benefit cultural resources within the project area by decreasing the potential for adverse effects caused from high intensity, high severity wildfires. Alternative C's diameter limit would have no direct bearing on the impacts to cultural resources. Because alternative C reduces the fire hazard less effectively for a shorter duration, alternative B has more benefits to cultural resources.

No impacts to cultural resources are anticipated from road maintenance and temporary road construction activities because of mitigation measures. All proposed haul roads and temporary

road locations would be surveyed and cultural resources identified for avoidance, or mitigation measures would be used to minimize the impacts to the sites to result in no adverse effects. Based on previous survey data and the stipulations of appendix J of the programmatic agreement and the protection measures outlined in section II of appendix J are met, no adverse impacts to cultural resources are anticipated from mechanized and prescribed burn treatments.

Neither alternatives B nor C would result in unavoidable, irreversible, or irretrievable impacts to cultural resources in the project area. Neither alternative would affect traditional cultural properties.

Cumulative Effects

During the 1980s through the early 1990s, approximately 17,000 acres of the project area were harvested for timber. Based on the forests' GIS databases, more than half of the project area has been harvested for timber and 6,450 acres have burned. Some of the cultural resource surveys conducted in the 1990s reported that the land area was heavily impacted by past timber harvesting activity. Records indicate that most of the roads constructed for the timber sales were surveyed for cultural resources. Some timber roads were never surveyed and unrecorded sites could have been impacted. The project area has also been grazed by cattle and sheep. A small portion of the northwest area (929 acres) of the project is within the Limestone allotment, and 11,540 acres of the southern end of the project area is within the Long Tom allotment. The Heber-Reno Historic Sheep Driveway crosses the project area at the southern end of the proposed treatment area (413 acres). Sites within the grazing allotment may have been impacted by past intensive grazing activities that were allowed during the 1900s.

Most of the lands within the project area are located in a fire-adapted ecosystem. Evidence that prehistoric sites have been repeatedly burned (prior to active fire suppression) is demonstrated by fire scarred trees and thermally (fire) altered artifacts. Wildfires have burned approximately 6,475 acres of the project area. Many of the areas that were harvested for timber have been treated with prescribed fire.

Existing records indicate that past management activities have not caused adverse effects to known cultural resources within the project area, except for the General Crook Trail. Documents indicate that some historic blazed trees and features associated with the General Crook Trail may have been altered or destroyed due to lack of identification during project planning and implementation, public awareness, and intentional vandalism.

Three projects within the Apache-Sitgreaves National Forests' boundary are adjacent or in close proximity to the Rim Lakes Project area. The Nagel Forest Health Project area (north of Rim Lakes) and the Little Springs and Forest Lakes Project areas are located east of Rim Lakes. Private landowners have made efforts and would foreseeably continue to make efforts in the area to treat for fuels reduction and restoration. These projects are not expected to have an adverse effect to cultural resources.

Existing records indicate that previous management activities have generally resulted in no adverse impacts to cultural resources within the project area. Recent studies have identified the potential for combustible features associated with the Apache ceremonial site in the project area. These features may have been altered or destroyed by prior natural and management ignited fires. Presently, prior to any actions or ground-disturbing activities that have the potential to affect the

character or use of cultural resources, the ASNFs ensures compliance with the NHPA by following the stipulations of the programmatic agreement. If cultural resources are located within the project areas, avoidance or appropriate mitigation measures are implemented to achieve a determination of no effect or no adverse effect to cultural resources.

The expected cumulative effects on cultural resources in the project area from alternative A would be that the archaeological sites would continue to exist in their current condition. Alternatives B and C are not expected to have direct cumulative impacts to cultural resources since no direct or indirect effects are expected. Cultural resources would be avoided or protected as appropriate from project activities so the action would not have an adverse effect.

Effects of the Forest Plan Amendments to Cultural Resources

The effects to heritage resources of the amendment proposed in alternatives B and C would be the same as those described in the "Cultural Resource" section above. Because the treatments are managed to avoid effects in either action alternative, there would be no difference.

Contemporary American Indian Uses

American Indian Tribes are sovereign nations. They are government entities with which the Forest Service establishes and maintains government-to-government relationships. Through statutes, the Federal Government has a trust responsibility to each tribal government. The Forest Service has certain legal responsibilities to American Indian Tribes. These legal responsibilities are clarified in statutes, executive orders, and case law enacted and interpreted for the protection and benefit of federally recognized American Indian Tribes. Some of those laws include the National Historic Preservation Act and subsequent amendments, Archaeological Resources Protection Act, American Indian Religious Freedom Act of 1978, National Environmental Policy Act, and the National Forest Management Act. Executive Orders and Memorandum include, 1994 Government-to-Government Relations with Native American Tribal Governments, E.O. 13007 Accommodation of Sacred Sites, E.O. 13175 Consultation and Coordination with Indian Tribal Governments, and E.O. 12898 Environmental Justice. Forest Service Manual 1563 provides direction for establishing government relations with American Indian and Alaska Natives and procedural requirements and general guidelines for implementing the Forest Service tribal relations program.

In meeting these responsibilities, the Apache-Sitgreaves National Forests consults with tribes when proposed policies or management actions may affect their interests. The nine federally recognized tribal governments, representing five American Indian Tribes, have aboriginal territories and traditional ties to the lands now administered by the ASNFs were consulted for this project: the San Carlos Apache Tribe, White Mountain Apache Tribe, Pueblo of Zuni, Hopi Tribe, Navajo Nation, Tonto Apache Tribe, Yavapai-Apache Nation, Fort McDowell Yavapai Nation, and the Yavapai-Prescott Tribe. Responses were received from the Navajo Nation and Hopi Tribe. At present, the tribes have not expressed concerns that the alternatives would affect their use and access to forest resources, sacred places, traditional cultural areas and places. It should be noted that some tribes may not reveal specific locations of traditional use or sacred places to nonpractitioners because of cultural restrictions and/or religious beliefs unless that location is at risk of being adversely impacted by project activities.

Environmental Effects of Alternatives A, B, and C

Since no concerns or issues were identified regarding the proposed alternatives to the access and use of forest resources, sacred places and traditional cultural areas, the alternatives are expected to have no effect to traditional and contemporary American Indian uses. If there are no direct and indirect effects, the alternatives do not have the potential to cause cumulative effects.

Engineering and Transportation

Successful implementation of the recommended treatments for the Rim Lakes Forest Restoration Project is dependent on the Apache-Sitgreaves National Forests road system. Although vegetation management is the focus of the project, motorized access would be necessary to treat certain areas. Mechanized treatments and product removal would require maintenance on the existing road system. Details are listed in the engineering specialist report (Johnson 2011).

Analysis of the existing transportation system was completed using on-the-ground reconnaissance and observations, the Apache-Sitgreaves National Forests map, maps produced from the forest GIS database (including GPS data collected), Infra Data (database of record for roads), sale area maps of previous timber sales, personal consultation with other forest employees who are familiar with the area, and professional judgment based on past experience. The specialist report in the project record provides information on methodology, law, regulation, and policy detailed in the specialist report (Johnson 2011).

Engineering related actions in the Rim Lakes Project include opening approximately 184 miles of maintenance level 1 roads (currently closed), constructing 2.60 miles of temporary roads, and maintenance on the road system. Vegetation prescriptions involving biomass removal would require access for log trucks, chip vans, chippers, grinders, loaders, skidders, and other equipment. Turnouts and landings would be constructed for these treatment areas.

Work in the Chevelon Inventoried Roadless Area (IRA) is prescribed burning only. This action would not construct any roads. No mechanical treatments are proposed in the IRA.

Road maintenance items anticipated for identified system roads and temporary roads within the analysis area are described as follows:

- Spot Surfacing – Crushed aggregate would be placed at locations along the roadway to improve load bearing where rutting is evident.
- Spot Borrow – Pit-run rock borrow would be used to reestablish road templates, armor roadway shoulders, and construct drainage dips.
- Drainage Structures – This work would consist of installing and/or maintaining drainage features, sediment traps, and hardening natural crossings to handle expected increased runoff from treatment areas to protect roadbeds.
- Clearing – Trees would be removed and trimmed as needed to meet health and safety requirements for road width and vertical clearance (See Johnson, 2011, Appendix III for specifications).
- Dust Abatement – Water may be used on sections of roadway to reduce dust.

The analysis area contains a number of National Forest System roads ranging from smooth gravel-surfaced roads to rough, primitive, and unsurfaced roads. These roads are classified as forest roads under the jurisdiction of the Forest Service and needed for long term motor vehicle access. Most of these system roads were planned and constructed during past commercial timber harvest activities and most are not considered to be all weather roads. Main forest system roads link with double-lane paved State highways to form a transportation system that provides access to National Forest System lands for a variety of uses from towns and communities in the surrounding area.

Forest system roads within the analysis area are managed in accordance with current management objectives that are based on a variety of needs for access and use of forest resources. This area contains roads that are operated and maintained for use by passenger cars, high-clearance vehicles, and nonmotorized uses such as hiking, horseback riding, and cross-country skiing.

According to the forest GIS database, there are a total of 385 miles of Forest Service system roads within the project area. In addition, there are an unknown number of unauthorized roads within the project area created by repeated cross-country travel as is currently allowed by the forest plan (USDA 1987, as amended). A summary of the roads can be found in table 90 and a list of the roads can be found in the specialist report (Johnson 2011, appendix 1).

As the table illustrates, the majority of the roads are maintenance level 1 (closed) and level 2 (high-clearance vehicles). Most of these roads were constructed during past timber harvest activities. Most level 1 roads are closed by physical barriers (gates, berms, logs, rocks, etc.) and would require removal of those barriers to access the project area. Some level 1 roads are also used as nonmotorized trails and for snowmobiling, cross-country skiing, horseback riding, mountain biking, hiking, hunting, and camping (see “Recreation and Lands” section page 211). Other uses of the road system within the area include access for firewood cutting, Christmas tree cutting, grazing permittees, fire suppression, and forest administration.

Table 90. Road analysis summary

Objective Maintenance Level	Miles	Total Area (mi^2)
		52.50
1–Basic custodial care (closed)	291.58	Road Density (mi/mi^2)
2–High clearance	45.89	7.34
3–Suitable for passenger vehicles	25.68	Open Road Density (mi/mi^2)
4–Moderate degree of user comfort	10.77	1.78
5–High degree of user comfort	11.22	
Total Roads	385.14	
Total Open Roads	93.56	

Forest plan direction for road density is specific to management of the transportation system. Total road densities should average 3.5 miles per square mile or less of total forest area. Open road densities should average 2 miles per square mile or less (UDSA 1987). The open road density would not change due to the proposed treatments.

The transportation system includes haul routes that go through 11.5 miles of dispersed camping areas. These roads are identified in table 91.

Table 91. Haul route roads located within dispersed camping areas in the project area.

Road Number	Miles	Maintenance Level
9350	0.98	2
9354	1.53	2
9512E	2.50	2
84	1.33	3
169	1.19	3
171	0.08	3
171	1.85	3
171	0.51	3
195	0.72	3
300	0.39	3

Environmental Effects

Alternative A

Under this alternative, no treatments would be performed and the existing road system density and maintenance levels within the Rim Lakes area would remain as it is currently. Road maintenance activities would be limited to regularly scheduled maintenance. There would be no road improvements related to the proposed project. Forest system roads that are currently closed would not be reopened, thus precluding any new soil erosion taking place within the area (see "Watershed, Water Quality, Soils, Riparian, Noxious Weeds" section page 196). There would be no effects to recreation-related travel in the area and no safety concerns regarding hauling from trucks.

Alternatives B and C

In either alternative B or C, different types of treatments would be performed in areas designated according to vegetation type, slope, and accessibility which would reduce the likelihood of an uncharacteristically severe fire behavior immediately post treatment. Treatments would reduce the existing fuel loading, and increase canopy openings allowing for more frequent surface fires rather than canopy fires. To gain access, approximately 184 miles of maintenance level 1 roads would be opened which would include the removal of closure barriers already in place (dirt berms, boulders, and gates). Some level 1 roads would require clearing of vegetation grown in since the road was closed.

Approximately 2.6 miles of temporary roads would be necessary in order to access mechanical treatments and to protect portions of Crook Trail. No design standards are required by engineering other than to meet the BMPs. Temporary roads are authorized by contract, permit, lease, or other written authorization. They are not a forest system road and are not included in a forest transportation atlas (36 CFR 212.1, FSM 7705).

These temporary roads would be located on the ground prior to construction. Work could include minimum clearing and material spotting, locating them in areas where little to no resource damage can occur, filling in soft spots with pit run materials, spotting rough spots to accommodate haul vehicles, and limb removal for overhead clearances. There are no design standards required other than to meet the required BMPs. Temporary roads would be obliterated at the completion of project treatment activities accessed by that road.

Road maintenance would be in accordance to the BMPs listed in appendix B of this EIS. Specific project road specifications are found in the specialist report (Johnson 2011, appendix III and IV).

Surface replacement would be required to provide adequate surfacing, subgrade, embankment, and strengthening/armor material for project road maintenance.

Project traffic would affect the condition of Forest Road 300 from milepost 40.73 to milepost 43.92. FR 300 is an arterial road that runs through the Rim Lakes Recreation Area. Increased traffic and heavy loads would cause potholes and degradation of the chip seal surfacing on this portion of the road. Condition of the road surface would affect the long-term suitably for passenger cars and the desired operation and maintenance level. Currently pothole repair is completed as needed through forest allocations. This need for repair would increase. However, the repairs would be undertaken as needed to maintain the road.

Public safety risks would be minimized by adhering to the mitigation measures, including seasonal haul restrictions. Also, signing would follow the “Manual on Uniform Traffic Control Devices” (MUTCD). Speed limits would be appropriate to provide for public health and safety.

A list of roads identified to be used for the project are included in the specialist report (Johnson 2011, appendix I). A summary of the roads used for this project is in table 92.

Table 92. Road use summary

Objective Maintenance Level	Current Miles	Miles to Use (or Open)	Miles to Construct	Miles Not Used	Miles to Close	Miles to Decom-mission	Final Miles
					At End of Project Completion		
1 – Basic custodial care (closed)	291.58	183.96	NA	107.62	183.96	0	291.58
2 – High clearance	45.89	38.20	NA	7.69	0	0	45.89
3 – Suitable for passenger vehicles	25.68	25.68	NA	0	0	0	25.68
4 – Moderate degree of user comfort	10.77	9.89	NA	0.89	0	0	10.77
5 – High degree of user comfort	11.22	1.32	NA	9.91	0	0	11.22
Subtotals	385.14	259.05	0	126.11	183.96	0	385.14
Temporary roads	NA	2.60	2.60	NA	NA	2.60	NA
Roads outside of project	1.57	1.57	NA	0	0	0	1.57
Totals	386.71	263.22	2.60	126.11	183.96	2.60	386.71

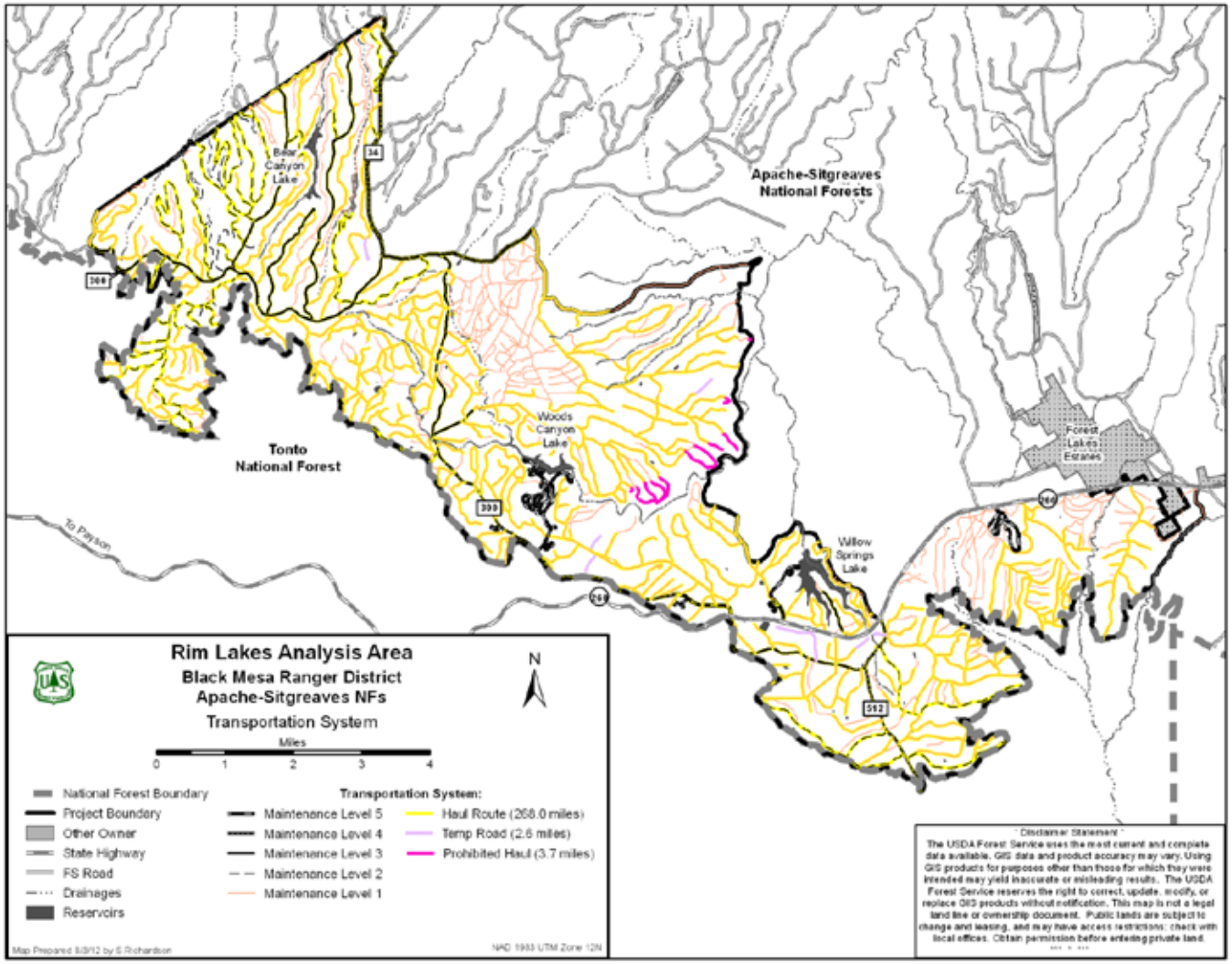

Figure 22. Transportation system

Cumulative Effects

Alternative A

There are no direct or indirect effects from implementing alternative A, so there are no contributions to cumulative effects. The forest is currently undergoing analysis of the Travel Management Rule, but no road changes are proposed in the Rim Lakes area.

Alternatives B/C

There are other timber projects that are part of the White Mountain Stewardship Contract in the operation phase of hauling timber out Forest Road 300. Currently these operations account for anywhere from 20 to 55 loads a day being removed when they are in full operation. Coordination of these projects, road user conflict, and dust generated on the road system would increase under either alternative B or C.

Public safety risks would be minimized by adhering to the mitigation measures. Signing would follow the "Manual on Uniform Traffic Control Devices" (MUTCD). Speed limits would be appropriate to provide for public health and safety.

The forest is currently undergoing analysis of the Travel Management Rule, but no road changes are proposed in the Rim Lakes area, therefore, no cumulative effects from that decision. The travel management analysis would amend the forest plan to prohibit driving off the designated road system, which would also not have cumulative effects to the Rim Lake Project's effects.

Short-term Uses and Long-term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

Implementation of either of the action alternatives does not jeopardize the long-term productivity of the Apache-Sitgreaves National Forests. As described throughout chapter 3, implementing either of the action alternatives would improve soil condition, watershed condition, forest sustainability, herbaceous plant growth, and others favorable conditions to productivity.

Unavoidable Adverse Impacts

Given the mitigation measures included with the action alternatives, implementing either of these alternatives would result in no long term adverse impacts to resources in the project area. Short term adverse impacts that cannot be avoided include sedimentation to streams, which is predicted to be minimal but unavoidable. Short term adverse impacts to recreation use would occur during implementation, but these would be of limited duration, with project design limiting conflicts by avoiding implementation during the heaviest recreation season.

Irreversible and Irretrievable Commitments of Resources

An irreversible commitment of a resource is one that cannot be regained, such as the extinction of a species. An irretrievable commitment is one where the value of the resource is lost for a period of time, such as the loss of soil productivity. Based on analysis found in chapter 3 of this document, either action alternative would make no irreversible and irretrievable commitments of resources. Soil and watershed conditions would be improved (see page 188). Wildlife habitat would be improved for species such as goshawk that prefer open forests. Visual quality would become more diverse.

A likely result of the no action—alternative A—is an uncharacteristic wildfire. The effects of such a fire as described in chapter 3 would result in long-term changes to the landscape that would be both irreversible and irretrievable.

Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with other environmental review laws and executive orders." This environmental impact statement has been prepared in accordance with the National Historic Preservation Act, which governs ground disturbance in historical places, and the Endangered Species Act, which covers projects that have threatened or endangered species in its boundaries.

Chapter 4. Consultation and Coordination

The Forest Service consulted the following individuals, Federal, State, county, and local agencies, and tribes during development of this environmental impact statement.

Federal, State, and Local Agencies Consulted

Jon Cooley, Dave Dorum, Arizona Game and Fish Department
Shaula Hedwall, Ryan Gordon, U.S. Fish and Wildlife Service
State Historic Preservation Office
White Mountain Stewardship Monitoring Board
Natural Resources Working Group

Tribes Consulted

Fort McDowell Yavapai Nation
Pueblo of the Zuni
San Carlos Apache Tribe
The Hopi Tribe
The Navajo Nation
The Ramah Navajo Chapter
Tonto Apache Tribe
Yavapai – Apache Nation of the Camp Verde Indian Reservation
Yavapai – Prescott Tribe of the Yavapai Reservation
White Mountain Apache Tribe

Public Notification

Letters of notification of the proposed action were sent to the agencies, groups, and individuals listed on the Rim Lakes Forest Health Project scoping mailing list located in the project record. The name of the project was changed to the Rim Lakes Forest Restoration Project after that initial scoping period.

Public announcements about the project and public meeting (January 26, 2008, Overgaard, AZ) were printed in the Mogollon Connection (January 16, 2008), The Pioneer (January 16, 2008) and in the White Mountain Independent (January 18, 2008) and were available on the Apache-Sitgreaves NFs Web site newsroom.

In September 2011, notice was given that the environmental assessment was available for review following the HFRA objection process.

After considering the objection and other factors, the forest elected to prepare an environmental impact statement (EIS). Consequently, a notice of intent (NOI) to prepare an environmental impacts statement was published in the Federal Register on March 29, 2012. In addition, notice was given through scoping letters sent to more than 100 interested people and organizations, including members of the Four Forest Restoration Initiative (4FRI) collaborative group. Notice of an April 2012 public meeting were also posted.

List of Preparers

Name	Position	Contribution	Education	Years of Relevant Experience
Brown, Lance	Wildlife Biologist, Clifton RD	Wildlife Analysis	BS Wildlife Management	17
Doyle, Ruth	Regional Landscape Architect, R3 Regional Office	Scenery Specialist Report	Masters of Landscape Architecture	26
Dykstra, Brian	Wildlife Biologist, Black Mesa RD	Wildlife Analysis	B.S. Forestry; M.S. Wildlife Biology	25
Dykstra, Elizabeth	Recreation and Lands Staff, Black Mesa RD	Project Leader, EA IDT and Recreation/ Lands Analysis	BS – University of Wisconsin-Stevens Point, 1982 MA – University of New Mexico, 1992	23
Hurlocker, Sandy	District Ranger, Santa Fe National Forest	Project Leader, EIS	BS Science Education, MS Journalism	28
Johnson, Steven R.	Civil Engineer, Apache-Sitgreaves NFs	Transportation Report	BS in Civil Engineering, University of Arizona	10
McMillan, Kathy	Fisheries Biologist, Apache-Sitgreaves NFs Supervisors Office	Fisheries and Aquatic Analysis	B.S. Fishery Science, B.S. Wildlife Science	17
Nelson, Chris	Forest Soil Scientist Apache-Sitgreaves NFs	Soil and Water Specialist Report, Cumulative Effects Analysis	BS Watershed Management (Forestry), Graduate School Primarily Soil Science	34.
Nicolet, Tessa	Fire Ecologist, R3 Regional Office	Fuels and Fire Specialist Report	B.S. Biology/Ecology, M.F. Fire Ecology	7
Richardson, Gayle	Silviculturist, Black Mesa RD	Silvicultural Report	BS in Forestry from NAU	29
Richardson, Steve	Geographic Information System, Black Mesa RD	Geospacial Analysis and Display	BS in Forestry from NAU, 1980	20
Schofer, Jeannie	Archaeologist, Gila NF	Heritage Resources	B.A. Ecological Anthropology, M.A. Anthropology	7
Snyder, Jim	Forest Hydrologist, Apache-Sitgreaves NFs Supervisors Office	Hydrology and Soils Update	B.S. Geology and Mathematics	15
Schofer, Jeannie	Archaeologist, Gila NF	Heritage Specialist	B.A. Ecological Anthropology, M.A. Anthropology	7
Youtz, James	Silviculturist, R3 Regional Office	Coauthor, Silviculture Specialist Report	BS Forestry, emphasis in forest management, 1983 NAU	29

Others who contributed to this environmental impact statement include Lenda Quinn, Victoria Loewe, Melissa Schroeder, Parry Ryerse, Jim Probst, and Kendell Hughes. Dee Hines, district ranger at the Black Mesa Ranger District, has also been integral to the development of this document.

DEIS Distribution

This environmental impact statement has been distributed to individuals who specifically requested a copy of the document. In addition, copies (paper or electronic) have been sent to appropriate Federal agencies, federally recognized tribes, State and local governments, and organizations representing a wide range of views regarding this project.

The document is also available on the Apache-Sitgreaves National Forests Internet site.

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Appendix A. Silviculture Treatment Details

The following prescription parameters and mitigation measures apply to alternatives B and C.

Mechanical Treatments: Mechanical treatments refer to a variety of possible "tools" to meet objectives. These include, but are not limited to: the use of chain saws or feller-bunchers to cut trees and lop slash, skidders to move material to landings, bulldozers to pile slash, and specialized equipment to cut, chop, break, lop, or in some way treat the fuels to meet objectives. The work would be accomplished in many ways including the use of Forest Service personnel and contractors. Some of the trees that are cut may be sold in personal use and commercial wood product sales. This would help to offset the total cost for treatments by reducing the cost of cutting trees and treating slash.

Meadow and Riparian Enhancement: All conifers would be removed and cleared where they have encroached into existing meadows and riparian areas favoring hardwood species. Trees that provide streambank stability would be maintained regardless of size. Slash would be removed from the drainage and hand piled or lopped to the ground. Three existing and potential snags would be left around meadows for wildlife. Alternative C would remove conifers up to 16 inches d.b.h..

> ***Alternative B*** - No diameter limit.
>
> ***Alternative C*** - No trees 16 inches d.b.h. or larger would be removed. In some locations, this would result in incomplete attainment of objectives.

Aspen and Oak Exclosures: All encroaching conifers would be removed from areas previously fenced to exclude elk. Fences would continue to be maintained to exclude elk from aspen and oak regeneration. Alternative C would remove conifers up to 16 inches d.b.h..

> ***Alternative B*** - No diameter limit.
>
> ***Alternative C*** - No trees 16 inches d.b.h. or larger would be removed. In some locations, this would result in incomplete attainment of objectives.

Mexican Spotted Owl Habitat (MSO)
Pine-Oak and Mixed Conifer Proposed Treatments

MSO Protected Habitat Areas: Intermediate thinning[21] would be used in stands with diameter limits of 9 inches d.b.h.. Thinning would promote health and vigor of the larger trees and reduce the fire hazard. Smaller trees would be cut maintaining the largest, healthiest trees (table 1, fig. 4). Where areas are dominated by VSS 4-5-6, remove all trees < 9 inches d.b.h.. Where areas are dominated by VSS 3, retain 60–80 square feet of basal area (BA) [22]. Where trees are dominated by VSS 1–2, retain trees at the rate of 200 trees per acre. Residual basal area would vary by stand. Where possible, early seral species (southwestern white pine, ponderosa pine, Douglas-fir, aspen) should be favored for retention and regeneration.

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[21] Intermediate Treatment – also referred to here as intermediate thinning. The thinning or cutting of trees to improve the composition, structure, condition, health, and growth of remaining trees (SAF 1998).

[22] Basal area (BA) – the cross-sectional area of a single tree stem, including bark, measured at breast height in square feet (SAF 1998).

MSO Restricted Habitat (Other): Group selection[23] would be used to regenerate ponderosa pine, white pine, and Douglas-fir in openings .25–4 acres in size over 20 percent of the area within excess VSS classes and/or diseased patches. Where necessary retain additional seed trees of desirable species and characteristics. The remaining matrix area would receive intermediate thinning, cutting smaller trees to leave the larger, healthier trees, increasing health and vigor of the remaining larger dominant[24] and codominant[25] trees and reducing fire hazard (fig. 4). Southwest-facing slopes would be thinned to 60–80 BA and north-facing slopes 80–100 BA. No hardwood species would be removed. Stands with no large trees would be thinned from below with an intermediate thinning to promote health and vigor of the larger trees and reduce fire hazard. Smaller trees would be cut maintaining the largest, healthiest trees. Groups of trees smaller than 12 inches d.b.h. would be thinned to a lower density of 40–60 BA while trees in the larger size classes would be thinned to 60–80 BA. Early seral species (southwestern white pine, ponderosa pine, Douglas-fir, aspen) would be favored for retention and regeneration.

Where severe dwarf mistletoe infection centers are located; focus on removal of infected trees to establish new regeneration groups (VSS 1) or to favor existing regeneration. Where regeneration groups are not to be established, focus on reduction of severely infected trees (DMR = 3+) within the leave tree groups.

Small inclusions of aspen remnants within portions of ponderosa pine would be regenerated by removing all conifers in the immediate area, ½ to 1 chain from the clone, with some removal of aspen or site-disturbing activity such as ripping of aspen roots adjacent to large aspen clone. The preferred method is removal of all trees within and adjacent to the clone, retaining all healthy aspens in the clone. Where aspen is present in mixed conifer it may be promoted through group selection described above with removal of all conifers, 1/2 to 1 chain from the aspen clone. Aspen clones would be evaluated and fenced as needed. Trees would be retained according to the diameter limit for specific stands.

> ***Alternative B*** - No trees 24 inches d.b.h. or larger would be removed.
>
> ***Alternative C*** - No trees 16 inches d.b.h. or larger would be removed.

In many locations, this would result in no creation of functional regeneration group openings, or less of the area opened for regeneration than desired. It would also result in implementation tradeoffs between attainment of stand density/fuels management, and forest structure/forest health objectives.

MSO Restricted Habitat (Threshold): All treatments in these stands would maintain 150–170 BA where present. The remaining area would receive an intermediate treatment removing the smaller trees to reduce fire hazard. No hardwood species would be removed. No trees 24 inches d.b.h. or larger would be removed. Early seral species (southwestern white pine, ponderosa pine, Douglas-fir, aspen) would be favored for retention and regeneration.

---

[23] Group Selection – a cutting procedure which creates a new age class by removing trees in groups or patches to allow seedlings to become established in the new opening (SAF 1998).

[24] Dominant – trees that receive full light from above the canopy and partially from the sides. Crowns extend above the general level of the canopy (USDA 2008).

[25] Codominant – Tree crowns receive full light from above, but comparatively little from the sides (USDA 2008).

Alternative B - No trees 24 inches d.b.h. or larger would be removed.

Alternative C - No trees 16 inches d.b.h. or larger would be removed.

In many locations, this would result in no creation of functional regeneration group openings, or less of the area opened for regeneration than desired. It would also result in implementation tradeoffs between attainment of stand density/fuels management and forest structure/forest health objectives.

MSO Restricted Habitat (Target Threshold): Intermediate thinning would be used removing the smaller trees and leaving the larger, healthier trees, increasing health and vigor of the remaining larger dominant and codominant trees and reducing fire hazard. These stands would be thinned to reach a target BA of 150–170. No trees 24 inches d.b.h. or larger would be removed. No hardwood species would be removed. Early seral species (southwestern white pine, ponderosa pine, Douglas-fir, aspen) would be favored for retention and regeneration.

Alternative B - No trees 24 inches d.b.h. or larger would be removed.

Alternative C - No trees 16 inches d.b.h. or larger would be removed.

In many locations, this would result in no creation of functional regeneration group openings, or less of the area opened for regeneration than desired. It would also result in implementation tradeoffs between attainment of stand density/fuels management and forest structure/forest health objectives.

Goshawk Habitat
Ponderosa Pine Proposed Treatments

Goshawk Foraging FA and PFA Habitat Stands: Group selection would be used to regenerate ponderosa pine, white pine, and Douglas-fir in openings 1/10 to 4 acres in size over 20 percent of the area within excess VSS classes and/or diseased patches, figure 1. When openings exceed 1 acre in size, 5–10 desirable seed trees per acre would be retained, with 3–5 seed trees at least 15 inches d.b.h. and larger. Where necessary, retain additional seed trees of desirable species and characteristics (fig. 4). Tree groups would be maintained by VSS class, ranging from .25–1 acre in size and generally in groups of 4–20 trees (1/10 acre basis). Strive to distribute percentages according to desired VSS percentages in the forest plan. Residual stand density would vary, but would average 50–70 square feet of basal area per acre in foraging areas, and would average 70–80 square feet in PFA. Where stand structures are predominantly even-aged, thin the stand matrix in an irregular density fashion, striving to create groups and clumps of residual trees. Desirable dominant and codominant white pine and ponderosa pine would be left as single trees or groups throughout the area. See figures 2 and 3.

Where severe dwarf mistletoe infection centers are located; focus on removal of infected trees to establish new regeneration groups (VSS 1) or to favor existing regeneration. Where regeneration groups are not to be established, focus on reduction of severely-infected trees (DMR = 3+) within the leave tree groups.

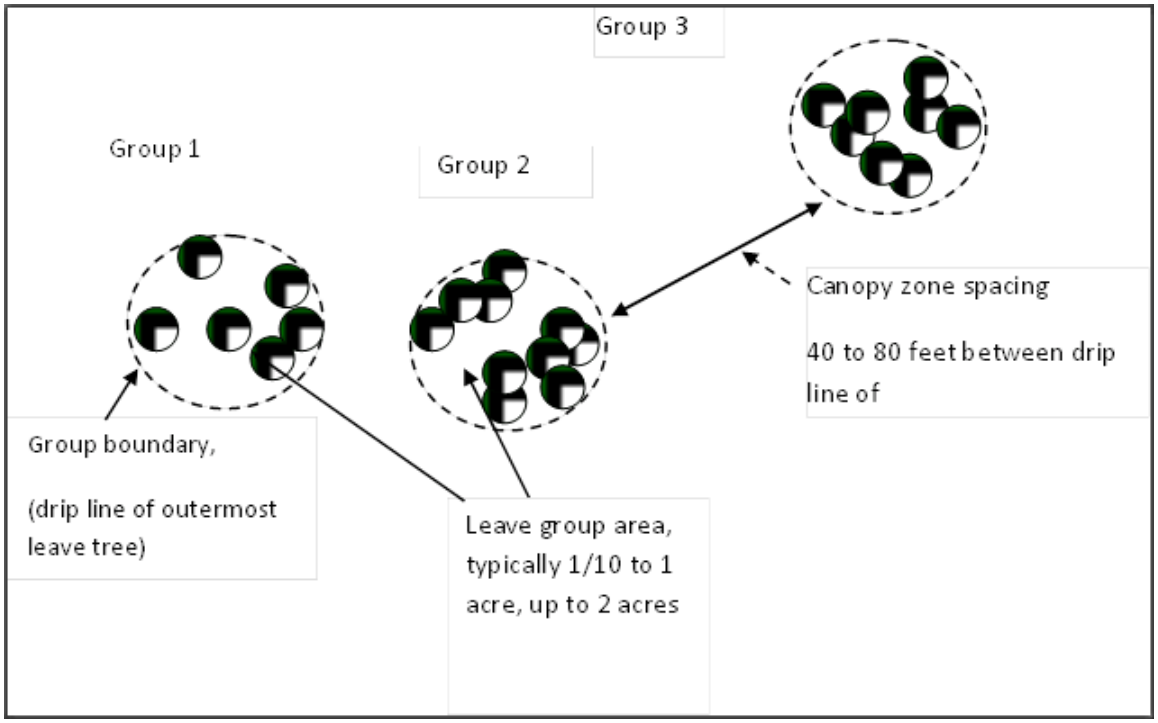

Figure 1. Illustration of desired spatial arrangement of leave groups (average of 40–60 percent canopy closure at the group level)

Small inclusions of aspen remnants within portions of ponderosa pine would be regenerated by removing all conifers in the immediate area, ½ to 1 chain from the clone, with some removal of aspen or site-disturbing activity such as ripping of aspen roots adjacent to large aspen clones. The preferred method is removal of all trees within and adjacent to the clone, retaining all healthy aspens in the clone. Where aspen is present in mixed conifer it may be promoted through group selection described above with removal of all conifers, 1/2 to 1 chain from the aspen clone. Aspen clones would be evaluated and fenced as needed. Trees would be retained according to the diameter limit for specific stands.

Alternative B - No diameter limit.

Alternative C - No trees 16 inches d.b.h. or larger would be removed.

In many locations, this would result in no creation of functional regeneration group openings, or less of the area opened for regeneration than desired. It would also result in implementation tradeoffs between attainment of stand density/fuels management and forest structure/forest health objectives.

Table 1. Goshawk habitat areas outside of PFAs (foraging areas)

		Typical Number of Trees Per Group for Different Group Sizes [1]					Typical Intra-Group (within group) Densities[1] (All Group Acreage Sizes)	
VSS	D.B.H. Range	1/10 Acre Group	¼ Acre Group	½ Acre Group	¾ Acre Group	1 Acre Group	Relative Spacing Range (feet)	Basal Area[2] (ft2/acre)
1 & 2	0–4.9"	39	69	198	297	396	8–14	NA
3	5–11.9"	14	34	68	102	136	NA	50
4*	12–17.9"	5	12	23	35	46	NA	60
5*	18–23.9"	3	8	15	23	30	NA	70
6*	24"+	2	5	11	16	21	NA	85

[1] Center on these values

[2] Rounded to nearest 10 square feet per acre

* Densities are equivalent to 40 percent canopy cover

Table 2. Goshawk PFA habitat areas

		Typical Number of Trees Per Group for Different Group Sizes[1]					Typical Intra-Group (within-group) Densities[1] (All Group Acreage Sizes)	
VSS	D.B.H. Range	1/10 Acre Group	¼ Acre Group	½ Acre Group	¾ Acre Group	1 Acre Group	Relative Spacing Range (feet)	Basal Area[2] (ft2/acre)
1 & 2	0–4.9"	39	69	198	297	396	8 – 14	NA
3	5–11.9"	27	68	135	203	270	NA	50
4*	12–17.9"	14	34	69	104	138	NA	85
5**	18–23.9"	8	20	40	60	80	NA	90
6**	24"+	6	14	30	43	55	NA	110

[1] These are typical values for the desired condition; variation can occur and is desired. However, ranges should center on these values.

[2] Rounded to nearest 10 square feet per acre

* Densities are equivalent to 55 percent canopy cover.

** Densities are equivalent to 50 percent canopy cover.

Table 3. Physical characteristics to consider when choosing leave trees (for ponderosa pine and Douglas-fir)

Leave trees must meet and possess all of either the desirable or acceptable physical characteristics. Trees with desirable characteristics should rarely be cut. Trees possessing acceptable characteristics may or may not be left. Trees with nondesirable characteristics should rarely be designated as leave trees. Trees possessing acceptable characteristics would be the "pool" from which to choose to meet density management objectives.

Evaluation Criteria	Desirable (usually leave) (Keene's A)	Acceptable (maybe leave, maybe cut) (Keene's B & C)	Nondesirable (usually cut) (Keene's D)
Live Crown Ratio	>40% for ponderosa pine	25–40% for ponderosa pine 35–50% for other species	Less than 25% for ponderosa pine Less than 35% for other species
Crown Class	Dominants	Codominates and better intermediates	Suppressed/over-topped, poor form**
Insects, Animal, Fire, Misc. Disease (see next row for mistletoe)	None	Minor insect or animal defoliation (< 25% live crown ratio). Barking of ponderosa pine or Douglas-fir < 50% of bole circumference. Fire kill of cambium < 50% of bole circumference or the scorch is on the lower two-thirds of the crown.	Any bark beetle attacks. Defoliation >25% of live crown. Barking of ponderosa pine or Douglas-fir > 50% of bole circumference. Any significant barking of other species. Any significant top killing. Fire kill of cambium >50% of bole circumference, or the scorch reaches into the upper third of the crown. Any conks on stem which indicate rot.
Hawksworth Dwarf Mistletoe Rating—DMR*	0	VSS 5 groups with trees 3 or lower (where VSS 5/6 is deficit), where not overtopping desired VSS 1, 2, and 3 groups. VSS 6 groups with any DMR where VSS 6 is deficit.	All VSS 2-4 with any visible dwarf mistletoe All VSS 5 groups with trees averaging 4 or greater DMR where overtopping desired VSS 1, 2, and 3 groups.
Form Defects	None	MINOR (no significant weakening of the tree anticipated. Minor crooks, sweeps, and tight forks which are < 30% of total tree height are acceptable if the tree is dominant or codominant and otherwise has good vigor).	Major (weakening of tree or multiple tops)
Soundness Defects	None	None	Any

Reserve tree requirements are not subject to physical characteristics criteria for tree selection.

*This is example text and actual treatments for dwarf mistletoe would vary on a stand level basis.

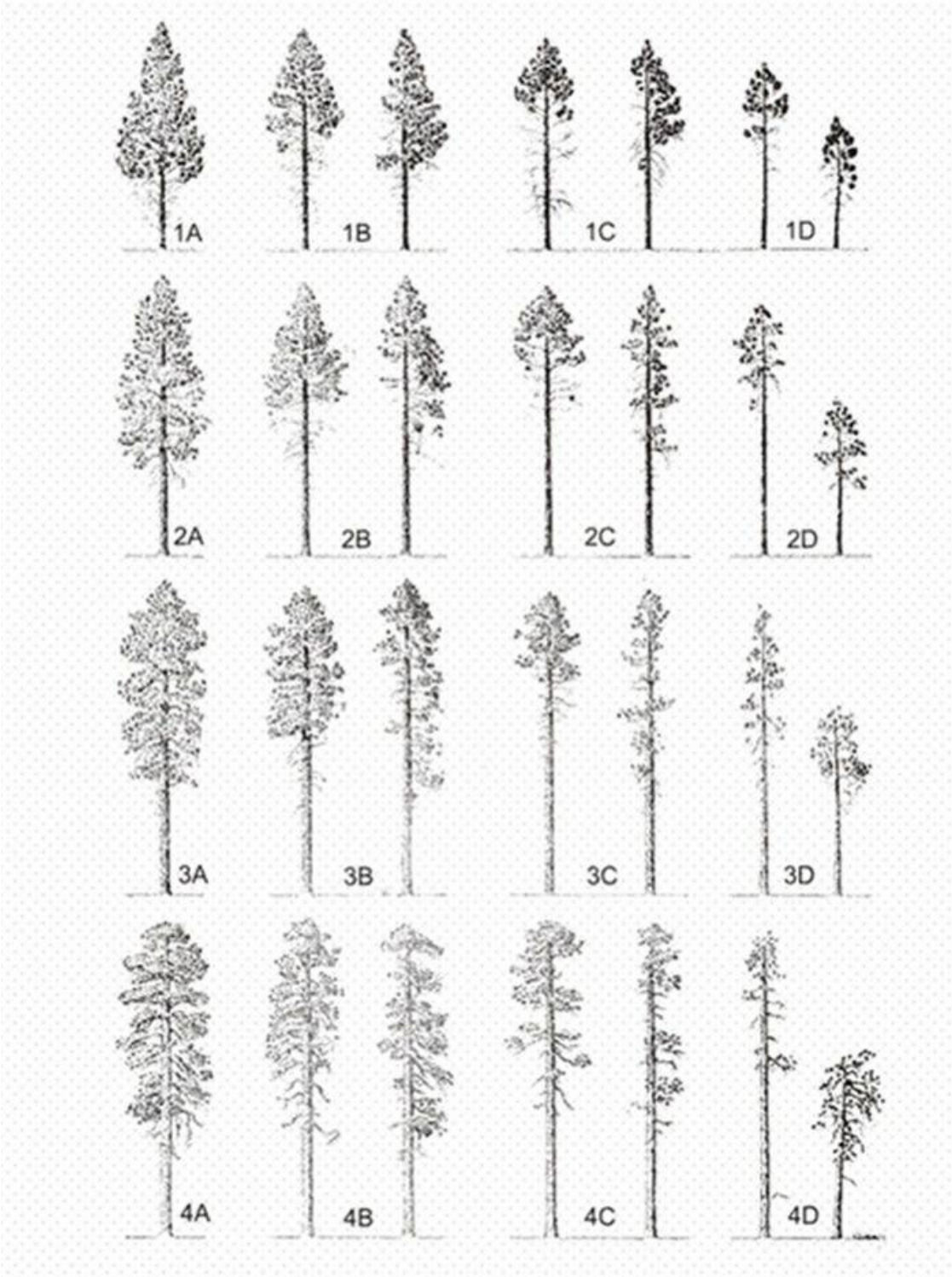

Figure 2. Keen's Classification of trees based on age and vigor

Keen's tree classification taken from "Ponderosa Pine Tree Classes Redefined" (Keen 1943)

Appendix B. Mitigation Measures

Air Quality Protection

Smoke from prescribed burning would comply with Arizona Department of Environmental Quality (ADEQ) requirements. ADEQ considers the cumulative effects of smoke emissions from multiple jurisdictions prior to approving daily prescribed burning activities. This mitigates the potential for severe smoke effects from multiple prescribed fire projects to the entire action area.

Aquatic Protection

The forest plan emphasizes maintaining satisfactory riparian areas in MA 3. This management gives priority emphasis to the following streams: Chevelon Creek, Willow Springs Creek, Woods Canyon Creek, and Willow Creek. Specific standards and guidelines for riparian areas in MA 3 include:

1. Prevent siltation not to exceed 20 percent (85 mm) in riffle areas.
2. Manage for and maintain at least 80 percent of near natural shade over water surfaces.
3. Maintain 80 percent of the spawning gravel surface free of inorganic sediment.
4. Manage for stream temperatures not to exceed 68 degrees Fahrenheit, unless not technically feasible.
5. Manage for and maintain at least 60 percent of the woody plant composition in three or more riparian species.
6. Manage for and maintain at least three age classes of riparian plants, with at least 10 percent of the woody plant cover in sprouts, seedlings, and saplings.
7. Manage for and maintain at least 60 percent near natural shade and tree crown cover.
8. Manage and maintain or improve all riparian areas to satisfactory riparian condition.
9. Manage for or maintain at least 60 percent of potential habitat capability (HCI) for Apache trout, rainbow trout, brook trout, brown trout, loach minnow, and Little Colorado spinedace.
10. Manage for and maintain at least 80 biotic condition index in all perennial streams.
11. In addition, forest plan direction for MA 3 for both priority and nonriparian area includes:
    - Manage and maintain or improve all riparian areas to satisfactory riparian condition.
    - Manage for or maintain at least 60 percent of HCI for Apache trout, rainbow trout, brook trout, brown trout, loach minnow, and Little Colorado spinedace.

Cultural Resource Protection

1. Cultural resources in the Rim Lakes Project area are vulnerable to impacts from mechanical treatment, road construction and improvements, prescribed fire, and human disturbance associated with these undertakings.
2. All Rim Lakes proposed treatments should be managed as having either “no effect” or “no adverse effect” to cultural resources. This means that all sites listed, eligible, or

unevaluated for the National Register Historic Places (NRHP) would be avoided or not adversely affected by proposed activities. Per appendix J of the programmatic agreement, prior to the authorization of on-the-ground work for each phase of the project, the following must be completed:

- Inventory (survey), identification (site recording) and NRHP evaluation are documented in a Section 106 compliance inventory report and a signed Forest Service inventory standards and accounting (ISA) form are completed.
- Site protection requirements shall be documented in the inventory report and on the FS ISA form and the protection requirements shall be completed.

3. Timber and fire project managers will work with the zone archaeologist to assure there is adequate notification and time to conduct inventory surveys prior to implementation. Since the entire area may not be 100 percent surveyed and the entire area is proposed for prescribed burning, all phases will result in a "no adverse effect" (unless no cultural resources are present). All reports shall be sent to the SHPO. Protection measures shall be selected from appendix J, section II. Section II includes a list of protection measures that the forests can draw from to ensure that adverse effects to cultural resources are avoided or minimized. These measures include but are not limited to the following:
   - No treatments or ground disturbance within site boundaries -or-
   - Allow treatments within site boundaries provided: cutting is accomplished using hand tools only; large diameter trees are felled away from all features; materials removed from the site are removed by hand; no dragging of logs, trees, or thinned material across or within site boundaries.
   - No use of vehicles or other mechanized equipment within site boundaries.
   - No staging of equipment within site boundaries.
   - No slash piles within site boundaries.
   - The forest archaeologists may approve additional measures to further protect sites.
   - In the case of broadcast burning, only fire sensitive sites will require protection from prescribed fire. Generally sites sensitive to fire effects include, but are not limited to, rock art, prehistoric sites with flammable architectural elements and other flammable features or artifacts, dendrogylphs (aspen art), historic sites with standing or down wooden structures, or other flammable features or combustible artifact materials (such as wood, historic properties) will require protection.
   - For mechanized treatments, all cultural resources (excluding the General Crook Trail and Heber Reno Sheep Driveway) listed, eligible, or unevaluated for the NRHP will be marked for avoidance. Treatments and associated project activities will comply with the guidelines for the General Crook Trail stated in the forest plan.
   - Use of motorized vehicles on any portion of the route not specifically designated and designed for motorized vehicle travel is prohibited. Emphasize protection for the historic value of the trail route. Manage a 200-foot-wide corridor to preserve evidences of historic roadway and landscape character, including related historic trees, markers, gravesites, and water holes.

- Motorized use of the route is defined as traveling on the trail route by motorized vehicle/equipment. Roads for access and hauling will be used that cross over the nonmotorized portion of the trail. This activity is in compliance with the forest plan and will not adversely affect the trail and its associated historic features. Segments of the trail that are specifically designed for motorized vehicle travel will be used.
- The proposed activities will not adversely affect the characteristics that make the Heber-Reno Sheep Driveway District eligible for the NRHP. No protection measures are necessary for the driveway. Should additional sites be discovered during project implementation, all work in that locale shall be halted and the forest or zone archaeologist will be notified immediately. Work shall not resume in that area until the zone or forest archaeologist has notified the district ranger that work may proceed.
- Terms and conditions of Section 106 compliance shall include appropriate postproject monitoring requirements as determined necessary by the forest archaeologist to assess the effectiveness of protection measures. All site monitoring shall be documented on a site update form and/or monitoring report as appropriate. Per protocol, the Apache-Sitgreaves NFs shall maintain an updated list of sites to be monitored that are part of the Rim Lakes Forest Health Project, which will include the date monitoring is completed and the monitoring results.
- During prescribed burning, protect fire-sensitive sites by excluding from the burn area, protect by hand line/black line/wetline/foam retardant/structural fire shelter or remove heavy fuels from site by hand.
- Remove heavy fuels from site by hand: (1) prevent in-situ heavy fuels that cannot be removed from ignition (e.g., flush cut and bury stumps); and (2) implement same protective measures for future maintenance burns.
- Protect selected other sites from burning (optional): allow burning over nonfire-sensitive sites provided no ignition points within site boundaries and no staging of equipment within site boundaries and no slash piles within site boundaries.
- No vehicles allowed within site boundaries.
- No firewood gathering within site boundaries, or allow firewood gathering provided no dragging of logs, trees, or cut material across or within site boundaries.
- Materials removed from the site are removed by hand.
- Allow firewood cutting in areas of large, continuous, low density artifact scatters that cover large portions of a landscape provided that: all features and artifact concentrations are recorded and avoided; use of vehicles is prohibited during wet ground conditions; periodic monitoring is used to assess impacts and if impacts are noted, firewood cutting will be prohibited in the area.

Protect Range Allotment Infrastructure

Protective measures will be put in place for range improvement structures.

Recreation Public Health/Safety

1. To maintain health and safety for all users on the roads within the analysis area, project haul traffic speeds will be no greater than 25 miles per hour (m.p.h.).
2. Restrict hauling within the Rim Lakes Recreation Area during times of highest recreation use. The highest recreation use and associated traffic is on weekends between Memorial Day and Labor Day. On the weekends of Memorial Day, July 4th, and Labor Day, recreation use and associated traffic is high, including nonholiday days around the holiday. For example, when July 4 falls on Tuesday, Wednesday, or Thursday, the recreation use and associated traffic is high the whole week.
3. No hauling between 1200 noon Fridays and 0600 Mondays for weekends between and including Memorial Day and Labor Day.
4. No hauling on the Federal observed holiday for Memorial Day, July 4th, or Labor Day.
5. All operations will require appropriate signing, gates, or other traffic accommodations to provide for the safety of the public in the project area. Signs placed along haul routes and adjacent forest development roads must meet the current MUTCD standards developed by the U.S. Department of Transportation. Implement road closures and/or area closure restrictions as deemed necessary by forest officials for health and safety concerns during any operation.
6. Restrict treatment activities in units adjacent to the Rim Lakes Recreation Area and the forest system roads listed: 9514L, 9512E, 149, 148, 181, 9500A, 300X, 195, 9354, 208 89, 260C2, 171, 84, 89A, 105, 300A, 9350, 300B, 105A through 105N, 260, 300 from 300B east to the state route.
7. No treatments before 8 a.m. every day between Memorial Day and Labor Day.
8. No treatments between 12 noon Fridays and 8 a.m. Mondays.
9. No treatments on Federal observed holidays.
10. No treatments the week of the Federal observed July 4th holiday if the Federal observed July 4 holiday falls on Tuesday, Wednesday, or Thursday.
11. Implement road closures, one-way traffic, and area closure restrictions as deemed necessary by forest officials for health and safety concerns during any operation.
12. Evaluate and adjust haul routes and restrictions within the Rim Lakes Recreation Area and to the north to reflect any increase or decrease in traffic volume of forest visitors in the foreseeable future.
13. Separate designated snowmobiles trails and project implementation traffic/haul routes.

Road Protection

1. To protect the existing road system, all hauling shall take place only during dry or frozen conditions.
2. There will be seasonal haul restrictions on FR 300 based on snow level and saturation of soil. Snow level on the ground should be between 12 and 36 inches. Roads should be dry or frozen and have a minimum of 4 inches of snowpack at all times. Typical closure could

be, but is not limited to, December 20 through April 1 of any given year. If needed, an alternate route can be used to divert around the paved section of FR 300 in order to protect the integrity of the road surfacing. This alternate route would include the use of FR 105, 9500, and the 235 corridor. This action will need to receive prior approval from the Forest Service before any activity could take place.

Scenic Resource Protection

Stump heights should be 6 inches or less within the immediate foreground (up to 300 feet from National Forest System roads and trails, scenic byways, other designated visually sensitive travelways. This also applies within developed recreation sites and adjacent to known or designated dispersed camping sites.

Vegetation Protection

1. Broadcast burning will be conducted under conditions to preserve desired forest structures and densities.
2. Priority for maintenance burns should be ponderosa pine forest types that have not experienced fire in the last 10 years. Areas that have experienced fire in the last 2 years should be of lowest prioty. Some areas can receive fire in consecutive years but then should be rested from fire for at least 3 years.
3. Dry mixed conifer forest that have not experienced fire in the last 25 years should be a priority for maintenance burning. Areas that have experienced fire in the last 5 years should be lower priority. Areas in dry mixed conifer should not experience fire in consecutive years.
4. Areas adjacent to recent fires should be of lower priority than those farthest from recent fires.
5. Stands that are being managed for old growth will not be prescribed burned in years associated with drought.
6. Stands that are being managed for old growth will be burned frequently.
7. Stands that meet or are being managed for old growth will be thinned to a desired basal area prior to prescribed burning.

Watershed Protection

The following are site-specific BMPs required for the project. The following list covers watersheds, riparian areas, uplands, roads, and noxious weeds. Some of the BMPs listed for one purpose may benefit other purposes.

General

1. If unforeseen events occur in the future (e.g., large wildfires, prescribed burns producing higher than planned levels of severely burned conditions, etc.) that result in significant disturbances to a sixth code watershed involved in this project, and if those effects are above those anticipated from this project, an equivalent disturbed area (EDA) analysis

would be performed to determine if the watershed has sustained levels of disturbance which are above threshold values (generally interpreted as an EDA level equivalent to 15 percent of a sixth code watershed). This analysis would be used, along with field investigations, to determine if the planned schedule of treatment activities in that watershed needs to be revised to allow for recovery of watershed conditions before the next treatment action there is taken.

2. The timber sale administrator or contracting officer representative will require operators to maintain a copy of these BMPs onsite for each vehicle conducting operations within a task order unit.
3. No more than 50 percent of a sixth code watershed would be treated within any 2-year time period.
4. The Canyon Creek watershed has a current EDA rating of 11.3 percent. Any action/treatment(s) taken in this watershed will require “timing” and “spacing” which would result in no additional increase to the current calculated EDA. The Canyon Creek watershed may be prescribe burned and/or hand thinned with no consideration for timing or spacing. The mechanical thinning should begin no sooner than the second year of the project, estimated to be 2014 to 2015.
5. The Christopher Creek watershed EDA of 14.7 percent will go above the 15 percent threshold based on Tonto National Forest actions/treatments on that portion of Christopher Creek within the Tonto National Forest boundary. The Rim Lakes treatments are a small portion of projected worst-case scenario EDA. It is recommended that treatments are spaced in two or three increments over a 10-year span beginning in year 2 or 3 (2014-2015). This would allow for recovery of treatments being implemented at this time on the Tonto NF and other past vegetative and fire treatments.
6. The Chevelon Creek Headwaters/Woods/Willow Springs watershed EDA of 2.7 percent could potentially move above the threshold if actions/treatments are not allotted with appropriate timing, spacing, and/or mitigation of treatments. Vegetation, fuels, and watershed specialists met and modified proposed treatment of residual material on approximately 25 percent of the treated area. Disturbance factors were reduced where top and limb material was lopped and scattered instead of piled and burned, or whole trees were to be removed. This action improves resistance to overland flow and generally results in quicker ground cover response. By implementing actions in three stages over 10 years, recovery of portions of the watershed can mitigate actions. The timing of treatment implementation is expected to mitigate cumulative effects within this watershed.
7. Final unit closeout or seasonal closeouts shall include a combination of water-barring, ripping/seeding, and slash of skid trails, haul roads, landings, disturbed areas, and areas potentially impacting intermittent, ephemeral, and perennial drainages. Any disturbed route, road, or trail having slopes exceeding 3 percent shall be water-barred.

Riparian/Stream Measures (Including Wetlands, Springs, Seeps)

1. Use project area maps for designating stream courses for water quality protection. Locations of protected stream channels and filter strips (streamside management zones) will be delineated on the project area and contract maps. Riparian areas and meadows designated for protection will also be delineated on the project area and contract maps. A

smaller map of buffers is located at the end of the "BMP" section of the satershed report (Nelson 2011).

2. Streamside management zones (SMZs) were created using the following criteria: width is based on the nature of resource values at risk (such as the presence of aquatic ESA species or its potential introduction), special concerns for water quality degradation, erosion hazard, existing vegetative ground cover conditions, streambank and riparian conditions, natural geologic features, and flow regime. SMZ widths were designated using the established matrix as a guide.
3. A map of the buffers (Strm_Buffers_nad83.mxd) can be found in the project record.
4. Stream channels and other wetlands to be protected will be shown on the project contract maps along with their associated streamside management zones (SMZs), if applicable. SMZs shall be designated along intermittent and perennial stream channels and selected ephemeral channels.
    - Stream channels shall be crossed at designated crossings only and shall be preapproved by the authorized Forest Service (FS) officer.
    - Unless approved otherwise by the authorized FS officer, SMZ BMPs may prohibit, limit, or constrain mechanized activities within all or part of the SMZ.
    - There shall be no skidding or road construction longitudinally within stream channels.
    - There shall be no decking and machine piling of slash within stream channels.
    - Leadout ditches or waterbars shall not be constructed in such a manner as to divert runoff into stream channels.
    - Unless designated by the authorized FS officer, debris generated from treatment activities will be removed from stream channels.
    - Trees designated for removal shall be felled outside the stream channel.
    - Trees, in or on the banks of stream courses that are providing bank and stream channel stability are not to be removed.
    - The authorized FS officer will identify exceptions where restoration or additional thinning is needed for resource concerns.
    - The authorized FS officer will use their authority for skid trail and log landing location to protect, as needed, stream courses that were not designated on the project contract map.
5. Mechanical slash piling shall not occur in meadows, SMZs along perennial and intermittent streams, and riparian areas.
6. Wetlands, springs, seeps and meadow protection during tree removal activities: These areas will be protected from treatment activities and include a 50-foot buffer that excludes mechanized equipment. Treatments may occur within these areas if specific restoration objectives are identified and approved by the FS officer. Ground based harvest operations may only be conducted within the buffer if at least 6 inches of snow cover over a minimum of 3 inches of frozen ground are present. Harvest operations will be suspended if these conditions are not met due to warm temperatures. This BMP will be applied to mapped and unmapped wetlands, springs, seeps, and meadows.

7. For SMZs along perennial and intermittent streams, directional falling of trees shall be away from the stream channel. Ground skidding, decking of logs, and machine piling are permitted only on existing roadbeds that are located within SMZs. Road construction and burning of concentrated slash are prohibited within the SMZ. Stream channels to be protected within SMZs will be identified on watershed and project area contract maps. Stand prescriptions shall include a sketch of the SMZ location and width. Ground based harvest operations may be conducted in SMZs if at least 6 inches of snow cover over a minimum of 3 inches of frozen ground are present. Harvest operations will be suspended if these conditions are not met due to warm temperatures.
8. Log landings (decking areas) shall not be allowed in meadows, riparian areas, stream channels, and SMZs along perennial and intermittent streams. The authorized FS officer may authorize landings, in these areas, if required. These treatment areas will be clearly designated on the project area contract map.
9. Prescribed burn to allow for low to moderate burn intensities for the retention of long-term soil productivity, to maintain the sediment filtering capacity of streamside management zones, and to reduce erosion,
10. Fire control lines shall not be constructed on slopes greater than 40 percent or within SMZs. Exceptions will be identified by the authorized FS officer and specific mitigations will be determined at that time.
11. Ignition shall be above slope breaks of active flood plain. Fire will be managed such that burning into streamside management zones is limited to 15 percent or less of the area of the SMZ when adjacent upland zones have not recovered hydrologically from project entries. Utilize jackpot burning where appropriate.
12. Livestock grazing will be coordinated with prescribed burning, especially relative to drainages and their flood plains. Livestock use may be deferred, if necessary in order to establish grasses in sufficient quantity to carry fire, prior to burning, or to protect new growth after burning.

Ephemeral Drainages

1. Ephemeral drainages are recognized in the following ways: (1) they form the lowest spot of the surrounding ground; (2) they form obvious channel continuity along its length and joins with more obvious channels downstream; and (3) they show evidence of having run water on previous occasions, i.e., litter and vegetation has moved, or there is a lack of litter in the channel.
2. The water quality objectives for harvest treatments within close proximity to ephemeral drainages is to provide for or to retain sufficient amounts of ground cover possible to mitigate sediment input to the stream system and to minimize the number of crossings to retain streambank and stream bottom stability. No specific stream buffers are recommended, however, there are harvest techniques that aid in the retention of ground cover and are considered best management practices. The following are recommended BMPs for harvesting activities around ephemeral drainages, whether designated on a map or not (ephemeral channels).
    - No skidding will be allowed up or down ephemeral channels or in low points or swales. (ephemeral channels).

- No road construction will be allowed in or immediately adjacent to ephemeral streams except at designated crossings (ephemeral channels).
- All skid trails crossing drainages will be designated and approved by the authorized FS officer prior to activity, and will be at right angles to streambanks.
- Minimize the number of skid trail and road crossings across these channels.
- No log decks will be located within or immediately adjacent to the ephemeral streams or depressions.
- Maintain an undisturbed filter strip of vegetation and litter between skid trails/log decks/roads and the channel wide enough to prevent sediment from entering the channel.
- Construct water control features (waterbars, leadout ditches, etc.) on these skid trails and roads.
- Minimize the amount of logging debris deposited in ephemeral channels and remove excess debris by hand or end lining with one end suspension except where coarse woody debris is needed for stream health as identified by fisheries or watershed specialists (ephemeral channels).
- Do not cut trees where the root system is important in maintaining the integrity of the bank.
- The preferred method for extracting biomass using feller-buncher or grapple skidder equipment near ephemeral drainages (within 75 feet) will be to approach the material to be extracted on the contour to the ephemeral drainage as much as possible, cut or grapple biomass, then back equipment out as much as possible. This action will reduce ground disturbance by limiting the turning of equipment in or near the stream channels, and will retain as much of the filtering effect of undisturbed ground cover as possible. Slash can be placed to drive equipment over to reduce rutting and soil disturbance.
- Outslope roads/skid trails to minimize concentration of water/sediment into streams closer than 50 feet to channel.
- During servicing or refueling of equipment, pollutants shall not be allowed to enter any waterway, riparian area, or stream course. Select service and refueling areas well away from wet areas and surface water, and by constructing berms around such sites to contain spills. Spill prevention, containment, and countermeasures plans are required if the fuel exceeds 660 gallons in a single container or if total storage at a site exceeds 1,320 gallons. The project contract administrator shall designate the location, size, and allowable uses of service and refueling areas. The authorized FS officer shall be aware of actions to be taken in case of a hazardous substance spill (pollution/refuse control).
- Place water control features so there is adequate filter distance between structure outlets and stream channels (minimum of 50 feet and width can increase as slope steepness increases).

Water/Soil Protection

1. The contractor shall take all reasonable precautions to prevent pollution of all national forest soil and water. Equipment operators shall maximize the recovery and proper disposal of all fuels, fluids, lubricants, empty containers, and replacement parts. Refuse resulting from the contractor's use, servicing, repair, or abandonment of equipment shall be removed from National Forest System lands by the contractor to the appropriate disposal facilities. Any leaks originating from contractor equipment shall be repaired or the equipment replaced in a timely manner (pollution/refuse control).
2. Acceptance of Project Erosion Control Measures Before Project Closure: the authorized FS officer will verify that the contractor has implemented erosion control practices prior to closure of the project contract (general).
3. Machine Piling of Slash: Where slash is machine piled, minimize disturbance to existing ground cover, surface soil, and rock material, and any existing surface organic material (i.e. surface litter and duff and old semidecomposed branches and logs). Rough piling will also reduce impacts from equipment. Rough piling involves piling only large concentrations of slash, leaving areas of low concentration undisturbed. Machine pile when soils are dry or solidly frozen. Refer to the "Apache-Sitgreaves National Forests Guidelines for Excessive Rutting," 6/10/92, as a guide to determine when soils are too wet to operate. Keeping slash piles free from soil material will minimize smoldering of piles when burning, which should have a positive effect on air quality. Refer to number 5 above for retention of coarse woody debris (soil productivity).
4. Landings created by the treatment would be approximately one quarter to 1 acre in size with an average of one landing every 20 acres. Landings would have material piled onsite or moved into smaller piles out from the landings or moved back along skid trails. Material from the landings may be lopped and scattered in disturbed areas to reduce erosion (erosion control).
5. Log Landing Erosion Prevention and Control: Immediately after use, landings will be scarified as needed to eliminate compaction. Once scarified, log landings are to be reseeded, as needed, with an erosion control seed mix consisting of primarily native species. Slash or chips will be scattered on landings to further retard formation of rills and gullies (soil productivity).
6. Limit the Operating Season Ground-disturbing Activities (tractor skidding, decking, and machine piling, etc.): shall be limited to dry or solidly frozen soil conditions to reduce compaction and soil displacement (rutting) that is associated with tree removal activities when soils are wet or are saturated. Hauling and skidding will be restricted on all soils by the contract administrator during wet periods to prevent damage to the road system. (See the "Apache-Sitgreaves National Forests Guidelines for Excessive Rutting," 6/10/92). This is most important in areas associated with terrestrial ecosystem unit survey mapping units 197 and 207.
7. Tractor Skidding Design: Skid trail design will be agreed upon by the authorized FS officer and the contractor. To minimize soil disturbance by equipment use, trees are to be felled to the lead and the authorized FS officer shall locate skid trails as far apart as possible to reduce the number of skid trails needed to harvest the unit. Use existing skid trails where properly located. Designate new skid trails throughout the project area to prevent long, straight skid trails from running up and down slopes. Skidding of logs will

be with one end of the log suspended above the ground surface. Skidders will be required to stay on the skid trail system, except where other objectives take priority (like maximum site disturbance wanted for seed cuts, etc.), which shall be noted on the stand prescription field card (soil productivity).

8. Erosion Control on Skid Trails: Skid trails will be water-barred, scarified, and seeded with primarily native species as needed. All berms and depressions such as ruts will be filled in or removed, restoring skid trails to the natural grade of the slope to the greatest extent possible. In addition, slash generated from the project may be spread in addition to water barring where conditions require (erosion control).
9. Soil Productivity/Coarse Woody Debris: To maintain or improve soil productivity in areas more than a half mile from private land, manage toward a minimum of 7–14 tons per acre of coarse woody debris in pine types, and 8–16 tons per acre in the mixed conifer types, in the 3-inch plus size class. Where 7–14 tons per acre of coarse woody debris currently exists, break up the continuity to reduce potential fire spread. Reduced levels of organic debris may be allowed within fuelbreaks. Manage toward a minimum of 8–16 tons per acre on mixed conifer sites of large woody material (3-inch plus) (soil productivity).
10. Soil Productivity/Coarse Woody Debris: Within a half mile around private land; to maintain or improve soil productivity and maintain low fuel loads, manage toward a minimum of 3–6 tons per acre of coarse woody debris in pine types, in the 3-inch plus size class. Manage toward a minimum of 5–10 tons per acre on mixed conifer sites of large woody material (3-inch plus) (soil productivity).

Noxious Weeds

1. If noxious/invasive weed populations are identified prior to implementation, avoid WUI treatment in the area until noxious weeds are eliminated, or avoid the site occupied by the weeds. Monitor the site for a minimum of three growing seasons post weed treatment to determine success of eradication (noxious weeds).
2. If noxious/invasive weeds are identified within a treatment unit while treatment is occurring, equipment will be cleaned and inspected before moving to another treatment unit (noxious weeds).
3. Any fills, mulches, or revegetation seeding used during or after project implementation will be certified weed free (noxious weeds).
4. The Forest Service will be notified prior to each piece of equipment entering the national forest. Notification will include the location of the equipment's most recent operations (noxious weeds).
5. Ensure that all contract equipment moved onto the national forest is free of soil, weeds, vegetative matter, or other debris that could harbor seeds. Inspect each piece of equipment to ensure cleanliness, prior to entering the national forest (noxious weeds).
6. Highly disturbed areas with significant bare ground will be reseeded using native seed to reestablish perennial plants (noxious weeds).
7. Seeding will be considered if natural revegetation of ground cover species does not occur rapidly enough to protect an area from erosion (noxious weeds).

8. Survey for noxious weeds in treatment units at a time when the growing season is well established and prior to treatment implementation (noxious weeds).
9. If noxious/invasive weeds are identified during or post implementation, treat the weeds and monitor the site for a minimum of three growing seasons to determine weed treatment success (noxious weeds).
10. Minimize soil disturbance by limiting the extent of the area traveled by vehicles, and by avoiding areas with wet soils (noxious weeds).

Monitoring

1. Conduct Implementation and Effectiveness Monitoring for Best Management Practices: The desired result of BMP monitoring is to document that BMPs have been applied as prescribed and that they appear effective in reducing sediment and moderating flow regimes in forest streams. BMPs that are found to be ineffective in protecting identified resource, aquatic, and water quality goals will be adjusted. EDA related BMPs (monitoring).
2. Soil disturbance class monitoring (Page-Dumroese 2009) will be used to monitor site disturbance during and after treatment. Strive to limit soil disturbance class to 3–5 percent or less in the administration of the operation. Class 3 can be minimized by using the following BMPS (monitoring).

Wildlife Habitat Protection

1. All VSS 6 groups will be retained where they occur throughout the project area in alternative C as described in the forest plan (as amended).
2. Mexican spotted owl timing restrictions will be applied to management activities within one-quarter mile of PACs. Within these areas, no treatment related activities will occur from March 1 through August 31.
3. Implement forest plan and MSO recovery plan guidelines for treatments in Mexican spotted owl protected and restricted habitats.
4. Retain all trees greater than 24 inches in diameter in MSO restricted habitat areas.
5. Broadcast burning in MSO restricted and protected habitat will be to reduce woody debris while retaining other habitat components. Broadcast burning will be managed to preserve large (greater than 24 inches) trees of all species, maintain dense forest canopy where it exists, and retain snags and downed logs at or above forest plan amendment 6 guidelines.
6. No broadcast burning or thinning will occur within the 100-acre core areas of MSO PACs.
7. Burning proximate to PAC(s) during the breeding season (March 1–August 31) would be conducted in such a manner that only limited smoke would occur within a PAC and smoke would not settle in PACs for long durations having a negligible indirect effect to MSO.

8. During all treatments, retain substantive amounts of key MSO and goshawk habitat components (e.g. snags greater than or equal to 18 inches in diameter, logs greater than or equal to 12 inches in diameter, and hardwood tree species).
9. Fire-created openings should be minimal and not greater than 2 acres in restricted habitat.
10. In mixed conifer stands where low severity burning is allowed, broadcast burning will not occur until mechanical treatments are completed in those units. Low severity burning is allowed in mixed conifer stands not proposed for mechanical treatment.
11. Live trees with the potential to provide nesting habitat cavities will be favored for retention.
12. Northern goshawk timing restrictions will be applied to management activities within PFAs. No treatment related activities will occur from March 1 through September 30.
13. Advanced regeneration (20 percent of group openings) will be protected with reduced burn intensity.
14. Created openings in goshawk habitat will not exceed the size directed by forest plan direction (2 acres in PFAs, 4 acres outside PFAs), and will occur over no more than 20 percent of the entire project area to create VSS 1 and manage VSS 2.
15. Low severity broadcast burn in goshawk PFAs to reduce woody debris while retaining a more dense mosaic of VSS classes than areas outside the PFA. Manage for snag and log numbers at or above forest plan amendment 6 guidelines.
16. Existing snags will be protected outside of landing areas. Recruitment of future snags will occur as treatment stands are marked for mechanical treatment. Retain two to three large (greater than18 inches in diameter) trees per acre as recruitment snags. Live trees with dead tops or lightning scars are top priority for retention as future snags. Retain three snags and recruitment snags per acre around meadows.
17. American peregrine falcon timing restrictions and habitat alteration guidelines will be applied around existing eyries. Treatment related disturbances a half mile around an active eyrie and line-of-sight disturbances up to 3 air miles from an active eyrie will be avoided from February 1 through August 15.
18. Maintain forested escape cover around at least half the perimeter of stock tanks, springs, and wetlands.
19. Protect existing elk exclosure fences during all treatment activities.
20. Preserve existing known turkey roosts.
21. Buffer known raptor nests from mechanical treatments according to forest plan or other established guidelines.
22. For bald eagle, enforce a forest closure period (March 1 through August 31) unless the first nesting attempt fails and another nesting attempt does not occur within 45 days after the failure.
23. Where known, bald eagle roost trees will be protected from project activities. If bald eagle winter roost sites are discovered in the EMA during project implementation, buffers will be established around the sites according to guidelines in the “Bald Eagle Conservation and Assessment Strategy.”

Appendix C. Specialist Report List

Rim Lakes Forest Restoration Project specialists' reports that are summarized and incorporated by reference in the EIS

Brown, Lance. 2011
Wildlife Specialist Report
Appendix A – Maps
Appendix B – Apache-Sitgreaves National Forest Concurrence List from USFWS, 2008
Appendix C – Best Management Practices
Appendix D – Summary of Northern Goshawk Activity in the EMA

Brown, Lance. 2012
Wildlife Specialist Report Addendum

Doyle, Ruth. 2011
Scenery Specialist Report

Dykstra, Elizabeth. 2011
Recreation and Lands Specialist Report
Appendix A – A Recreation Opportunity Spectrum Class definition
Appendix B – Niche Statement: Apache-Sitgreaves National Forests
Appendix C – ROS classification within the Rim Lakes EMA.
Appendix D – List and map of recreation facilities within the Rim Lakes EMA.
Appendix E – Map of Chevelon Canyon segments eligible and suitable as Wild and Scenic River.
Appendix F – Eligibility Evaluations Woods Canyon/Chevelon Creek
Appendix G – DN, Rancho Allegre Access
Appendix H – Map of Chevelon Inventoried Roadless Area

Hughes, Kendell. 2011
Noxious Weeds Report

Johnson, Steven R. 2011
Engineering Specialist Report
Appendix I – Existing Transportation Road System & Proposed Haul Designation.
Appendix II – Maps
Appendix III – Road Maintenance Details
Appendix IV – R3 Standard Road Maintenance Specifications (T-specs)

McMillan, Kathryn. 2011
Aquatics Specialist Report

Nelson, Chris. 2011.
Watershed Specialist Report
Appendix A – Regulatory Requirements.
Appendix B – Best Management Practices
Appendix C – Possible Management Activities
Appendix D – Soil and Water Monitoring Plan for Watershed

Nicolet, Tessa. 2011.

Fire and Fuels Specialist Report
Appendix A – Description of Models Used for Analysis
Appendix B – Burning Implementation Strategies
Appendix C – Monitoring and Maintenance Burning Recommendations

Probst, Jim. 2008
Cumulative Watershed Effects Analysis (revised report in 2010 by Chris Nelson)

Richardson, Gayle; M. Manthei; J. Youtz. 2011. (revised 2012 by Richardson/Youtz)
Silviculture Specialist Report for the Rim Lakes Forest Health Project
Appendix A – Diagnosis, Data, Forest Vegetation Simulator, Economics
-Common Stand Exam and Forest Vegetation Simulator Data (CD)
-Table 1. Mechanical Thinning and Burning Activities
-Economics (CD)
-Diagnosis – initial stand data and diagnosis spreadsheets (CD)

Appendix B – Maps
Map 1 – Forest Plan Habitats (MSO and Goshawk forest habitats)
Map 2 – Old Growth Alternative A
Map 3 – Old Growth Alternatives B and C
Map 4 – Alternative B Proposed Treatments
Map 5 – Alternative C Proposed Treatments

Appendix C – Stand Density, Vegetative Structural Stage, and Dwarf Mistletoe

Appendix D – Descriptions for Treatments for Proposed Action

Appendix E – Old Growth Data (CD)

Appendix F – Literature Reviewed and Considered

Appendix G – Hurteau, S. 2010. Preliminary Forest Spatial Structure Representation at Eagar South and Mineral. Draft data prepared by The Nature Conservancy. Flagstaff, AZ.

Schroeder, Melissa R. 2011
Cultural Resources Specialist Report
Appendix A – Previous Cultural Resource Surveys

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