United States
Department of
Agriculture

Forest
Service

**Southwestern
Region**

Environmental Assessment for Elk Park Fuels Reduction and Forest Health

Mormon Lake Ranger District, Coconino National Forest, Coconino County, Arizona

Cover photo: A group of mature trees in the Elk Park project area (*Courtesy: Forest Service*).

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Printed on recycled paper • February 2007

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List of Frequently Used Acronyms

BBS	Breeding bird survey
BMP	Best Management Practice
dB	decibels
DBH	diameter breast height
DN	Decision Notice
DRC	diameter root crown
EA	Environmental Assessment
ERI	Ecological Restoration Institute
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
FLEA	Flagstaff/Lake Mary Ecosystem Analysis
FONSI	Finding of No Significant Impact
FSH	Forest Service Handbook
FSM	Forest Service Manual
FSR	Forest Service Road
IDT	Interdisciplinary Team
MA	Management Area
MIS	Management Indicator Species
MSO	Mexican Spotted Owl
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOGO	Northern Goshawk
PAC	Protected Activity Center
PF	Post-fledgling Family Area
PRD	Project Record Document
ROW	Right of way
SOPA	Schedule of Proposed Actions
TEP	Threatened, Endangered, and Proposed species
TES	Terrestrial Ecosystem Survey
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFWS	U.S. Fish and Wildlife Service
VSS	Vegetative Structural Stages

Chapter 1. Purpose and Need for Action

Introduction

The Forest Service has prepared this draft environmental assessment (EA) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This EA discloses the direct, indirect, and cumulative environmental impacts that would result from implementing the Proposed Action or alternatives. The document is organized into five chapters and includes a glossary, references, and appendices:

Chapter 1. Purpose 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. Proposed Action and Alternatives - 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 issues raised during scoping. This discussion also includes mitigation measures. Finally, this section provides a comparison of alternatives including environmental effects.

Chapter 3. Affected Environment and Environmental Consequences - This chapter describes the environmental effects of implementing the Proposed Action and other alternatives. This analysis is organized by resource area.

Chapter 4. Monitoring - This chapter describes the type of monitoring that would occur under the action alternative during the life of the decision.

Chapter 5. Consultation and Coordination - This chapter provides a list of preparers and agencies consulted during development of the environmental assessment.

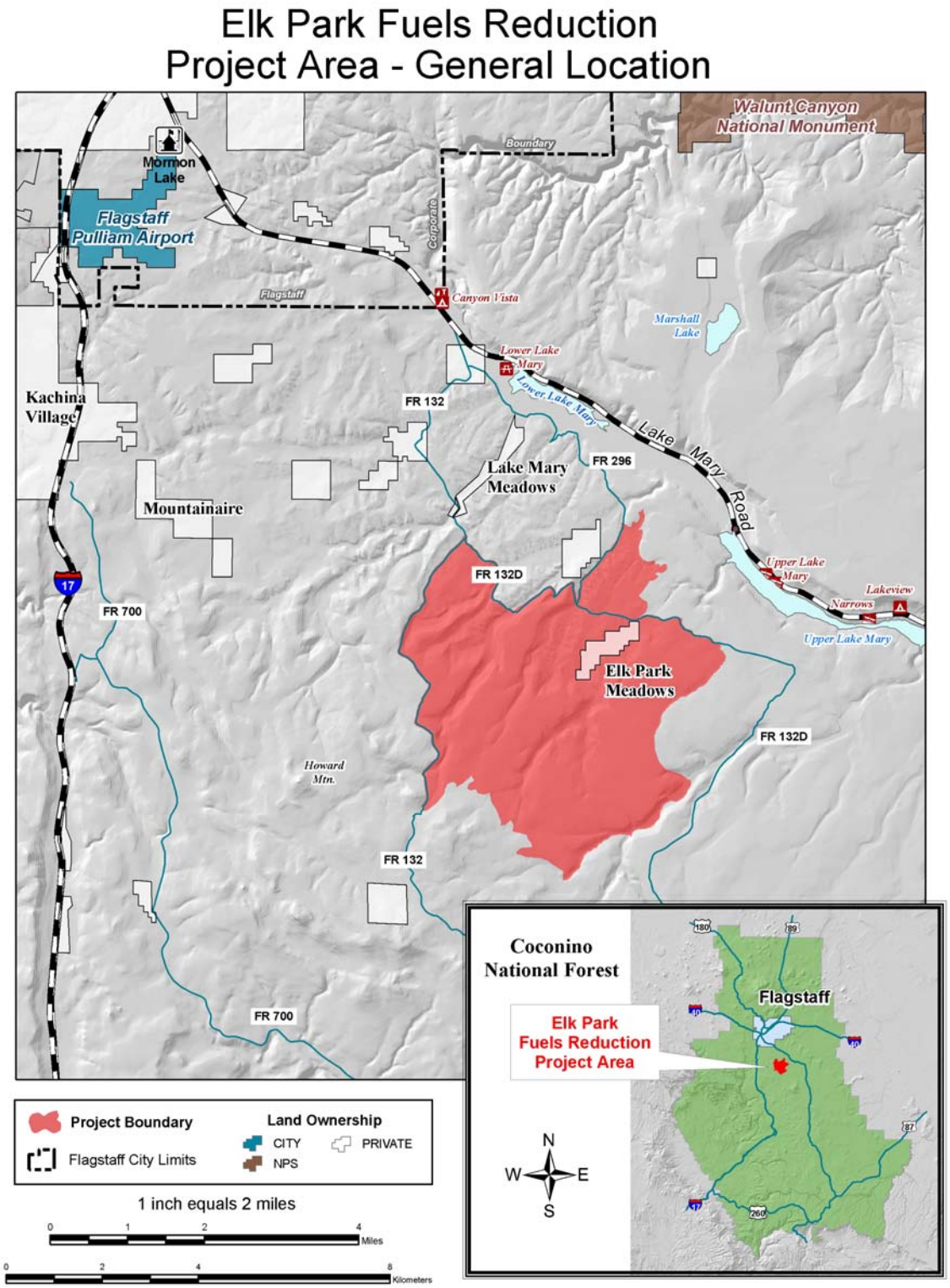
Additional documentation, including specialist reports, correspondence, and public comments and responses, may be found in the project record document [PRD] located at the Peaks Ranger District in Flagstaff, Arizona. These records are available for public review pursuant to the Freedom of Information Act (5 U.S.C. 552).

Project Background

The Elk Park project area is located approximately 6 miles southeast of Flagstaff, Arizona (see Figure 1) adjacent to and surrounding the entire community of Elk Park Meadows west of Forest Highway 3 (Lake Mary Road). The project area consists of a total of 6,886 acres; 6,731 acres of National Forest System land and 155 acres of private land (Elk Park Meadows). Approximately 6,485 acres are forested (ponderosa pine) and the remaining 246 acres are meadows. The project area is located within all or portions of T19N, R7E Sections 1 and 12-13; T19N, R8E Sections 3-9 and 15-20; T20N, R7E Section 36; and T20N, R8E Sections 31-33.

Elk Park Meadows is an unincorporated community not serviced by any fire district. The community is a former 160-acre homestead that was subdivided in the 1960s. According to Coconino County property records, the Elk Park Meadows is comprised of approximately 65 developed lots; there are an additional 50 undeveloped lots. Most of the cabin owners are part-time/summer residents. Vehicle access into Elk Park Meadows is along Forest Service Roads (FSR) 132 and 132D, approximately 7 miles from the junction with Forest Highway 3. Around the turn of the century, high-grade timber harvesting was conducted within the project area to provide wood for the building of the railroad.

Figure 1. Location of the Elk Park project on the Coconino National Forest



Portions of the project area were logged again during the 1960s and 1970s. During the 1970s, approximately half of the project area was pre-commercially thinned. During the 1980s, some open draws and stump fields within the project area were planted with trees. Fire has been, for the most part, excluded from the project area for over 100 years.

Fire suppression over the past century has resulted in increased tree densities, surface fuel accumulation, changes in species composition, a more even-aged forest structure, and pine encroachment in meadows and drainage bottoms. Most of the project is in Condition Class III (a severe departure from the natural historical regime of vegetation characteristics, fuel composition, and fire effects) and a wildfire occurring under existing conditions would result in more severe effects than should occur for the natural fire regime. The community of Elk Park Meadows is currently at risk from a wildfire and was included in the Community Wildfire Protection Plan for Flagstaff and Surrounding Communities (2005).

Purpose and Need for Action

The purpose of this project is to reduce the threat of severe wildfire in and around the Elk Park project area. There is a need to change forest conditions that support desirable fire behavior and create a forest structure that more closely resembles the structure that existed prior to interruption of the historic fire regime.

The Purpose and Need is focused on two main topics: Wildfire Hazard and Forest Structure. For each of these topics, *Existing Conditions* describe the current ecological and biological conditions. *Desired Conditions* describes the goals and vision for the area. *Need for Change* describes the difference between existing and desired conditions that necessitate the need for changed conditions.

Wildfire Hazard

Existing and Desired Conditions

The Fire Regime indicates how often wildfires burned across this part of the landscape and with what level of severity. The area's natural fire regime is Fire Regime 1, where a fire recurrence of less than 35 years with a low percentage of overstory replacement would be expected under historical conditions. The condition class of an area indicates how far from historical norms the area has departed because the fire regime has been disrupted. Most of the project is in Condition Class III (see Table 1) due to a lack of fire occurrence. High canopy closure values and low crown heights, combined with an increasing number of stems per acre elevate the fire hazard beyond desirable levels for many portions of the project area. The existing fire hazard makes it very difficult for initial attack operations to control a wildfire starting under severe weather conditions that occur in April, May, June, and sometimes during September through October.

Flame length is a measure of fire intensity and anticipated tree mortality from wildfire. Dead and down fuel loading directly effects flame length and duration. The longer the flame length and duration, the more difficult it is to bring a fire under control. In addition, the longer the flame length and duration, the more likely a fire will transition into a crown fire.

Table 1. Wildfire hazard existing and desired values

Measure	Existing Condition	Desired Condition
Expected flame lengths	2.5 to 6 ft.	Less than 4 ft.
Fire regime / condition class[1]	1 / III	1 / I or 1 / II
Fire hazard rating	Extreme: 539 acres Very High: 380 acres High: 2,028 acres Moderate: 2,474 acres Low: 1,310 acres	Low or moderate

1. Condition Class I: vegetative structure, composition, and fire effects are within the natural range of variability
Condition Class II: moderate departure from the natural historical regime of vegetation characteristics, fuel composition, and fire effects
Condition Class III: severe departure from the natural historical regime of vegetation characteristics, fuel composition, and fire effects

Across the entire project area, the current fuel conditions would likely generate dangerous fire behavior and undesirable fire effects if and when a wildfire occurs. Although it would be difficult to initiate a crown fire within many sites, once a crown fire is initiated or is carried in from a neighboring area, many sites have sufficient crown bulk density coupled with sufficient canopy cover to sustain a crown fire and spread it to other stands. Initial attack forces would have great difficulty in controlling a wildfire occurring in the area under severe weather conditions.

One method to evaluate the risk of wildfire to an area is to determine a fire hazard rating. Fire hazard rating is a relative measure of how virulently a wildfire could burn under the 90th percentile weather conditions that occur from April through July. Fire hazard rating is a relative measure to demonstrate fire resilience between stands and is a good indicator of how effectively and safely fire suppression crews can attack a wildfire and bring it under control.

Fire hazard rating criteria include: height to live crown, dead and down fuel, canopy cover, aspect, slope, and stems per acre. Aspect and slope cannot be changed with treatments. Current values for the criteria that can be changed are:

Height to live crown	**4-32 ft.**
Dead and down fuel	**2-10 tons per acre**
Canopy cover	**30-90%**
Trees per acre (ponderosa pine)	**36-638**

To reach a low fire hazard rating, it is necessary to achieve some combination of height to live crown, dead and down fuel load, percent canopy cover, number of stems per acre, aspect, and percent slope that minimizes the chance of severe fire behavior occurring during the worst fire weather.

Habitat within the Clark Mexican spotted owl (MSO) protected activity center (PAC) is primarily ponderosa pine, with some pine/oak occurring mostly within the Clark drainage. Mixed conifer habitats do not occur within the Clark PAC and oak is poorly represented. Stands within the PAC are densely stocked with ponderosa pine, which is out competing Gambel oak where it occurs, resulting in decreased oak growth, health and vigor, and eventually leading to oak tree mortality. Ponderosa pine within the PAC varies from less than 5 in. to over 24 in. in diameter with the bulk of overstocked trees being 12 to 16 in. in diameter. Nesting owls have not been detected in the Clark PAC.

Need for Change

There is a need to improve the fire regime condition class at least one level. Fire hazard ratings need to be reduced from high and extreme to low or moderate. Some stands might remain higher after treatment due to lack of access or to accommodate other resource needs such as providing habitat necessary for a variety of wildlife species. However, most areas within a mile of private property would have a low rating, especially those areas in the direction of the prevailing wind. In order to improve nesting habitat for MSO and to reduce the potential for catastrophic wildfire there is a need to thin densely stocked ponderosa pine within the Clark PAC.

There is a need to reduce dead and down fuel loading low enough for safe, periodic prescribed burning, but sufficient enough to support habitat needs. There is a need to increase the average height to live crown and decrease expected flame lengths to less than 4 ft. Crown base heights would be high and the length of flame needed to initiate a crown fire would be above 15 ft. in most areas. Harvesting would reduce competition for water among remaining trees. This, in turn, would make trees more resilient to fire effects and resistant to crown fires. Decreased canopy continuity would increase site resistance to crown fires.

Forest Structure

Existing and Desired Conditions

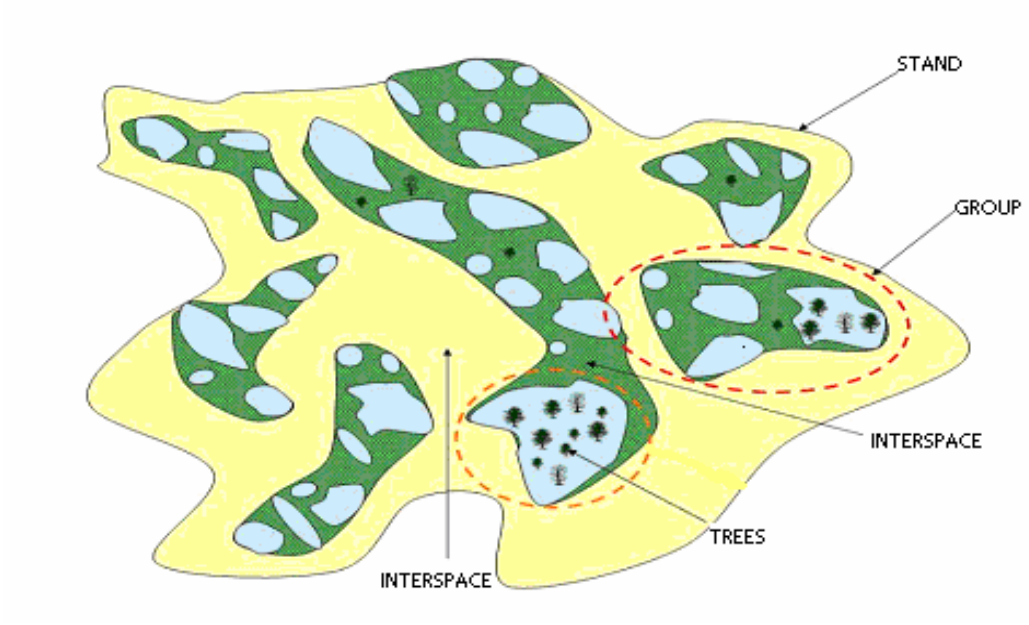
Research conducted by the Ecological Restoration Institute (ERI) at Northern Arizona University shows that prior to Euro-American settlement, ponderosa pine forests in the southwest were uneven-aged (Friederici 2004; Moore et al. 2004; White 1985). Uneven-aged is defined as an age arrangement in which the trees differ markedly in their ages. An uneven-aged stand contains at least three age classes (Nyland 1996). Historically, trees were arranged in 0.05 to 0.7 acre groups of 2-40 trees (White 1985; Covington et al. 1997).

During the railroad logging era and subsequent high-grade timber harvesting in the early 20th century, much of the older age classes of ponderosa pine were removed. In 1919, an unprecedented regeneration event occurred, resulting in massive amounts of pine seedlings. Seedlings continued to grow in dense stands, forming a closed canopy across much of the landscape and effectively inhibiting further regeneration of shade-intolerant ponderosa pine. As a result of these events, ponderosa pine forests of the southwest are now predominantly even-aged, with few trees less than 5 in. diameter breast height (DBH) or greater than 24 in. DBH. Even-aged is defined as an age arrangement in which the trees have only small differences in their ages (Nyland 1996). Even-aged species, such as lodgepole pine, which does not occur in the project area, are sustained ecologically either through catastrophic events, such as stand-replacing fire, or through management actions that mimic stand-replacing events, such as clear-cutting. The Elk Park project area is a prime example of a now even-aged forest with a species that would naturally be uneven-aged.

Vegetative structural stages (VSS) is a six-class vegetation scheme historically used in the Southwestern Region to describe the developmental stages of a forest ecosystem, from seedlings (VSS 1) to old forest (VSS 6). The forested lands in the Elk Park project area are primarily comprised of young to mid-aged ponderosa pine (VSS 3 and 4). Seedlings (VSS 1), saplings (VSS 2), mature (VSS 5), and old (VSS 6) pine are lacking in the project area.

Traditionally, silvicultural measurements normally averaged the VSS of groups or clumps at the stand level[1] and did not take into account the variability within a stand (see Figure 2). Each group[2] of trees may be a different VSS class. Grassy interspaces[3] are areas between tree groups that lack pre-settlement evidences and that should be maintained as grass, using prescribed fire to remove natural regeneration. The openings are areas within the stand where small trees will grow and make up VSS 1 and 2. Meadows or other permanent openings are entirely separate stands and do not have a forest structure, but contribute to the variability of the landscape.

Figure 2. Stand level variability (modified diagram courtesy of AZGFD & USFWS)



In past projects, existing forest structure data has been displayed at the stand level. The Elk Park project will emphasize the variability of groups, openings, and grassy interspaces within stands by using point-level stand exam data. To better measure progress towards desired goshawk habitat characteristics, tree diameter, canopy cover, and density ranges will be displayed at the point or group level, as well as the percentage of the landscape in groups, interspaces, and openings. The point level refers to stand exam point data collected across stands within the project area (see Table 2).

[1] A stand is a community or group of trees that grow together at a particular place that share unique vegetal characteristics which are distinguishable from adjacent stands, thus forming an individual management or silvicultural unit (Nyland 1996).

[2] Groups are generally clusters of 2-12 trees (possibly up to 40) that may have interlocking crowns and are externally-defined by interspaces surrounding them.

3 Interspaces are grassy, non-forested areas of varying sizes which occurred naturally between groups of trees prior to fire suppression.

Table 2. Forest structure existing and desired values

Measure	Existing Condition	Desired Condition
Forest structure	Predominantly even-aged: VSS 1= 5% VSS 2= 1% VSS 3= 34% VSS 4= 38% VSS 5= 16% VSS 6= 6%	Uneven-aged: VSS 1= 10% VSS 2= 10% VSS 3= 20% VSS 4= 20% VSS 5= 20% VSS 6= 20%
Tree arrangement	Pine: limited "groupy" structure, few openings and interspaces Oak in high competition with conifers	Approximately 30% of the landscape in tree groups, 50% as interspaces, and 20% openings for VSS 1 and 2 formation; groups approx. 0.05 to 0.7 acres based on evidences or existing groups of large trees[1] Reduce competition between oaks and conifers by enhancing oak clumps
Tree density (forested areas)	0-773 trees per acre	<200 trees per acre in target/threshold, PAC, and PFA <100 trees per acre in goshawk foraging areas (rest of project area) 2-40 trees per group, with an occasional single tree between groups
Canopy cover (forested areas)	0-87%	30-70%
Basal area (forested areas)	0-270 ft^2/acre	30-100 ft^2/acre
Dwarf mistletoe infection	697 acres, light severity	Dwarf mistletoe in isolated groups

1. White 1985; Covington et al. 1997

In the project area, Gambel oak is present, the majority of which consists of small diameter, young thickets with numerous stems. Most oak trees are less than 10 in. diameter at root collar and are being heavily browsed by elk. Forest understory (grasses and shrubs) productivity is low in areas with "closed" and "moderately closed" canopies and few interspaces. Additionally, meadows have been experiencing pine encroachment for over 100 years due to fire suppression.

Need for Change

Ponderosa pine forests in northern Arizona were historically uneven-aged and arranged in a "groupy" pattern across approximately 30% of the landscape, with approximately 70% of the landscape in grassy openings (Covington et al. 1997).

To obtain desired future conditions, there is a need to decrease the proportion of the project area in young to mid-aged forest by approximately 32%. VSS 1 and 2 are lacking across the project area. There is a need to create openings across approximately 14% of forested areas to increase natural regeneration. Additionally, there is a need to increase the proportion of the project area in mature and old forest by approximately 18%.

There is a need to create a more variable, patchy tree distribution across the project area, to more closely mimic the historic ponderosa pine forest structure. There is also a need to reduce canopy cover within groups to decrease competition between trees and increase tree vigor, health, and growth. There is a need to decrease stand densities on over 66% of the project area.

To restore the forest to a more historic, uneven-aged structure, the project area will be mechanically treated using uneven-aged management and thinning based on pre-settlement evidences (see References: Ecological Restoration model research) to determine the desired tree arrangement and density. Uneven-aged management and thinning will increase age/size class diversity and create a more open, groupy tree arrangement. Age/size class diversity results in a tree canopy with a more stratified vertical structure, which supports a more diverse biota than an even-aged canopy, resulting in increased biological diversity (Hunter 1990).

Proposed Action

To meet the project's purpose and need, the following activities are proposed:

- Selection harvesting and thinning on approximately 4,700 acres of ponderosa pine.
- Conduct initial prescribed burns on approximately 6,400 acres to reduce fuel loads and reintroduce low to moderate intensity surface fires. Conduct maintenance burns after initial prescribed burns to maintain historically light fuel loads.
- In association with tree harvesting and hauling of forest products, approximately 4 miles of temporary roads will be constructed. Forest Service Road (FSR) 132B would be relocated out of Elk Park Meadows and the surface and drainage along 1 mile of FSR 132B south of Elk Park Meadows would be improved.
- A site-specific forest plan amendment to allow the harvesting of ponderosa pine up to 16 in. DBH in the Clark PAC.

A more detailed description of the proposed treatments and a map is provided in Chapter 2.

Management Direction

The 1987 Coconino National Forest Plan (Forest Plan) and all subsequent amendments provide direction (and desired outputs) for all resource management programs, practices, uses, and protection measures on the Coconino National Forest.

Approximately 90% of Forest Service lands within the project area are classified as Management Area 3 (ponderosa pine and mixed conifer less than 40% slopes). The entire project area is located within the Lake Mary Watershed Management Area 35 of the Flagstaff/Lake Mary Ecosystem Analysis (FLEA) area. Approximately 3,632 acres are located within the ponderosa pine/urban interface Fire Management Analysis Zone (FMAZ). The FMAZ was identified in FLEA as an area of the forest with the highest priority for wildfire risk reduction.

This project was designed to comply with the forest-wide and FLEA area-wide direction and the standards and guidelines for management area (MA) 3-Ponderosa pine and mixed conifer less than 40% slopes; MA 4-Ponderosa pine and mixed conifer greater than 40% slopes; MA 6-Unproductive timber land; MA 9-Mountain grassland; and MA 35-Lake Mary watershed [PRD 73]. Table 3 lists the number of acres from this project and the Forest Plan emphasis of each of these management areas. Consistency with the Forest Plan applies only to the specific activities described in the alternatives.

Table 3. Coconino Forest Plan management areas within the Elk Park project area

Management Area (MA)	Project Acres	Forest Plan Emphasis
MA-3: Ponderosa pine and mixed conifer, less than 40% slopes	6,124	Sustained yield of timber and firewood production, wildlife habitat, livestock grazing, high quality water, and dispersed recreation.
MA-4: Ponderosa pine and mixed conifer, greater than 40% slopes	59	Wildlife habitat, watershed condition, and dispersed camping
MA-6: Unproductive timber land	302	Wildlife habitat, watershed condition, and livestock grazing
MA-9: Mountain grassland	246	Livestock grazing, visual quality, wildlife habitat
MA-35: Lake Mary watershed	6,731	Soil and watershed function, urban/rural influences, natural role of fire, lake shore species.

In order to meet Forest Plan direction related to old growth and MSO, the Proposed Action would allocate developing old growth and designate MSO target/threshold habitat within the project area. The definition of old growth standards and the methodology used to allocate acres to old growth is discussed in more detail under the “Vegetation” section in Chapter 3. The definition of target/threshold habitat standards and the methodology used to designate this type of habitat is also discussed in more detail under the “Vegetation” and the “Wildlife-Threatened and Endangered Species” sections in Chapter 3. Allocating old growth and designating target/threshold habitat are tied directly to implementing the Proposed Action.

Proposed activities are consistent with the Forest Plan with the exception of the diameter of trees harvested within the Clark PAC. Therefore, the Proposed Action includes a site-specific amendment to the Coconino Forest Plan to allow the harvesting of ponderosa pine up to 16 in. DBH in the Clark PAC. This amendment is described in more detail in Chapter 2 and an analysis of the proposed amendment is located in Appendix A.

Applicable Laws, Regulations, and Agency Policies

The planning and decision-making process for this project was conducted in accordance with applicable laws, regulations, policies, and plans. Listed below are Federal laws and executive orders pertaining to this project-specific planning and environmental analysis. This project is consistent with the following:

Clean Air Act of 1955: Proposed prescribed burning is not anticipated to cause disproportionate adverse human health or environmental effects to air quality (see “Air Quality” analysis in Chapter 3).

Clean Water Act of 1948, as amended: By implementing best management practices (BMPs), this project complies with Arizona State laws regarding natural resource protection, including but not limited to water quality (see “Design Features-Soil and Watershed Protection” in Chapter 2).

Multiple Use-Sustained Yield Act of 1960, as amended: This analysis has considered the multiple uses of the project area, including outdoor recreation, range, timber, watershed and wildlife. The proposed activities will help manage the forested project area, a renewable surface resource, for multiple use and sustained yield.

National Historic Preservation Act (NHPA) of 1966, as amended: A cultural resources clearance report has been completed for this project [PRD 19] and concludes under the Programmatic Agreement for Compliance with Section 106 of the NHPA that the proposed treatments would have no adverse effect on historic properties and values. Native American tribes and communities have been consulted and concurrence has been obtained from the Arizona State Historic Preservation Office (SHPO).

National Environmental Policy Act (NEPA) of 1969, as amended: The effects of the Proposed Action and alternatives have been analyzed and are disclosed in this EA.

Endangered Species Act (ESA) of 1973, as amended: The Endangered Species Act (ESA, PL 93-205), Forest Service Manual (FSM) 2670.11, 2670.21 and 2670.31 direction, and the Coconino National Forest Plan standards and guidelines (replacement pages 23 and 64) all require that National Forest System lands are not only managed for endangered, threatened and proposed (TEP) species, but also to recover TEP species. The ESA states that all Federal departments and agencies shall seek to conserve TEP species. FSM 2670 directs forests to manage National Forest System habitats to achieve recovery of TEP species and to avoid the need to implement special protection measures under the ESA.

The analysis and disclosure of effects to endangered, threatened, and proposed species is complete (see “Wildlife-Threatened and Endangered Species” analysis in Chapter 3). Section 7(a)(2) of the Endangered Species Act requires that Federal agencies consult with the U.S. Fish and Wildlife Service (USFWS), as appropriate, to ensure that our actions do not jeopardize the continued existence of species listed as threatened or endangered under the ESA, or destroy or adversely modify designated critical habitat. The Forest Service will be initiating formal consultation with USFWS for bald eagle.

National Forest Management Act (NFMA) of 1976, as amended: This project, and its associated design features and mitigation measures, addresses Coconino National Forest Plan forest-wide standards and guidelines and management area direction as they apply to the project area. This project is also in compliance with Forest Plan goals and objectives.

American Indian Religious Freedom Act of 1978: This project would not deny American Indians access to land within the project area for traditional and cultural purposes nor would it infringe upon the rights of Native Americans to worship through ceremonies or traditional rights within the project area. The tribes have been consulted on this project.

Executive Order 13007 (Indian sacred sites): Access to and ceremonial use of sacred sites by Indian religious practitioners would be accommodated with this project, and activities associated with this project would avoid adversely affecting the physical integrity of such places.

Executive Order 12898 (environmental justice): Implementation of this project is not anticipated to cause disproportionate adverse human health or environmental effects to minority or low-income populations (see “Environmental Justice” analysis in Chapter 3).

Executive Order 13186 (migratory birds): On January 10, 2001, President Clinton signed Executive Order 13186 for the “Responsibilities of Federal Agencies to Protect Migratory Birds” which directed Federal agencies to develop a memorandum of understanding with the U.S. Fish and Wildlife Service to promote conservation of migratory birds. Agencies shall identify potential impacts to migratory birds and their habitats, avoid or minimize adverse impacts, restore and enhance habitats, and evaluate the effects of actions on migratory birds. Where they exist, other analyses should be used, such as the Arizona Partners in Flight Conservation Plan. This project is consistent with the Migratory Bird Treaty Act of 1918, as well as Agency guidelines for conformance with the act (see “Wildlife-Migratory Bird Species” analysis in Chapter 3).

Management Indicator Species: The Forest Service is required to address MIS in compliance with various regulations and Agency policy (36 CFR 219, Forest Service Manual (FSM) 2621 and 1920), which are, themselves, tiered to the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the NFMA. The Coconino National Forest Plan was prepared under planning regulations issued in 1982. Effects to MIS were considered for this project and are summarized in this EA (see "Wildlife-Management Indicator Species" analysis in Chapter 3).

The Forest planning regulations were amended on January 5, 2005 (70 Fed. Reg.1023). The Department of Agriculture issued a final rule to remove the 2000 planning regulations at 36 CFR 219 (a) in their entirety. Regulation 36 CFR 219.14(f) provides clarification and the forests' MIS obligations. For forests, like the Coconino, that developed their forest plan under the 1982 NFMA regulations, the responsible official may comply with any obligations relating to MIS by considering data and analysis relating to habitat unless the plan specifically requires population monitoring or population surveys. The appropriate scale for MIS monitoring is the area covered by the Forest Plan, 36 CFR 219.14(f). The new planning regulations provide flexibility for MIS monitoring, which would allow for monitoring of habitat conditions as a surrogate for population trend data.

Forest Service Sensitive Species: Forest Service Manual 2621.2 directs managers to display findings under the various management alternatives considered for individual projects. This assessment is based on the current geographic range of sensitive species on the Coconino National Forest and the area affected by the project. This assessment considers, as appropriate for the species and area, factors that may affect the current trend for the species' population.

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 significant current or predicted downward trends in population numbers or density, or significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (FSM 2670.5(19))."

It is the policy of the Forest Service regarding sensitive species to:

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

Effects to Forest Service sensitive species were considered and a biological assessment and biological evaluation has been completed for the sensitive plant wildlife species found within the Elk Park project area (see "Sensitive Plant Species" and "Wildlife-Sensitive Species" analysis in Chapter 3).

Forest Service Environmental Policy and Procedures: Forest Service Handbook 1909.15, Chapter 18 requires that actions awaiting implementation and those of ongoing projects should be reviewed at least every three to five years to determine if the environmental analysis and documentation should be corrected, supplemented, or revised. Periodic maintenance burning proposed every 3-15 years would be subject to this analysis.

Decision Framework

This EA documents the environmental analysis of the Proposed Action and alternatives. Because the proposed action includes a Forest Plan amendment, the Forest Supervisor is the responsible official for deciding whether, and in what manner, lands within the Elk Park project area will be treated to reduce wildfire risk. Items in this decision include: number of acres treated mechanically, number of acres treated with prescribed fire, treatments within Mexican spotted owl protected activity centers, alterations to the transportation system, and emergency road closures. The decision is based on a consideration of the area's existing resource conditions, desired conditions, environmental issues, and the environmental effects of implementing the various alternatives. The Forest Supervisor may select any of the alternatives analyzed in detail, or may modify an alternative, as long as the resulting effects are within the range of effects displayed in this document.

This document is not a decision document. Rather, it discloses the environmental consequences which may occur if the Proposed Action or alternatives to that action are implemented. A decision notice (DN) and finding of no significant impact (FONSI), signed by the Forest Supervisor, will document the decisions made as a result of this analysis.

Public Involvement

This project was first listed in the Coconino National Forest Schedule of Proposed Actions (SOPA) in October 2006. Thirteen Native American tribes have also been consulted with on this project since February 2006. On October 10, 2006 a description of the Proposed Action and a series of maps were mailed to approximately 180 individuals and organizations who have expressed interest in similar past projects or who were otherwise determined to be affected (adjacent landowners, interest groups, and agencies). Thirteen comment letters were received during this public scoping period and no significant issues were identified [PRD 68]. Most residents responded favorably to reducing wildfire risk in the area and asked to be kept informed about the project. Others requested that additional information or clarification of specific actions be included in the EA. One letter suggested some additional alternatives to consider, which are discussed in more detail in Chapter 2.

Issues

The NEPA regulations direct agencies to "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review" (Sec. 1506.3). Significant issues are defined as those directly or indirectly caused by implementing the Proposed Action. Issues are considered "significant" because of the extent of their geographic distribution, the duration of their effects, or the intensity of interest or resource conflict. Some reasons for considering comments or issues as non-significant include: (1) outside the scope of the project's purpose and need; (2) already decided by law, Forest Plan, or other higher level decision; (3) irrelevant to the decision; (4) conjectural or not supported by scientific or factual evidence; or (5) a general comment, opinion, or position statement.

Public scoping comments on the Proposed Action were considered and analyzed during the development of this EA [PRD 68]. Residents of Elk Park Meadows who responded to the proposed action had several general questions related to project implementation, such as when the project would start and how much it would cost. Most of these questions are addressed in the "Economics" section of Chapter 3.

Many residents were concerned about the effects of logging trucks on FSR 132D leading into Elk Park Meadows and FSR 132 north of the community. Because the Forest Service plans to use FSR 296 and 296A as the primary haul routes for this project, logging truck traffic is going to bypass almost all of FSR 132 and most of 132D leading into Elk Park Meadows (FSR 296A connects again with FSR 132 approximately 0.25 mi. south of the Lake Mary Highway). There are no specific road improvements planned for FSR 132D, however the surface and drainage of this road will likely be upgraded where logging truck traffic occurs because timber operators working under a timber sale or stewardship contract are required to leave roads in the same or better shape.

Questions about effects of this project on bald eagles and Mexican spotted owls are addressed in the "Wildlife-Threatened and Endangered Species" section of Chapter 3. The Forest Service has completed the requisite inventory and monitoring for threatened, endangered, and sensitive species that occur within the project area, following approved Region 3 protocols and recovery plans. The Forest Service will be initiating formal consultation with the US Fish and Wildlife Service. Effects to other migratory birds are disclosed in the "Wildlife-Migratory Birds" section of Chapter 3.

Three additional alternatives were requested, which are discussed in more detail under the "Alternatives Considered but Eliminated from Detailed Study" section in Chapter 2. These alternatives were not considered in detail because they either did not meet the project's purpose and need or components of the requested action were already integrated into the Proposed Action design features or mitigation measures.

Based on the above criteria, there were no significant issues identified during public scoping that warranted the development of additional alternatives [PRD 76].

Chapter 2. Proposed Action and Alternatives

This chapter describes and compares the alternatives considered for the Elk Park project area. It includes a description of each alternative considered in this analysis. This section also presents the alternatives in comparative form, defining the differences between each alternative and providing a clear basis for choice among options by the decision maker. The information used to compare the alternatives is based upon the purpose and need for the action, the effects of each action, and considered in the context of the environmental, social, and economic effects of their implementation.

Alternatives Considered in Detail

The Forest Service analyzed two alternatives, the No Action and Proposed Action. A comparison of the activities and environmental effects for each alternative is found in Tables 5 and 6 at the end of this chapter.

Alternative 1

No Action

The Forest Service is required to analyze the "No Action" alternative under the provisions of NEPA (40 CFR 1502.14).

Alternative 1 would not implement mechanical treatments or prescribed burns to reduce fuel loads in the Elk Park project area. No improvements or relocation would be made to FSR 132B, nor would new temporary roads be built. There would be no habitat improvements prepared for the Mexican spotted owl in the Clark PAC. Under this alternative, the community of Elk Park Meadows would remain at an elevated risk to wildfire.

Alternative 1 does not meet the purpose and need of reducing the threat of severe wildfire in and around the Elk Park project area. Alternative 1 also does not meet the need of improving forest conditions that support desirable fire behavior. Attempts to create a forest structure that more closely resembles a forest structure that existed prior to interruption of the historic fire regime would not be achieved.

Alternative 2

Proposed Action

The goal of Alternative 2 is to utilize an ecosystem restoration approach to create a more open, groupy, uneven-aged forest with interspaces and openings that more closely resembles the structure that existed prior to interruption of the historic fire regime, and reduce the risk of severe wildfire to the community of Elk Park Meadows. Alternative 2 includes the following activities:

- Uneven-aged harvesting and thinning on approximately 4,700 acres of ponderosa pine
- Prescribed burns on approximately 6,400 acres to reduce fuel loads and reintroduce low to moderate intensity surface fires
- Construct approximately 4 miles of temporary road as well as reroute and resurface approximately 1 mile of FSR 132B
- A site-specific forest plan amendment to allow the harvesting of ponderosa pine up to 16 in. DBH in the Clark PAC, outside of the 100-acre no-treatment buffer to maintain and encourage a healthy MSO habitat.

Mechanical Treatments

Approximately 4,700 acres of ponderosa pine will be mechanically treated. Because ponderosa pine forests were historically uneven-aged, the Elk Park project area will be treated through uneven-aged management, in addition to thinning. Under uneven-aged management, age and size class diversity will be improved through selection harvesting to create openings for natural regeneration (VSS 1 and 2 groups). A more open, groupy tree arrangement will be achieved through thinning by creating interspaces between groups and thinning within groups.

An Ecosystem Restoration model (*see* References) modified to meet northern goshawk foraging habitat guidelines will be used to guide management of treatments within the ponderosa pine. Pre-settlement evidences (e.g. stumps, stump holes, and downed logs) will be used to guide placement or retention of trees groups, interspaces, and openings. Tree groups will consist of 2-40 trees ranging in size from 0.05 to 0.7 acres with interspaces between groups. However, there may be cases where existing groups of large trees with no pre-settlement evidence would be retained because they provide important habitat for wildlife. Canopy cover within groups would vary from 30 to 70%. Outside of MSO restricted and target/threshold habitat and northern goshawk PFAs, openings will range in size from 0.5 to 4 acres. Within northern goshawk PFAs and MSO protected and target/threshold habitat, openings will range in size from 0.5 to 2 acres. An Ecosystem Restoration approach would create a more open, groupy, uneven-aged forest with interspaces and openings that more closely resembles the structure that existed prior to interruption of the historic fire regime.

Within the Clark PAC, approximately 400 acres of ponderosa pine would be mechanically treated through uneven-age harvesting and thinning. (This acreage is included in the 4,700 total proposed harvesting and thinning acres above.) Openings within the PAC will range in size from 0.5 to 1 acre.A 100-acre no-treatment buffer has been established around historic roosts and harvesting will maintain at least 50% canopy cover within the PAC and allow trees up to 16 in. DBH to be harvested (current Forest Plan direction limits harvesting in the PAC to 9 in. DBH).

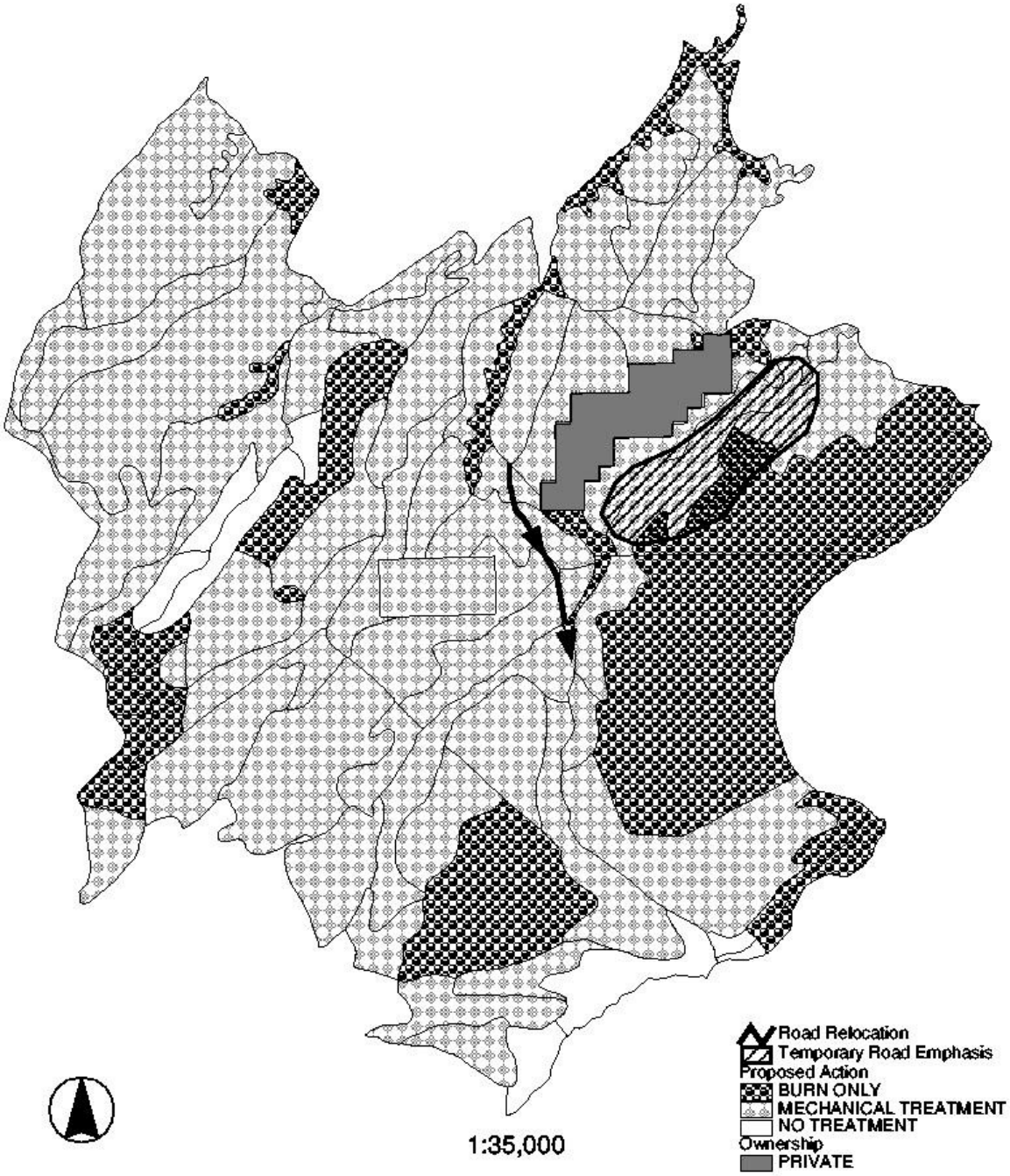
Prescribed Burning

A total of 6,400 acres would receive prescribed burn treatment. All 4,700 acres proposed for mechanical treatment would be burned after harvesting to remove activity-created slash, duff, and needle cast. In addition to areas mechanically harvested, an additional 1,700 acres would receive a burn-only treatment.

After the initial burn, maintenance burns would be conducted periodically (every 3-15 years)[4] to mimic the historic fire interval patterns in southwestern ponderosa pine forests. Maintenance burns aid in reducing fuels loads, raising crown base heights of live trees, and promoting understory growth. Burning would occur when weather and environmental factors such as wind, fuel moistures, and humidity are suitable for burning.

[4] Subject to FSH 1909.15 Chapter 18 review.

Figure 3. Proposed action



Temporary Roads and Improvements

There is a large network of existing roads within the project area. These existing roads, including Level 1 (closed) roads, will be used to the extent possible for hauling harvested trees. The area immediately southeast of Elk Park Meadows has few existing roads. Up to 4 miles of temporary roads will need to be constructed within this area to assist with tree harvesting and hauling (see "temporary road emphasis" area in Figure 3). Temporary roads would be rehabilitated after harvesting has been completed

In order to eliminate road related impacts to the Hoxworth Spring riparian area and to provide legal access around private land in Elk Park Meadows, a portion of FSR 132B would be relocated (see Figure 4). Approximately 0.80 miles of new permanent road would be constructed west of the Elk Park Meadows private land boundary and reconnect south of the community with the existing FSR132B. The existing road would be decommissioned after the relocated road section is complete.

A 0.75 mile segment of 132B, north of the Elk Park Meadows boundary to FSR 132D would be reconstructed to elevate the roadbed and surfacing will be applied. The existing road is heavily entrenched and intermittently braided as a result of years of wet weather use.

Approximately 1 mile of FSR 132B south of Elk Park Meadows would also be reconstructed (resurfaced and improved drainage) in order to facilitate hauling of forest products from the southern project area.

Site-Specific Amendment to the Forest Plan

The Forest Plan guideline for harvesting within Mexican spotted owl PACs states:

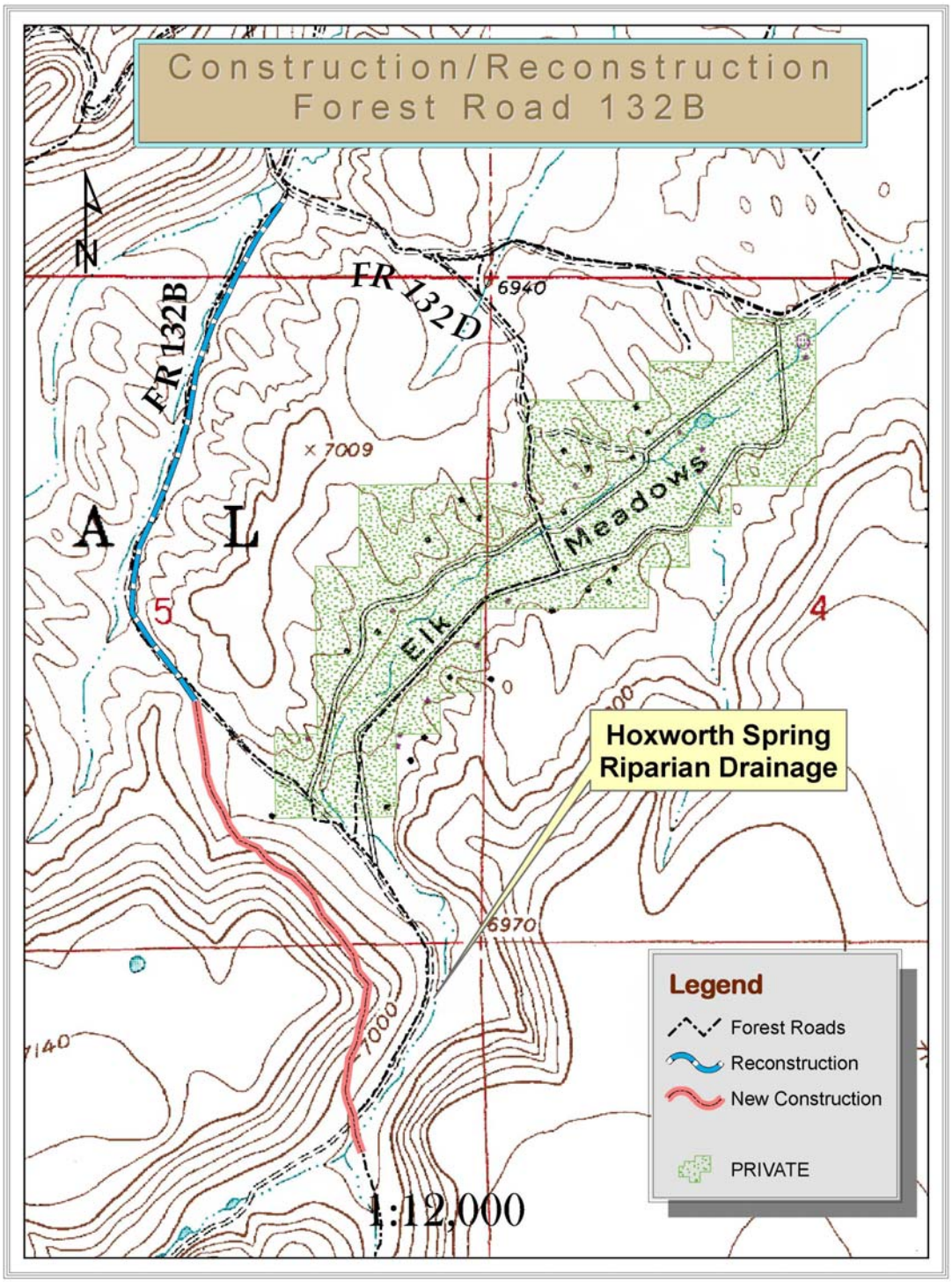
> *"Harvest conifers less than 9 inches in diameter only within those protected activity centers treated to abate fire risk as described below.*
>
> --*Use combinations of thinning trees less than 9 inches in diameter, mechanical fuel treatment and prescribed fire to abate fire risk in the remainder of the selected protected activity center outside the 100 acre "no treatment" area"* (p. 65-2).

The majority of overstocked ponderosa pine within the Clark PAC ranges in size from 12-16 in. DBH. If the harvesting of trees is limited to 9 in. DBH, an insufficient number of pines would be removed, resulting in no significant improvements to forest health, growth, and vigor, owl habitat, fire regime condition class, or reduction in fire hazard within the PAC. A Forest Plan amendment would be necessary to allow harvesting of ponderosa pine up to 16 in. DBH in the Clark PAC.

The proposed amendment (see Appendix A) would allow for the harvesting of ponderosa pine up to 16 in. DBH in the Clark PAC exclusively, and has been included with the Proposed Action to help achieve the goal of maintaining a healthy habitat for the Mexican spotted owl. All treatments will occur outside of the required 100-acre no-treatment buffer region. Current conditions of the PAC area do not encourage or support MSO occupation. Presently, there have been no MSO nests identified in the Clark PAC.

Harvesting trees up to 16 in. DBH will decrease competition between trees for moisture, nutrients, and sunlight, increase overall tree health, growth, and vigor, promote the development of larger diameter trees, improve health and longevity of existing old trees, promote faster development of old growth forest structures, improve forage and nesting habitat and reduce the potential effects of wildfire within the PAC. This amendment would apply only to the Clark PAC.

Figure 4. Proposed relocation of Forest Service road 132B



Summary

Alternative 2 meets the purpose and need of working towards reducing the threat of severe wildfire in and around the Elk Park project area. Alternative 2 would also move the project area towards desired forest conditions that support desirable fire behavior and improve wildlife habitat and forest health.

Design Features

Applicable Forest Plan standards and guidelines, Best Management Practices, and Forest Service Manual and Handbook direction will be incorporated into project design and implementation. The following features are design elements that further detail management actions, mitigate environmental consequences, and establish priorities for implementation.

Harvesting Operations

- Within restricted habitat, trees greater than 24 in. DBH will not be harvested.
- No old, “yellow” ponderosa pine or Gambel oak will be cut except under very rare circumstances for a landing to avoid skidding long distances.
- Old, “yellow” ponderosa pine will have duff raked away from the bases where high litter depth (greater than 10 in. DRC) may result in girdling and mortality.
- Tree arrangement after harvesting will mimic historic tree densities and patterns of tree distribution across the landscape. Variation in tree spacing, group sizes, and canopy gaps will provide a mosaic pattern of individual and clustered trees interspersed among interspaces, openings, or meadows.

Broadcast Burning

- Design prescribed burns to cover large areas (approximately 150 acres/day) and be of short duration (2 to 7 days). Burning will occur when weather and prescription criteria are met.
- Minimize loss of snags, logs, and roost trees during broadcast burning activities.
- Minimize residual tree scorch through fire prescriptions.
- Oak mortality will be mitigated in burn plans by raking duff from the base of large oaks (greater than 10 in. DRC) and not placing slash piles near oaks.
- No prescribed burning or preparation within occupied goshawk nest stands during the breeding season.
- No prescribed burning or preparation within the 100-acre MSO nest core at the Clark PAC.

Slash Treatment

- Pile and burn slash resulting from harvesting operations.
- Remove slash from within 500 ft. of private property.
- Piles shall be located so that burning will minimize damage to standing live trees, snags, down logs, sensitive plants or physical improvements such as fences, poles, signs, and cattle guards.

- Large logs (greater than 12 in.) that exist on the landscape prior to treatment will not be piled during slash treatment.
- Chipping and removal of biomass will be used as an alternative in preference to pile burning, where access allows, if biomass material is desired at the time of implementation.

Sensitive Plant Protection

The effects of all management actions should be mitigated by following the guidance of the Management Plan for *Hedeoma diffusum* Greene: Elden, Flagstaff, Mormon Lake, and Sedona Ranger Districts (Boucher 1984). The guidelines include direction on slash disposal, burning, tree removal and road construction and maintenance within Flagstaff pennyroyal habitat.

- Slash piling and burning is prohibited within known populations. Slash piles generated from harvesting activities should be constructed and burned at least 10 to 20 ft. away from known populations. These sites will be marked by a Forest Service Botanist, Wildlife Technician or Sale Administrator during project implementation.
- Road construction or reconstruction is prohibited within known populations and major haul route construction should remain 100 ft. or more away from known populations to reduce indirect effects such as dust accumulation. To assure these criteria are met, areas of new road construction should be surveyed before construction begins.
- Relocate and mark the Flagstaff pennyroyal fire study plots (location/site 359/004 and 361/003). Avoid destruction of these plots during project implementation. Work with the Forest Botanist to develop a plan and monitor the effects of treatments on the plots. Maintain the untreated control plots as untreated if possible.

Recreation and Social Considerations

- For public safety, camping will be prohibited within active harvesting and burning areas.
- Harvesting activities should be avoided (cutting and hauling) on the following holiday weekends: Memorial Day, Fourth of July, and Labor Day.
- Coordinate the timing of harvesting and burning activities with Forest Service permittees.

Cultural and Historical Resource Protection

- Historic and pre-historic cultural resources will be excluded and protected from burning activities and ground disturbing activities. An archaeologist will flag sites prior to implementation. Sites will be lined and monitored during prescribed burning operations.
- Areas where temporary roads will be constructed will be inventoried prior to implementation.
- Should the tribes identify any plants in the area having traditional importance, the District will encourage and protect the natural regeneration of such plants.

Wildlife Protection

<u>Northern Goshawk</u>

- Harvesting and hauling within occupied northern goshawk PFAs will not occur during the breeding season (March 1 to September 30).

- No prescribed burning or preparation within occupied nest stands during the breeding season.
- Prescribed burn plans for nest areas within PFAs will minimize smoke impacts to nesting birds and minimize loss of nest trees.

Turkey

- Turkey roost trees will not be harvested and duff and debris will be raked away from the base of roost trees prior to broadcast burning where litter depth layers are greater than 10 in. (Roost trees have been identified with a metal “Wildlife Tree” tag.)

Wildlife Cover

- Maintain hiding covers at least 200 ft. wide around known dependable waters in the area.

Snags and Logs

- Snags and downed logs that are necessary to meet wildlife management objectives for the area are identified and fire lined to protect them.
- Snags greater than18 in. DBH, and at least 3 logs greater than 12 in. in diameter midpoint per acre, will be fire lined before broadcast burning.
- Oak snags that are at least 10 in. DRC and 10 ft. tall shall be lined or use ignition techniques to minimize their loss.

Soil and Watershed Protection

Best management practices (BMP) are designed to prevent or reduce the amount of water pollution generated by non-point sources to a level compatible with water quality goals. Best management practices will be incorporated into applicable harvesting, burning, and road activities. Authority and guidance to prescribe and implement BMPs is defined in FSM 2501, 2530, FSH 2509.22 and the Forest Plan.

Use of Terrestrial Ecosystem Survey Timber Harvest Limitation Rating (24.11)

1. Objective. To identify severe and moderate erosion hazard areas and other soil limitations in order to adjust treatment measures to prevent downstream water quality degradation.

Limiting the Operating Period of Timber Sale Activities (24.13)

1. Objective. To ensure that the Purchaser conducts operations, including but not limited to erosion control work, road maintenance, and log landing drainage in a timely manner, within the time period specified in the Timber Sale Contract.

The CT6.3 "Plan of Operation" provision is required in all Timber Sale Contracts. This provision states that the Purchaser must submit a general plan of operation which will set forth planned periods for and methods of road construction, timber harvesting, completion of slash disposal, erosion control work, and other contractual requirements. Forest Service written approval of the Plan of Operation is a prerequisite to the commencement of the Purchaser's operation. Provision BT6.6 can be used to suspend operations because of wet or saturated soils in order to protect soil and water resources.

Tractor Skidding Location and Design (24.18)

1. Objective. To minimize erosion and sedimentation by designing skidding patterns to best fit the terrain. Proper skid pattern management involves such things as locating skid trails to avoid stream courses and restriction of skidders to designated trails. The Sale Administrator locates the skid trails with the timber Purchaser or by agreeing to the Purchaser's proposed locations prior to construction.

Log Landing Location (24.2)

1. Objective. To locate landings so creation of unsatisfactory watershed conditions which lead to water quality degradation is avoided.

Erosion Prevention and Control Measures During Timber Sale Operations (24.21)

1. Objective. To ensure that the Purchaser's operations shall be conducted reasonably to minimize soil erosion.

Equipment shall not be operated when soil conditions are such that accelerated soil erosion will result. The kinds and intensity of control work required of the Purchaser shall be adjusted to soil and weather conditions and the need for controlling runoff. Erosion control work shall be kept current immediately preceding expected seasonal periods of precipitation or runoff.

Slash Treatment in Sensitive Areas (24.3)

1. Objective. To comply with Federal and state water quality standards by protecting sensitive areas from degradation, which would result from using mechanized equipment for slash disposal.

Protected stream courses will be designated on the sale area map. Disturbance from mechanical equipment will be minimal within 50 ft. on either side of the protected stream course.

Obliteration of Roads (41.3)

1. Objective. To reduce sediment generated from unneeded roads, roads that run in streambeds, and roads that are located in streamside management zones by closing them to vehicle use and restoring them to productivity.

Roads that are no longer necessary for public access or management purposes need to be obliterated. Roads that are allowed to exist without proper maintenance are subject to continued, uncorrected damage and can become chronic sediment sources.

Cave Protection

- Harvesting and prescribed burning treatments will be excluded within a 300 ft. radius of known cave entrances.
- Previously undiscovered or unknown caves found during project implementation will be reported to the Forest Cave Coordinator.
- Cave entrances will not be used as a disposal site for slash, waste rock or fill materials, or other refuse.

Scenery Management Considerations along Roads and Trails

- Consideration will be given to scenery management when harvesting is done along National Forest System roads. Slash and treatment areas will be treated or rehabilitated promptly for the protection of scenic values

Mitigation Measures

The Forest Service would apply the following mitigation measures to any action alternative to minimize and reduce potential impacts from proposed activities.

Soil and Watershed: The Hoxworth drainage below the crossing of FSR132B to Elk Park (see "Soil and Watershed" analysis and Figure 5 in Chapter 3) is currently unstable in terms of both vertical and lateral stability. The Proposed Action has the potential to increase localized peak flow runoff and exacerbate problems in the lower Hoxworth drainage. To mitigate this effect, approximately 0.5 mile of the Hoxworth channel reach below the FSR132B crossing will be restored to a stable profile. Restoration would involve hydrologic analysis of anticipated peak flow, topographic survey, design, and construction of a stable channel geometry including a natural meander pattern. Channel reconstruction would involve modifying the existing channel and/or building a new channel with a small bulldozer based on Agency design and experience from other channel restoration projects. This action should be implemented after the proposed FSR132B road relocation and either before or after harvest activities.

Threatened and Endangered Species: Mitigation measures or implementation parameters described in the wildlife biological assessment and biological evaluation are required to minimize the impacts on bald eagles and Mexican spotted owl species and habitat.

Bald Eagle

There are no known eagle nests or roosts within the project area. The closest nest site is approximately one half mile from the project boundary, along a proposed haul route. The following mitigation measures should be implemented:

- Prescribed burning will not occur within a 2-mile radius of an occupied nest.
- Individual pile burning may occur when it is over one mile away from active breeding or nests.
- Log hauling and commercial traffic will not be allowed within one quarter mile of nesting or breeding eagles. This precludes the use of FS-296 as a haul route during this time period.
- For log trucks, no jake brakes will be allowed and a 20 mph speed limit will be maintained within one quarter mile of any occupied nest site.

Mexican Spotted Owl

Mexican spotted owl habitat occurs within and adjacent to the Elk Park project area. The following mitigation measures would be implemented to reduce impacts to MSO.

- MSO restricted habitat will be surveyed in the project area the year of implementation or one year prior to implementation.
- In protected and restricted habitat where treatments are planned, pre- and post-treatment micro-habitat monitoring will occur as specified in the MSO recovery plan.

- Mechanical harvesting and all prescribed fire activities, including lining of snags and logs, line prep, layout and broadcast burning, will not occur within the Clark PAC during the breeding season (March 1 to August 31).
- No mechanical harvesting, hauling, or prescribed burning will occur in any other known PACs within the project area, or within a half mile of nests and roosts during the breeding season.
- The general public will not be allowed to use the temporary roads within the Clark PAC during harvesting and all temp roads within the Cark PAC will be rehabilitated and closed once mechanical treatments are completed.
- No prescribed burning or mechanical harvesting within the 100-acre nest core at the Clark PAC.

Noxious Weeds and Sensitive Plant Species: To help control and/or eradicate existing populations of diffuse knapweed and Dalmatian toadflax, biocontrol weed treatments will be implemented in conjunction with the proposed action (see Appendix C for details). Three sites are proposed for biocontrol treatments after harvesting and burning are implemented because of the existing conflict between these weeds and the Flagstaff pennyroyal (Table 4). These areas should receive priority during noxious weed treatments.

Table 4. Areas containing Flagstaff pennyroyal and noxious/invasive weeds within the project area

Common Name	Infestation size (acres)	Location/Site	Proposed Action Treatment for
Dalmatian toadflax	0.1	360/001	Mechanical treatments
Diffuse knapweed	0.1	361/003	Burn only
Dalmatian toadflax	0.1	361/003	Burn only

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the Proposed Action sometimes provide suggestions for alternative methods of achieving the purpose and need.

Alternative Timber Hauling Route

The primary road identified for hauling timber (FSR 296) was found to be located within ¼ mile of a historic bald eagle nest (used in 2005) and winter roosting area. This route is currently a gated administrative road only. Hauling timber along this route (Proposed Action) could affect future nesting and roosting bald eagles. Therefore, an alternative was considered that would have utilized different roads for hauling logs to avoid potential impacts to bald eagle.

First, the Forest Service interdisciplinary team (IDT) looked at hauling timber on FSR 132, the primary access route into Lake Mary Meadows, Elk Park Meadows, and the project area. Currently, the Forest Service does not have legal right-of-way (ROW) on portions of FSR 132 traveling through private property in Lake Mary Meadows and also north at a site locally known as “Waller’s Corner.” The IDT contacted each landowner about obtaining legal ROW, but neither one was interested.

Additionally, there are dangerous curves near Waller's Corner and this area has a history of vehicle accidents. These curves would need to be realigned in order to safely haul logs. The IDT considered construction of a bypass route to address both the ROW and safety issue at Waller's Corner altogether. The cost of new construction was estimated to be $500,000/mile. The landowner was not interested in contributing to road bypass costs because the current situation is acceptable to them. The Forest Service contacted Coconino County since they maintain part of the 132 road and have a mutual interest in obtaining ROW, but they were unable to commit funding toward a bypass route. Without some other substantial funding assistance, this option was cost prohibitive to the USFS. Furthermore, even if a bypass route was constructed, it would not have solved the lack of right-of-way further south in Lake Mary Meadows.

The IDT considered the possibility of land exchanges in order to obtain legal right of way. However, land exchanges are planned at least 5 years ahead of schedule with the Southwestern Regional Office, so this option would have further delayed a decision and implementation of fuels reduction treatments in the project area.

The IDT looked at utilizing roads south of the project area for hauling. This idea was discussed with USFWS during the Mountainaire project environmental analysis and they strongly discouraged this option because of the numerous MSO PACs in the area that haul trucks would be traveling through. Based upon the complex right-of-way issues and reconstruction costs associated with a bypass route and potential impacts to other species, this alternative was eliminated from further study.

No Forest Plan Amendment

Prior to public scoping, the IDT considered the same Proposed Action treatments for the project area but without a Forest Plan amendment. As described under the Proposed Action section of this chapter, adhering to a 9 in. diameter restriction would result in no change or improvement to forest and habitat conditions in the PAC. Essentially, following current Forest Plan direction would have the same net effect as not treating the Clark PAC. A 'No Forest Plan Amendment' alternative was not fully developed and analyzed in detail because the effects are already analyzed as components of the No Action and Proposed Action alternatives. The effects of not treating the Clark PAC (No Action) and harvesting trees <9 in. DBH are disclosed in this EA for comparison purposes (see "Vegetation" analysis Table 17 in Chapter 3). The other activities proposed for the rest of the project area are analyzed as the Proposed Action.

Alternatives Suggested During Public Scoping

During public scoping, the Forest Service was asked to "evaluate an alternative without machine piling and fully analyze and disclose the impacts of machine piling when proposed" [PRD 62]. An alternative without machine piling was not analyzed in detail because the effects can be mitigated through design features and implementation standards, as outlined earlier in this chapter. Hand piling is much more expensive than machine piling. However, in areas where machine piling is impractical or machine impacts are unacceptable, the generated slash will be piled by hand. Hand piling approximately 4,700 acres could not be done in a timely or cost-effective manner. The effects of machine piling on soil productivity, erosion and sedimentation are discussed under the Soils and Watershed section of Chapter 3. In areas where the resultant fire effects are acceptable, generated slash will be lopped, scattered, and burned on the forest floor.

The Forest Service was asked to "evaluate an alternative that is limited to firewise precautions around structures" because fuels reduction beyond the immediate vicinity of structures is

ineffective and unneeded [PRD 62]. This alternative was not analyzed in detail because it would not meet the purpose and need of this project (to reduce the fire hazard of the entire project area).

The Forest Service was also asked to “evaluate an alternative that encourages the establishment of native flora and reduction of the spread of non-native invasive plants by manually removing all invasive plants before thinning and prescribed burning” [PRD 62].

This alternative was not analyzed in detail because the requested action has already been considered into the design of this project. First of all, it would be very labor intensive and expensive to *manually remove* (e.g. by hand) all invasive plants within the project area. It is also unfeasible to expect that every single invasive plant could be removed prior to harvesting of trees and burning. Invasive plants have been located and assessed in the project area. To mitigate the effects of management activities on existing populations of noxious or invasive weeds, treatments (hand pulling to eradicate musk thistle, biocontrol insects for controlling diffuse knapweed and Dalmatian toadflax, and best management practices to contain/control specific populations of cheat grass) will be implemented under the Proposed Action. (See “Invasive Plants” analysis Chapter 3 and Appendix C.) Existing weed populations will be monitored after implementation of tree harvesting/prescribed burning to determine effects and after the specified weed treatments in order to determine effectiveness.

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in the following tables lists different levels of effects or outputs that can be distinguished quantitatively or qualitatively among alternatives.

Table 5. Comparison of management activities

Activity	No Action	Proposed Action
Mechanical thinning	0	4,739 acres
Initial prescribed burning	0	6,462 acres
Maintenance prescribed burning	0	6,462 acres
Temporary road construction	0	<4 miles
Road relocation (FSR 132B)	0	0.8 miles
Road reconstrution (FSR 132B)	0	1.75 miles
Hoxworth channel restoration (Mitigation)	0	0.5 mile reach
Noxious weed treatment (Mitigation)	0	1.5 acres

Table 6. Comparison of environmental effects

Effect	No Action	Proposed Action
Soils and Watershed	No Effect	Temporary increase in runoff from disturbed areas; minor impact to soil quality and productivity; decreased sediment delivery and improved stability in Hoxworth drainage
Vegetation	Existing After 40 Years	After Treatment After 40 years
Forest structure	VSS 1 5% 4% VSS 2 1% 0% VSS 3 34% 17% VSS 4 38% 44% VSS 5 16% 22% VSS 6 6% 13%	VSS 1 20% 10% VSS 2 1% 10% VSS 3 18% 22% VSS 4 27% 14% VSS 5 22% 21% VSS 6 12% 23%
Stand density; *expressed as % of maximum stand density index (SDI), which is 450 in ponderosa pine.*	<25% 18% 11% 25-34% 15% 6% 35-49% 18% 14% 50-59% 9% 9% 60%+ 40% 60%	<25% 63% 51% 25-34% 19% 20% 35-49% 7% 17% 50-59% 2% 2% 60%+ 9% 11%
Forest health	No change to current dwarf mistletoe (DM) levels; will continue to spread 1-2 ft/yr; decreased defense to bark beetle	Reduce existing level of DM; open, patchy forest structure will reduce rate of spread; increased tree defense to bark beetle
Species diversity	Decreased Gambel oak health, growth, and vigor; Decreased understory productivity Pine encroachment on historic meadows	Improved Gambel oak health, growth, and vigor; Increased understory productivity Historic grasslands/meadows restored
Fire and Fuels		
Fire hazard rating	Moderate to extreme	Decreases: low to moderate
Condition Class	Predominently Class III	Decreases: predominently Class II
Crown bulk density	0.01000 lbs/ft^3	Decreases: 0.0043 to 0.0063 lbs/ft^3
Expected flame length	Up to 23 ft.	Decreases: <5 ft. (avg. 3 ft.)
Expected rate of spread	Up to 65 chains/hour	Decreases: <18 chains/hour (avg. 11 ch/hr)
Wildfire tree mortality	40-99% probability	Decreases: 8-57% probability
Air Quality	No Effect; Emissions from a wildfire would exceed air quality standards	Emissions from slash pile burning, intial precribed fire, and maintenance burning would meet air quality standards. A wildfire occuring after treatment would also likely meet stds.
Sensitive plants		
Flagstaff pennyroyal	No Effect	May impact individuals but not likely to result in a trend toward federal listing or loss of viability
Arizona sneezeweed Flagstaff beardtongue	No Effect	May affect potential suitable habitat

Effect	No Action	Proposed Action
Invasive Plants (4 sp.)	Existing populations would continue to expand	BMPs and manual and biocontrol treatments will eradicate, maintain, or control existing populations
Wildlife		
Bald eagle	No Effect	May affect, likely to adversely effect (hauling on FSR 296)
Mexican spotted owl	No Effect	May affect, not likely to adversely effect
Sensitive (5 species)	No Effect	May impact individuals but not likely to result in a trend toward federal listing or loss of viability
MIS (7 species)	No Effect	No change to forest-wide habitat or population trends
Migratory birds (7 sp.)	No Effect	Will not change existing forest trend
Recreation, Scenery, and Transportation	No Effect Meets VQOs	Short-term, temporary disruption to recreational activities and public road use Meets VQOs
Economy	Cost = $0 No contribution to local economy	Est. cost = $3.8M over 5-10 years Slight contribution of jobs in agricultural sector
Historic Resources	No Effect; sites at risk from wildfire damage	No Adverse Effect; threat from wildfire damage reduced

Chapter 3. Affected Environment and Environmental Consequences

Introduction

This chapter summarizes the physical, biological, social, and economic environments of the project area and the effects of implementing each alternative on that environment. It also presents the scientific and analytical basis for the comparison of alternatives presented in the previous chapter linked to references and specialist reports. The following analysis of environmental consequences is organized by resource area and discloses the direct, indirect, and cumulative effects of the alternatives on those resources.

Direct effects are those caused by the action and occur at the same time and place. *Indirect effects* are caused by the action and are later in time or farther removed in distance. *Cumulative effects* are 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.

To analyze cumulative effects, activities, and natural events that overlap in time and space with the proposed activities and project area were considered. The temporal and spatial boundaries for cumulative effects analysis varies by resource and, as such, is defined under each resource area analyzed in this chapter. The tables in Appendix B identify past, present and reasonably foreseeable activities and natural events that may have been considered in each resource area cumulative effects analysis. Information from these lists of activities and/or natural events were carried forward into each individual resource cumulative effects analysis based on that resource's spatial and temporal parameters. Not all of these activities or events are applicable to each resource cumulative effects analysis.

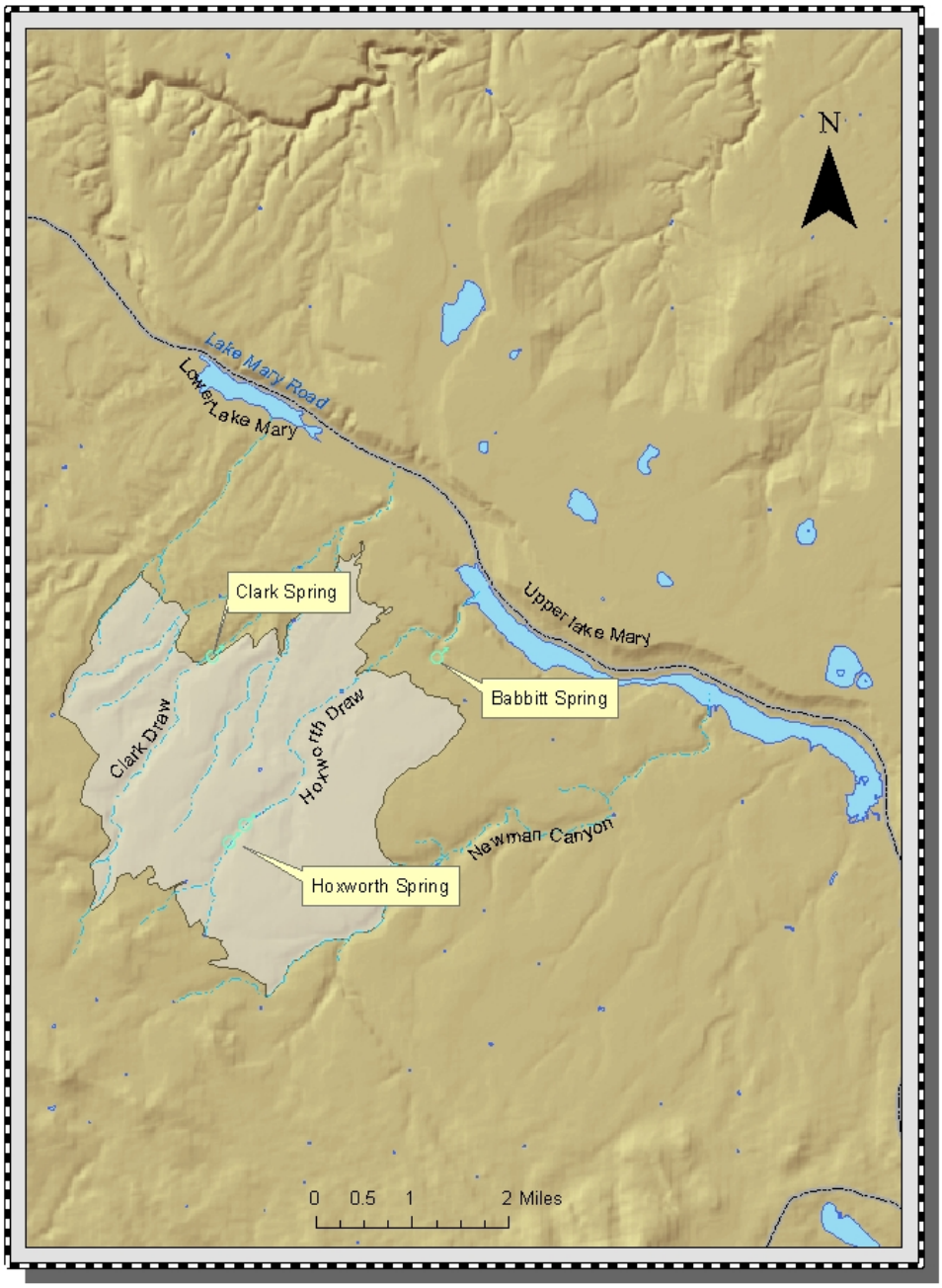
Soils and Watershed

The purpose of this section is to describe the affected environment as it relates to watershed condition, and to describe the direct, indirect, and cumulative effects of the No Action and Proposed Action alternatives on soils and water. The following information has been summarized from the Soil and Watershed Specialist report [PRD 75], located in the project record.

The Elk Park project area is located entirely within the Walnut Canyon 5th Code watershed. Important water features in this area include Upper and Lower Lake Mary, Hoxworth Spring, Clark Spring, and Babbitt Spring (see Figure 5). Clark Draw, Hoxworth Draw, and Newman Canyon are major drainage features into the Lake Mary system. Upper Lake Mary is a significant source of municipal water for the city of Flagstaff, and both Lakes are important recreation areas for the public. Protection and enhancement of water resources merit considerable attention in this area.

The majority of runoff from this watershed occurs during the fall and winter months (October to April). Snowmelt, from late February to mid-May produces most of the runoff. Occasional winter frontal storms also produce runoff from heavy or prolonged rain events. Very little runoff occurs during the months of mid-May to October. Maintenance of soil condition and productivity are essential elements of maintaining favorable conditions of stream flow and supporting water quality goals. This project will emphasize reducing the likelihood of adverse effects to communities and to natural resource from intense, landscape level wildfire.

Figure 5. Project area important water features and relationship to Lake Mary



Affected Environment

Soils*:* Soils information is derived from the Coconino National Forest Terrestrial Ecosystem Survey (USDA 1995). The Terrestrial Ecosystem Survey contains information that should be used in land planning and management programs on the Coconino National Forest: predictions and limitations of soil and vegetation behavior for selected land uses and hazards or capabilities inherent in the soil and the impact of selected uses on the environment. Other ecosystem properties that can affect land use are also described.

Eight terrestrial ecosystem survey (TES) map units exist within the proposed action area (see Figure 6 and Table 7). Each unit describes an area with similar slope, vegetation, climate, and physical soil properties. The survey units contain predictions and limitations of soil and vegetation behavior for selected land uses. The survey also highlights hazards or capabilities inherent in the soil and the impact of selected uses on the environment.

Approximately 0.75 miles of FSR 132B is adjacent to a wet meadow, an unfavorable yet unavoidable landscape position. The existing road is heavily entrenched and intermittently braided as a result of years of wet weather use.

Organic matter consists of humus, litter, and dead woody material on or in the soil. These materials are important because they increase infiltration, improve aeration and retention of moisture, support microbial activity, and are reservoirs for short and long term nutrient supply. Coarse woody debris (CWD) is material from tree limbs, boles, and roots greater than 3 in. in diameter. Coarse woody debris performs such functions as protection of forest floor, seedlings and wildlife, and acts as a sink for nutrients such as sulfur, phosphorous, and nitrogen. In the project area, where fire frequencies historically are often less than 10 years, CWD has probably increased in abundance due to lack of natural fire over the last 100 years.

Municipal Water Source*:* Upper Lake Mary on a 10 year average produces 50% of the municipal water for the City of Flagstaff. The Arizona Department of Environmental Quality, under the Clean Water Act has designated the Lake Mary Reservoir System as a Cold Water Fishery. The current turbidity standard for this designation is 10 nephelometric turbidity units (NTU), while actual turbidity is often higher. The actual turbidity varies by season and in accordance with runoff events. Some causes are thought to be related to roads, unstable stream channels, and small particle size inherent with basalt soils.

Riparian Habitat*:* Clark Spring Draw, Newman Canyon and Hoxworth Spring Draw occur within the Elk Park project boundary. Vehicle access into Clark Draw and into Hoxworth Spring has been eliminated since 1996. Stream channel stabilization projects have been accomplished in much of Hoxworth Draw and fencing has been established around the upper channel to protect riparian habitat and vegetation.

Figure 6. Elk Park project soil map units

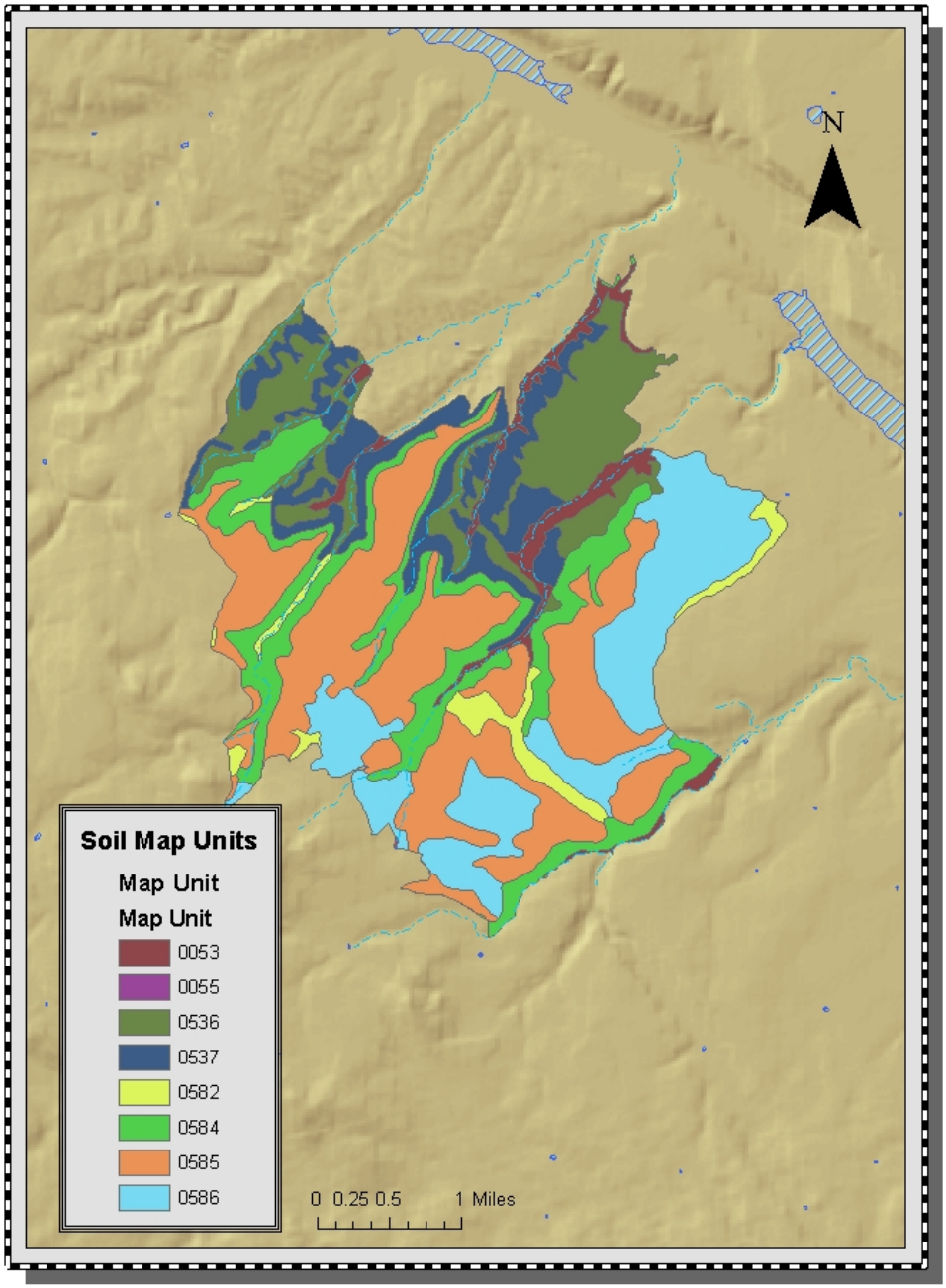


Table 7. TES Units located with the Elk Park Project Area (Miller et al. 1995)

TES Unit	Soil Type	Landform	Acres	Natural Regeneration Potential	Natural Revegetation Potential	Erosion Hazard	Windthrow Hazard	Timber Harvest Limitations	Mitigation Measures
53	Deep Loam	Valley Plains	215	N/A - Meadows	High	Slight	N/A	N/A	Restrict ground disturbing activities to periods when the soils are dry
55	Deep Loam/Clay Loam	Valley Plains/ swales	1	N/A - Meadows	Low - High (Depending on clay content)	Slight - Moderate	N/A	N/A	Restrict ground disturbing activities to periods when the soils are dry
536	Fine Sandy Loam	Elevated Plains	969	High	High	Slight - Moderate	Slight	Severe (low strength)	Maintain vegetative groundcover to prevent sheet and rill erosion. Restrict ground disturbing activities to periods when the soils are dry.
537	Very Stony Sandy Loam	Hills/Scarp Slopes of Plains	795	High	Low (Stony)	Moderate - Severe	Moderate - Severe (Shallow)	Moderate - Severe (Erosion)	Restrict ground disturbing activities to periods when the soils are dry. Maintain vegetative ground cover to prevent erosion. Rock fragments may limit management activities.
582	Gravelly /Cobbly Clay Loam	Elevated Plains	246	High	Moderate - High (Cobbly)	Slight	Moderate - Severe (Low strength, shallow)	Moderate - Severe (Low strength)	Restrict ground disturbing activities to periods when the soils are dry. Well suited for timber production.
584	Very Stony/ Cobbly Loam	Hills/Scarp Slopes of Plains	1112	High	Low (Stony)	Moderate - Severe	Moderate - Severe (Low strength)	Severe (Erosion, low strengh)	Restrict ground disturbing activities to periods when the soils are dry. Maintain vegetative ground cover to prevent erosion. Surface rock fragments are variable and may restrict certain management activities. Well suited for timber production.
585	Extremely Stony/Very Cobbly Loam	Elevated Plains	2134	Low - High (Depending on soil depth)	Low (Stony/Cobbly)	Slight	Severe (Shallow, low strength)	Moderate - Severe (Rocky, low strength)	Restrict ground disturbing activities to periods when the soils are dry. Rock fragments may limit management activities.
586	Very Stony Loam	Elevated Plains	1259	High	Low (Stony)	Slight	Severe (Low Strength)	Moderate - Severe (Low strength)	Restrict ground disturbing activities to periods when the soils are dry.

Table 8. Current soil condition rating by TES unit

TES Map Unit	Composition (%)	TES Soil Condition	Overall by Map Unit	% Current/ % Potential Bare Soil	% Current/ % Potential Vegetative Ground Cover	Slope Range (%)	Refined Forest-Level Soil Condition by TES Component	Refined Forest-Level Soil Condition by TES Unit
53.1	85	Satisfactory	Satisfactory	50/10	45/90	0-5	Impaired	Impaired
55.1	65	Unsatisfactory		70/5	25/90	0-5	Impaired	
536.1	55	Satisfactory		35/5	55/85	0-15	Satisfactory	
536.2	20	Satisfactory	Satisfactory	30/5	60/85	0-15	Satisfactory	Satisfactory
537.1	50	Satisfactory		5/5	75/80	15-40	Satisfactory	
537.2	30	Satisfactory	Satisfactory	5/5	75/75	15-40	Satisfactory	Satisfactory
582.1	65	Satisfactory		15/5	60/85	0-15	Satisfactory	
582.2	20	Satisfactory	Satisfactory	15/5	65/85	0-15	Satisfactory	Satisfactory
584.1	40	Satisfactory		10/5	70/85	15-40	Satisfactory	
584.2	35	Satisfactory	Satisfactory	10/5	75/85	15-40	Satisfactory	Satisfactory
585.1	40	Satisfactory		10/5	40/75	0-15	Satisfactory	
585.2	30	Satisfactory	Satisfactory	20/5	45/85	0-15	Satisfactory	Satisfactory
586.1	45	Satisfactory		10/5	50/85	0-15	Satisfactory	
586.2	40	Satisfactory	Satisfactory	15/5	55/85	0-15	Satisfactory	Satisfactory

Map Unit: Components within a map unit are identified by a decimal and followed by a number (.l to .4). A maximum of four major named components are allowed in each map unit. Each map unit can have two minor inclusion components (.5 and .6). The map unit number will appear on scale maps while the map unit number and component will appear in the reports.

Since the original TES Forest soil assessment, additional site specific monitoring has led to a refined Forest level soil condition interpretation for both TES Component and Map Unit

Channel Stabilization at Hoxworth Drainage

The Hoxworth drainage below the crossing of FSR 132B to Elk Park (see Figure 7) is unstable in terms of both vertical and lateral stability. Channel walls are generally steep and actively eroding due to ongoing incision. Sediment production and transport downstream is far above what would be expected under stable channel conditions. This condition can be attributed to man-made changes brought on by construction of a series of impoundments sometime in the last 60 years. This condition also existed above the 132B crossing, but has been stabilized by channel modification or restoration projects begun in 1996.

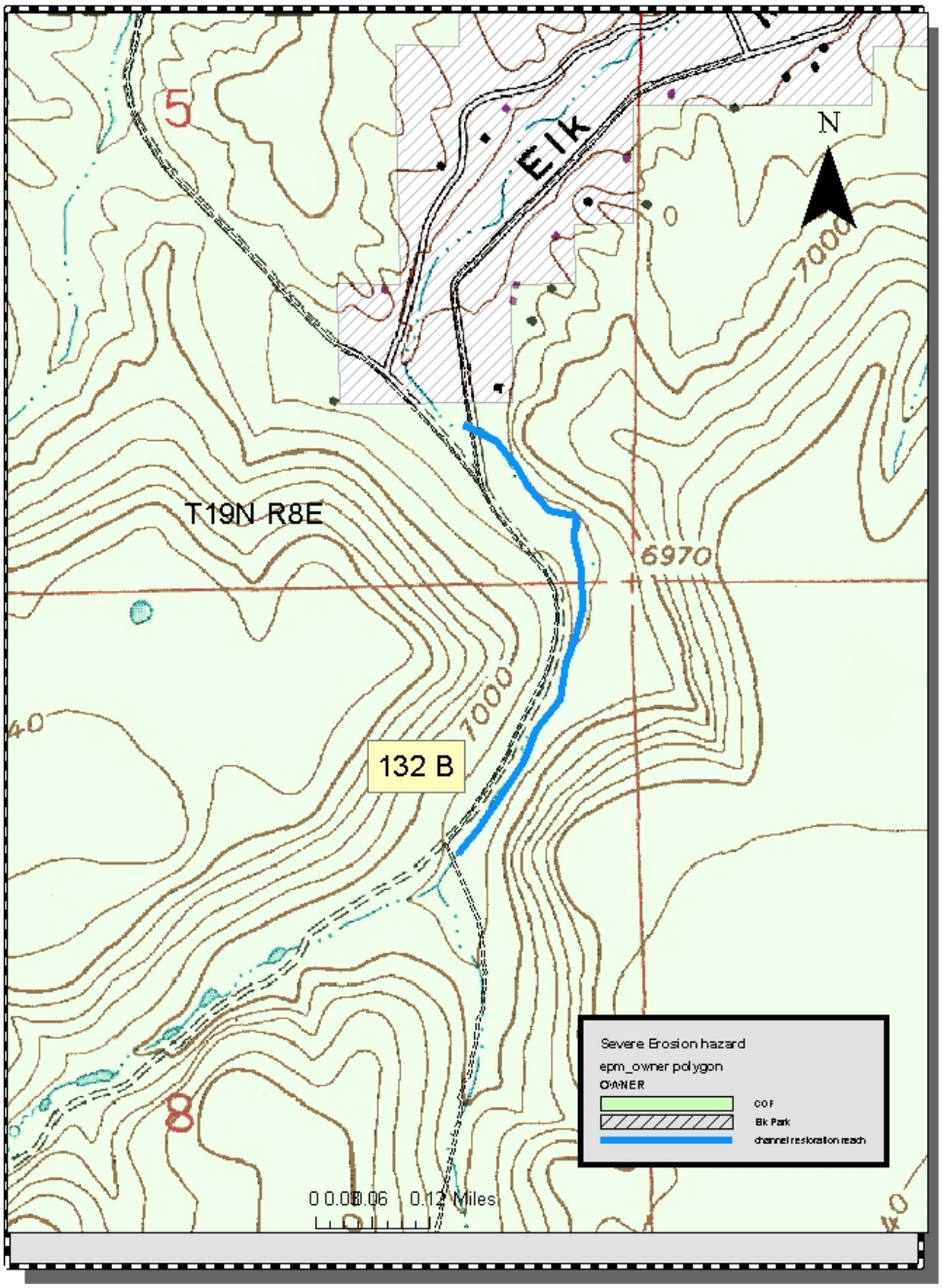
Gullies most commonly grow by upstream retreat of a near-vertical headwall; water falling over the lip of the headwall excavates a plunge pool at its base, undercutting the headcut and stream banks, which promotes toppling failures and allows the feature to widen and to progress upstream. Seepage at the base of the headcut also can increase rates of undercutting and in some areas can be the dominant mechanism for headcut retreat (Higgins et al. 1990).

Gully stream banks are modified by bank erosion after the headcut passes, and often gully width increases and wall gradient decreases downstream, reflecting progressively longer periods of recovery. Headcut movement may halt if the headcut encounters non-erodible material or if the contributing area becomes too small to generate flows capable of maintaining the cutting action. (Reid draft 2005)

At any sites where logging has been extensive enough to modify runoff characteristics, small channels with erodible beds and banks are likely to adjust to the altered flow regime through bank erosion, incision, and downstream accumulation of sediment. The extent of the adjustment would depend in part on the magnitude of the flow changes and their persistence. (Reid draft 2005)

This reach of the Hoxworth drainage will recover very slowly as gully walls widen, decrease slope, and eventually become vegetated. Because the channel is in such poor condition currently, the proposed action has the potential to moderately increase localized peak flow runoff and exacerbate the problem. Mitigation for this situation would be to restore the channel reach (approximately 0.5 mile) to a stable profile as has been done upstream of the 132B crossing. This activity would involve hydrologic analysis of anticipated peak flow, topographic survey, design, and construction of a stable channel geometry including a natural meander pattern. Channel reconstruction would involve modifying the existing channel and/or building a new channel with a small bulldozer based on design and experience gained from previous projects. The new channel would have a relatively constant slope of <1.5% and a cross section capable of passing flood flows with little to no soil erosion. This action should be implemented after road relocation and either before or after harvest activities.

Figure 7. Location of Hoxworth drainage channel restoration



Environmental Consequences

Direct and Indirect Effects of Alternative 1

There will be no change in soil condition from current conditions. This alternative will perpetuate forest conditions that are conducive to the occurrence of intense wildfire. Fuel conditions and fire hazard within the watershed will remain the same or worsen over time. If and when such an event occurs in the area, severe fire effects on hydrologic function could occur.

Wildfire can have major effects on vegetation, ground cover, and soil properties, resulting in reduced infiltration and increased overland flow. Intense wildfire can reduce soil surface resistance to erosion resulting in accelerated soil erosion, particularly during periods of heavy summer precipitation on newly exposed soil. Peak discharges are likely to increase because of wildfire, and water quality is likely to decrease due to increased sediment loads that can lead to increases in turbidity.

As forest canopy and protective soil organic matter (e.g. duff, litter) is consumed by severe fire, interception of rainfall by pines branches etc. would be reduced and soil erosion could increase. Changes in forest canopy cover that result in large openings can effect snow accumulation and melt patterns. Consequently the timing, quantity, and quality of runoff from severely burned watersheds. Changes in soil and watershed conditions become more significant as fire size and intensity increase.

Severe heating from a wildfire may cause changes in soil properties such as the reduction of structure, reduction of porosity, and change of soil color. Burning reduces soil organic matter, and plant and litter cover. In most cases, soil erosion by wind and water is increased. The severity and duration of accelerated erosion depend on slope, soil texture, recovery of plant material, severity and extent of burning, and post fire precipitation timing and intensity. Duration of the effects of fire on soil structure range from 1 year to many decades depending on the severity of the fire and rate of recovery (Wells et al. 1979).

Direct and Indirect Effects of Alternative 2

Pre-commercial thinning operations (without yarding) have small, short-lived impacts on runoff and sediment production, even when operations extend over large areas. Commercial thinning and yarding has a greater potential to increase runoff, erosion, and sediment yields because of the more extensive removal of the forest canopy, greater ground disturbance due to skid trails, cable rows, and landings, greater ground disturbance due to more intensive harvest, need for more extensive road access, and increase in heavy truck traffic. The potential increases in erosion and sediment yield can be minimized by reducing the area and amount of soil disturbance, establishing buffer strips along stream channels, and minimizing overland flow by restoring severely disturbed areas.

Vegetative recovery after fuel treatments is generally very rapid, with erosion rates typically dropping to pre-fire levels within 1-2 years. Hydrologic recovery after fuel treatments also tends to be more rapid than after clearcutting or high burn severity fires because a smaller proportion of the forest canopy is being removed.

Reducing forest cover (removing trees) decreases interception and transpiration, and in wetter areas, this generally increases annual water yields. In areas where the annual precipitation is less than 18 to 20 in, thinning of the forest canopy is unlikely to significantly increase annual water yields. In drier areas, the decrease in interception and transpiration is generally offset by the increase in soil evaporation, and there is no net change in runoff assuming there is no change in

the underlying runoff processes. Since evapotranspiration rapidly recovers in partially thinned areas with vegetative regrowth, any increase in runoff due to thinning operations is likely to persist for no more than 5-10 years. (Robichaud et al. in press)

Surface erosion is the movement of individual particles of soil. Other things being equal, the rate of this type of erosion is closely correlated with vegetative cover, especially litter on the soil surface (Rice et al.1972). In general, erosion rates are acceptably low when the proportion of bare soil is less than 30 to 40% (Benavides-Solorio and MacDonald 2005; Gary 1975; Swank 1989).

The most important direct effect on soil condition from the action alternative will be from mechanical activities (machine piling, feller buncher, skidder). Approximately 4,700 acres, or 70% of the project area, will receive mechanical treatments and prescribed burning. Ground cover will be disturbed through mechanical actions. Skid trails will tend to compact the ground and, in some cases, channel water. Based on past experience in timber sale administration on similar projects, skid trails are estimated to occur over <10% of the areas that are mechanically treated (474 acres). The expected duration of effects is less than 10 years. Based on Water Erosion Prediction Project (WEPP) Fuel Management Erosion Analysis (FuME) modeling results, forest thinning is not expected to result in a noticeable increase in sedimentation (predicted 0% increase).

Additional short-term loss of ground cover will occur through the burning phase of the project. WEPP FuME indicates a 20% sediment increase over background levels; however, the prescribed burning will reduce the risk of intense wildfire or reduce the intensity of wildfire a far greater contributor to sedimentation within the watershed. The combination of thinning to open the stand and prescribed burning will likely result in the promotion of herbaceous vegetation as the major component of ground cover. Stand canopy conditions and fuel loading will be reduced so that the potential effects of intense wildfire are substantially reduced. Approximately 270 acres (4% of the project area) will receive no treatment at all under the proposed action, so there will be no direct effects to soils on these acres.

Some potential off-site effects include sedimentation resulting from ground disturbing activities, and potential short term increases in runoff from disturbed surfaces. Adequate buffers have been developed on all major drainages in the area. Only a small portion of anticipated soil loss will travel off site and enter ephemeral stream channels. Most of this sediment will remain in storage rather than move downstream into Lake Mary. Other indirect effects include long term decreases in accelerated soil erosion from re-routing the 132 road and rehabilitating temporary roads, and reduction in the potential effects of intense wildfire within the treated watershed. Each of these effects may have a slight influence on water quality within the Lake Mary system.

Prescribed Burning

High severity wildfires increase runoff and erosion rates by two or more orders of magnitude, while low and moderate severity burns have much smaller effects on runoff and sediment yields. If areas are burned at low severity, the potential for increasing peak flows and erosion rates is relatively small. However, if prescribed fires are conducted under dry duff moisture conditions and larger areas are burned at high severity, there is a much greater risk for significantly increasing runoff and erosion rates. The natural regrowth on severely burned areas means that overland flow rates and sediment yields generally return to pre-burn levels in approximately four years. Water yields may remain elevated for a longer period due to the time required for interception and transpiration rates to return to pre-burn levels.

This alternative will effectively reduce the probability of intense wildfire within the treatment areas. Prescribed burning will occur over approximately 1,700 acres (26% of the project area) and

will have the effect of reducing litter accumulations and most likely promoting herbaceous vegetation. Short-term reductions in ground cover will result where litter is totally consumed (previous experience on the forest; Lindenmuth 1960; Ffolliett et al. 1968; and Sackett et al. 1994) shows that this bare soil is covered by litter or vegetation within one to two years. This temporary and moderate reduction in ground cover will result in a potential increase in sedimentation. Total consumption of ground cover will be patchy and will not adversely affect overall ground cover.

The degree to which soil is heated depends on a variety of factors including soil moisture, fuel loading, fuel moisture, fuel distribution, and soil texture. The peak temperature and duration of heating greatly influences subsurface soil temperature. The amount of change in soil properties is largely dependent on the amount of energy radiated downward into the underlying duff and mineral soil. Their amount of heat radiated downward increases as fire severity increases. Low severity fires burning only surface fuels do not significantly heat the soil surface. Soil temperatures do not rise substantially where repeated cool-burning fires are used to reduce fuel buildup (Debano et al. 1998).

Table 9. Proposed treatment type by TES unit

Soil Map Unit	Proposed Treatment	Acres Affected
53	Burn only	155
	Mechanical treatment	53
	No treatment	7
55	Mechanical treatment	1
536	Burn only	38
	Mechanical treatment	925
	No treatment	5
537	Burn only	20
	Mechanical treatment	756
	No treatment	20
582	Burn only	58
	Mechanical treatment	165
	No treatment	23
584	Burn only	198
	Mechanical treatment	745
	No treatment	169
585	Burn only	527
	Mechanical treatment	1,574
	No treatment	33
586	Burn only	727
	Mechanical treatment	519
	No treatment	13

Erosion Hazard

Erosion Hazard Ratings are predicted on the basis of relative susceptibility of the soil to erosion upon removal of vegetation and litter.

A *slight* rating indicates that all vegetative groundcover (vegetation basal area and litter) could be removed from the site and resulting soil loss will not exceed tolerance soil loss rates. This does not imply that site degradation is not occurring. Removal of the organic matter source (natural vegetation) will lead to short-term undesirable changes in soil chemical and physical properties. Areas rated within a slight erosion hazard class generally stabilize under natural conditions.

A *moderate* rating indicates that predicted rates of soil loss will result in a reduction of site productivity if left unchecked. Conditions are such that reasonable and economically feasible mitigation measures can be applied to reduce or eliminate soil loss.

A *severe* rating indicates that predicted rates of soil loss have a high probability of reducing site productivity before mitigating measures can be applied.

Experience through many years of similar timber related projects shows that complete or even extensive removal of groundcover does not occur. On the other hand, experience with intense wildfire suggests that extensive removal of groundcover and resulting soil erosion and site degradation is common. Based on WEPP modeling, erosion and sedimentation from harvest is not likely; from low severity fire is somewhat likely; from severe fire is likely.

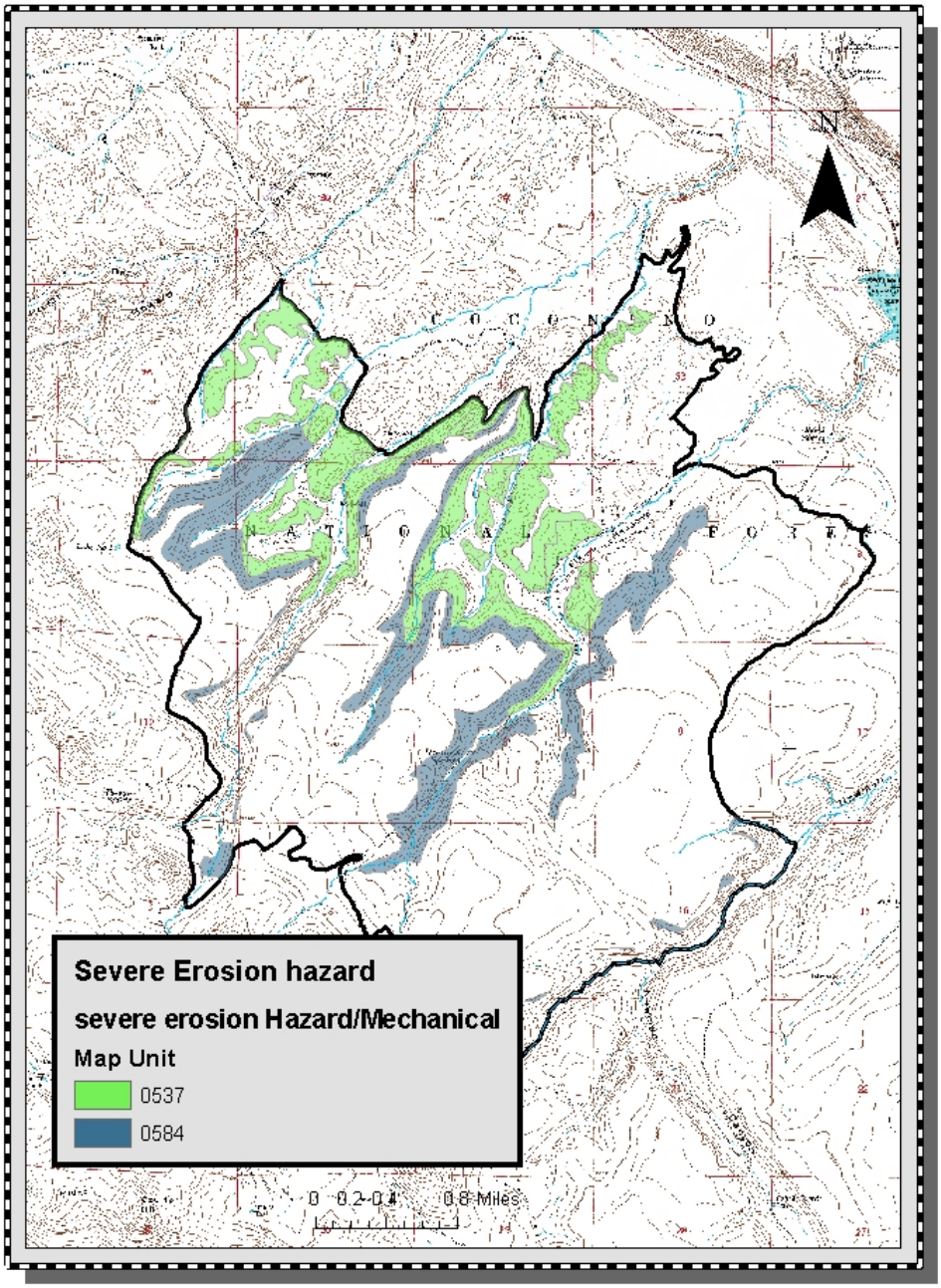
Timber Harvest Limitations are the limits to be considered when evaluating the impact of timber harvest with regard to maintenance of soil productivity. Limits relate to year-round or seasonal use of equipment as the result of climate, soil characteristics, and landform.

Areas of severe erosion hazard are shown in Figure 8. A moderate or severe erosion hazard rating directs the land manager to areas that require some measure of mitigation in order to avoid impairment of soil productivity. Logging systems can be employed that will adequately overcome many limitations. Seasons of logging can often be used to mitigate soil moisture problems (dry season or frozen/snow cover).

Provided that mitigation measures (BMPs) are followed (see Chapter 2), there will be only minor impacts to on-site soil quality and productivity from the proposed activities. Some minor soil compaction from skidding equipment will occur in mechanical treatment areas, and some on-site soil loss would occur on soils with moderate and severe erosion hazards. Best management practices, including skid trail location prior to felling, attention to wet weather operations, and effective erosion control treatments will minimize adverse soil effects on soils with moderate and severe erosion hazards.

To provide for long-term soil productivity, roughly five tons per acre of CWD will be retained in the project area, and will be retained through both piling techniques and burning under conditions where organic matter is not totally consumed. Reductions in soil porosity may occur from heavy loads compacting the soil or from removal of ground cover and organic matter. Best management practices such as designating skid trails to limit the extent of disturbance, operating equipment under relatively dry conditions, utilizing proper equipment size, and maintaining soil cover will preserve soil porosity. Compaction will be minimized on all soil units through directional tree falling and skid trail location approval.

Figure 8. Severe erosion hazard areas



Slash Treatment

The proposed treatments will generate a large volume of debris (slash) that will remain on site and require some sort of treatment to reduce the fuels hazard. This material is generally comprised of small to medium limbs and needles. Options for slash treatment include burning on site, machine piling and burning on site, or skidded (attached to the tree) to the log landing then piled and burned. Leaving slash untreated on the forest floor is not a viable option given the fuels hazard this would present. The following types of slash treatments may occur:

Mechanical Slash Piling: Mechanical piling involves gathering slash into a compacted pile and eventually burning. Some disadvantages of this technique include soil disturbance and displacement from machinery tracks and brush rake. This effect can be relatively severe or benign depending on the intensity of treatment and operator skill.

Although slash pile scars only cover a small (approximately <1.0%) of forest ecosystems, they are problematic because they may assist the spread and establishment of undesirable non-native plants into the forest interior following thinning. Burning slash piles with high-intensity fire significantly reduces densities of mycorrhizae (association between a fungus and a plant). Slash pile scars often remain unvegetated for a long time unless seeds are manually distributed. In some cases, invasive species take hold at slash pile sites and spread from them (Korb et al. 2004).

Best management practices will be employed for any areas selected for machine piling. These practices include:

- Use of Terrestrial Ecosystem Survey Timber Harvest Limitation Rating
- Limiting the Operating Period of Timber Sale Activities
- Slash Treatment in Sensitive Areas
- Intensity of piling will be moderate to avoid excessive disturbance. This treatment is referred to as “rough piling” where only the concentrations of heavy slash are piled and sufficient CWD is left on the forest floor to protect long term soil productivity.

Broadcast Burning Only of activity generated slash: In areas of heavy slash, this treatment has several disadvantages. Broadcast burns feeding on heavy loads of slash can be destructive to soils, fungi, the seed bank, and plants, and can kill trees remaining after thinning. Smoke from large broadcast fires may be long term in duration and be a nuisance to the public. Soil impacts from this treatment will be unacceptable in terms of reduced productivity and potential erosion problems, particularly on soils with severe erosion hazard. This treatment will only occur in those areas where slash is sufficiently sparse

Whole Tree Skidding: This harvest method is becoming common for small diameter harvest. Slash is removed to the landing where it is eventually piled and burned. Although the intensity of soil heating is probably greater than any other treatment, the aerial extent of disturbance is very limited. Disturbance of the forest floor from machine piling is avoided.

Transportation System

Roads greatly increase runoff and erosion rates at the project and road segment scale. The effect of these increases at the watershed scale depends on the connectivity of the road and stream networks, but several studies have indicated that roads have minimal effect on runoff at larger spatial scales. More studies have shown that unpaved forest roads are chronic sediment sources, and that roads can increase sediment yields on small to moderate-sized catchments. The basalt soils in the Elk Park area are fairly resistant to erosion, and produce little sediment from the road

system, even though many of the roads are poorly maintained. Road building, road maintenance, and road obliteration can generate short-term increases in runoff and sediment.

The effects of forest roads on runoff and sediment yields can be greatly reduced by improved road placement, road designs that dissipate runoff and direct it away from streams, and the widespread use of erosion mitigation techniques.

The proposed action will require up to 4 miles of temporary road construction. Temporary roads are defined as roads associated with a timber harvest contract, not intended to be a part of the forest development transportation system, and not necessary for resource management (FSM 77-5.7/27/94). Extensive research has demonstrated that improved road design, construction, and maintenance can reduce road-related surface erosion at the scale of individual road segments. Key factors are road location (particularly the layout relative to stream systems), road drainage, surfacing, and cut slope and fill slope treatments. These implementation standards will help reduce the direct and indirect effect of temporary road construction.

The reconstruction of 0.75 miles of FSR 132B will substantially reduce current impacts to the adjacent wet meadow area. The relocation of the 132B will greatly reduce sediment delivery and reduce road and vehicle encroachment to the Hoxworth Spring stream channel, as well as reduce impacts to the riparian meadow. Additionally, the proposed channel reconstruction (mitigation) below the 132B crossing will also stabilize this drainage and reduce erosion.

Cumulative Effects

The cumulative effects of land disturbing activities can be seen as on site, or downstream of the activity. On-site effects include changes to soil characteristics, vegetation, and nutrient cycling. Downstream effects may include changes in the amount and timing of overland flow, and sediment transport. An appropriate area to consider cumulative effects area is the Walnut Creek 5th code watershed.

A ten year time period is reasonable to consider when evaluating cumulative effects for soil and watershed because any on or offsite effects from ground disturbing activities generally become negligible after this period of time. The effects from a major wildfire would be an exception, but none have occurred in the watershed for many years. Within the last 10 years, Forest Service activities have occurred within or adjacent to the Elk Park project area or within the watershed (see Appendix B). These activities will be considered in terms of on-site cumulative effects.

All vegetation and soil disturbing land uses that reduce water infiltration rates or remove excessive amounts of vegetative cover from sites can increase runoff and sediment from storm events. Assuming that soil and watershed BMPs are employed, the harvesting and burning treatments proposed in Alternative 2 would have little incremental cumulative effect on soil condition and water quality when considered with the effects of other projects, both past and in the foreseeable future. The ground disturbing effects in the adjacent Mountainaire project will be moderated substantially by the time the Elk Park project begins. Impacts from livestock grazing have been absent since 2001 when the overlapping grazing allotment went into non-use status. The adjacent Lake Mary Fuels Reduction treatment has had no discernable adverse effects on soil condition so contributes nothing to cumulative effects.

Relocating FSR 132B and restoring Hoxworth channel, when combined with the past Upper Hoxworth channel restoration project and Lake Mary Watershed maintenance projects will improve long-term soil condition and contribute to improved downstream water quality.

Treatments in Alternative 2 are designed to reduce the likelihood of a landscape level wildfire and the watershed disturbing effects associated with such a fire. Additional maintenance burning

is generally recommended every 3-15 years and the associated effects would re-occur during each treatment cycle.

Alternative 1 could result in the greatest impact to soil condition and water quality if a fire occurred, and therefore, the greatest cumulative effect. A severe crown fire would result in large increases in soil movement and runoff for at least a few years after the event. Sediment yields from high severity wildfires are much greater than the increase in sediment yields of planned fuel management activities, but the recurrence interval of such wildfires can be hundreds of years.

Vegetation

The purpose of this section is to describe the affected environment as it relates to forest vegetation, and to describe the direct, indirect, and cumulative effects of the No Action and Proposed Action alternatives on ponderosa pine, Gambel oak, understory species, and grasslands. The following information has been summarized from the Vegetation/Silvicultural Specialist report [PRD 78], located in the project record.

Throughout this analysis, the terms “sustainability” and “uneven-aged” are used repeatedly. The Dictionary of Forestry defines “sustainability” as “the capacity of forests, ranging from stands to ecoregions, to maintain their health, productivity, diversity, and overall integrity, in the long run, in the context of human activity and use.” “Uneven-aged” is defined as an age arrangement in which the trees differ markedly in their ages. An uneven-aged stand contains at least three age classes (Nyland 1996). An uneven-aged forest canopy with a well-stratified vertical structure supports a more diverse biota than an even-aged canopy, resulting in increased biological diversity (Hunter 1990). Because many insects favor trees within a certain diameter range, uneven-aged stands tend to be more resilient to insect attack and mortality due to a diversity of age and size classes. Because ponderosa pine forests were historically uneven-aged, the Elk Park Fuels Reduction and Forest Health Project will utilize uneven-aged management.

Affected Environment

Forest Structure: Definitions of VSS classes were taken from “Management Recommendations for the Northern Goshawk in the Southwestern United States” (Reynolds et al. 1992) and the Rocky Mountain Resource Information System User Guide (USDA 1993). VSS classes were determined by calculating the basal area within each diameter class. The diameter class with the highest calculated square foot basal area is the assigned VSS class. The following table defines the VSS classes:

Table 10. Vegetative structural stages

Class	Forest successional stage	Tree size (diameter)
VSS 1	grass/ forb/shrub	non-stocked openings and trees 0-1” DBH
VSS 2	seedling/sapling	1-5” DBH
VSS 3	young forest	5-12” DBH
VSS 4	mid-aged forest	12-18” DBH
VSS 5	mature forest	18-24” DBH
VSS 6	old forest	>24” DBH

Table 11 displays vegetative structural stages (VSS) by percent of the project area. Currently, 34% of the project area is young forest and 38% is mid-aged forest. Only 5% is grass/forb/shrub, 1% is seedling/sapling, 16% is mature forest, and 6% is old forest. While areas classified as "old forest" have the majority of their basal area in trees greater than 24 in. dbh, there are no stands located within the project area that currently meet the minimum criteria for the structural attributes used to determine old-growth, as outlined on p. 70-2 of the Coconino National Forest Plan.

Table 11. Existing trees per acre, basal area, canopy cover, and quadratic mean diameter[1] by VSS for the Elk Park project area

VSS[2]	% of Project Area	Trees per Acre	Basal Area (ft^2/acre)	Canopy Cover (%)	Quadratic Mean Diameter (inches)
1	5	0	0	0	0.0
2A	1	500	18	18	2.5
3A	3	14-136 (88)	10-60 (45)	3-49 (36)	9.0-11.6 (10.3)
3B	10	117-527 (221)	72-110 (89)	54-64 (59)	7.2-11.2 (8.7)
3C	21	211-773 (450)	101-255 (172)	62-86 (75)	5.0-13.5 (8.6)
4A	9	17-95 (51)	20-80 (58)	21-56 (46)	10.8-17.9 (14.6)
4B	10	67-256 (147)	80-120 (97)	56-67 (61)	6.9-16.6 (11.3)
4C	19	107-585 (259)	120-270 (178)	67-87 (76)	7.5-16.3 (11.8)
5A	4	13-80 (43)	30-100 (58)	39-62 (46)	11.1-23.1 (16.9)
5B	4	51-173 (94)	58-120 (99)	59-67 (62)	11.3-16.9 (13.4)
5C	8	121-396 (243)	101-210 (166)	62-81 (75)	7.0-16.5 (11.7)
6A	5	5-29 (22)	25-90 (51)	27-59 (42)	16.5-29.4 (23.7)
6B	0	--	--	--	--
6C	1	73	225	83	23.8

1. Values expressed as ranges, with averages in parentheses

2. VSS further categorized by level canopy cover where A=open; B=moderately closed; C=closed.

Table 11 also displays percent canopy cover by percent of project area. Because values can range dramatically within VSS classes, the values in Table 11 are expressed as ranges, with an average in parentheses to provide a more thorough picture of canopy cover and stand density conditions. Currently, 49% of the project area has a closed canopy. Only 27% is classified as "open" and 24% is "moderately closed".

Figure 9 displays Forest ERA data for canopy cover within the project area. Currently, tree arrangement lacks a groupy arrangement and there is a lack of openings. Only 52 acres within the project area contain openings of 2 acres in size or greater (canopy cover less than 10%). A forest of young to mid-aged ponderosa pine trees with a moderately closed to closed canopy forms a homogenous structure throughout most of the project area.

Desired conditions for forest structure within the project area include increased age and size class diversity, uneven-aged stand structure, improved successional dynamics, and increased horizontal heterogeneity. The desired VSS distribution for the Northern goshawk, according to the Forest Plan (Amendment 11, 1996), in comparison with existing conditions and the resultant gap, is

displayed in Table 12. The desired tree arrangement includes trees left in groups of 2-40 trees across approximately 30% of the landscape. These tree groups will range in shape and size from approximately 0.05 – 0.7 acres, with approximately 50% of the project area in grassy interspaces between tree groups in order to increase horizontal heterogeneity.

To obtain desired conditions, there is a need to decrease the proportion of the project area in young to mid-aged forest by approximately 32%. VSS 1 and 2 are lacking across the project area. There is a need to create openings across approximately 14% of forested areas to increase natural regeneration. Outside of MSO restricted and target/threshold habitat and northern goshawk PFAs, openings will range in size from 0.5 to 4 acres. Within northern goshawk PFAs and MSO protected and target/threshold habitat, openings will range in size from 0.5 to 2 acres. Within MSO PACs, openings will range in size from 0.5 to 1 acre. Additionally, there is a need to increase the proportion of the project area in mature and old forest by approximately 18%. There is also a need to create a more variable, patchy tree distribution across the project area that would more closely mimic the historic ponderosa pine forest structure that existed prior to fire suppression.

Table 12. Desired VSS distribution for the Northern goshawk

VSS Distribution	VSS 1	VSS 2	VSS 3	VSS 4	VSS 5	VSS 6
Forest Plan Direction	10%	10%	20%	20%	20%	20%
Existing Condition	5%	1%	34%	38%	16%	6%
Need for Change	+5%	+9%	-14%	-18%	+4%	+14%

Outside of Mexican spotted owl protected habitat, canopy cover within groups will vary from 30% to 70%. There is a need to decrease the amount of the project area in “closed” and “moderately closed” canopy conditions. Within Mexican spotted owl protected habitat, canopy cover will average 50%+ at the PAC level. Within Mexican spotted owl target/threshold habitat, canopy cover will average 50%+ at the stand level. There is a need to decrease the amount of MSO protected habitat in “closed” canopy conditions.

Stand Density*:* One way in which to quantify stand development and the level of inter-tree competition is through Stand Density Index (SDI). SDI is a relative measure of stand density based on the number of trees per acre and the mean diameter (Reineke 1933). SDI expresses the actual density in a stand relative to the theoretical maximum density possible for trees of that diameter and species. SDI is useful in maintaining sustainable forest conditions because it can be used to measure competition thresholds, which are very important in a moisture-limiting system. At less than 25% of the maximum SDI, stand conditions would be “open”, with little inter-tree competition. Between 25% and 35% of the maximum SDI, competition between individual trees begins to increase. Between 35% and 60% of the maximum SDI, inter-tree competition increases significantly and individual trees exhibit reduced tree growth and vigor due to competitive stress. Above 60% of the maximum SDI, individual trees exhibit very little or no growth due to inter-tree competition and a lack of adequate moisture, nutrients, and sunlight. Stands are at extreme risk of successful bark beetle attack and mortality and stand-replacing fire. The Maximum SDI for ponderosa pine is 450.

Figure 9. Forest ERA canopy cover data layer (90m resolution) within the Elk Park project area

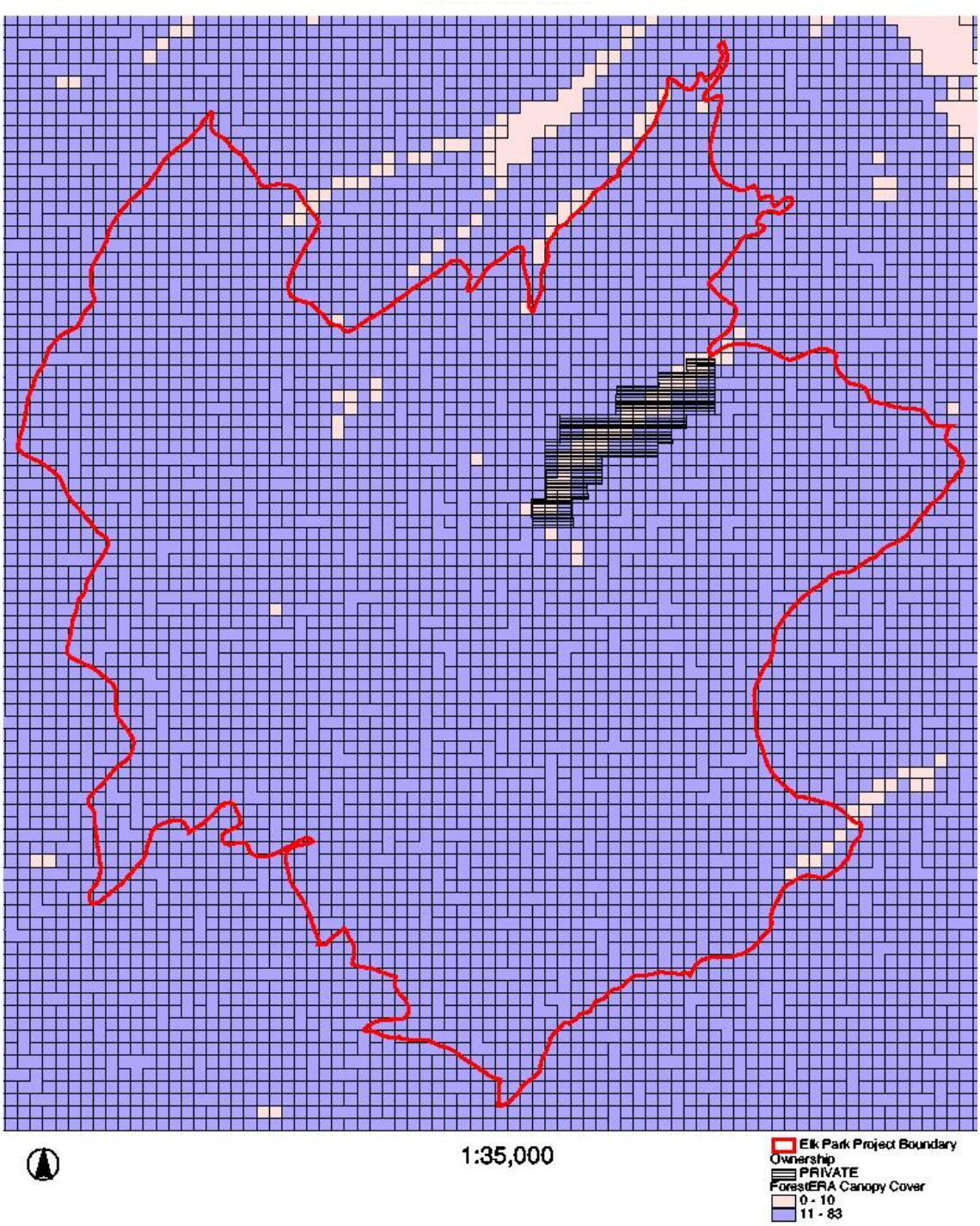


Table 11 also displays trees per acre, basal area, percent canopy cover, and quadratic mean diameter by VSS. Quadratic mean diameter ranges from 0 in. to 29.4 in., with approximately 84% of the project area between 5.0 to 17.0 in. Over 66% of the project area contains stand densities of greater than 100 trees per acre. Over 50% of the project area contains basal areas greater than 100 sq ft per acre.

Due to high stand densities, trees within the project area in general are experiencing increased competition for moisture, nutrients, and sunlight, decreased tree vigor, increased susceptibility to successful bark beetle attack and mortality, decreased diameter growth, decreased "yellow" pine longevity, decreased natural regeneration, and decreased understory productivity. Eventually, those trees that are out-competed will die, resulting in increased fuel loading, increased fire hazard, and increased risk of bark beetle attack to residual trees.

Percent of maximum stand density index (SDI) is displayed in Table 13. Currently, 18% of the project area is below 25% of the maximum SDI for ponderosa pine. Approximately 67% of the project area is at densities above 35% of the maximum SDI, suggesting that over two-thirds of the project area is experiencing increased levels of inter-tree competition.

Table 13. Current percent of maximum stand density index for forested stands located within the Elk Park project area

Maximum Stand Density Index (SDI)	Percent of Project Area
<25%	18
25-34%	15
35-49%	18
50-59%	9
60%+	40

At these densities, individual trees exhibit reduced tree growth and vigor due to competitive stress. Unless the number of trees is reduced by thinning or natural disturbance, individual stand densities will eventually approach the maximum stand density, with imminent, competition-based mortality occurring at approximately 50% to 60% of the maximum SDI (approximately 9% of the project area). These stand densities are not ecologically sustainable and are at high risk for successful bark beetle attack and mortality. Approximately 40% of the project area is above 60% of the maximum SDI, with individual trees exhibiting very little or no growth due to a lack of adequate moisture, nutrients, and sunlight. Stands are at extreme risk of successful bark beetle attack and mortality and stand-replacing fire.

Forest Health: Dwarf mistletoe (DM) is a parasitic plant that infects ponderosa pine. Infection is spread via pressure-released seeds and expands at a rate of 1-2 ft. per year (Conklin 2000). DM is considered a tree pathogen because infection results in reduced tree growth, reduced tree vigor, branch deformations, and shortened life span of the infected host. Additionally, in comparison to uninfected trees, trees infected with DM are more flammable due to the accumulation of resin and branch deformations (Conklin 2000). Since Euro-American settlement and the advent of fire suppression, DM populations in the southwest are thought to have increased with increased forest densities (Conklin 2000). A more open, park-like forest structure would have limited the spread of DM infection. DM infection is rated on an individual tree basis on a scale of 0 to 6, with 0 representing no infection and 6 representing a tree that is severely infected. For this project, DM

infection across an entire stand was considered “severe” if the mean dwarf mistletoe rating (DMR) for the stand was 2.0 or greater. DM infection was considered “moderate” if the mean DMR for the stand was between 1.0 and 1.9. DM infection was considered “light” if the mean DMR for the stand was less than 1.0. Currently, four stands (697 acres) within the project area contain a light level of DM infection. DM infection ranges from 6 to 31 trees per acre.

Mortality from DM ranges from 0 to 4 trees per acre. Additional infection centers or “pockets” of DM may exist within the project area that is not reflected by current stand exam data.

High stand densities and SDI within certain portions of the project area signify moderate to high inter-tree competition and decreased tree vigor. Natural defense mechanisms against insect attack, such as the production of pitch, are limited at these densities, resulting in increased susceptibility to successful bark beetle attack and mortality. Currently, bark beetle activity within the project area is limited to pockets of mortality within stands of higher densities.

There is a need to decrease the extent, or isolate the incidence, of dwarf mistletoe infection. Creating a more groupy tree arrangement with interspaces between groups and decreasing tree densities will decrease the spread of dwarf mistletoe infection and decrease susceptibility to disease and successful insect attack and mortality.

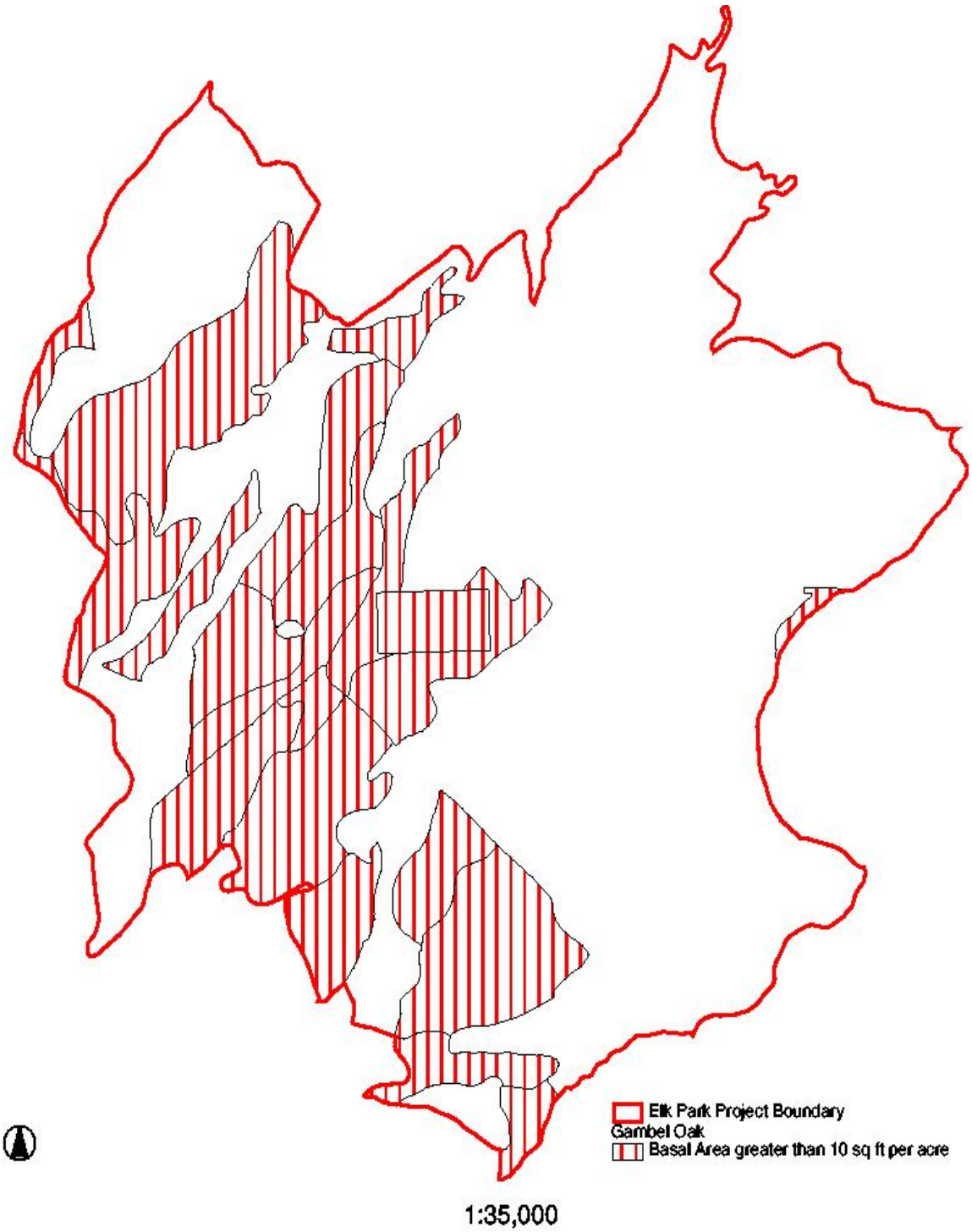
Species Diversity: Figure 10 displays stands within the project area that contain a minimum of 10 ft^2 basal area of *Gambel oak*. The majority of these stands are located in the southern and western portions of the project area within the ponderosa pine cover type. Due to the proximity of the project area to Flagstaff, Elk Park Meadows, and numerous parcels of private property and a history of illegal wood cutting, the majority of existing Gambel oak consists of small, young thickets with numerous stems and are less than 10 in. diameter at root collar (DRC). Additionally, Gambel oak is being heavily browsed by elk.

Data was not collected on *understory vegetation* within the project area. However, research at the Fort Valley Experimental Forest has shown that massive declines in herbaceous vegetation have occurred over the past century due to increased stand densities, increased canopy covers, and increased forest floor depth (Covington et al. 1997). Within the project area, understory productivity is low in areas with “closed” and “moderately closed” canopies.

Approximately 294 acres within the project area are classified as meadows (*grasslands*) by Terrestrial Ecosystem units. In 1979, a portion of the meadows were planted with ponderosa pine in the northern portion of the project area. Mortality within planted areas approached 50%. Plantations located in areas with low site productivity contain trees with heights ranging from 1 to 10 ft. High mortality and continued browsing by elk and cattle have resulted in small plantations of pine trees with numerous, forked tops and a brushy/shrubby form. Additionally, grasslands have been experiencing pine encroachment for over 100 years due to fire suppression.

There is a need to protect existing Gambel oak; promote development of larger diameter oaks; decrease pine competition around Gambel oak clumps; and improve health and longevity of large Gambel oak trees. There is also a need to increase diversity and abundance of understory species and decrease pine density in areas that were historically meadows.

Figure 10. Basal area of Gambel oak greater than 10 ft² per acre in the Elk Park project area



Environmental Consequences

Stand exam data for the vegetation effects analysis was projected over 40 years using the Forest Vegetation Simulator (FVS). FVS is an individual tree, distance-independent, growth and yield computer simulation model. In past project analyses, data has been extracted at the stand level from the Field Sampled Vegetation Database (FS Veg) for use in FVS. Data from several stand exam points across a given stand are used by FVS to obtain one average for trees per acre, basal area, VSS, canopy cover, etc. These stand averages in past projects may have incorporated densely-treed areas and openings with few or no trees, which bring the stand average up or down and do little to describe the natural variability that occurs within stands. In an attempt to better capture this within-stand variability, stand exam data for the Elk Park Fuels Reduction and Forest Health Project was extracted from FS Veg on a point by point basis.

Recently, the US Forest Service Southwestern Region (2006) provided further clarification of the intent of the "Northern Goshawk Management Recommendations". The Region emphasizes assessment of VSS and canopy cover at the group level, rather than the stand level, to provide a more accurate description of variations in forest structure within a stand. In response to this direction, the vegetation analysis for this project measured effects to canopy cover, VSS, and stand densities at the group level in areas outside of Mexican spotted owl protected and target/threshold habitat. Data was not averaged across an entire stand. Averages did not include openings or grassy interspaces between tree groups. Data reflects forested sites only. In this way, data more accurately describe variations in tree densities and forest structures within a stand, rather than obtaining one average for an entire stand. However, within Mexican spotted owl protected and target/threshold habitat, canopy cover and stand density measures were assessed at the stand level to meet the intent of the Recovery Plan for the Mexican spotted owl (USDI 1995).

Direct, Indirect and Cumulative Effects of Alternative 1

Forest Structure: Table 14 displays the percent of VSS under the No Action Alternative projected over 40 years. Under the No Action Alternative, there would be no direct effect to forest vegetation because no trees would be harvested. There would be no change in forest structure from the existing forest structure. However, the No Action Alternative would indirectly effect forest structure over the long-term.

Table 14. Projected trees per acre, basal area, canopy cover, and quadratic mean diameter[1] by VSS for the Elk Park project area under the No Action Alternative

VSS	Year	% of Project Area	Trees per Acre	Basal Area (ft²/acre)	Canopy Cover (%)	Quadratic Mean Diameter (inches)
1	Existing Conditions	5	0	0	0	0.0
	after 20 years	4	0	0	0	0.0
	after 40 years	4	0	0	0	0.0
2A	Existing Conditions	1	500	18	18	2.5
	after 20 years	1	383	11	5	2.3
	after 40 years	0	--	--	--	--
3A	Existing Conditions	3	14-136 (88)	10-60 (45)	3-49 (36)	9.0-11.6 (10.3)
	after 20 years	0	--	--	--	--

VSS	Year	% of Project Area	Trees per Acre	Basal Area (ft²/acre)	Canopy Cover (%)	Quadratic Mean Diameter (inches)
	after 40 years	0	--	--	--	--
3B	Existing Conditions	10	117-527 (221)	72-110 (89)	54-64 (59)	7.2-11.2 (8.7)
	after 20 years	1	111	115	66	10.4
	after 40 years	1	369	86	49	6.5
3C	Existing Conditions	21	211-773 (450)	101-255 (172)	62-86 (75)	5.0-13.5 (8.6)
	after 20 years	21	187-684 (390)	106-299 (185)	63-90 (77)	6.4-11.6 (9.3)
	after 40 years	16	106-519 (342)	142-300 (209)	71-90 (80)	8.1-12.8 (10.4)
4A	Existing Conditions	9	17-95 (51)	20-80 (58)	21-56 (46)	10.8-17.9 (14.6)
	after 20 years	4	13-65 (46)	21-81 (64)	23-56 (48)	14.8-18.0 (16.3)
	after 40 years	1	55	90	59	17.3
4B	Existing Conditions	10	67-256 (147)	80-120 (97)	56-67 (61)	6.9-16.6 (11.3)
	after 20 years	11	40-155 (101)	83-135 (111)	57-70 (64)	11.2-19.3 (14.9)
	after 40 years	4	27-101 (64)	102-140 (119)	63-71 (66)	15.0-21.3 (17.5)
4C	Existing Conditions	19	107-585 (259)	120-270 (178)	67-87 (76)	7.5-16.3 (11.8)
	after 20 years	33	61-617 (237)	92-262 (184)	60-87 (77)	6.8-17.7 (12.5)
	after 40 years	39	74-559 (226)	133-262 (197)	69-85(79)	7.9-18.8 (13.3)
5A	Existing Conditions	4	13-80 (43)	30-100 (58)	39-62 (46)	11.1-23.1 (16.9)
	after 20 years	4	16-34 (27)	36-78 (60)	36-58 (48)	18.3-22.2 (20.5)
	after 40 years	3	13-39 (25)	33-92 (65)	34-60 (49)	20.4-23.2 (22.0)
5B	Existing Conditions	4	51-173 (94)	58-120 (99)	59-67 (62)	11.3-16.9 (13.4)
	after 20 years	3	17-79 (62)	96-127 (109)	61-68 (64)	15.0-19.4 (17.1)
	after 40 years	8	17-146 (67)	97-145 (120)	61-71 (67)	12.4-22.4 (18.6)
5C	Existing Conditions	8	121-396 (243)	101-210 (166)	62-81 (75)	7.0-16.5 (11.7)
	after 20 years	9	117-373 (192)	151-226 (186)	73-83 (78)	8.8-18.1 (13.6)
	after 40 years	11	58-382 (188)	133-245 (198)	69-85 (79)	9.9-18.7 (14.6)
6A	Existing Conditions	5	5-29 (22)	25-90 (51)	27-59 (42)	16.5-29.4 (23.7)
	after 20 years	4	5-28 (12)	30-87 (47)	32-59 (41)	24.0-33.2 (28.4)
	after 40 years	6	5-27 (13)	34-95 (54)	34-61 (45)	24.8-35.8 (29.2)
6B	Existing Conditions	0	--	--	--	--
	after 20 years	4	33-76 (52)	86-122 (108)	58-67 (64)	14.4-24.8 (18.6)
	after 40 years	4	31-73 (57)	106-132 (120)	64-69 (67)	16.3-26.1 (20.3)
6C	Existing Conditions	1	73	225	83	23.8
	after 20 years	1	69	219	82	24.1
	after 40 years	3	66-360 (252)	147-214 (187)	72-81 (78)	8.8-24.3 (13.7)

1. All values expressed as ranges, with averages in parentheses

After 40 years of no action, 44% of the project area would be mid-aged forest, with 17% in young forest and 22% in mature forest. Seedlings/saplings would not be represented due to a lack of openings of adequate size in which pine seedlings can regenerate. The grass/forb/shrub stage would exist in limited amounts (4%) as small openings within forested areas and would decrease over time as tree canopies extend and close.

Under the No Action Alternative, trees would grow into larger diameter classes and VSS classes at a much slower rate due to high stand densities and high competition between trees, resulting in stagnation of VSS classes and slower development of old growth forest structures. Under the No Action Alternative, no stands would be designated as Developing Old Growth. Old growth forest would develop at a slower rate. Within 40 years, only 13% of the project area would reach the old forest stage. Additionally, trees reaching maturity and changing their appearance from black bark to yellow bark will still occur biologically at approximately 150 years old, but they will have smaller diameters than we usually associate with old trees, depending on density conditions within the site. Smaller diameter trees will continue to out-compete and crowd out the remaining older yellow pines and oaks, resulting in decreased growth, vigor, and longevity. There will be few replacement trees of large diameter size into the yellow pine category for 50 to 100 years.

Without openings of sufficient size for regeneration of shade-intolerant ponderosa pine and with limited old forest development, the recommended VSS distribution for the northern goshawk and a sustainable, uneven-aged forest structure will not be achieved in the foreseeable future. Forest structure would be predominantly even-aged for decades into the future. Percent canopy cover by VSS under the No Action Alternative is displayed in Table 14. Under the No Action Alternative, there would be no direct effect to canopy cover because no trees would be harvested. There would be no change in canopy cover from the existing canopy cover. However, the No Action Alternative would indirectly effect canopy cover over the long-term. Within 40 years, 69% of the project area would have “closed” canopies, while only 10% would be “open”. Closed canopy conditions would continue to inhibit understory development, productivity, and diversity. Due to the shade-intolerance of ponderosa pine, natural regeneration would be severely limited under a closed canopy, resulting in a lack of VSS 1 and 2 classes. Mortality of smaller, over-topped blackjack pines would increase, resulting in increased risk of bark beetle attack.

Stand Density: Table 14 also displays trees per acre, basal area, and quadratic mean diameter under the No Action Alternative projected over 40 years. Under the No Action Alternative, there would be no direct effect to stand densities because no trees would be harvested. There would be no change in stand densities from the existing stand densities. However, the No Action Alternative would indirectly effect stand densities over the long term. Under the No Action Alternative, approximately 85% of the project area would have basal area values in excess of 100 ft^2 within 40 years. The number of trees per acre would decrease over the next 40 year period due to competition-based mortality and a lack of natural regeneration.

However, approximately 60% of the project area would still have greater than 100 trees per acre within 40 years. As a result of these high stand densities, quadratic mean diameter would continue to increase at a slower rate for a minimum of 40 years. Trees would move into larger diameter classes and VSS classes at a slower rate. Trees would experience increased competition for water, nutrients, and sunlight, decreased tree vigor and growth, and decreased health for a minimum of 40 years.

Table 15 displays percent of maximum stand density index over 40 years under the No Action Alternative. Under the No Action Alternative, there would be no direct effect to stand density index because no trees would be harvested. There would be no change in stand density index from the existing stand densities. However, the No Action Alternative would indirectly effect

stand density index over the long term. Within 40 years, only 11% of the project area would be at less than 25% of max SDI. Approximately 83% of the project area would be at or above 35% of max SDI within 40 years. Inter-tree competition increases significantly at these densities. Individual trees exhibit reduced tree growth and vigor due to competitive stress. Imminent, competition-based mortality will occur as individual stand densities eventually approach 50% to 60% of max SDI. Nearly 70% of the project area would meet or exceed this threshold within 40 years, signifying ecologically unsustainable stand densities. Competitive stress would result in very little or no tree growth or vigor due to a lack of adequate moisture, nutrients, and sunlight. Existing old, "yellow" pines would experience decreased vigor and longevity. Trees in general would be unable to produce pitch to fight off bark beetle attack. Trees would also be more susceptible to attack from other insects and diseases. Within 40 years, the majority of the project area will be at extreme risk of successful bark beetle attack and mortality.

Table 15. Projected percent of maximum stand density index for forested stands located within the Elk Park project area under the No Action alternative

Maximum Stand Density Index (SDI)	After 20 Years No Action	After 40 Years No Action
	(Percent of Project Area)	
<25%	14	11
25-34%	10	6
35-49%	13	14
50-59%	15	9
60%+	49	60

Forest Health: Under the No Action Alternative, there would be no direct effect on dwarf mistletoe infection because no trees would be harvested. There would be no change in the level of dwarf mistletoe infection from existing levels. However, the No Action Alternative would indirectly effect the level of dwarf mistletoe infection over the long term. Under the No Action Alternative, dwarf mistletoe infection would continue to spread throughout infected stands, expanding at a rate of 1-2 ft. per year.

Increased dwarf mistletoe infection would result in reduced tree growth, reduced tree vigor, branch deformations, and shortened life span of the infected host (Conklin 2000). Reduced tree vigor and altered pitch flow associated with dwarf mistletoe infection would result in compromise of a tree's defense mechanisms to combat bark beetle attack, thus increasing the risk of successful bark beetle attack and mortality. Reduced tree growth and shortened life span would result in stagnation of VSS classes. Additionally, the accumulation of resin and branch deformations associated with dwarf mistletoe infection would result in increased fire hazard.

Under the No Action Alternative, increasing stand densities will result in increased inter-tree competition and decreased tree vigor. Natural defense mechanisms against insect attack, such as the production of pitch, would be limited, resulting in increased susceptibility to successful bark beetle attack and mortality. As stand densities continue to increase over time, those trees that are out-competed would die, thus attracting bark beetles to the project area and further increasing the risk of bark beetle attack to residual trees.

Species Diversity: The No Action Alternative would indirectly affect *Gambel oak* within the project area. Over a minimum period of 40 years, ponderosa pine would continue to compete with

Gambel oak for moisture, nutrients, and sunlight, resulting in reduced oak growth, vigor, and longevity. There would be few replacement oaks of large diameter size for at least 80 to 100 years.

The No Action Alternative would indirectly effect *understory vegetation* within the project area. Understory productivity and diversity would continue to decrease over the next 40 years as stand densities continue to increase and crown canopies close. With a lack of broadcast burning across the project area, understory production would be further inhibited by increasing fuel loads and a lack of nutrient recycling from fire.

The No Action Alternative would indirectly effect *grasslands* within the project area. Over a minimum period of 40 years, grasslands would continue to experience pine encroachment. As pine increase in density over time, grasslands would experience decreased understory productivity and diversity and loss of functionality in terms of hydrology, biodiversity, horizontal heterogeneity, and wildlife habitat diversity.

Direct and Indirect Effects of Alternative 2

Forest Structure: Table 16 displays the percent of VSS under the Proposed Action projected over 40 years.

Table 16. Projected trees per acre, basal area, canopy cover, and quadratic mean diameter [1] by VSS for the Elk Park project area under the Proposed Action

VSS	Year	% of Project Area	Trees per Acre	Basal Area (ft^2/acre)	Canopy Cover (%)	Quadratic Mean Diameter (inches)
1	after treatment	20	0	0	0	0.0
1	after 20 years	10	0	0	0	0.0
1	after 40 years	10	0	0	0	0.0
2A	after treatment	1	20	1	0	2.5
2A	after 20 years	20	0-40 (12)	0-5 (2)	0-5 (2)	0-3.5 (1.9)
2A	after 40 years	10	ND	ND	ND	ND
3A	after treatment	7	14-138 (91)	10-64 (42)	3-51 (35)	6.8-11.6 (9.2)
3A	after 20 years	4	29-125 (88)	5-69 (52)	1-53 (35)	5.4-14.4 (9.9)
3A	after 40 years	20	19-25 (21)	2-5 (3)	0-2 (1)	4.0-5.9 (4.6)
3B	after treatment	4	127-238 (185)	75-114 (92)	36-65 (54)	7.4-11.0 (9.3)
3B	after 20 years	1	67	83	57	9.7
3B	after 40 years	0	--	--	--	--
3C	after treatment	7	211-546 (386)	101-299 (192)	62-90 (77)	5.8-10.9 (9.4)
3C	after 20 years	3	269-413 (354)	143-297 (221)	56-90 (79)	9.4-10.9 (10.2)
3C	after 40 years	2	264-340 (314)	208-298 (242)	81-90 (84)	10.3-12.0 (11.2)
4A	after treatment	16	17-115 (58)	20-76 (48)	19-55 (40)	8.3-17.9 (12.2)
4A	after 20 years	9	23-105 (64)	21-82 (61)	22-57 (49)	10.2-16.2 (13.3)
4A	after 40 years	7	38-89 (62)	14-78 (55)	11-56 (40)	8.2-17.1 (12.4)

VSS	Year	% of Project Area	Trees per Acre	Basal Area (ft²/acre)	Canopy Cover (%)	Quadratic Mean Diameter (inches)
4B	after treatment	7	47-141 (97)	71-112 (86)	53-65 (58)	8.3-15.0 (12.3)
4B	after 20 years	5	50-149 (90)	58-122 (91)	48-67 (59)	10.9-15.2 (12.2)
4B	after 40 years	5	39-119 (84)	75-113 (97)	30-65 (57)	11.0-21.1 (13.4)
4C	after treatment	4	62-212 (148)	60-180 (140)	49-77 (67)	11.1-14.1 (12.7)
4C	after 20 years	5	70-339 (175)	88-260 (172)	59-86 (69)	11.6-15.5 (13.4)
4C	after 40 years	2	137-301 (215)	165-262 (203)	44-87 (70)	11.6-14.8 (13.3)
5A	after treatment	19	13-80 (41)	30-100 (56)	27-57 (45)	11.6-23.1 (16.3)
5A	after 20 years	15	26-81 (49)	35-92 (66)	22-60 (50)	13.4-19.7 (16.0)
5A	after 40 years	8	32-76 (48)	33-84 (60)	34-58 (47)	13.1-22.5 (15.1)
5B	after treatment	2	51-130 (93)	90-106 (100)	59-64 (62)	12.3-12.9 (12.6)
5B	after 20 years	6	41-125 (86)	93-132 (114)	60-69 (65)	14.0-16.2 (14.8)
5B	after 40 years	10	35-127 (88)	68-136 (107)	35--70 (61)	11.5-20.0 (14.7)
5C	after treatment	1	47	175	76	14.7
5C	after 20 years	2	64-176 (120)	190-194 (192)	78-79 (79)	13.3-14.2 (13.8)
5C	after 40 years	3	47-167 (94)	87-210 (161)	58-81 (70)	13.0-16.7 (15.2)
6A	after treatment	10	5-49 (29)	25-90 (49)	27-59 (43)	12.0-29.4 (20.0)
6A	after 20 years	16	10-77 (38)	30-80 (61)	31-56 (48)	13.2-24.6 (18.0)
6A	after 40 years	17	12-62 (39)	35-85 (64)	35-58 (50)	15.4-27.5 (17.8)
6B	after treatment	1	34-64 (49)	80-94 (87)	56-60 (58)	16.4-17.6 (17.0)
6B	after 20 years	3	43-71 (48)	99-109 (105)	27-64 (54)	15.7-24.7 (19.5)
6B	after 40 years	5	27-91 (55)	93-136 (116)	28-70 (60)	14.3-26.0 (18.7)
6C	after treatment	1	49	184	78	26.2
6C	after 20 years	1	52	180	77	25.2
6C	after 40 years	1	55	177	77	24.3

1. All values expressed as ranges, with averages in parentheses. ND=no data.

The Proposed Action will have a direct effect on the distribution of VSS classes within the project area immediately after treatment. Grass/forb/shrub will increase from 5% to 20% of the project area. Young forest will decrease from 34% to 18% of the project area. Mid-aged forest will decrease from 38% to 27% of the project area. Mature forest will increase from 16% to 22% of the project area. Old forest will increase from 6% to 12% of the project area. The Proposed Action would also indirectly effect the distribution of VSS classes across the project area. Because diameter growth is a function of tree density, trees will grow into larger diameter classes (and VSS classes) at a faster rate than the No Action Alternative. Forty years after implementation of the Proposed Action, the project area will very closely resemble the VSS distribution recommended for the northern goshawk.

Grass/forb/shrub will comprise approximately 10% of the project area. Seedlings/saplings will comprise approximately 10%. Young forest will comprise approximately 22%. Mid-aged forest

will comprise approximately 14%. Mature forest will comprise approximately 21%. Old forest will comprise approximately 23%. While areas classified as “old forest” have the majority of their basal area in trees greater than 24 in. DBH, most of the areas designated as Developing Old-Growth will not reach the minimum age requirements for old-growth forest for a minimum of 70-80 years, as defined by the Coconino National Forest Plan. Under the Proposed Action, 4,858 acres would be designated as Developing Old-Growth (see Figure 11).

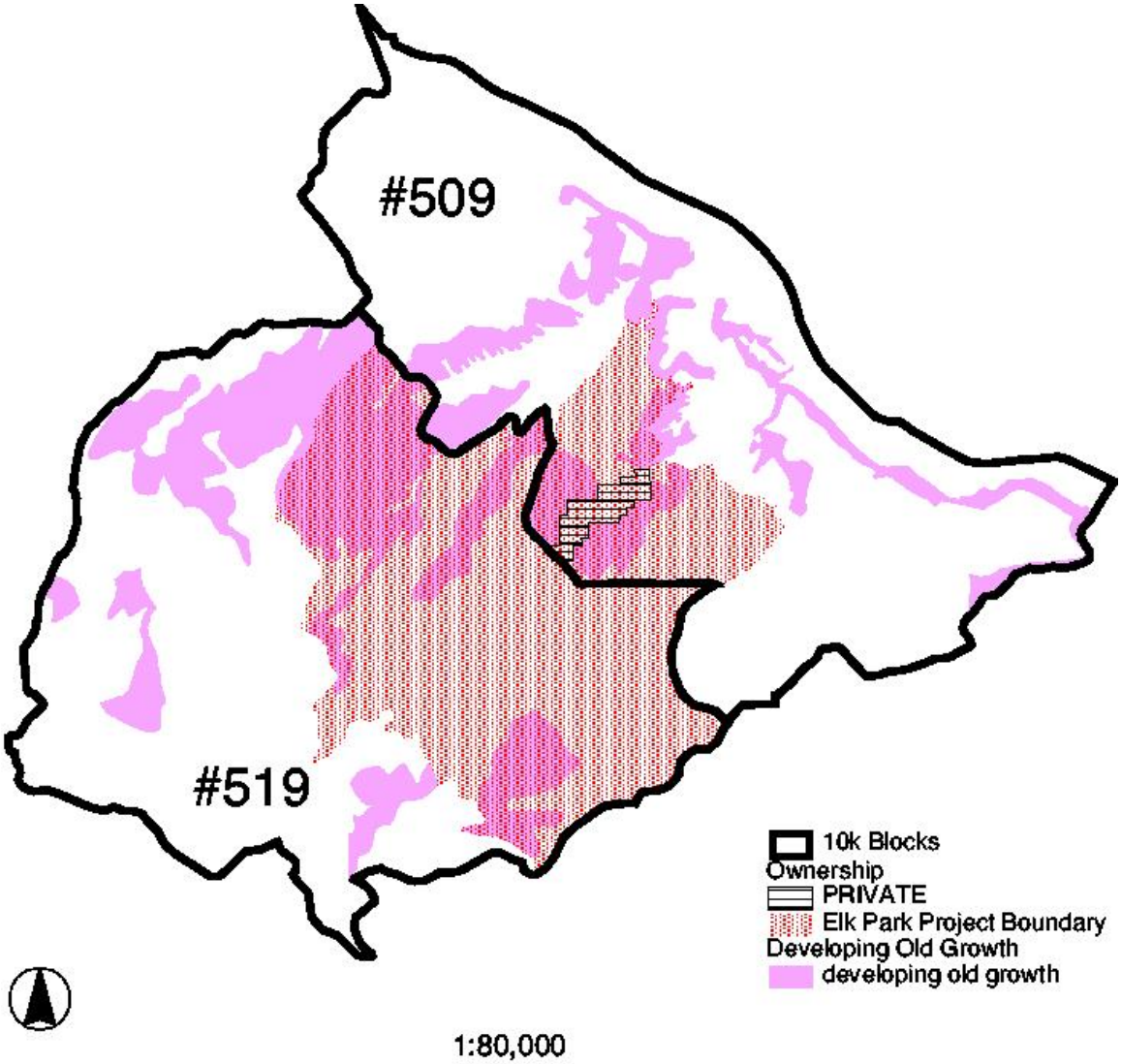
Within the project area, there are two ecosystem management areas or 10k blocks. Block 509 has a total of 7,855 forested acres. Under the Proposed Action, 1875 acres (24% of the 10k block) would be allocated to developing old growth, thus exceeding forest plans standards of 20%. Block 519 has a total of 11,613 forested acres. Under the Proposed Action, 2,983 acres (26% of the 10k block) would be allocated to developing old growth, also exceeding forest plans standards. The Proposed Action would exceed forest plan standards by a total of 10% for the two 10k blocks. Stands designated as developing old-growth are those stands that will reach old growth conditions in the shortest time frame. However, not all of these stands will reach old growth conditions at the same time. Timeframes may vary between 20 to 100 years. Under the Proposed Action, old-growth forest structures would develop at a faster rate due to decreased stand densities, increased tree health, growth, and vigor, decreased competitive stress, and improved longevity of old, yellow pines. Trees reaching maturity and changing their appearance from black bark to yellow bark (old trees) will still occur biologically at approximately 150 years old, but they will have larger diameters, in comparison with the No Action Alternative, depending on density conditions within the site.

Under the Proposed Action, all stands outside of the MSO PAC nest center will receive a broadcast burn. Prescribed fire may have a direct effect on the number of large and old trees through tree mortality. Mature “yellow” pines are susceptible to prescribed fire in terms of root damage; however survival is highly dependent upon forest floor depth at the base of the tree (Sackett 1995). In order to mitigate the effects of prescribed fire on yellow pine mortality, the duff will be raked around the base of yellow pines prior to burning when the duff layer exceeds 10 in.

The Proposed Action does not immediately result in the desired VSS distribution as outlined in the Forest Plan (see Table 13) however treated areas will progress towards desired conditions described in the Forest Plan.

Percent canopy cover by VSS under the Proposed Action is displayed in Table 16. The Proposed Action will have a direct effect on percent canopy cover. Immediately after treatment, “open” canopy conditions will increase from 27% to 73% of the project area. “Closed” canopy conditions will decrease from 49% to 13% of the project area. Because all of the thinning treatments under the Proposed Action involve the creation of openings, leave trees in groups, and do not utilize spacing guidelines, the residual forest structure will be more variable, patchy, and groupy. There would also be indirect effects of reduced canopy cover associated with the Proposed Action. Due to this variable, groupy tree distribution, canopy cover will be higher within pine groups, with grassy interspaces between groups. Areas with higher canopy covers will exhibit decreased understory development and decreased natural regeneration. Grassy, tree-less interspaces, large openings, and a more open crown canopy within the majority of tree groups will result in increased sunlight to the forest floor, increased understory development, productivity, and diversity, and increased natural regeneration. Forty years after the Proposed Action, 72% of the project area would have “open” canopy conditions while only 8% would be “closed”.

Figure 11. Areas that will be designated as developing old-growth under the Proposed Action



Under the Proposed Action, emphasis will be placed on leaving trees in variable groups to mimic the spatial arrangement of trees that existed pre-settlement. Direct effects of the proposed leave tree arrangement include a groupy tree arrangement, with groups varying in size from a few trees up to 0.7 acres. Groups will also vary in canopy cover, from “open” to “closed” canopies. Groups may be even- or uneven-aged, depending on existing stand structure. The Proposed Action will emphasize the retainment and enhancement of existing groups. In order to create/enhance groups, grassy interspaces will be created between groups of trees. These interspaces will be maintained as grassy areas through periodic prescribed burning to thin natural regeneration. Some trees will also be thinned within the groups, resulting in indirect effects such as increased diameter growth, increased tree vigor, improved forest health, variable densities, and a diversity of structures. Additionally, openings 0.5 to 4 acres in size will be created across 20% of the project area for the purpose of natural regeneration and the formation of VSS 1 and 2 classes. Indirect effects of the

proposed leave tree spatial arrangement depend upon the residual density of tree groups and the size of the interspaces between groups. Groups that are thinned and left with more “open” canopy covers, with large interspaces between groups, will have decreased inter-tree competition, increased tree vigor, improved health, increased understory production, increased natural regeneration, and will be more likely to develop uneven-aged structures. In comparison, groups that are not thinned and have “closed” canopies, with smaller interspaces between groups, will demonstrate a higher level of inter-tree competition, decreased growth and vigor, less understory production and regeneration due to decreased sunlight to the forest floor, and will remain more even-aged.

Stand Density: Table 16 displays trees per acre, basal area, canopy cover, and quadratic mean diameter under the Proposed Action, projected over 40 years. The Proposed Action will have a direct effect on stand densities across the project area. The percent of the project area with greater than 100 trees per acre will decrease from 66% to 23%. The percent of the project area with greater than 100 ft^2 per acre basal area will decrease from 50% to 16%. There will be no change in the range of quadratic mean diameters. However, the percent of the project area with a quadratic mean diameter between 5 and 17 in. will decrease from 84% to 57%. Within Mexican spotted owl protected habitat and northern goshawk PFAs, stand densities will remain higher, with basal areas ranging between 70 to 150 ft^2 per acre. The Proposed Action will also have indirect effects related to decreased stand densities. Under the Proposed Action Alternative, approximately 27% of the project area will have basal area values in excess of 100 ft^2 within 40 years, compared to 85% under the No Action Alternative. Approximately 12% of the project area will have greater than 100 trees per acre within 40 years, compared to 60% under the No Action Alternative. Decreased stand densities will reduce competition between trees for moisture, nutrients, and sunlight and increase tree vigor and growth. Thinning of smaller, black-barked pine trees around oak clumps and the drip lines of existing “yellow” pines will increase nitrogen, carbon, and water uptake of oak and “yellow” pines, thus decreasing inter-tree competition and stress and increasing tree vigor, growth, and longevity (Stone et al. 1999). Trees in general will be less susceptible to insect and disease outbreaks. Residual trees will have a decreased risk of bark beetle attack and mortality. Decreased inter-tree competition will also result in increased diameter growth for individual pine trees. Quadratic mean diameter will increase at a faster rate for a minimum of 20 to 40 years. Trees would move into larger diameter classes and VSS classes at a faster rate.

Under the Proposed Action, trees up to 16 in. DBH will be harvested within the Clark Mexican spotted owl protected activity center.

Table 17 displays basal area, trees per acre, canopy cover, and quadratic mean diameter under the Proposed Action and the No Action Alternative, in comparison to harvesting trees less than 9 in. DBH. The Proposed Action will have a direct effect on stand densities. Harvesting trees up to 16 in. DBH reduces the average basal area from 139ft^2 per acre to less than 100ft^2 per acre. The average canopy cover, as measured across the PAC rather than the group level, will decrease from 66% to 51%. The average quadratic mean diameter will increase from 9.5 in. to 11.3 in. after treatment due to the removal of smaller trees and the retainment of larger trees. In comparison, harvesting trees up to 9 in. DBH, as recommended by the Recovery Plan for the Mexican Spotted Owl, would have little direct effect on stand densities. Average basal area would decrease from 139 ft^2 per acre to 127 ft^2 per acre. Average canopy cover would decrease from 66% to 62%.

The Proposed Action would also have indirect effects on stand densities. Over the 40 years following treatment, lower stand densities and canopy covers will result in decreased competition

between trees, decreased tree stress, and increased tree vigor, increased understory productivity and diversity, increased natural regeneration, a more uneven-aged stand structure, and a decreased risk of successful bark beetle attack and mortality. Trees will grow into larger VSS classes at a faster rate. Existing old trees will exhibit improved longevity due to decreased competition. The removal of pine around oak clumps will decrease competitive stress between trees and increase oak health, growth, vigor, and longevity. However, the beneficial effects of the Proposed Action will begin to decrease in 40 years. The crown canopy will close in 20 to 40 years and additional thinning is recommended to reopen the canopy, create openings for regeneration, decrease inter-tree competition, and stimulate understory production.

Under the Proposed Action, approximately 13% of the MSO restricted habitat (240 acres) will be designated as target/threshold habitat. According to the Recovery Plan for the Mexican Spotted Owl (USDI 1995), 10% of the restricted habitat within the project area is to be designated as target/threshold habitat. The Proposed Action exceeds the minimum requirements for target/threshold habitat by 3%. Table 18 displays target/threshold conditions for Stand 389/03 (240 acres) under the Proposed Action projected over 40 years. Under the Proposed Action, stand 389/03 will receive a burn only treatment. Within 20 years, this stand will meet stand density requirements for large trees required for target/threshold habitat (15% stand density in each of the larger size classes and 20 large trees greater than 18 in. DBH), as outlined in the MSO Recovery Plan. Within 40 years, this stand will meet basal area requirements of 150 ft^2 per acre.

Table 19 displays percent of maximum stand density index, projected over 40 years, under the Proposed Action. There will be a direct effect on stand density index across the project area. The percent of the project area below 25% of max SDI will increase from 18% to 65% immediately after treatment. The percent of the project area above 50% of max SDI will decrease from 49% to 10%. The Proposed Action will also have indirect effects related to reduced stand density index. For the 20 year period following treatment, inter-tree competition will be relatively low across the majority of the project area. Tree diameter growth, vigor, and longevity will increase significantly over current conditions. However, additional treatment is recommended within 20 to 40 years to maintain these conditions. With additional treatment, over half of the project area will be below 25% of max SDI after 40 years, while approximately 27% will be above 35% of max SDI. Inter-tree competition increases significantly above 35% of max SDI. At these densities, individual trees are growing at less than full potential due to competitive stress. Trees exhibit decreased vigor and longevity. Imminent, competition-based mortality will occur due to self-thinning as individual stand densities reach 50% to 60% of max SDI. Only 10% of the project area will meet or exceed this threshold within 40 years, signifying ecologically unsustainable stand densities and the need for additional thinning treatments.

Table 17. Comparison of thinning treatments within the Clark MSO PAC

	No Treatment (No Action)				Harvest Trees 0-9" DBH (Current Forest Plan Direction)				Harvest Trees 0-16" DBH (Proposed Forest Plan Amendment)			
Year	**Basal Area (ft²/acre)**	**Trees per Acre**	**Percent Canopy Cover**	**Quadratic Mean Diameter (inches)**	**Basal Area (ft²/acre)**	**Trees per Acre**	**Percent Canopy Cover**	**Quadratic Mean Diameter (inches)**	**Basal Area (ft²/acre)**	**Trees per Acre**	**Percent Canopy Cover**	**Quadratic Mean Diameter (inches)**
Existing/After Treatment	95-195 (139)	191-642 (314)	53-78 (66)	5.2-12.4 (9.5)	90-172 (127)	138-610 (206)	50-73 (62)	5.2-14.7 (11.6)	89-98 (94)	68-610 (173)	50-51 (51)	5.2-16.2 (11.3)
+ 20 years	123-212 (170)	167-620 (289)	60-81 (72)	6.3-14.0 (10.9)	117-190 (154)	128-593 (197)	58-76 (68)	6.0-15.8 (13.0)	108-124 (119)	62-593 (167)	53-60 (58)	6.0-16.5 (13.0)
+ 40 years	143-213 (190)	161-573 (267)	65-84 (76)	7.1-15.3 (12.0)	142-206 (175)	118-569 (189)	65-78 (72)	6.8-16.8 (14.1)	115-148 (140)	56-569 (160)	55-65 (63)	6.8-19.3 (14.4)

Table 18. Target/threshold conditions for stand 389/03 under the Proposed Action over 40 years

Year	Basal Area (ft²/ac)	% Stand Density of trees 12-18" DBH	% Stand Density of trees 18-24" DBH	% Stand Density of trees >24" DBH	Density of Large Trees >18" DBH
Existing Conditions	95	23	21	9	13
+20 years	131	33	21	16	20
+40 years	157	35	21	19	24

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Table 19. Projected percent of maximum stand density index for forested stands located within the Elk Park project area under the Proposed Action

Maximum Stand Density Index (SDI)	After Treatment	After 20 Years	After 40 Years
	(Percent of Project Area)		
<25%	63%	48%	51%
25-34%	19%	27%	20%
35-49%	7%	13%	17%
50-59%	2%	3%	2%
60%+	9%	9%	11%

Forest Health: The Proposed Action will have a direct effect on the level and extent of dwarf mistletoe infection within the project area. Infected acres within the project area will be treated by showing a preference for leave trees that do not exhibit signs of infection or through the placement of openings in infection centers, thus resulting in a decreased level and extent of infection. The Proposed Action will also have an indirect effect on dwarf mistletoe infection within the project area. The Proposed Action will result in a decreased rate of spread between individual trees and throughout the infected stand. According to Conklin (2000), dwarf mistletoe infection spreads at an average rate of 1-2 ft. per decade. Furthermore, dwarf mistletoe populations in the southwest are thought to have increased since Euro-American settlement due to increased forest densities resulting from fire suppression. A more open, patchy forest structure would have limited the spread of dwarf mistletoe infection (Conklin 2000). Additionally, DM infection occurs more abundantly in the lower crown due to its mechanism of spread.

The historic fire regime may have decreased the severity of infection through partial crown scorch and a “sanitizing” effect on lightly to moderately infected trees (Conklin 2000). Under the Proposed Action, broadcast burning will be conducted across infected areas to emulate the effects of the historic fire regime on dwarf mistletoe infection. Although decreasing canopy covers and broadcast burning will decrease the severity and spread of DM infection, the beneficial effects of the Proposed Action will be short-lived without additional treatments. Without additional treatments within 40 years, canopy covers will begin to close and approach pre-treatment conditions. Additional thinning treatments are recommended to decrease canopy cover, maintain a patchy tree distribution, create openings in the canopy, and treat latent infection. Broadcast burning is also recommended each decade to treat dwarf mistletoe infection. Without treatment, DM infection would continue to spread throughout stands and the project area. Increased DM infection results in reduced tree growth, reduced tree vigor, branch deformations, and shortened life span of the infected host (Conklin 2000). Trees infected with dwarf mistletoe are more susceptible to insect attack, such as bark beetles, and diseases. Reduced tree growth and shortened life span result in stagnation of VSS classes. Additionally, in comparison to uninfected trees, trees infected with dwarf mistletoe are more flammable due to the accumulation of resin and branch deformations (Conklin 2000). Conklin also states that areas infected with dwarf mistletoe often have higher fuel levels, compared to uninfected areas, resulting in more intense fires. Due to the damaging effects of DM on tree growth, the Coconino National Forest Land and Resource Management Plan states, “Silvicultural prescriptions emphasize treating dwarf mistletoe infections to bring them down to acceptable levels…”(Forest Plan, p. 122-1). However, complete elimination of DM from the project area is neither practical nor desirable. Proposed treatments

are not designed to completely eliminate dwarf mistletoe from the project area, but rather decrease infection to manageable levels. Although DM increases fire hazard and has many damaging effects on tree growth, it is a natural occurrence in ponderosa pine ecosystems and has many beneficial effects. Increased snag densities and witches' brooms in large, infected trees improve habitat values for several wildlife species. Additionally, infection areas are associated with increased insect populations and, therefore, present increased foraging opportunities for insect-feeding birds. Although not a primary food source, many wildlife species feed on DM fruits, shoots, and infected bark (Conklin 2000). By decreasing canopy cover and creating a patchy tree distribution, the proposed treatments will decrease the rate at which infection spreads to more closely mimic the natural range of variability.

Current stand densities within the project area provide excellent habitat for increases in bark beetle and other insect populations. Insects are attracted to trees under stress from competition and a lack of resources, such as water, nutrients, and sunlight. The Proposed Action will have an indirect effect on susceptibility to insect attack and mortality. Decreasing stand densities will reduce competition between trees, resulting in increased tree vigor. Individual trees will be better able to defend themselves against bark beetle attack. After implementation of the Proposed Action, the risk of insect attack and mortality for residual trees will be greatly reduced across the project area. After the slash generated from thinning activities has been burned, the majority of the project area will be broadcast burned, further reducing the risk of mortality from bark beetles and other insects.

Species Diversity: The Proposed Action will have an indirect effect on *Gambel oak* health, growth, and vigor. Thinning of ponderosa pine around clumps of Gambel oak will result in decreased inter-tree competition for moisture, nutrients, and sunlight, and increased growth, vigor, and longevity of oak. Gambel oak is a relatively slow-growing hardwood species. Therefore, increased growth rates in response to thinning will be less noticeable in oak, compared to ponderosa pine. Maintenance burning is recommended each decade to prevent regeneration from eventually overtopping oak clumps. Additional thinning is also recommended around oak clumps within 20 to 40 years as the pine canopy grows laterally and begins to overtop oak clumps.

The Proposed Action will have an indirect effect on *understory* productivity and diversity. According to research conducted in ponderosa pine around Flagstaff, restoration treatments result in changes in microclimate on the forest floor, specifically increased sunlight penetration to the forest floor, increased soil temperatures, and increased understory productivity (Meyer et al 2001). Additional studies have shown that understory response to thinning treatments is directly related to the intensity of the treatment and the use of prescribed fire (Griffis et al 2001).

Under the Proposed Action Alternative, 1,723 acres will receive a Burn Only treatment and all treated stands will receive a broadcast burn. Stands chosen for burn only treatments have existing canopy covers of less than 50%, steep slopes, or are located in the Mexican spotted owl PACs or northern goshawk PFA. Broadcast burning, in conjunction with harvesting or existing open canopies, will have beneficial effects on understory productivity and diversity. According to research conducted on the San Juan National Forest in ponderosa pine, thinning in conjunction with prescribed burning resulted in a significant increase in herbaceous richness (Lynch et al. 2000). Research conducted at the Gus Pearson Natural Area found that thinning and prescribed burning in ponderosa pine resulted in significant increases in herbaceous biomass and species richness (Moore et al. 1992-1999). Research conducted at the Fort Valley Experimental Forest also found that thinning and prescribed burning resulted in significant increases in herbaceous production (Covington et al. 1997). Research conducted by Griffis et al. (2001) in ponderosa pine

forests of northern Arizona found an increase in overall plant diversity and an increase in the abundance of graminoids in thinned and burned stands. FIRESUM modeling in southwestern ponderosa pine found that thinning and prescribed burning in ponderosa pine resulted in significant increases in herbaceous production (Covington et al. 2001). Additional benefits of prescribed burning include seed bed and site preparation. Research at Chimney Spring found good seedling establishment on burned sites, while unburned sites contained no seedlings (Sackett 1995). Furthermore, prescribed burning is essential to nutrient cycling in ponderosa pine ecosystems. Research at Chimney Spring found significant increases in ammonium levels and microbial nitrogen mineralization on burned plots, compared with control plots (Sackett 1995). Increases in nutrient levels were evident in both understory and overstory vegetation.

The Proposed Action will reduce the number of trees within areas that were historically *grassland* vegetation types. Under the Proposed Action, grasslands will be restored to pre-settlement densities. Indirect effects of reduced densities in these areas include increased understory productivity and diversity and restoration of their functionality in terms of wildlife habitat, watershed production, fire hazard, and scenic values. Pre-settlement densities are an important reference condition for restoration because they are the densities that evolved in these areas over centuries with fire, drought, frost, wildlife, insects, and disease.

Cumulative Effects of Alternative 2

Past, present (ongoing), and future activities considered in the cumulative effects analysis are listed in Appendix B. Over the past century, several events including fire exclusion, livestock grazing, and high-grade timber harvesting occurred over the majority of the project area and in adjacent stands. These events resulted in disruption of the historic fire regime that consisted of frequent, low-intensity surface fires. In 1919, climatic events favored dense ponderosa pine regeneration. At this time, understory production was greatly decreased by grazing and offered little competition with pine regeneration. As fire suppression and sawlog harvesting continued through the 20th century, regeneration from 1919 continued to grow in density. In the mid to late 1900s, commercial thinning treatments in and adjacent to the project area removed a large proportion of the mature and old trees, contributing to a more even-aged forest structure. After the 1990s, the majority of the treatments in and adjacent to the project area consisted of precommercial thinning treatments that reduced the density of younger forest, mainly through even spacing of residual trees. Although these treatments did provide some short-term improvement to forest health, vigor, and growth by reducing stand densities and increasing the growing space of individual trees, they also caused further departure from the variable, patchy tree distribution that typified the historic ponderosa pine forest structure. Additionally, blending treatments were used to produce a single age class deemed “more manageable” in terms of regulated timber harvesting.

Past events have resulted in increased stand densities, decreased age and size class diversity, altered stand structure, changes in successional dynamics, altered insect and disease dynamics, decreased understory productivity and diversity, decreased tree vigor, increased fuel accumulation and continuity, increased crown fire potential, increased fire size and intensity, and a more even-aged forest structure (Long 2003). The density of trees has increased significantly over time, especially in diameter classes less than 13 in. With this tremendous increase in smaller size classes, size class diversity has decreased, resulting in a more even-aged forest structure. Currently, there are two ongoing projects located adjacent to the project area. The purpose of both the Eastside and Mountainaire projects is to reduce hazardous fuel accumulation, while improving forest health and promoting the development of VSS distributions recommended by management recommendations for the Northern goshawk.

Treatments under the Proposed Action and ongoing projects are not based on spacing guidelines, involve the creation of openings and enhancement of groups, and thin to varying densities. The Proposed Action, in combination with ongoing projects adjacent to the project area, will result in a landscape which is more open, variable, and groupy for a minimum of 40 years into the future. The creation of openings and a more open canopy will result in increased natural regeneration across the landscape and a more uneven-aged forest structure. A mosaic of varying forest structures, patterns, densities, and size classes results in increased horizontal and vertical heterogeneity, increased biological diversity, improved forest health, and a more sustainable forest structure at the landscape-level. A more sustainable forest structure is more resilient and capable of maintaining its health in the face of perturbation. The Proposed Action and ongoing treatments will result in a decreased risk of insect attack and mortality at both the project and landscape levels. Also, the risk of a crown fire of sufficient intensity to significantly alter forest structure would be reduced. Additionally, these treatments will also result in faster development of a landscape-level VSS distribution recommended for the Northern goshawk by retaining large trees, creating openings for regeneration, and increasing tree growth and vigor. The creation of grassy interspaces and openings across the landscape will also result in increased understory abundance, increased diversity at the landscape scale, and increases in insects, such as butterflies, that serve as prey bases for a suite of wildlife species. Lastly, by focusing on the removal of smaller diameter trees, this and other projects will retain and produce larger diameter trees for both ecological and social/aesthetic values.

The beneficial effects of the Proposed Action would be short-lived without additional treatments in 20 to 40 years. Current research has shown that obtaining the recommended VSS distribution for the Northern goshawk is not a matter of simply harvesting one time (Sheppard et al. 2002). In order to obtain the recommended VSS distribution for the northern goshawk, additional treatment is recommended within 20-40 years, specifically:

- Harvesting and prescribed burning within some mature stands to create and/or maintain the recommended percentages of openings, seedlings/saplings, young, and mid-aged forest;
- Thinning of some young, mid-aged, and mature forest to decrease density and competition and maintain health in order for groups to grow into mature and old-growth forest classes;
- Commercial and pre-commercial thinning and prescribed burning to maintain some VSS classes beneficial to northern goshawks; and
- Prescribed burning and/or pre-commercial thinning to control density of stands and regeneration, create spatial diversity, and maintain health in order for groups to grow into larger VSS classes.

These treatments were simulated over a 40-year period as a part of analyzing Alternative 2. With additional treatments, the recommended VSS distribution for the Northern goshawk could be reached within approximately 70 years.

Fire and Fuels

The purpose of this section is to describe the affected environment as it relates to wildfire and forest fuels, and to describe the direct, indirect, and cumulative effects of the No Action and Proposed Action alternatives on fire hazard and fire regime condition class. The following

information has been summarized from the Fire and Fuels Specialist report [PRD 77], located in the project record.

This area was historically dependent on frequent low-intensity fires. Fire suppression has successfully excluded these historic fire intervals. Many desired future condition values for forest structure and composition come directly from Forest Plan Amendment 11 (USDA 1996) and Reynolds 2004. Areas immediately adjacent to communities and particularly areas upwind of communities should have a low wildfire hazard rating.

The fire suppression personnel making the initial attack on wildfires that may occur within the project area are assumed to be wildland fire engines. These initial attack forces can generally take effective suppression action against wildfires with flame lengths less than 4 ft. Fires with flame lengths longer than 4 ft. generally require bulldozers and sometimes air tankers. It might even require an indirect-attack strategy, which requires considerably more distance and time than can be afforded this close to developments.

Some sites within the project area may retain a higher fire hazard condition because of important wildlife considerations or because they are inaccessible by mechanized equipment. This may require further hazard reduction in the surrounding sites to mitigate the higher hazard condition of un-thinned sites.

Affected Environment

Field data pertaining to percent of canopy closure, height to bottom of live-crown, tree height, tree diameter, dead fuel loading, and tree stems per acre was collected in 2005 and 2006 by fuel crews. Fire regimes and condition classes were assessed during the field surveys for this project. In some cases, Brown's Transect Dead and Down Fuel Inventories were taken to determine dead fuel loading in most sites. Across the balance of the sites, the Photo Series for Quantifying Forest Residues in the Southwestern Region were used to estimate dead and down fuel loading.

Fire Hazard Rating: One method to evaluate the risk of wildfire to an area is to determine a fire hazard rating. Fire hazard rating is a relative measure of how virulently a wildfire might burn under the 90 percentile weather conditions that occur from April through July. It is a relative measure from site to site and from pretreatment to post treatment. It is a good indicator of how effectively and safely fire suppression crews can attack a wildfire and bring it under control.

For all fuels reduction projects analyzed on the Peaks and Mormon Lake Ranger Districts, the fire hazard rating is derived by accumulating hazard points associated with canopy closure, tree stems per acre, height to the bottom of the live crown, dead and down fuel loading, slope steepness, and aspect. While we cannot affect a change in slope steepness or aspect, their effects on fire behavior may influence how much we attempt to reduce other factors.

The fire hazard of the project area's existing condition across the sites surveyed to date is listed in Table 20 (may include some private lands).

Table 20. Existing condition acres by fire hazard rating

Extreme	Very High	High	Moderate	Low
539 acres	380 acres	2,028 acres	2,474 acres	1,310 acres

The higher fire hazards were generally driven by spikes in 2 or 3 of the above criteria. Dead and down fuel loads were higher than desired (>5 tons/acre) across 46% of the sites. In many sites stems per acre, canopy closures, or crown base heights by themselves drove the fire hazard beyond a desirable level for a wildland urban interface.

The existing fire hazard makes it very difficult for initial attack forces to control a wildfire starting in some parts of the project area under severe weather conditions that occur in April, May, June, and sometimes September and October.

Flame length is a reliable indicator of fire intensity and probable tree mortality. It can also indicate how effectively an alternative meets other fire-related objectives. Dead and down fuel loading directly effects flame length and duration. The longer the flame length and duration the more difficult it is to bring a fire under control. Also the longer the flame length and duration, the more likely a fire is able to transition into a crown fire. Prescribed burning reduces the amount of dead and down fuel loading and therefore, reduces the expected flame length and duration.

Table 21. Existing expected flame lengths by fire hazard rating in the project area

Extreme	Very High	High	Moderate	Low
Flame Length 4.5’	Flame Length 4.5’	Flame Length 3.5’ – 4.5’	Flame Length 3.5’ - 5’	Flame Length 2.5’

The modeling indicates an extremely high occurrence of wildfire induced tree mortality (8-100%) among trees 8-26 in. diameter at breast height (DBH). Critical flame lengths are the threshold distances where ground fire can move into the canopy of a site. Average critical flame length for tree-torching and transitioning to a crown fire is relatively low (3–9 ft.). The expected ground fire flame lengths ranged from 5-12 ft.

Height to the bottom of live crown directly effects how easily a fire “torches” trees producing firebrands, as well as, how easily a fire transitions into a crown fire. Number of tree stems per acre also affects how easily a fire is able to transition into a crown fire. Thinning increases the height to the bottom of a live crown, decreases the number of stems per acre, decreases canopy closure, and so reduces the ease with which a fire can “torch” trees, produce firebrands, as well as, the ease with which it transitions to a crown fire.

Canopy closure directly effects how easily a fire is able to transition into a crown fire by containing and accumulating heat below the crown layer. It can prevent necessary heat dispersal. Canopy closure also affects how easily a crown fire can sustain itself and spread as a crown fire. Thinning from below reduces canopy closure, heat accumulation below the crown and so the ease with which a fire can transition to a crown fire. It also reduces the ease with which a fire can “torch” trees and produce firebrands, as well as the height to which firebrands are lofted and the distance at which spot fires would be expected to occur. Tree harvesting to achieve uneven-aged management reduces canopy closure and stems per acre, but does not increase height to bottom of live crown as effectively as thinning from below. Uneven-aged management does result in greater age class diversity.

During severe weather conditions heat can accumulate under canopy closures greater than 50% and result in tree-torching and pockets of trees torching with multiple spot fire ignitions. Although existing fire behavior programs can not model this, fire from a relatively light fuel load has been frequently observed to climb the trunks of trees during drought conditions and torch the tree tops even though ground fire flame lengths have been less than 3 ft. Only a more open canopy and reduced crown bulk density can mitigate this fire behavior problem.

Fire Regime Condition Class: Another assessment method required of the Forest Service nationally is called the Fire Regime Condition Class rating. The Fire Regime indicates how often wildfires burned across this part of the landscape and with what level of severity. The plants and animals that inhabit this area have come to depend on that fire regime to maintain ecosystem

balance. The condition class of an area indicates how far from historical norms the area has departed because the fire regime has been disrupted. In many cases, it is no longer practical to return an area to its naturally occurring fire regime and condition class, but the assessment is still valuable in determining a close-fitting proposed action.

The entire project area is Fire Regime 1, where a fire recurrence of less than 35 years with a low percentage of overstory replacement would be expected under historical conditions. Reviewing the field data taken for this project suggests that most of the area is in Condition Class 3 due to a lack of fire occurrence (a severe departure from the natural historical regime of vegetation characteristics, fuel composition, fire frequency, severity and pattern). A wildfire occurring under existing conditions would result in more severe effects than should occur for the natural Fire Regime. However, a significant number of sites would receive an improved condition class rating once prescribed fire was reintroduced, since the vegetation characteristics are within the historical range of variability. Other sites would receive an improved condition class rating after mechanical harvesting and prescribed burning, since the “late-open” sites have filled-in to become “mid-closed” sites.

Table 22. Existing condition class by fire regime

Fire Regime 1: Frequent Fires (0-35 years), low to mixed burn severity		
Condition Class I	**Condition Class II**	**Condition Class III**
200 Acres	2,093 Acres	4,437 Acres

The current fuel conditions would likely generate dangerous fire behavior and undesirable fire effects when a wildfire occurs. The modeling indicated considerable torching and spot-fires as much as ½ mile a head of an intense surface fire. Although it would be difficult to initiate a crown fire within many sites, once initiated or if carried in from a neighboring area, many sites had sufficient crown bulk density coupled with sufficient canopy closure to sustain a crown fire and spread it through other sites. Initial attack forces would have difficulty in controlling a wildfire occurring in this area under severe weather conditions. The forest condition after a high intensity wildfire would not meet management direction in the Forest Plan for a variety of resources.

Environmental Consequences

Both the Fuel Management Analyst (Version 3+) and BEHAVE 3 programs were used to model fire behavior and fire effects for this analysis. The Fuel Management Analyst program is more sensitive to varying crown base height and crown bulk density. The BEHAVE 3 model discretely analyzes the ground fuel model and is sensitive to herbaceous fuel moisture. Fire behavior analysis is most accurate when multiple models are compared in light of their unique limitations.

Crown-base heights, percent canopy closures, and stems per acre displayed in the environmental analysis reflect point-level data. Some of the isolated groups of trees left with interlocking crowns could display more severe fire behavior within the group but would not represent the more modest fire behavior across the balance of the site.

Weather inputs cannot be used to measure how much safer an area will become after treatment, but they are valuable in comparing relative fire hazard ratings across sites and relative to pre- and post-treatments effects. The fuel moisture and weather characteristics used to model the fire effects are the same as those used for other Peaks and Mormon Lake district fuels projects since

the year 2000, in order to maintain consistency when comparing fire hazard. Many of these conditions can occur throughout the year, but occur locally most often from April through early July:

Fuel Moisture and Weather Characteristics:

1-Hour Fuel Moisture: 2%
10-Hour Moisture: 3%
100-Hour Moisture: 4%
20-Foot Wind Speed: 20 mph
Air Temperature: 85°F

One of the fuel treatment objectives for this project is to reduce the probability of crown fire initiation. This is achieved by reducing the crown bulk density (the volume of fuel available in treetops) throughout the sites, by increasing the effective crown base height (the height at which tree branches can be ignited by ground fire), and by reducing the expected flame length (the heat emitted by a ground fire).

Another fuel treatment objective is to reduce the capability of the sites to sustain a crown fire should one develop. This is achieved by reducing the percent of canopy closure as well as the tactics identified to reduce crown fire initiation.

Another fuel treatment objective is to reduce the number of firebrands that could ignite spot fires. This also can be achieved by reducing the crown bulk density, by increasing the effective crown base height, and by reducing the expected flame length.

Another fuel treatment objective is to reduce the distance at which firebrands would be expected to ignite spot fires. This can also be achieved by reducing the number of treetops that would burn simultaneously if ignited by ground fire. In turn, one must reduce the crown bulk density and canopy closure.

The treatments proposed would be expected to maintain these objectives for approximately 20 years by periodic prescribed burning without additional thinning treatments. Periodic prescribed burning can reduce the expected flame lengths by maintaining a low dead and down fuel loading. To facilitate prescribed burning canopy closures must be reduced. Also to reduce the fire hazard across this project area canopy closure must be reduced and crown base height must be raised. Thinning reduces canopy closure, crown bulk density, and can increase the effective crown base height.

A final fuel treatment objective is to bring the project area closer to the natural historic fire regime of vegetation characteristics, fuel composition, fire frequency, severity and pattern. This can be achieved by thinning followed by prescribed burning at appropriate intervals.

Direct and Indirect Effects of Alternative 1

Alternative 1 (No Action) does nothing to address the fuel treatment objectives of this project and the existing conditions would continue (see Tables 20, 21, and 22). The existing fire hazard makes it difficult for initial attack forces to control a wildfire in many parts of the project area under severe weather conditions that occur in April, May, June, September, and October and the results would likely be catastrophic.

The fire behavior characteristics of crown bulk density, expected flame lengths, critical flames lengths, and expected rate of spread are compared to Alternative 2 in Table 24. When a wildfire occurs, expected flame lengths would exceed 4 ft. in many sites, making it difficult and unsafe for initial attack crews to control a wildfire occurring under modeled conditions. The critical flame

lengths (treetop ignition) would commonly range 3-9 ft. Modeling indicates that many sampled sites had three to four times the crown bulk density necessary to sustain a crown fire. Canopy closure would exceed 70% in many sites and completely close-in over the course of 20 years.

Mortality of ponderosa pine trees 8-14 in. DBH would range as high as 94%. Ponderosa pine trees 16 in. DBH and greater could also suffer mortality rates as high as 94%. Mortality of oak trees 10 in. DRC and greater would be expected to reach 84% in most sites. These effects are compared to Alternative 2 in Table 25.

The indirect effects of not taking action would allow the fire hazard to worsen over time as vegetation grows and fuel accumulates. Competition between trees for moisture, nutrients, and sunlight would continue resulting in decreased tree vigor, increased susceptibility to infestation, disease and then mortality. Those trees that die, further increase the fuel load, the fire hazard, and increase the risk of successive attacks on the remaining trees. An indirect effect may be the loss of habitat and wildfire damage to the private property in the vicinity of Elk Park Meadows.

Cumulative Effects of Alternative 1

The prevailing winds for this project area are out of the southwest. The area analyzed for the cumulative fire effects of this project includes those projects occurring in the vicinity of Flagstaff and Elk Park Meadows. It constitutes most of the forested land subject to the prevailing winds driving a wildfire into these communities.

The time period analyzed for the cumulative fire effects of this project includes a twenty-five year period from 2005 to 2025. Prior to that time, the only activities in the area that affected the fire hazard were aggressive fire suppression and the continuing growth of forest vegetation. After year 2025, models indicate that the continuing growth of forest vegetation will cause the fire hazard to approach current conditions in many respects; canopy closures will fill-in, crown bulk densities will increase, and the number of new trees and shrubs will lower the effective crown base height.

A cumulative effect of the no action alternative is an increase in the number of acres of national forest that are vulnerable to severe fire effects. The vegetation type across the project area requires periodic fire to remain balanced. Fuel conditions have reached a point where fire effects are more severe than desired and more severe than would naturally occur. The fire hazard and fuel profile increases with time as the vegetation grows and dies.

Another cumulative effect of the no action alternative increases the possibility that a wildfire can get established and burn with sufficient intensity to exceed the capability of emergency response personnel. Wildfires in the wild-land/urban interface place particularly high demands on emergency response personnel. Such a fire threatens multiple structures and multiple groups of people in a very short span of time. Firefighting resources must be deployed to protect the people and properties that lie in the fire’s path, thus leaving fewer personnel to actually bring the fire under control. This generally results in larger wildfires and greater resource damage to the national forest.

The treatments within these projects do not eliminate the chance of a crown fire, but greatly reduce the chance of a crown fire initiating within their bounds. By leaving a large area like Elk Park Meadows untreated, we increase the risk of a crown fire starting in Elk Park Meadows and spreading as a crown fire through an adjacent area that has been treated.

Finally, Alternative 1 leaves much of the area in Condition Class III (a severe departure from the natural historical regime of vegetation characteristics, fuel composition, fire frequency, severity

and pattern). As time passes, even more area would transition to a Condition Class III and further result in destructive wildfires more severe than the area's historic fire regime.

Direct and Indirect Effects of Alternative 2

The fire hazard ratings after implementation of Alternative 2 are listed in Table 23. Some acres are still rated with a higher hazard rating than desirable. They may have been reduced from an even higher rating, but these areas were either inaccessible, limiting thinning opportunities, or they were deferred to meet certain wildlife habitat needs.

Table 23. Alternative 2 post-treatment acres by fire hazard rating

Extreme	Very High	High	Moderate	Low
96 acres	55 acres	647 acres	954 acres	4,978 acres

Alternative 2 addresses the purpose and need though mechanical treatments and prescribed burning by reducing the crown bulk density, reducing the canopy closure, increasing the effective crown base height in most sites, reducing expected flame length, and reducing the number and shortening the distance at which spot fires would be expected to occur (see Table 24).

Areas receiving mechanical harvesting would be expected to have 30-70% canopy closure, flame lengths after treatment would be expected to range between 0.5 and 3 ft. (some sites that would be thinned very lightly might still reach 6 ft.), making initial attack of a wildfire occurring under modeled conditions generally safe and effective. The critical flame lengths (treetop ignition) would range from 7-30 ft. The sampled sites would have a crown bulk density of 0.0003 to 0.0082 lbs/ft^3. While many sites might retain enough crown bulk density to sustain a crown fire, the resulting canopy openness is not likely perpetuate such a fire. The remaining canopy cover would increase over the course of 20 years.

Areas that receive prescribed burning only would be expected to have a slight decrease in canopy closure (10%), flame lengths after treatment would be expected to range between 0.5 and 3 ft. (some sites with closed canopies might still reach 6 ft.), making initial attack of a wildfire occurring under modeled conditions generally safe and effective. The critical flame lengths (treetop ignition) would range from 7-30 ft. The sampled sites would have a crown bulk density of 0.0003 to 0.0082 lbs/ft^3. While a few sites might retain enough crown bulk density to sustain a crown fire, all but two of the sites are too open to perpetuate such a fire. Those two sites that retain both a high crown bulk density and a closed canopy are isolated by sites that would not sustain a crown fire. As with all treatments, the canopy cover would increase over the course of 20 years.

Table 24. Comparison of fire behavior pre and post-treatment by treatment type

Fire Behavior Characteristic	Treatment Type	Using BEHAVE3 (Representative Stand)	Using Fuel Mgt Analyst (Average)
Crown Bulk Density (pounds/cubic foot)	No Treatment/Existing Condition	NA	0.0100 lbs/ft^3
	Mechanical Treatment and Burning	NA	0.0043 lbs/ft^3
	Burn Only	NA	0.0043 lbs/ft^3
	Restricted MSO Habitat	NA	0.0063 lbs/ft^3
Expected Flame Length (Feet)	No Treatment/Existing Condition	3' - 18'	23'
	Mechanical Treatment and Burning	2' - 4'	3'
	Burn Only	2' - 5'	3'
	Restricted MSO Habitat	2' - 4'	3'
Critical Flame Length (Feet)	No Treatment/Existing Condition	3' - 7'	7'
	Mechanical Treatment and Burning	7' - 15'	13'
	Burn Only	4' - 7'	13'
	Restricted MSO Habitat	7' - 15'	12'
Expected Rate of Spread (Chains/Hour)	No Treatment/Existing Condition	3 - 65 ch/hr	35 ch/hr
	Mechanical Treatment and Burning	3 - 5 ch/hr	11 ch/hr
	Burn Only	3 - 18 ch/hr	11 ch/hr
	Restricted MSO Habitat	3 - 5 ch/hr	12 ch/hr

Prescribed burning would be relatively easy to execute and maintain in all but two of the burn-only sites. Should a wildfire occur after this treatment, it is unlikely that state air quality standards would be exceeded. Wildfire-induced mortality of ponderosa pine trees 8-14 in. DBH would average less than 57%. Wildfire mortality of ponderosa pine trees 16 in. DBH and greater would not likely exceed 8%. Wildfire mortality of oak trees 10 in. DRC could reach 32%, but would not be expected to exceed 7% (see Table 25).

An indirect effect of Alternative 2 would be to maintain this suite of fuel treatment objectives for approximately 20 years through periodic prescribed burning and without additional thinning. Alternative 2 would result in a short-term increase in wildfire hazard potential while treatments are occurring. While the proposed thinning reduces crown fire ladders, canopy closure, and crown loading, the thinning slash will usually be piled on site increasing the dead and down fuel loading until the piles are burned within prescription. Until the material composing these piles dries out they do not pose a significant hazard. These piles will be burned soon after they dry out. By timing thinning activities and piling activities so that the slash piles do not pose a hazard for more than a few months, this short-term increase in fuel hazard is offset by a long-term decrease in wildfire hazard.

Table 25. Probability of wildfire induced mortality by treatment type

Tree Species/ diameter	Treatment Type	Using BEHAVE3 (Representative Stand)	Using Fuel Mgt Analyst (Average)
Ponderosa Pine/up to 8" DBH	No Treatment/Existing Condition	99%	90%
	Mechanical Treatment and Burning	35%	57%
	Burn Only	35% - 99%	57%
	Restricted MSO Habitat	35%	33%
Ponderosa Pine/10" DBH	No Treatment/Existing Condition	99%	82%
	Mechanical Treatment and Burning	25%	30%
	Burn Only	25% - 99%	30%
	Restricted MSO Habitat	25%	34%
Ponderosa Pine/12" DBH	No Treatment/Existing Condition	98%	57%
	Mechanical Treatment and Burning	19%	21%
	Burn Only	19% - 98%	21%
	Restricted MSO Habitat	19%	24%
Ponderosa Pine/14" DBH	No Treatment/Existing Condition	97%	67%
	Mechanical Treatment and Burning	14%	16%
	Burn Only	14% - 97%	16%
	Restricted MSO Habitat	14%	17%
Ponderosa Pine/16+" DBH	No Treatment/Existing Condition	96%	40%
	Mechanical Treatment and Burning	11%	8%
	Burn Only	11% - 96 %	8%
	Restricted MSO Habitat	11%	10%
Oak/10+" DRC	No Treatment/Existing Condition	99%	94%
	Mechanical Treatment and Burning	27%	32%
	Burn Only	41%	32%
	Restricted MSO Habitat	27%	31%

Cumulative Effects of Alternative 2

The cumulative effect of this project adds to other wildland/urban interface areas recently or currently treated for fuels that are in the path of the prevailing winds around Flagstaff and its suburbs: Bear Park Urban Fuel Reduction, Fort Valley Restoration, A-1 Multi-Product, Mars Hill, Arboretum, Airport, Hoxworth Meadow Restoration, Woody Ridge, Kachina Village, Lake Mary Fuel Reduction, Lake Mary Meadows, Lake Mary Watershed, Mint Springs, Mormon Lake Basin, Mountainaire, and Skunk Hollow Fuel Reduction.

These projects accumulate in the neighborhood of 83,000 acres analyzed and 65,000 acres proposed for treatment. As more acres that are treated in this way these benefits accumulate. As these projects are accomplished we expect the fire hazard rating for all acres analyzed to shift as shown in the following table.

Table 26. Expected cumulative change in fire hazard rating, expressed as a percent of all projects analyzed to date

	Extreme	Very High	High	Moderate	Low
Pre-Treatment	13%	14%	21%	33%	19%
Post-Treatment	4%	4%	11%	29%	51%

The Mormon Lake Ranger District anticipates one additional project in the vicinity of the Elk Park project (Marshall). This project might require analysis of an additional 12,000 acres. It is currently unknown exactly how many of those acres might receive mechanical treatments since neither fire hazard nor equipment-access has been assessed. It is expected that most of those acres would be prescribe-burned.

The treatments within these projects do not eliminate the chance of a crown fire, but greatly reduce the chance of a crown fire initiating within their bounds. By treating Elk Park Meadows, we reduce the risk of a crown fire starting in Elk Park Meadows and spreading as a crown fire through adjacent areas.

Fuel reduction treatments within the wildland/urban interface should reduce expected fire behavior to a level at which a small number of personnel can quickly and effectively control a wildfire. This is beneficial, reducing the possibility that wildfires can get established and reducing the intensity with which wildfires can burn. This further reduces the probability that the demand on emergency response personnel will be exceeded and reduces the threat to life and private property. Wildfires can be controlled with fewer acres burned resulting in less damage to National Forest lands. Also, wildfires burn less severely resulting in less resource damage to each acre burned.

Since existing conditions and proposed treatments vary widely across these projects and even within individual projects, it is difficult to summarize the fire effects. It is accurate to state that fire-induced tree mortality across all size classes will be dramatically reduced by these treatments. It is also accurate to state that wildfires occurring in these treated areas will be easier to control and burn less severely with less acreage burned than if the areas were left untreated. These projects combine to form a defensible space for Flagstaff and its surrounding communities.

The Fire Regime would of course remain the same (Fire Regime 1=open forest maintained by frequent mixed intensity fires), but the condition class would move closer to a Condition Class I, where vegetation composition, structure, and fuels are similar to those of the historic fire regime and do not predispose the system to risk of loss of key ecosystem components. A wildfire occurring under post-treatment conditions would be characteristic of the historic fire regime behavior, severity, and patterns.

Table 27. Post-treatment fire regime condition class

Fire Regime 1: Frequent Fires (0-35 years), surface burn severity		
Condition Class I	**Condition Class II**	**Condition Class III**
393 Acres	6,179 Acres	158 Acres

Air Quality

The purpose of this section is to describe the affected environment as it relates to air quality and to describe the direct, indirect, and cumulative effects of the No Action and Proposed Action alternatives on air quality standards. The following information has been summarized from an air quality analysis contained within the Fire and Fuels Specialist report [PRD 77], located in the project record.

The Elk Park Meadows project area is in the Little Colorado River air shed. The community of Elk Park Meadows is surrounded by the project. The community of Flagstaff is located north northwest of the project. Other suburbs of Flagstaff are within 15 miles of the project. The Forest Highway 3 corridor passes 3 miles north of the project. Interstate Highway 17 passes 5 miles west of the project. There is a significant level of recreation activity, especially in the summer months, within the vicinity of the analysis area.

The Fuel Management Analyst (Version 3+) was used to model the amount of slash generated for this analysis. The Simple Approach Smoke Estimation Model (SASEM) version 4.0 was used to model the amount of emissions from prescribed burning as well as from wildfire occurrence. The Arizona Department of Environmental Quality requires that this model should be used.

Affected Environment

The prevailing winds for this project area are out of the southwest. However, as storm fronts pass, winds can arrive from any compass direction for a period ranging from a few hours to 3 days. Atmospheric inversions can prevent smoke from dispersing. Within the project area, inversions occur between October and December more than at other times of the year. Stagnant atmospheric conditions result from low mixing heights and light transport winds. These conditions when they occur, may last from 12 hours to 7 days (Arizona Department of Environmental Quality, Fort Collins Weather Database).

Air quality surrounding the project area is generally good. However, smoke from wood-burning stoves and haze from automobile traffic can be seen at times during the winter months. Prescribed burning from other fuel treatment projects generates emissions that must be balanced with the air mass' ability to disperse emissions on any given day.

Smoke from prescribed fire must meet federal, state, and local air quality regulations. The basic framework for controlling air pollutants in the United States is mandated by the 1970 Clean Air Act (CAA), as amended in 1999 and 1990. The EPA has established National Ambient Air Quality Standards (NAAQS) for specific pollutants emitted in significant quantities throughout the country that may be a danger to public health and welfare.

All forest burning activities are regulated and administered by Article 15, Forest and Range Management Burn Rules (10/8/96). The Arizona Department of Environmental Quality (ADEQ) models emissions/pollutants from all prescribed burning within the state. Any prescribed burn planned by the Forest Service must be approved by ADEQ on a daily basis. ADEQ will not allow more acres burned per day, per air shed, than is acceptable with current air quality forecasts. The Forest Service burn boss is responsible for monitoring smoke plume trajectories to assure impacts are within predicted values. The Forest Service burn boss will make changes as needed when unpredicted weather threatens stronger impacts.

Environmental Consequences

Direct and Indirect Effects of Alternative 1

No direct effects would occur since pile burning or prescribed burning would not occur. However, emissions from a wildfire occurring within the project area have been modeled. The amount of fuel consumed and the smoke generated by a wildfire occurring under Alternative 1 would be greater than that under the action alternative (see Table 28). The resulting smoke would spread wider and farther than under prescribed burning. Nighttime smoke would reach farther and impact the nearby communities more severely. Smoke would exceed air quality standards in both volume and duration.

The current fuel and vegetative conditions would generate severe fire effects on many parts of the project area. Even after a wildfire was extinguished there would be bare soil areas that when exposed to wind would continue to produce air pollutants. A wildfire occurring within the project area under the weather conditions described in the Fire and Fuels section of this chapter would in places require an indirect attack for successful suppression. This would result in a larger burned area with more emissions than a prescribed fire occurring after implementing the proposed action.

Cumulative Effects of Alternative 1

The natural fire regime for the project area is Fire Regime 1 (frequent surface fires that generally do not involve much of the tree canopy. These would occur at 3 to 35 year intervals. This is a necessary function of this ecosystem.

Most of the project area has not experienced fire in over 70 years. By not burning periodically the fuels have accumulated to an unnatural level contributing to more severe fire effects and smoke impacts when wildfires occur. This is a combined result of vegetative growth, aggressive wildfire suppression, and insufficient prescribed-burning. While these actions minimized suppression costs, resource damage, and protected private property in the short-term, they have contributed to an increasing forest fuel problem.

The Coconino National Forest averages about 400 wildfires a year. Roughly half of these are human-caused with the balance caused by lightning. On average there are 85 days a year in which multiple wildfires start. The vast majority of these fires are stopped at 1/10th of an acre. Large destructive fires pull the average-annual-wildfire-acres up to 4,000 acres a year. Smoke from a wildfire occurring under modeled conditions would exceed air quality standards. As more area is left untreated, smoke from a wildfire occurring under Alternative 1 could accumulate with emissions from other wildfires if they occurred at the same time and further exceed air quality standards.

Direct and Indirect Effects of Alternative 2

Alternative 2 seeks to reduce the fire hazard while retaining as many nutrients on site as possible. It proposes burning the piled thinning slash (4,739 acres), as well as, prescribed burning of the forest floor (6,462 acres). A direct effect of the proposed action is that smoke from prescribed burning will have short-term impacts on local air quality. These effects come from three sources: 1) pile burning of slash generated from thinning trees, 2) initial prescribed-burning the forest floor in small blocks, and 3) maintenance-burning of the forest floor. Emissions generated by these actions have been modeled for the project area.

Pile-burning is relatively efficient combustion producing fewer emissions than either a wildfire (no or pre-treatment) or initial-entry prescribed-burning. Piles can be burned during rain and snowstorms with excellent smoke dispersion and little daily smoke flow into the canyons or

basins. Proper pile burning consumes a majority of the piled fuel before atmospheric cooling begins. This leaves little fuel to produce smoke for nighttime subsidence flows.

Some smoke from pile burning may still subside into the neighborhoods in and around the project area. Pile burning immediately adjacent to subdivisions may cause short-term (1-day) smoke impacts to a subdivision. This is a direct effect of Alternative 2. Public notification of burning would take place prior to ignition of all three types of prescribed burning.

The initial prescribed-burning of the forest floor produces considerably more emissions than pile-burning, but less than most wildfires (no or pre-treatment) burning in the same fuel bed. The initial broadcast burning of each block in the project area will generate smoke for as long as 72 hours after ignition. The emissions from implementing would generally meet National and State Ambient Air Quality Standards because we can select the weather conditions under which we burn and control the size of the area burned on any given day. The following table displays modeled volumes of smoke emissions between the alternatives.

Table 28. Comparing emissions from Alternatives 1 and 2

Comparison of Burn Emissions	Existing Condition Wildfire (Alt. 1)	Post Treatment Wildfire (Alt. 2)	Pile Burn (Alt. 2)	Initial Prescribed Burn (Alt. 2)	Maintenance Prescribed Burn (Alt. 2)
Ground Fuel Consumed (tons per acre)	8	2	Not Applicable	7	2
TSP Total Emissions Tons	30	0.3	6	13	3
Air Quality Standards	Exceeded	Unlikely	Unlikely	Rarely Exceeded	No

Successive maintenance burns on a given block (initiated to mimic the historic fire regime) will generate far less smoke volume and have virtually no smoke after sunset of ignition day. Hence there would be no nighttime smoke (subsidence flow) impacts from maintenance burning. The emissions from implementing Alternative 2 would generally meet National and State Ambient Air Quality Standards because we can select the weather conditions under which we burn and control the size of the area burned on any given day. This is a direct effect of Alternative 2.

The high level of recreation activity that occurs in the summer months is not likely to be impacted by smoke because very little prescribed-burning is conducted during those times. Hunters and other people recreating in the project area in the fall and spring could be impacted by smoke from prescribed-burning. This could last for as long as 72 hours during the initial prescribed-burning, but only 6 hours during the maintenance prescribed-burning.

Smoke plume trajectories indicate that the communities within and adjacent to the project area, Forest Highway 3 and Interstate Hwy 40 may be impacted by smoke when burning. Short-term air quality degradation and reduced visibility may be experienced in the smoke plume trajectories. After sunset, cooling atmospheric conditions will carry smoke down drainages like water flows. Under Alternative 2, these down canyon flows reach the communities around the project area in the early morning hours.

These early morning flows may carry smoke down slope and reduce visibility along Forest Highway 3 and Interstate Hwy 40 when blocks adjacent to them are being burned. These portions will be posted with appropriate signs warning motorists of reduced visibility. Ignition of each day's block would be completed in the afternoon, thus limiting the smoke generated after atmospheric cooling begins. Smoke impacts would be much worse should a wildfire occur under modeled weather conditions without the implementation of the proposed action.

As stated above, under Alternative 2, broadcast burning could be conducted without violating air quality regulations.

The reduction in the fuel load and the increased openness of the canopy will allow future broadcast burning under a wider range of weather conditions than the existing conditions. The ability of burn managers to limit undesirable smoke impacts is increased by having a wider range of weather parameters within which to burn. The areas thinned mechanically would allow the widest range of prescribed burning weather and lowest risk of smoke impacts because they result in the most open canopy conditions. The areas thinned by hand would allow the next widest range. Areas receiving burn-only treatments may or may not have an open canopy dependant on their existing condition. This is an indirect effect of Alternative 2.

Cumulative Effects of Alternative 2

As stated earlier, this project lies within the Little Colorado River air shed. There are other current and future prescribed fire projects that affect this airshed (Airport, Apache Maid, Bald Mesa, Blue Ridge, East Clear Creek, Eastside, Good Enough/Tule, IMAX, Kachina Village, Lake Mary, Mars Hill, Mint, Mountainaire, Munds Park, Pocket Baker, Skunk, Spearmint, Valley, Victorine and Woody).

Although smoke from a wildfire occurring after treatment under Alternative 2 would be unlikely to exceed air quality standards by itself, it could combine with the emissions of other wildfires and the accumulation might exceed air quality standards. As stated earlier, the forest averages 400 wildfires a year and 85 days a year having multiple fire-starts. This scenario is not very likely under the Alternative 2 because fuel loading will be reduced by the proposed treatments. This cumulative effect would also be unlikely because after treatment, the wildfires could be controlled at a smaller size, burning fewer acres and fewer days, thus producing less smoke.

In sites with more closed canopies, forest floor fuel accumulates more quickly. In sites where canopies are denser, prescribed-burning can only be executed under a narrower window of weather conditions. Denser canopies result in fewer opportunities to burn and this in turn is likely to result in less frequent prescribed-burning of those areas. Fuel accumulates more quickly and is prescribe-burned less often resulting in greater smoke impacts.

Since ADEQ limits total acres burned per day per air shed, daily emissions from prescribed-burning do not accumulate to exceed air quality standards. The number of days per year in which prescribed burning occurs is likely to increase as projects are implemented, but exceeding air quality standards will not be an effect. Smoke from pile-burning may combine with smoke from wood-burning stoves and automobile smoke on some days when inversions are strongest during the winter. The following table displays estimates of current forest prescribed-burning with estimated capacity assuming normal weather patterns.

Table 29. Coconino National Forest's annual prescribed burning versus estimated capability

	Initial Prescribed Burning	Est. Burn Days	Maintenance Prescribed Burning	Est. Burn Days	Prescribed Pile Burning	Est. Burn Days
Current (Actual) Execution	13,000 acres	37 days	7,000 acres	8 days	1,700 acres	17 days
Estimated Capability with Typical Weather	17,000 acres	50 days	11,000 acres	18 days	8,500 acres	43 days

Noxious or Invasive Weeds

The purpose of this section is to describe the affected environment as it relates to noxious or invasive weeds and to describe the direct, indirect, and cumulative effects of the No Action and Proposed Action alternatives on the proliferation of these invasives. The following information has been summarized from the Botany specialist report [PRD 83], located in the project record.

The noxious or invasive weed species found within the project area include musk thistle (*Carduus nutans*), diffuse knapweed (*Centaurea diffusa*), Dalmatian toadflax (*Linaria dalmatica*) and cheatgrass (*Bromus tectorum*).

Affected Environment

The desired conditions for noxious or invasive weeds, as outlined in the FEIS for Integrated Treatment of Noxious or Invasive Weeds for Coconino, Kaibab and Prescott National Forests (USDA 2005) are to:

- Eradicate, control or contain certain weed species as identified in the FEIS. Eradicate is defined in the FEIS as attempting to totally eliminate a species from the Coconino, Kaibab and Prescott National Forests by the end of the ten year planning period of the document. Control is defined as preventing the spread of seed and reducing the acreage of existing populations. Contain is defined as preventing the species from expanding beyond the boundaries of existing populations.
- Prevent introductions of additional noxious or invasive weed species on the forests.

Table 30 below shows the weeds present in the Project Area and the objectives as outlined in the FEIS. Each species was ranked using a numerical rating. This ranking was based on several factors including acreage, difficulty of control and perceived success of control measures.

Table 30. Noxious or invasive weeds and treatment priorities as identified in the FEIS

Common Name	Species Rank (FEIS)	Objective
Musk thistle	8	Eradicate
Diffuse knapweed	9	Contain/Control
Dalmatian toadflax	18	Contain/Control
Cheatgrass	22	Contain/Control specific populations

Desired condition in the Project Area would include accomplishing the objectives for each species as outlined in Table 30. For additional treatment information, refer to the FEIS.

The objectives listed in the table are goals to be reached by the end of the normal life span of 10 years of a NEPA decision for the FEIS. The objectives should be applied to all the species identified above. Goals for cheatgrass will be achieved through mitigation and implementation of Best Management Practices. Control measures for the remaining species will be addressed in the environmental consequences discussion.

Musk Thistle

Musk thistle is an introduced biennial which grows up to 6 ft. tall. Musk thistle invades disturbed areas and can spread rapidly, forming large monocultures. Musk thistle reproduces solely from seed. However, individual plants may self-pollinate, so a single plant may form a large colony if not quickly controlled. This species receives a high rating for control because the known acreage on the Coconino National Forest, and within the project area, is relatively limited.

Diffuse Knapweed

Diffuse knapweed was first detected in the Flagstaff area in the late 1970s and has spread from a few scattered plants to infestations on thousands of acres in the urban interface around east Flagstaff. These populations continue to expand and new infestations are being created. This species poses serious threat to restoration efforts because of its high rates of expansion and ability to outcompete native vegetation. The control goal for this species is contain/control. The predicted growth rate is 14% per year for existing populations. Knapweed may be able to dominate disturbed sites indefinitely (Sheley and Petroff 1999).

Dalmatian Toadflax

Dalmatian toadflax is the most widely spread noxious or invasive weed within the ponderosa pine vegetation type on the Coconino National Forest. There are numerous infestations of this species throughout the forest and within the project area. The management objective for this species is contain/control. The predicted rate of spread for this species is 10% per year.

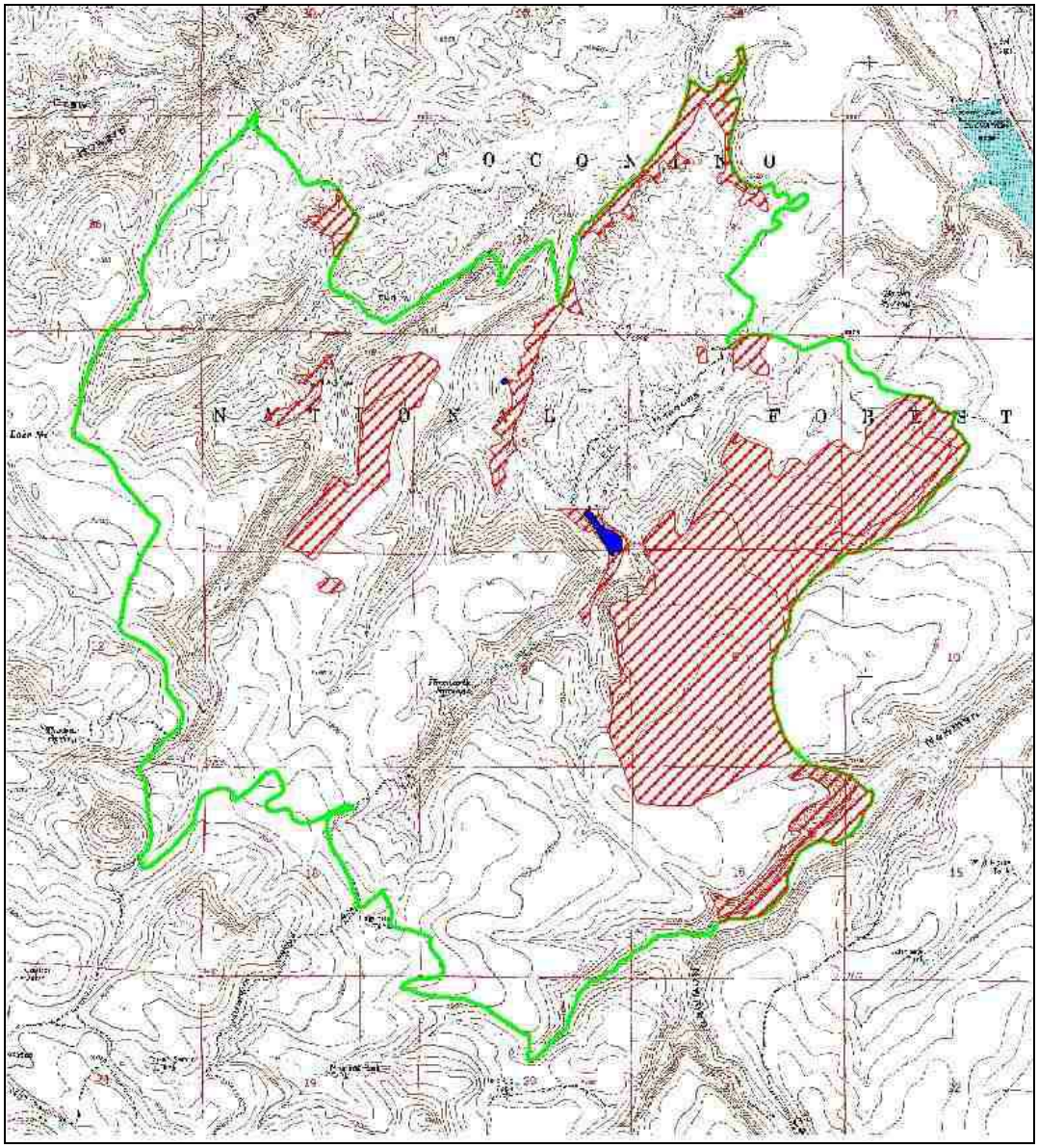
Biological control insects to control Dalmatian toadflax have been introduced and established in two stands in the project area: location/site 373/002 and in location/site 362/001 (just southwest of the Elk Park Meadows community (see Figure 12).

Cheatgrass

Cheatgrass provides a flammable link between open areas and forested areas, allowing fires to move from one habitat type into another. The presence of cheatgrass has increased the fire frequency in grassland and sagebrush ecosystems (Zouhar 2003). Cheatgrass is also common in ponderosa pine forests throughout the western United States. The shorter periods between fires in these ecosystems will eventually cause the loss of native plants not adapted to frequent fire and the replacement of these native plants by non-native annual grasses. Live cheatgrass plants can be killed by fire, but seeds survive relatively severe fires and colonize recently burned areas.

Controlling cheatgrass requires elimination of live cheatgrass plants on the site, prevention of seed formation and elimination of emerging seedlings. Cheatgrass tends to be very persistent once it becomes established (Zouhar 2003). Several techniques to control cheatgrass have been used, including timing of burns, herbicide treatments, grazing and competitive planting. On the Coconino, treatments are limited to populations that overlap with the habitat of rare plant species.

Figure 12. Biological control insect release to control Dalmation toadflax within the project area in 2005 (release area appears as solid black)



Environmental Consequences

Direct, Indirect and Cumulative Effects of Alternative 1

In this alternative no management actions would occur. No tree thinning would occur and there would be no prescribed burning. Under the no action alternative, noxious weed treatments or mitigations that would help prevent the spread of noxious or invasive weeds will not occur as part of the management actions currently under consideration. Under the no action alternative, no noxious or invasive weed treatments would occur in the project area except those accomplished by other projects such as limited manual control by Forest Service crews or control efforts by other

entities such as releases of biological control agents provided by APHIS. Most noxious weed populations will remain untreated and continue to expand. Mitigation measures that would help control the spread of noxious or invasive weeds would not be implemented.

With no treatment, fire hazard will continue to increase in the project area and the threat of severe wildfire in the Elk Park Meadows area will not be reduced, which in turn could result in indirect effects to noxious or invasive weed populations within the project area. Factors that contribute to fire hazard ratings such as canopy cover, trees per acre and dead and down fuel loading will not be reduced. The risk of wildfire transitioning to crown fires will increase in many areas of the project area resulting in the increased risk of severe wildfire. Severe wildfires often result in complete removal of tree canopy, complete loss of ground cover and understory plant community and alteration of soil structure and nutrients, resulting in severe disturbance. These conditions provide potential sites for weed invasion through creation of bare soil, increased light and absence of competition from desirable plant species. Therefore, increases in fire hazard and severity that will occur with no action will also increase the risk of weed invasions in the project area.

Direct and Indirect Effects of Alternative 2

The location of known noxious or invasive weeds the type of treatment that location would receive under the Proposed Action are listed in Table 31.

Table 31. Noxious/invasive weeds within the project area and proposed treatment type

Common Name	Infestation size (acres)	Location	Site	Proposed Treatment
Musk thistle	0.1	362	1	Burn only
Musk thistle	0.1	362	1	Burn only
Diffuse knapweed	0.1	361	3	Mechanical
Dalmatian toadflax	0.1	350	4	Mechanical
Dalmatian toadflax	0.1	350	4	Mechanical
Dalmatian toadflax	0.1	350	5	Mechanical
Dalmatian toadflax	0.1	350	5	Mechanical
Dalmatian toadflax	0.1	350	6	Mechanical
Dalmatian toadflax	0.1	350	8	Mechanical
Dalmatian toadflax	0.1	350	8	Mechanical
Dalmatian toadflax	2	350	32	Burn only
Dalmatian toadflax	3	350	32	Burn only
Dalmatian toadflax	0.1	360	1	Mechanical
Dalmatian toadflax	1	360	3	Burn only
Dalmatian toadflax	0.1	361	2	Mechanical
Dalmatian toadflax	0.1	361	2	Mechanical
Dalmatian toadflax	0.1	361	3	Mechanical
Dalmatian toadflax	0.1	361	5	Mechanical
Dalmatian toadflax	0.1	361	8	Burn only
Dalmatian toadflax	0.1	361	8	Burn only
Dalmatian toadflax	0.1	361	9	Mechanical
Dalmatian toadflax	0.1	361	9	Mechanical

Common Name	Infestation size (acres)	Location	Site	Proposed Treatment
Dalmatian toadflax	0.1	361	9	Mechanical
Dalmatian toadflax	0.1	362	1	Burn only
Dalmatian toadflax	0.1	362	1	Burn only
Dalmatian toadflax	0.1	362	5	Mechanical
Dalmatian toadflax	0.1	362	6	Mechanical
Dalmatian toadflax	0.1	362	6	Mechanical
Dalmatian toadflax	0.4	362	10	Burn only
Dalmatian toadflax	0.5	373	1	Burn only
Dalmatian toadflax	0.5	388	5	Mechanical
Dalmatian toadflax	0.2	389	1	Mechanical
Dalmatian toadflax	0.1	389	7	Mechanical
Cheatgrass	2	350	32	Burn only
Cheatgrass	3	350	32	Burn only
Cheatgrass	0.5	361	2	Mechanical
Cheatgrass	0.1	361	2	Mechanical
Cheatgrass	0.1	361	8	Burn only
Cheatgrass	0.1	373	8	Burn only
Cheatgrass	0.1	389	2	Mechanical
Cheatgrass	0.1	389	3	Mechanical
Cheatgrass	0.1	389	7	Mechanical
Cheatgrass	0.1	389	8	Mechanical
Cheatgrass	0.1	389	12	Mechanical

A direct effect common to all management activities and all noxious or invasive weed species addressed in this report is disturbance, which has the potential to increase the acreage and/or density of the existing noxious weed infestations within the project area. Forms of disturbance include ground disturbance and creation of bare soil created through such activities as tree removal, road construction, reconstruction and/or maintenance, removal of ground cover, and alteration of soil nutrients and composition through burning. Disturbance is a natural process in our landscape but it can contribute to the spread of noxious or invasive weeds by creating potential sites for invasion. Disturbance may contribute to the spread of weeds by eliminating competition from existing vegetation and creating bare ground that can be more easily invaded than in undisturbed areas. The level of disturbance is important. Severe disturbance removes competitive vegetation, alters nutrient composition, creates bare soil and can severely reduce or eliminate shade, making potential sites for the invasion or spread of noxious or invasive weeds. Examples of management activities that would create localized severe disturbance include burned areas from slash piles, log decks and bare soil created through road construction, reconstruction and decommissioning and by machinery during mechanical thinning. Other management activities associated with the project will be sources of disturbance but the level of disturbance will not be as severe. Examples include broadcast burning.

Another direct effect includes increased risk of introduction of noxious or invasive weeds to uninfested areas within the project area. This could be expansion of weed species known to exist

in the project area or additional species not yet existing in the area. These effects can be mitigated by following the Best Management Practices as identified in Appendix B the FEIS for the Integrated Treatment of Noxious or Invasive Weeds.

Treatments that reduce the tree canopy and lower the stand density can benefit understory plants including noxious or invasive weeds by allowing more sunlight to reach the forest floor, increasing available nutrients, temporarily decreasing interspecies competition as well as intraspecies competition, and increasing bare soil. The increased availability of resources and decrease in competition can provide favorable conditions for noxious or invasive weeds and could increase the size and density of existing populations, especially in areas where weed infestations already exist.

Prescribed burning is a disturbance that can release nutrients, reduce plant competition, increase the amount of available sunlight and increase bare soil. This can benefit understory plants including noxious or invasive weeds. Over the life of this decision, all acres within the project area will receive prescribed burning treatments at least once. The effects of prescribed burning are similar to those of tree removal and may contribute to expansion of existing weed populations by allowing more sunlight to reach the forest floor, increasing available nutrients, temporarily decreasing competition, and increasing bare soil

Pile burning will create localized severely burned areas and is a source of severe disturbance. Consequences include but are not limited to the reduction or loss of the seed bank on pile burn sites (Korb 2001); death or reduction of soil organisms (Raison 1979; Ballard 2000; Korb et al. 2004) and development of hydrophobic soil (Ballard 2000). Slash pile sites are more prone to invasion from noxious or invasive weeds than surrounding areas and may contribute to the persistence and spread of noxious or invasive weeds in treated areas. A possible mitigation for these effects is to use previously disturbed areas including old pile sites or previously used decking areas where available instead of creating new sites within the forest. Additionally, pile sites should be monitored after burning occurs to identify and treat infestations. As stated above, management actions can be mitigated by following Best Management Practices.

The direct and indirect effects of burning activities to biological control insects established southwest of the Elk Park Meadows community are currently unknown.

Cumulative Effects of Alternative 2

Cumulative effects to noxious or invasive weeds include many past activities that contributed to the introduction and spread of these species within the project area and onto the Coconino National Forest as a whole. Frequently, the source of each introduction into a specific area is unknown. However, activities such as vehicle travel and contaminated seed and feed products deliver propagules to specific areas. To become successfully established, these propagules must enter an appropriate habitat or an unoccupied niche. These niches are produced by disturbance, creating bare soil and reducing existing vegetation cover. Past ground-disturbing activities that have contributed to bare soil and reduction of vegetative cover include, but are not necessarily limited to, Airport Fuels Reduction Project broadcast burn, Fort Tuthill to Kachina Village Trail, grazing, Kachina Village FHP, Lake Mary Fuels Reduction Project, Pumphouse Multiproduct Timber Sale, Skunk Fuels Reduction, various prescribed fires and wildfires, recreation activities and facilities, and road construction and maintenance. Many of these activities occurred before the relationship between ground-disturbing activities and the introduction and expansion of noxious or invasive weeds was locally recognized. Recent projects such as the Skunk Fuels Reduction project have recognized and mitigated the effects of noxious or invasive weeds by incorporating a series of BMPs.

Past control actions for noxious or invasive weeds on forest lands have affected some infestations forest-wide. These include manual control measures such as hand pulling, herbicide treatments and introductions of biological control agents including sheep and biological control insects. The comprehensive effects of these treatments on noxious or invasive weeds in the project area and forest-wide are difficult to assess at this time, but control efforts for noxious or invasive weeds are increasing on a forest-wide basis as a result of implementing the noxious weed EIS.

Biological control agents have been released on diffuse knapweed, spotted knapweed and Dalmatian toadflax. The primary purpose of these releases was to establish local insectaries for biological control insects. However, insects are successfully established in the selected areas, they will begin to disperse. Localized reduction in areal coverage and density of the targeted noxious or invasive weed infestations will begin to occur. Dewey Murray, the Arizona Domestic Program Coordinator for APHIS, has already documented such observations in 2005 and 2006. One introduction of the biological control agent, *Mecinus janthinus* within the project area in 2005 has become successfully established and the area size where insects were detected has expanded since the initial introduction. There are additional introductions of this agent in several nearby locations in the Lake Mary Watershed (Murray 2005 and 2006). These insects have become successfully established in location/site 373/007 and in location/site 362/001 within the project area. Both of these stands are currently scheduled for prescribed burning treatments. The effects of burning on persistence on the biological control insects are currently unknown.

There have been many ground-disturbing activities on non-forest lands that cannot be managed through Forest Service actions. Examples of this include the establishment and management of public and private roadways, activities such as grazing on non-forest lands, timber harvest and prescribed burning on non-forest lands, and private land use. Uncontrolled noxious or invasive weed populations on non-forest lands may negatively affect control efforts for noxious or invasive weeds on forest lands. Currently, the forest can only encourage weed treatments through cooperative efforts such as those initiated through the San Francisco Peaks Weed Management Association.

Other recent activities that may affect weed populations include control efforts undertaken by various other agencies on areas within or adjacent to forest lands. These include, but are not limited to, herbicide treatments, manual control, and biological control. Arizona Department of Transportation executes herbicide treatments on federally controlled highways in northern Arizona. Coconino County has manually controlled noxious or invasive weeds along Forest Highway 3. Additionally, various government and civic groups periodically sponsor noxious or invasive weed “pulls” where individuals hand pull weeds in various areas. Although acreage of these efforts has in the past been small and limited, repeated efforts have reduced or removed infestations in some localized areas.

Sensitive Plant Species

The purpose of this section is to describe the affected environment as it relates to designated sensitive plants and to describe the direct, indirect, and cumulative effects of the No Action and Proposed on each plant species and its habitat. The following information has been summarized from the Botany Report and Sensitive Species Biological Assessment and Evaluation [PRD 83] located in the project record.

Sensitive species are defined as “those plant and animal species identified by a regional forester for which population viability is a concern, as evidenced by: (a) significant current or predicted downward trends in population numbers or density, or (b) significant current or predicted

downward trends in habitat capability that would reduce a species' existing distribution" (FSM 2670.5(19)).

It is the policy of the Forest Service regarding sensitive species to: (1) assist states in achieving their goals for conservation of endemic species; (2) as part of the National Environmental Policy Act process, review programs and activities, through a biological evaluation, to determine their potential effect on sensitive species; (3) avoid or minimize impacts to species whose viability has been identified as a concern; (4) if impacts cannot be avoided, analyze the significance of potential adverse effects on the population or its habitat within the area of concern and on the species as a whole (the line officer with project approval authority makes the decision to allow or disallow impacts, but the decision must not result in loss of species viability or create significant trends toward Federal listing); and (5) establish management objectives in cooperation with the state when projects on National Forest System lands may have a significant effect on sensitive species population numbers or distributions. Establish objectives for Federal candidate species, in cooperation with the U.S. Fish and Wildlife Service and Arizona State (FSM 2670.32).

A list of Threatened, Endangered, or Proposed (TEP) plants for the Peaks and Mormon Lake Districts was reviewed and the project area does not include any locations or potential habitat for TEP plant species. The only Southwestern Region Sensitive plant detected in the project area is Flagstaff pennyroyal (*Hedeoma diffusum*) and the effects to this species are included in this EA.

The project area may contain suitable habitat for two other sensitive plants: Flagstaff beardtongue (*Penstemon nudiflorus*) and Arizona sneezeweed (*Helenium arizonicum*); however, no locations for these plants were detected during surveys. Since there are no occurrences of these two species within the project area, there was determined be no effect to these species from either alternative [PRD 83]. No further discussion of these two species will be provided in this EA.

Affected Environment

Flagstaff Pennyroyal

Flagstaff pennyroyal occurs in three distinctive habitats in the ponderosa pine forest: rock pavement, cliffs and limestone. Forest canopy cover ranges from zero to 86%, averaging 26.5% (Phillips 1984). There are two major population areas for this species on the Coconino National Forest; the first includes the project area and extends roughly from Flagstaff, east to Marshall Lake and Fisher point, then south to the vicinity of Mountainaire, then to Lower Lake Mary. A second population area is near the rim of Oak Creek Canyon and its tributaries (Boucher 1984; Phillips 1984). There are 30 documented locations for Flagstaff pennyroyal within the project area; this includes multiple occurrences across nine different stands.

Desired conditions for Flagstaff pennyroyal are to maintain or increase the populations of these species within the project area. Additionally, suitable habitat for this and other sensitive plant species should be maintained or enhanced. Management actions in or near populations of Flagstaff pennyroyal should follow the guidance of the *Hedeoma diffusum* Management Plan. Implementation of the mitigation measures outlined in the Plan will mitigate the effects of management actions and help assure population viability and sustain suitable habitat for Flagstaff pennyroyal. These mitigations will have beneficial effects in both the immediate and foreseeable future.

When the *Hedeoma diffusum* Management Plan was prepared in 1984, the effects of fire on Flagstaff pennyroyal were unknown. The plan recommended that fire as a forest restoration tool be avoided until the effects of fire could be assessed and the forest initiated a prescribed fire study in 1989. The study encompassed factors such as fire intensity and season of burning. The study

consisted of two areas with five treatments each: pre-monsoon, hot burn; pre-monsoon, cool burn; post-monsoon, hot burn; post-monsoon, cool burn; and control plots where no burning occurred. There were twenty 1/10th acre plots within the two sites. The numbers of individual Flagstaff pennyroyal plants were counted on each plot once yearly through 1995. Initially, the numbers of Flagstaff pennyroyal plants decreased on all treatments, even on control plots (Phillips et al. 1993). After six years, Flagstaff pennyroyal numbers were higher on all fire treatments compared to control plots, and no long-term adverse effects on Flagstaff pennyroyal were detected (Crisp 1997). However, Dalmatian toadflax was detected in the areas of the plots later (Phillips and Crisp 2001). The fire study plots are in location/site 359/004 and 361/003. These areas are proposed for uneven-age harvesting and prescribed burning in Alternative 2. These sites will need to be marked and care taken to avoid destruction of these plots during project implementation.

Environmental Consequences

The following evaluation criteria were used to compare the environmental consequences for the alternatives:

- Many locations of Flagstaff pennyroyal within the project area were found during surveys.
- Suitable habitat exists within the project area.
- Undiscovered plants could be damaged during mechanical thinning
- Flagstaff pennyroyal is adapted to fire.

Direct, Indirect, and Cumulative Effects of Alternative 1

Under the no action alternative, there will be no direct effects to Flagstaff pennyroyal because none of the proposed management activities will occur. There would be no effect from the construction of temporary roads or reconstruction or realignment of roads on Flagstaff pennyroyal.

With no treatment, fire hazard will continue to increase in the project area and the threat of severe wildfire in the Elk Park Meadows area will not be reduced, which, in turn could result in indirect effects to Flagstaff pennyroyal. Factors that contribute to fire hazard ratings such as canopy cover, trees per acre and dead and down fuel loading will not be reduced. The risk of wildfire transitioning to crown fires will increase in many areas of the project area resulting in the increased risk of severe wildfire. Severe wildfires often result in complete removal of tree canopy, complete but temporary loss of ground cover and understory plant community and alteration of soil structure and nutrients. These changes could adversely affect the habitat and populations of Flagstaff pennyroyal by damaging soil, killing existing plants and by reducing or destroying the seed bank of Flagstaff pennyroyal. Noxious or invasive weeds such as Dalmatian toadflax more easily invade areas of severe wildfires than unburned areas. Therefore, if a severe wildfire occurred in the habitat of Flagstaff pennyroyal within the project area, noxious or invasive weeds could also increase and contribute to the degradation of the habitat and loss of individuals and populations of Flagstaff pennyroyal.

Goodwin (1983) observed decreases in plant vigor and population density in areas of heavy litter accumulation. With no action, dead and down fuels that could be reduced by prescribed fire will continue to increase, which in turn could negatively affect the vigor of Flagstaff pennyroyal populations occurring within the project area.

Noxious or invasive weeds such as Dalmatian toadflax more easily invade areas of severe wildfires than unburned areas. Therefore, if a severe wildfire occurred in the habitat of Flagstaff pennyroyal within the project area, noxious or invasive weeds would cumulatively increase and contribute to the degradation of the habitat and loss of individuals and populations of Flagstaff pennyroyal.

Direct and Indirect Effects of Alternative 2

Of the 30 documented locations of Flagstaff pennyroyal, all but two are proposed for mechanical thinning; the other two locations are proposed to receive burn only treatments.

Potential direct effects under the proposed action would include alteration of habitat or deaths of individual plants or population groups. Factors contributing to these effects would include disturbance from management activities including tree thinning, burning, road construction or decommissioning and fireline construction. These activities cause negative direct effects by causing mortality of individual plants.

Some negative direct effects could be plant mortality resulting from heavy equipment operation, creation of skid trails, temporary roads, fire lines and log landings. Dalmation toadflax in particular will successfully establish in burned Flagstaff pennyroyal sites, as it has on the experimental plots (Phillips and Crisp 2001). This may increase competition. Log landings and slash piles are not expected to recover rapidly due to the degree of soil disturbance, heat generated from burning and/or soil compaction.

Prescribed burning may cause direct and indirect short and long-term effects. Burning will benefit Flagstaff pennyroyal by removing heavy litter accumulation resulting from absence of fire and by releasing nutrients held in the litter back into the soil. The effects of prescribed burning would be positive based on the preferred timing of burning in the spring and fall. In a burning experiment conducted at various intensities during pre-monsoon (spring) and post monsoon periods (fall) by the Coconino National Forest, no adverse effects on Flagstaff pennyroyal were detected (Crisp 1997).

Slash pile burning is a more intense and localized burning activity. Typically, burning on slash pile sites is more severe, and fire on the site is of longer duration, compared to the prescribed burning where fuels are ignited across the landscape, and there are typically large concentrations of burning material. The direct and indirect effects of slash pile burning include deaths of individuals (immediate), loss of seed bank (long term) and potential alteration of habitat (long term).

Thinning of trees will have direct and indirect effects on Flagstaff pennyroyal. Goodwin (1984) concluded that light to moderate disturbance from timber harvest did not adversely affect Flagstaff pennyroyal, which tends to be found in relatively open areas with less than 30% canopy. Therefore, tree thinning will benefit Flagstaff pennyroyal in some areas of the project by reducing tree canopy and stand density in areas where the plant occurs and in potential habitat. This will in turn provide more growing space and increase the amount of resources available to all plants including Flagstaff pennyroyal. The effects will be most noticeable in short term but will decrease over time as canopy and stand density increase. However, the reduction in the stand density from these actions could have a negative indirect effect in areas where noxious or invasive weeds such as diffuse knapweed or Dalmatian toadflax already occur in the habitat of Flagstaff pennyroyal. Survey data show there are several stands proposed for treatment that contain one or more locations of these noxious or invasive weeds. In these areas in particular, competition from these weeds could have negative effects if control measures are not taken for the weed populations.

Direct and indirect effects of road construction and reconstruction include death of individual plants, and alteration of habitat. Deaths of individual plants may occur through the direct destruction of plants. Indirect effects include physical alteration of habitat or accumulation of dust on existing plants and increased risk of spreading or introducing noxious or invasive weed infestations. However, these effects will be mitigated by following the *Hedeoma diffusum* Management Plan (see the Mitigation Measures in Chapter 2).

Cumulative Effects of Alternative 2

Cumulative effects to Flagstaff pennyroyal include disturbance, destruction of individual plants and alteration of habitats. In the recent past, the Forest Service has initiated activities that may have affected Flagstaff pennyroyal including, but not necessarily limited to, Airport Fuels Reduction Project broadcast burn, Fort Tuthill to Kachina Village Trail, grazing on Windmill allotment, Kachina Village FHP, Lake Mary Fuels Reduction Project, Pumphouse Multiproduct Timber Sale, Skunk Fuels Reduction, Mountainaire HFRA fuels reduction project, Eastside Project, recreation activities and facilities, road construction and maintenance, and land exchanges. Effects of these projects have been addressed individually. Land exchanges have shrunk the amount of suitable habitat that was formerly held in Forest Service ownership, reducing the overall distribution of Flagstaff pennyroyal. Subsequent development on these lands has probably reduced the amount of suitable habitat and resulted in losses of individual plants in these areas.

Activities on non-federal lands such as state and private lands have also contributed to cumulative effects on Flagstaff pennyroyal and include timber harvest, fuels reduction projects, recreational uses and development. Land development on non-federal parcels has affected the amount of suitable habitat available, reducing the amount of suitable habitat in these areas. Activities on non-Forest Service lands tend to have more adverse effects on populations and habitat for Flagstaff pennyroyal because they are not subject to mitigation that similar actions on the forest would be. The overall result has been the reduction in the overall distribution and amount of suitable habitat for Flagstaff pennyroyal throughout its range.

Determination: The Elk Park Project may impact individuals of Flagstaff pennyroyal, but is not likely to result in a trend toward federal listing or loss of viability.

Wildlife

The purpose of this section is to describe the affected environment as it relates to wildlife, and to describe the direct, indirect, and cumulative effects of the No Action and Proposed Action alternatives on wildlife species and habitat. This section is organized by species status: threatened and endangered species, sensitive species, management indicator species, and migratory birds. The cumulative effects area analyzed for each species is defined differently based on the species range and habitat preferences. The following information has been summarized from the Wildlife Report and Sensitive Species Biological Assessment and Evaluation [PRD 80], located in the project record.

Threatened and Endangered Species

Section 2 of the Endangered Species Act of 1973, as amended declares that "…all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act." Section 7 directs Federal agencies to ensure that actions authorized, funded, or carried out by them are not likely to

jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of their critical habitats (16 U.S.C. 1536 et seq.).

Federal agencies also must consult with the U.S. Fish and Wildlife Service (USFWS) whenever an action authorized by the Agency is likely to affect a species listed as threatened or endangered or to affect its critical habitat. The act mandates conference with the Secretary of the Interior whenever an action is likely to jeopardize the continued existence of any species proposed for listing as threatened or endangered, or whenever an action might result in destruction or adverse modification of critical habitat proposed for listing (16 U.S.C. 1536(a)4).

The threatened, endangered and proposed species (TEP) list for the Peaks and Mormon Lake Ranger Districts was reviewed for this project; there are no endangered or proposed animal species within the analysis area. The analysis area contains habitat for the Mexican spotted owl and bald eagle, both of which are threatened species and are analyzed in this report.

Bald Eagle

Data Sources: Bald eagles are primarily winter visitors to the Coconino National Forest occupying all habitat types and elevations. Eagle sightings are strongly influenced by the amount of open water and prey availability. The Arizona Game and Fish Department (AGFD) coordinates annual statewide counts of wintering bald eagle each January, with an average of 288 eagles tallied between 1992 and 1998 (Beatty and Driscoll 1999). On the standardized route closest to the project area, up to 69 eagles were counted during one survey. Between 1975 and 2000, 4,525 sightings of wintering bald eagles were recorded at Mormon Lake (Grubb 2003).

Adjacent to the project area, there is a bald eagle emphasis area that encompasses roosting and nesting areas around Lower and Upper Lake Mary, where the majority of bald eagle sightings occur. There are no known roosts or nests within the project area itself. The closest known roost is approximately 0.25 miles, and the closest nest is 0.46 miles from the project boundary.

Bald eagles nesting on Lower Lake Mary produced one young in 2005 and three in 2006. This was the first time in over thirty years that nesting has been documented in the area. One of the Lower Lake Mary nests occurs in a historic eagle nest stand that was thought to be active in the late 1960s or early 1970s. Other nests on the forest are found more than 25 miles from the project boundary.

Life History and Affected Habitat: Bald eagles winter throughout the southwestern United States and then migrate to the northern United States and Canada to breed. However, a small resident population remains in Arizona and New Mexico during the breeding season. These eagles nest on cliff ledges and in live trees or snags along major rivers and reservoirs. Although bald eagles are primarily winter visitors to the Coconino National Forest, there are four nesting pairs on the forest; one along Lake Mary, one along Beaver Creek and two along the Verde River.

Major winter food items include coots, waterfowl, cottontails, jackrabbits and large mammalian carrion (Grubb and Kennedy 1982). Wintering eagles arrive in the fall, usually late October or early November, and leave in early to mid-April. In the winter, bald eagles forage primarily along rivers and streams and at lakes for waterfowl and fish. Bald eagles can be found along major roadways foraging on road-killed animals. Eagles opportunistically feed on animal carcasses throughout the forest. Though bald eagles mainly forage on waterfowl, fish and carrion, they do hunt for mammal species in the uplands.

Roost sites are of primary concern across the winter range of the bald eagle (Steenhof 1978; Grubb and Kennedy (1982). Grubb and Kennedy (1982) described winter roosts as “usually in live trees, in relatively dense stands, in protected situations such as draws or small drainages,

often several miles from the daytime loafing or foraging areas." Bald eagles are opportunistic foragers and both Steenhof et al. (1980) and Dargan (1991) found that eagles often roosted communally near large food sources.

Reproductive success can be negatively impacted by human disturbance. Threats to bald eagles include loss of existing or potential roosts due to catastrophic fires, fire suppression activities or past timber sales and loss of perches, particularly snags, due to fuelwood gathering, hazard tree removal, fire or wind. Bald eagle reproduction has been affected by heavy metal accumulation in portions of their southern range, resulting in eggshell thinning. Bald eagle mortality has occurred due to collision with vehicles.

The breeding season for the Lake Mary bald eagles has been inconsistent with those below the Mogollon Rim. In 2005, eggs were laid about two months later than those south of the rim. In 2006, nesting was about one month later.

Environmental Consequences

The following evaluation criteria were used to compare the environmental consequences of the alternatives:

- Trees >18 in. DBH suitable for perching or roosting
- Disturbance associated with project activities.
- Smoke and fire impacts
- There are no known nests or roosts within the project area
- Project duration

Direct, Indirect and Cumulative Effects of Alternative 1

Under the No Action alternative, current management plans would continue to guide management of the project area. There would be no direct effects from thinning, burning, or road management. The potential for adverse effects associated with a catastrophic wildfire would remain the same and likely increase through time. If a wildfire were to occur, nesting, roosting habitat could be destroyed.

Direct and Indirect Effects of Alternative 2

Alternative 2 proposes uneven-aged harvesting and thinning on approximately 4,700 acres, or approximately 74%, of the project area. Uneven-aged selection harvesting is designed to mimic the uneven-aged structure historically found in the project area. Age and size class diversity will be improved through selection harvesting using a modified restoration model that will create openings for natural tree regeneration. Primarily, trees 5-16 in. DBH will be cut. Modeling estimates: 9.5 trees per acre <16 in. DBH and 0.2 trees per acre >18 in. DBH will be cut.

An open, groupy tree arrangement will be achieved by creating interspaces between groups of trees and by thinning within tree groups. Tree groups will vary in the size of trees making up the groups, as well as the area of the group. Groups may consist of 2-40 trees covering an area of approximately .05 to .7 acres. Canopy cover within groups would vary from 30-70%.

Alternative 2 proposes prescribed burn treatments on 6,400 acres, or 97%, of the project area. All 5,000 acres proposed for mechanical treatment would be prescribed burned, with an additional 1,500 acres proposed for burn-only treatments.

Not every acre will be burned in a single year. Daily prescribed burns on any given project generally do not exceed 200-500 acres depending on weather conditions and the amount and type of fuel being burned. The District burns approximately 2,000-5,000 acres annually typically no more than 1,000 acres are burned in a given project area. Initial burning may take six years to complete depending on treatment schedules, weather patterns and funding.

Wintering eagles begin arriving in late October and generally leave by mid April. The majority of prescribed burning occurs in the fall from September through December, creating an overlap of approximately three months. In one stand prescribed burns will occur within 0.25 mile of a known winter roosts, all other roosts are over 0.25 mile away. Burning will result in smoke accumulations, particularly during the evening and early morning hours when cold air traps smoke in drainage bottoms. Most of this smoke dissipates by about 10:00 am when the cool morning air begins to warm and rise allowing the smoke to lift out of the drainages. Winter roosts are found on the slopes adjacent to drainage bottoms, which are typically above the area where smoke accumulates, therefore wintering eagles roosting or foraging adjacent to the project area should not be impacted by smoke from prescribed fires.

Eagles forage over large areas; daily prescribed burns are comparatively small and unlikely to have any affect on foraging eagles. Prescribed burning will take place on forested habitat, eagles primarily feed on fish and waterfowl, which are found in lake and wetland habitats.

Prescribed burning could have an affect on breeding bald eagles if it were to occur at the same time. On Lower Lake Mary we suspect that breeding is occurring in February, but it is difficult to know for sure since we only have two years of incomplete nesting data. If breeding occurs in February eaglets could leave the nest by July; the majority of prescribed burning typically occurs from September through December, which does not overlap with breeding eagles. To ensure that heavy smoke does not result in adverse impacts to nesting eagles broadcast prescribed burning will not occur within 2 miles of eagle nests when the District Biologists determine that eagles are breeding. Breeding includes courtship, nesting and fledging periods. After coordinating with biologists form the Arizona Game and Fish Department and U.S. Fish and Wildlife Service the District Biologists may determine that eagles are not nesting on Lower Lake Mary and timing restrictions may be lifted. However, individual pile burning may occur when it is over one mile away from active breeding or nests. Individual piles of logging slash or harvesting residue will be lined so that fire is not permitted to creep beyond the individual pile. The effects of smoke and fire from individual pile burning are short term and isolated as smoke dissipates quickly (see Air Quality analysis).

Maintenance burning is scheduled every 3-15 years to mimic the historic fire intervals for ponderosa pine forests. Maintenance burns may be larger in size, but because the fuel loading will be reduced from mechanical treatments and the initial prescribed burns; the duration and intensity of smoke is expected to be less; thereby having less affect on eagles.

Eagles can be affected by noise. When a sound source arouses an animal, the disturbance may affect metabolic rates by increasing activity levels. This increased activity can deplete energy reserves (Bowles 1995). The closest eagle roost is just over 0.48 mile (2,534 ft) from proposed mechanical treatments and the closest nest is just over 0.77 miles (4,065 ft). A noise study on goshawks conducted by Grubb et al. (1998) found that logging trucks did not elicit a discernible response when they passed within 500 meters (1,642 ft) of active nests. Stalmaster and Newman (1978 *in* Larkin 1996) remarked that “Normally occurring auditory disturbances were not unduly disruptive to eagle behavior. Gunshots were the only noises that elicited overt escape behavior…. Eagles were especially tolerant of auditory stimuli when the sources were partially or totally concealed from view.” Gunshots generate noise at 110 decibels (dB), while logging trucks

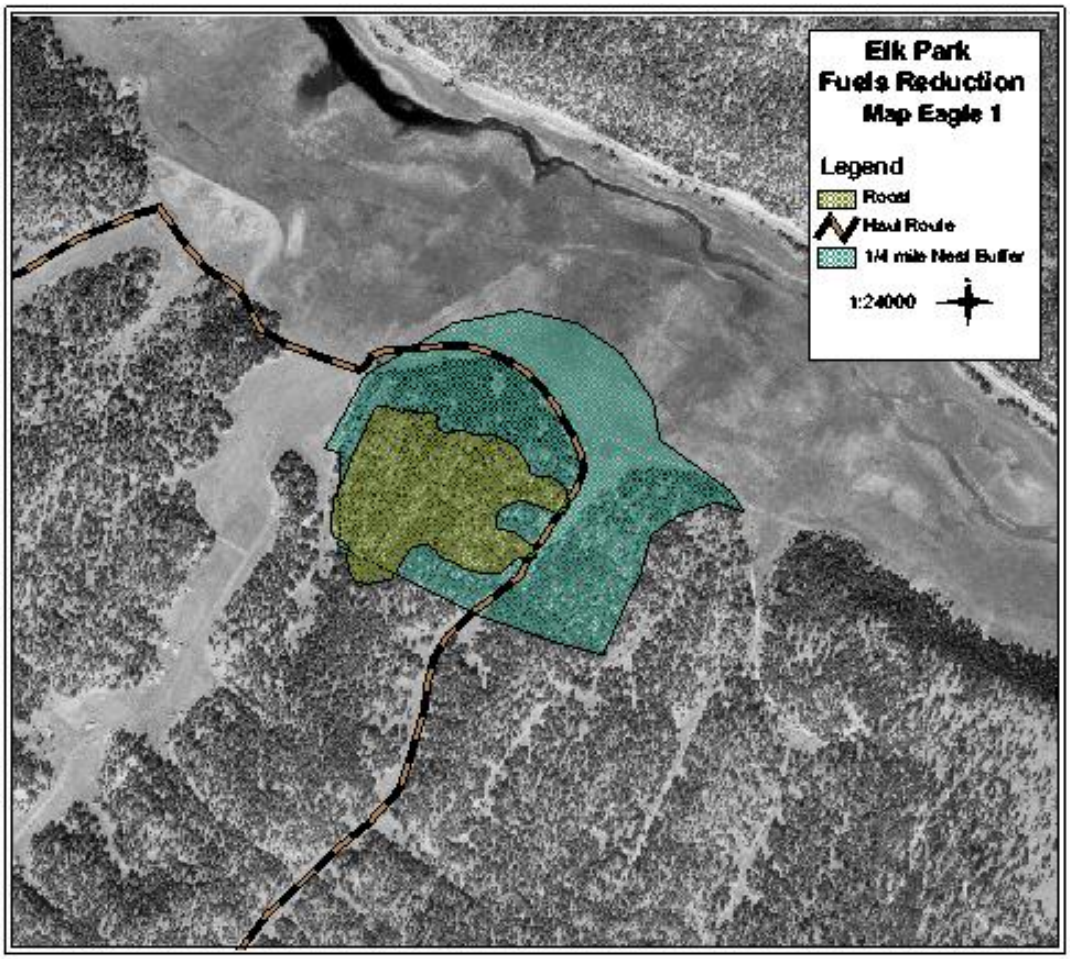
generate 83 dB and chainsaws at 46 dB. Both logging trucks and chainsaws generate less noise than guns however, these noises can last longer than a single gunshot.

Noise associated with commercial logging activities will be heard by roosting and nesting bald eagles but is not likely to be so loud that it will result in eagles flushing from nests or roosts, because: topography will block some of the noise, treatments cannot be seen and the distance to commercial harvesting operations within the project area.

Commercial logging activities may cause auditory or visual disturbances to foraging eagles. Eagles flying over or foraging within the project area during implementation may be disturbed by project activities. Although, the habitats within the project area consists primarily of forested upland habitat and provide only marginal foraging resources. If this disturbance should occur, it would be isolated, of short duration and low intensity.

Though there are no bald eagle nests or roosts within the project area, the proposed haul route passes within a quarter mile of both, see Figure 13.

Figure 13. Bald eagle roosting and nesting area near proposed haul route



Assuming that commercial harvesting may generate enough logs to fill one log truck per acre treated, approximately 8,000 log trucks (includes both loaded and empty logs trucks) will pass through a known winter roost and within 0.25 mile of a historic nest. This amount of commercial

traffic is likely to occur off and on over a period of three to five years and may generate enough noise and/or visual activity to disrupt roosting when it occurs. In order to reduce the amount of disturbance to breeding eagles this portion of the haul route will not be used when nesting or breeding eagles are present. Breeding and nesting will be determined by the District Wildlife Biologist in coordination with the Arizona Game and Fish Department and the U.S. Fish and Wildlife Service. In northern Arizona, eagles forage over a broad area primarily at lakes and rivers for fish and waterfowl, or along highways for carrion. Their primary food is fish, which is generally consumed twice as often as birds and four times as often as mammals (USDI 2006). Hauling, in general, is not expected to significantly affect foraging eagles, though it may be loud it is isolated and of short duration.

Alternative 2 does not propose tree removal, prescribed fire, or road construction within 0.25 mile of known bald eagle roosts or nests.

Other effects to the bald eagle may include alteration of habitat, prey species or prey species habitat. Eagles are opportunistic feeders primarily feeding on carrion, fish and waterfowl; though they also feed on upland species to a lesser extent. Proposed treatments will result in more open stands with trees in groups and clumps. Uneven-aged group selection harvesting and thinning across most of the project area will increase the amount of interspaces and openings between groups of trees, which should increase the site distance for bald eagles, facilitating better foraging conditions for the bald eagle. Prey, such as rabbits, should benefit from these treatments providing eagles with other forage opportunities.

Since eagles prefer to roost in large trees within close proximity to other large trees, the treatments proposed for the project should not reduce the quality and quantity of potential winter roosts. Eagles typically roost or perch in trees greater than 18 in. DBH. Less than 0.25 trees per acre greater than 18 in. DBH are targeted for removal.

Treatments for this alternative will meet the standards and guidelines for bald eagle habitat management identified in the Coconino National Forest Plan. Silvicultural practices will result in the growth and retention of large diameter trees in uneven-aged/multi-layered stands. Prescribed fires will improve the ability to protect roosts and nests from wildfires. Timing restrictions on hauling logs will reduce the amount of potential disturbance to nesting eagles.

Cumulative Effects of Alternative 2

The area of analysis includes the area that is bounded by the forest boundary to the west, north, east, and the Peaks and Mormon Lake District boundary on the south. Historic silvicultural practices that emphasized large tree removal combined with the suppression of fire have resulted in the existing conditions. Currently, the greatest threat to bald eagle habitat is attributed to private land development and catastrophic fire. Livestock and wildlife grazing occurs throughout the analysis area. Grazing utilization standards are designed to maintain or improve forage condition across the allotments. In most areas these standards provide sufficient cover and forage for potential bald eagle prey. Thinning projects recently completed or proposed on Anderson Mesa total approximately 20,000 acres. These projects are designed to restore grasslands on the mesa. Grassland restoration projects may improve forage and cover for potential bald eagle prey.

Past, present, and future thinning and fuels reduction projects within the pine type include Lake Mary, Mountainaire, Mint, Woody, Fort Valley, Mormon Lake Basin, Kachina and A-1, Skunk, Munds Park, Eastside, and Jack Smith/Schultz. Activities resulting from these projects include prescribed fire and/or mechanical treatments, which may result in short-term disturbance to bald eagles as described above.

Maintenance of power lines and power line corridors within the cumulative effects area is ongoing. Power line maintenance may include replacement or repair of power poles, transformers and power lines. Corridor maintenance includes trimming branches and cutting trees that may disrupt electrical service by falling on or growing into the existing transmission lines. Both live and dead trees of all species may be affected by corridor maintenance. Potential roost trees may be removed; corridor and power line maintenance activities could disturb eagles causing them to flush.

Log hauling from the Mountainaire project will cumulatively impact eagles because FSR 296 and 296A will also be used as a haul route for the southern portion of that project area. The Mountainaire project estimated 776 truckloads would occur over 1-3 breeding seasons, lasting approximately 40 to 50 days. Timing restrictions on log hauling for the Mountainaire and Elk Park project should mitigate potential negative effects associated with disturbance to nesting eagles. Though disturbance to roosting eagles, as described above, will likely occur when hauling outside of the breeding restrictions. Disturbance associated with the implementation of Alternative 2 may adversely affect roosting bald eagles, but is not likely to jeopardize the continued existence of bald eagles.

Mexican Spotted Owl

Data Sources: We have inadequate data to accurately estimate true population trends for Mexican spotted owls on the Coconino National Forest. A demography study on two research sites, one on the Coconino National Forest and one on the Gila National Forest in New Mexico has been conducted. Population estimates were made through 1998 as a result of this study (Seamans et al. 1999), however, this data is not adequate for estimating forest level or regional population trends. Annual rates of change indicated that both populations declined at greater than or equal to 10% per year from 1991 to 1997. The authors (Seamans et al. 1999) hypothesized that either a decline in habitat quality, or regional trends in climate were responsible for the decline of the population. After further analysis, however, they concluded that variation in precipitation likely was responsible for much of the temporal variability observed in reproductive output, and to a lesser extent, survival (Seamans et al. 2002). Therefore, unpredictable changes in the environment may play a large role in population dynamics and are probably responsible for part of the observed decline.

Since the late 1980s, the Coconino National Forest has surveyed nearly one million acres of potential habitat for spotted owls. The number of spotted owl Protected Activity Centers (PAC) increased dramatically in the early years of surveys, due primarily to an increase in survey effort. The number of PACs identified began to stabilize in the early 1990s and currently there are 183 known PACs on the forest.

Territories are monitored to assess occupancy and reproductive status. The data the Forest Service collects, however, is not designed to estimate population trend. Annual monitoring intensity is highly variable. Some PACs are rarely monitored, while others are monitored nearly every year. A summary of the data reveals that there have been dramatic fluctuations in occupancy and reproduction from 1987 to 2005; the reasons for these fluctuations are unknown though a decrease in prey as a result of sporadic precipitation patterns is suspected.

MSO habitat within the project area was inventoried according to approved protocols; no new territories were established as a result of these surveys. Approximately 747 total acres from three separate PACs occur within the project area. Of this, no acres occur within ½ mile of the community of Elk Park Meadows. No nests have been found within the project area. The Clark PAC was established based on two roost locations.

Table 32. Existing acres of MSO habitat with the project area

Habitat Type	Acres
Protected Outside of PACs	0
PAC	746
Restricted Habitat	1,605
Target/Threshold Habitat	0
Total	2,351
Critical Habitat	2,195*

* Critical Habitat is a subset of the total MSO habitat acres.

Life History and Affected Habitat: Important habitat attributes used by Mexican spotted owls include cool microclimates, multistoried, multi-species stands with high canopy cover, and large numbers of snags, high basal area, rock outcrops and/or cliffs, and small openings. At the time the Forest Plan was signed, spotted owls were only known to occur in mixed conifer habitats, usually associated with steep slopes. Since that time, owls have been found to use ponderosa pine/Gambel oak habitats as well, but do not appear to be strongly associated with ponderosa pine, or spruce-fir forests. Topography associated with owl habitat usually includes moderate to steep slopes. There is no mixed conifer habitat within the project area and only limited areas of steeper slopes.

Generally on the Coconino National Forest, there have not been any significant habitat alterations within PACs since 1987, although wildfires have affected some. When the Mexican spotted owl was proposed for listing in 1991, the US Forest Service Southwestern Region was managing territories with 450-acre core areas and 1500 acre foraging areas. The owl was listed as a threatened species in 1993 and a Recovery Plan was published in December 1995 (USDI 1995). At that time management shifted to the establishment of 600-acre PACs. The Regional Forester amended all Forest Plans in 1996 to implement the guidelines found in the Recovery Plan. These guidelines were incorporated into the Coconino Forest Plan with Amendment 11, which changed habitat management for MSO and goshawks, and adjusted old-growth direction (USDA 1996).

Mixed conifer habitats have changed little during implementation of the Forest Plan. Pine-oak habitat is also important to Mexican spotted owls because older oak trees provide cavities for nesting and food for potential prey. Forest biologists estimate that approximately 49% of owls on the Coconino National Forest rely primarily on pine-oak habitats, with approximately 44% in mixed conifer and 7% in ponderosa pine. Ponderosa pine habitats without an oak component are rarely used by spotted owls. Habitat trends for pine-oak follow trends described for ponderosa pine, with some losses in the older age-class from timber sales implemented early in the Forest Plan and some loss of large oaks to illegal fuelwood cutting.

Critical habitat refers to specific geographic areas that are essential for the conservation of a threatened or endangered species and that may require special management considerations. Critical habitat is made up of the physical and biological features necessary for the species' survival; these features are found in restricted and protected habitats. The final rule for MSO critical habitat was published in the Federal Register on August 20, 2004. This project is partially within Critical Habitat Unit UGM-11. Not all areas within the mapped critical habitat unit boundaries contain habitat elements important to the owl. The U.S. Fish and Wildlife Service requires consultation only on the activities that affect those areas that contain the primary constituent elements.

The primary constituent elements for critical habitat found in the project area are related to forest structure and prey and are synonymous with the protected and part of the restricted habitats of the project. There are 2,195 acres of critical habitat within the project area. Critical habitat within the project area is made up of protected and restricted habitat. The treatments proposed in these habitats are prescribed burning and thinning. None of the habitats will be treated so intensely that they will no longer meet the designations of protected or restricted habitats.

Nesting and roosting stands exhibit certain identifiable features, including high tree basal area, large trees, multi-storied canopy, high canopy cover and decadence in the form of downed logs and snags (Ganey and Dick 1995 *in* USDI 1995). The Recovery Plan for Mexican Spotted Owl quantifies nesting and roosting habitat in Table III.B.1 and calls it Target/Threshold Habitat. The desired target/threshold habitat values for pine-oak habitat present in the project area are shown in Tables 33 and 34.

Within any site-specific project area, a minimum of 10% restricted habitat must be identified as target/threshold habitat to help ensure that nesting and roosting habitat is maintained/developed within identified Mexican spotted owl habitat. Despite having over 700 acres of PAC habitat within the project area, target/threshold conditions are currently not found anywhere within the project; suggesting that this area is outside of habitat conditions that are typically used for nesting or roosting. However, the Recovery Plan anticipated this problem and accounts for it by stating "If a deficit (of target/threshold) occurs within the planning area, additional stands should be identified that (1) have the site potential to reach target conditions and (2) whose current conditions most closely approach those conditions." Within the Elk Park project area stand 389/03, which is outside of PAC habitats, has been identified as target/threshold habitat as it most closely resembles target/threshold conditions. This stand is 240 acres and would account for 13% of the restricted habitat within the project when designated, which exceeds the minimum requirement of 10% designation.

Environmental Consequences

According to the MSO Recovery Plan, the Forest Service should manage for landscape diversity by mimicking natural disturbance patterns, incorporating natural variation in stand conditions, retaining special features such as snags and large trees, and utilizing fires as appropriate (USDI 1995). While several types of natural disturbances occur within ponderosa pine ecosystems, fire represents the most important abiotic factor determining forest structure. Historically, ponderosa pine forests of northern Arizona were characterized by frequent, low-intensity surface fires occurring every 2 to 12 years. These fires maintained an open canopy structure and a variable, patchy tree distribution by thinning smaller trees from the understory.

The following evaluation criteria were used to compare the environmental consequences of the alternatives:

- MSO Habitat
- Prey habitat
- Disturbance
- PAC treatments
- Breeding season restrictions

Direct, Indirect and Cumulative Effects of Alternative 1

Under the No Action alternative, current management plans would continue to guide management of the project area and no Target/Threshold habitat would be designated. There would be no direct effects to MSO from thinning, burning, or road management. The potential for adverse effects associated with a catastrophic wildfire would remain the same and likely increase through time. If a wildfire were to occur, nesting, foraging and roosting habitat could be destroyed.

Direct and Indirect Effects of Alternative 2

The ultimate goal of the Proposed Action is to utilize an ecosystem restoration approach to create a more open stand, with trees arranged in groups, or patches of uneven-aged clumps separated by open interspaces that more closely resemble a forest structure that existed prior to the interruption of the natural fire regime, approximately 100-150 years ago. Using the restoration model, pre-settlement tree evidence, primarily old stumps and logs, will be used to determine how trees will be marked for removal. This restoration model will leave 1 ½ trees for every evidence in the areas proposed for mechanical treatment outside of PACs. Only ponderosa pine is targeted for removal. Modeling estimates that over 90% of trees targeted for removal will be 0-16 in. DBH and that over 95% of trees greater than 18 in. DBH will not be removed.

Of the 746 acres of protected PAC habitat within the project area, none are proposed for intensive fuel treatment. Approximately 390 acres within the Clark PAC are targeted for group selection treatments. Group selection treatments are recommended in the Mexican Spotted Owl Recovery Plan, because they target the removal of trees in all size classes to create uneven-aged stands that are continuously establishing themselves over time, thereby maintaining an uneven-aged stand. Even-aged stand structures are not used to any great extent by the Mexican spotted owl. Even-aged management may result in uniformity in tree age, size, spacing and density and is not a preferred management system for short-term development of spotted owl habitat. The MSO Recovery Plan recommends uneven-aged group selection to create a balance of age or size classes in small contiguous groups resulting in a mosaic of tree structures within a stand (USDI 1995).

Of the 746 PAC acres that occur within the project area: approximately 390 acres will be treated with prescribed fire and mechanical thinning. The remaining 356 acres of PAC habitat are within portions of the Crawdad and Holdup PACs, which will not be treated. Prescribed fire activities including: lining of snags and logs, line prep, layout and prescribed burning will be conducted outside of the MSO breeding season of March 1 to August 31. All thinning activities, including but not limited to hauling, layout, marking and cutting will be conducted outside of the MSO breeding season. Activities associated with prescribed burning and thinning treatments conducted outside of the breeding season normally do not result in excessive disturbance that may result in negative effects to the MSO.

The effects of prescribed fire include both negative and beneficial effects on spotted owl habitat. Beneficial aspects would include increased response of herbaceous vegetation after a fire. Negative effects would include the potential loss of spotted owl prey habitat components such as herbaceous cover, down logs and snags. The effects of fire on the prey base of the spotted owl are complex and are dependent on the variations in fire characteristics and in prey habitat. Fire intensity, size, and behavior are influenced by numerous factors such as vegetation type, moisture, fuel loads, weather, season, and topography. Fire can effectively alter vegetation structure and composition thereby affecting small mammal habitat. Prescribed fire is likely to have initial short-term negative effects on some rodent populations, but as cover and plant forage species recover, rodent populations, particularly *Peromyscus* sp, are likely to reach and exceed pre-treatment population numbers.

Population responses by small mammals to fire-induced changes in their habitat vary. For example, deer mouse populations might increase immediately following fire and then decrease through time (Ward and Block 1995). Campbell et al. (1977) noted that populations of peromyscus mice decreased immediately following a wildfire in an Arizona ponderosa pine forest that removed one-fourth (moderately burned) to two-thirds (severely burned) of the basal area; populations then returned to pre-fire numbers two years following the burn. Further, no differences were found in rodent populations between moderately and severely burned areas. They concluded that the effects of the fire that they studied were short term, and the short-term positive numerical responses of mice were attributed to an increase in forage, particularly grasses and forbs after the fire (Ward and Block 1995). The fire in this study removed trees making up the overstory, prescribed fire objectives for this project do not include overstory removal. Small mammal diversity and densities are typically depressed for one to three years after a fire (Wright and Bailey 1982). Biswell et al. (1973) suggested that rodent populations would be less affected during fall fires, because at that time of year rodents have accumulated seed caches that will mitigate loss of food sources. The majority of prescribed fire for this project will occur in the fall.

Predation of surviving rodents that are part of the diet of the spotted owl may increase immediately after prescribed fire. In one study in northern California, radio-collared northern spotted owls spent considerable time in burned-over areas. This activity was assumed to be due to easy capture of prey (Patton 1995).

The net effect of prescribed fires on spotted owl foraging is unclear: a fire that removes the tree canopy would likely render a portion of the area unusable for foraging by spotted owls, but if the spatial extent of crown loss is limited, a mosaic is created that could provide a diversity of prey for the owl and actually be beneficial (Ward and Block 1995). The objectives of prescribed burns in the Elk Park project is not to reduce the tree canopy, though torching is likely to occur in isolated portions of the burn. Furthermore, prescribed fire typically burns in a mosaic of intensities with some areas burning hot and others not burning at all. Because owl prey species evolved in ecosystems where fire was a natural process, we assume that historically, these species survived, and some even benefited from the occurrence of fire. Fire has been excluded from most southwestern ecosystems during the 20th century, resulting in systems where fire behavior may deviate substantially from natural conditions. The activities proposed in Alternative 2 are expected to improve the long term habitat of MSO for the project area by increasing its ability to withstand and mitigate the effects of a catastrophic/severe wildfire entering the project area and by short term increases in rodent populations benefiting MSO foraging habitat. Effects of fire on small mammals under present environmental conditions are unclear (Ward and Block 1995).

There is a total of 1,605 acres of restricted spotted owl habitat in the project area. Of this acreage approximately 65 acres occur within 0.5 mile of private land where fuel treatment is sometimes more intensive; however the treatments proposed in Alternative 2 are not so intensive that they no longer maintain restricted habitat characteristics. Initial treatments will not change the classification of any MSO habitat, but will improve foraging, roosting and nesting characteristics through time. Refer to Table 32 earlier for the acres of spotted owl habitat within the project area.

Stand 389-03 (240 acres) would be designated as target/threshold habitat, which accounts for 13% of the total restricted habitat in the project area. According to the Recovery Plan for the Mexican Spotted Owl (USDI 1995), 10% of the restricted habitat within the project area is to be designated as target threshold habitat. The project exceeds the minimum requirements for target/threshold habitat by 3%. Table 33 displays the existing target/threshold conditions for Stand 389-03 (240 acres) and the projected growth of this stand over 40 years, with the implementation Alternative 2. Under Alternative 2, stand 389-03 will receive a burn only

treatment. Within 20 years, this stand will meet stand density requirements for large trees required for target/threshold habitat, as outlined in the Recovery Plan. Within 40 years, this stand will meet basal area requirements of 150 ft^2 per acre. Prescribed fire treatments proposed for Alternative 2 will not hinder the development of target/threshold habitat identified by stand 389-03.

MSO may be disturbed during mechanical activities by noise created during the implementation of project activities. Therefore treatments including hauling and road work within ½ mile of nests and roosts will not occur within the breeding season of March 1 to August 31. Activities associated with mechanical thinning conducted outside of the breeding season or beyond ½ mile of nesting or roosting, or where topography is blocking noise normally do not result in disturbance that may result in negative effects to the MSO.

Table 33. Target/threshold conditions for stand 389-03

Time	Basal Area (ft^2/acre)	% stand density of trees 12-18" DBH	% stand density of trees 18-24" DBH	% stand density of trees >24" DBH	Density of large trees >18" DBH
Target/Threshold Requirements (from the MSORecovery Plan)	150	15	15	15	20
Existing Condition	95	23	21	9	13
+ 20 Years	131	33	21	16	20
+ 40 Years	157	35	21	19	24

Alternative 2 proposes thinning ponderosa pine up to 16 in. DBH within the Clark PAC. The Recovery Plan for the Mexican Spotted Owl states that "Two primary threats that managers should focus on are catastrophic wildfire and the widespread use of even-aged silviculture." (USDI 1995) The goal of treating within the PAC and of the recovery plan is "to protect conditions and structures used by spotted owls where they exist and to set other stands on a trajectory to grow into replacement nest habitat or to provide conditions for foraging and dispersal" (USDI 1995). The recovery plan and Forest Plan prohibit the harvest of trees greater than 9 in. DBH in PACs, unless the Forest Plan is amended and appropriate treatments to abate fire risk are implemented (USDI 1995, USDA 1987). The primary objective to be achieved by these guidelines and thinning within the Clark PAC is to protect the best available habitat for the Mexican spotted owl, while maintaining sufficient flexibility for land managers to abate high fire risks and to improve habitat conditions for the owl and its prey (USDI 1995). "The reason for the proposed management within PACs is to encourage a proactive approach to reduce fuel risks and simultaneously enhance prey habitat. If these objectives are achieved, existing owl habitat will be maintained and in some cases enhanced, while identified risks of catastrophic fire will be lessened (USDI 1995)."

The project objectives for thinning within the Clark PAC are consistent with the recovery plan, because treatments will enhance nesting, roosting and foraging habitat while reducing the risk of catastrophic fire to a portion of the PAC. The Recovery Plan states that "nesting/roosting stands exhibit certain identifiable features, including high tree basal area, large trees, multi-storied canopy, high canopy cover, and decadence in the form of downed logs and snags (Ganey and Dick 1995 *in* USDI 1995). In ponderosa pine forests these stands often contain a considerable Gambel oak component (USDI 1995). The Recovery Plan quantifies nesting and roosting habitat

components as target/threshold conditions. Table 34 displays the target/threshold condition, or conditions that are expected to occur for nesting and roosting in pine-oak habitat.

Table 34. Desired and existing target/threshold stand conditions for MSO nesting and roosting

Forest Type	Basal Area (ft^2/ac) of oak	% stand density of trees 12-18" DBH	% stand density of trees 18-24" DBH	% stand density of trees >24" DBH	Basal Area (ft^2/ac) of all trees	# Trees per acre >18" DBH
Desired Pine-Oak	20	15	15	15	150	20
Existing Clark PAC (stand 359-04)	13	41	15	5	156	13
Year 2026 Clark PAC (stand 359-04)	14	37	20	10	181	24

Under the Proposed Action, trees up to 16 inches DBH will be harvested within the Clark PAC. (see Table 10 in the "Vegetation" analysis section of this Chapter) displays basal area, trees per acre, canopy cover, and quadratic mean diameter under the Proposed Action and the No Action Alternative, in comparison to harvesting trees less than 9 in. DBH. The Proposed Action will have a direct effect on stand densities. Harvesting trees up to 16 in. DBH reduces the average basal area from 139 ft^2 per acre to less than 100 ft^2 per acre. The average canopy cover, as measured across the PAC rather than the group level, will decrease from 66% to 51%. The average quadratic mean diameter will increase from 9.5 to 11.3 in. after treatment due to the removal of smaller trees and the retainment of larger trees. In comparison, harvesting trees up to 9 in. DBH, as recommended by the Recovery Plan for the Mexican Spotted Owl, would have little direct effect on stand densities. Average basal area would decrease from 139 ft^2 per acre to 127 ft^2 per acre. Average canopy cover would decrease from 66% to 62%.

The Proposed Action would also have indirect effects on stand densities. Over the 40 years following treatment, lower stand densities and canopy covers will result in decreased competition between trees, decreased tree stress, and increased tree vigor, increased understory productivity and diversity, increased natural regeneration, a more uneven-aged stand structure, and a decreased risk of successful bark beetle attack and mortality. Trees will grow into larger VSS classes at a faster rate. Existing old trees will exhibit improved longevity due to decreased competition. The removal of pine around oak clumps will decrease competitive stress between trees and increase oak health, growth, vigor, and longevity. However, the beneficial effects of the Proposed Action will begin to decrease in 40 years. The crown canopy will close in 20 to 40 years and additional thinning is recommended to reopen the canopy, create openings for regeneration, decrease inter-tree competition, and stimulate understory production.

Though the majority of the Clark PAC is composed of pine-oak habitat, the condition of this habitat is not as good as those typically found in other MSO nesting and roosting habitats see Table 33. Stand 359-04 contains approximately 75% of the area to be treated within the Clark PAC and within the PAC most closely resembles target/threshold conditions. As shown in Table 33, this stand is deficit in the amount of oak, density of trees >24 in. DBH and the number of large trees per acre that are typically used for nesting and roosting by MSO. Treatments proposed

for the Clark PAC will increase the vigor and amount of oaks and large trees by reducing competition from pine less than 16 in. DBH and by opening the canopy above groups of oaks that are currently being suppressed. As displayed in Table 33, trees 12-18 in. DBH are abundant within stand 359-04, the majority of these trees are approximately 80 years old and less than 40 ft. tall. “Large trees” are generally considered >16-18 in. DBH and are tall >60 ft. Tree diameter in this stand does not necessarily correlate with the overall health or large trees in the stand. Many of these trees are “large” in diameter, but short and do not provide good nesting or roosting habitat. Thinning will improve the vigor and health of this stand, thereby creating better roost and nest habitat (see Table 34). Modeling predicts that the average tree height will increase by 5 ft. and the average diameter will increase over 2 in. twenty years after treatment.

The shorter trees in the foreground of Figure 14 (left photo) are approximately 25-35 ft. tall and <16 in. DBH. The taller trees in the background are approximately 45-60 ft. tall and are >16 in. DBH. The right photo was taken at the same sight as the left photo; trees less than 16 in. DBH, in the foreground, are flagged and represent trees that could be harvested. The largest tree in the foreground of the right photo, flagged, is 15.8 in. DBH and represents the largest tree that would be thinned from the PAC. Trees behind and to the left are greater than 16 in. DBH and will not be thinned (distance from the photographer makes them appear smaller). Thinning will maintain at least 50% canopy closure, create horizontal diversity, increase the vigor of oak and pine and reduce the risk of catastrophic fire.

Though the majority of the Clark PAC is composed of pine-oak habitat, the condition of this habitat is not as good as those typically found in other MSO nesting and roosting habitats (see Table 33). Stand 359-04 contains 90% of the area to be treated within the Clark PAC and within the PAC most closely resembles target/threshold conditions. As shown in Table 33, this stand is deficit in the amount of oak and the number of large trees per acre that are typically used for nesting and roosting by MSO. Treatments proposed for the Clark PAC will increase the vigor and amount of oaks and large trees by reducing competition from pine less than 16 in. DBH and by opening the canopy above groups of oaks that are currently being suppressed. As displayed in Table 33, trees 12-18 in. DBH are abundant within stand 359-04, the majority of these trees are approximately 80 years old and less than 40 ft. tall. “Large trees” are generally considered >16-18 in. DBH and are tall >60 ft. Tree diameter in this stand does not necessarily correlate with the overall health or large trees in the stand. Many of these trees are “large” in diameter, but short and do not provide good nesting or roosting habitat. Thinning will improve the vigor and health of this stand, thereby creating better roost and nest habitat (see Table 34). Modeling predicts that the average tree height will increase by 6 ft. and the average diameter will increase over 2 in. twenty years after treatment.

The shorter trees in the foreground of Figure 14 (left photo) are approximately 25-35 ft. tall and <16 in. DBH. The taller trees in the background are approximately 45-60 ft. tall and are >16 in. DBH. The right photo was taken at the same sight as the left photo; trees less than 16 in. DBH, in the foreground, are flagged and represent trees that could be harvested. The largest tree in the foreground of the right photo, flagged, is 15.8 in. DBH and represents the largest tree that would be thinned from the PAC. Trees behind and to the left are greater than 16 in. DBH and will not be thinned. Thinning will maintain at least 50% canopy cover at the PAC level, create horizontal diversity, increase the vigor of oak and pine and reduce the risk of catastrophic fire.

Figure 14. Stand 359-04 wide-angle shot (left) and close-up (right)

Within the Clark PAC, existing closed roads will be used for hauling logs. No new roads will be created and the existing roads will be rehabilitated and closed immediately after mechanical treatments are completed. Roads within the Clark PAC will not be open to the public and will be posted closed to public entry and barricaded during mechanical treatment.

Treatments in the Clark PAC will occur outside of the MSO breeding season and are expected to improve nesting and roosting conditions. Disturbance, prey and prey habitat affects as described above are expected to be short term and low intensity.

Approximately 1 mile of road 132K passes along and through the northern boundary of the Mustang PAC and is proposed as a haul route for the extreme southern part of the project. Some minor grading and spot fill will be needed to haul logs on this road. Breeding season restriction on road maintenance and hauling will be imposed within ½ mile of roosts and nests and within the PAC, as described above.

In order to eliminate road related impacts to the Hoxworth Springs riparian area and to provide legal access around Elk Park Meadows, a portion of road 132B would be improved and relocated. Approximately 0.80 miles of new road would be constructed west of the Elk Park Meadows subdivision to replace the portion of road 132B, which is located in the meadow bottom and is causing erosion resulting from the road location and OHV traffic. This portion of the meadow/drainage will be recontoured in order to restore the hydrological and biological function of the drainage and meadow. Additionally, a 0.75 mile segment of the 132B, north of Elk Park Meadows would be reconstructed to provide improved surface runoff and drainage, which will improve the hydrological and biological function of the drainage and meadow adjacent to the road.

None of these activities occur within MSO habitat, but may affect vole habitat, which is prey for the MSO. Voles live in the dry grassy meadows, normally adjacent to ponderosa pine, foraging

on plants, seeds and sometimes insects. Project activities may result in the mortality of voles and short-term disruption of vole habitat by recontouring meadow/drainages with heavy equipment. Seeding and improved hydrological function of the meadow/drainage is expected to occur within one year of project implementation and will result in improved habitat conditions and increase the amount of habitat available for voles. Currently the condition of vole habitat within the area to be treated is poor to marginal. The net effect to MSO is an increase in the amount of prey habitat and foraging opportunities. The short term loss of vole habitat is expected to be insignificant to the MSO and the vole population within the project area.

Critical Habitat: There are 2,195 acres of Critical Habitat within the Elk Park project area. Approximately 2,074 acres are proposed for mechanical harvesting/prescribed fire treatments and 121 acres are proposed for prescribed fire only. As stated above, none of the habitats will be treated so intensely that they will no longer meet the designations of protected or restricted habitats. Implementation of Alternative 2 may affect but is not expected to adversely affect critical habitat.

Cumulative Effects of Alternative 2

The area of analysis includes the project area plus a 1 mile buffer. Historical logging practices that emphasized large tree removal combined with the suppression of fire have resulted in the existing conditions. Currently, the greatest threat to Mexican spotted owl habitat is catastrophic wildfire. Wildlife forage on the entire project area. Only wildlife grazing occurs on 2,172 acres of the project; the remaining 4,714 acres are part of an existing allotment, but have not been grazed by livestock in over ten years, as these allotments are in a grass-bank or currently do not have the infrastructure for livestock. Grazing utilization standards are designed to maintain or improve forage condition across the allotment. In most areas these standards provide sufficient cover and forage for potential Mexican spotted owl prey.

The Mountainaire fuels reduction project is immediately west of this project and Lake Mary fuels reduction is to the north. The Lake Mary project did not treat MSO habitat or have effects to MSO, therefore there are no cumulative effects from this project. There are no PAC treatments in the Mountainaire project and MSO habitat treatments will not result in the loss of designated MSO habitat. The final determination of effects for MSO and its Critical Habitat was May Affect, Not Likely to Adversely Affect for the Mountainaire project.

Though development within the community of Elk Park Meadows is likely to continue, thinning and development on private lands will occur outside of MSO habitat and have no effect to MSO. Continued development and use within the community of Elk Park Meadows could result in increased recreational use of the area that may disturb roosting or nesting MSO.

Sensitive Wildlife Species

Sensitive species are defined as “those plant and animal species identified by a regional forester for which population viability is a concern, as evidenced by: (a) significant current or predicted downward trends in population numbers or density, or (b) significant current or predicted downward trends in habitat capability that would reduce a species’ existing distribution” (FSM 2670.5(19)). Forest Service policy regarding sensitive species is described in detail in the “Sensitive Plant Species” section of Chapter 3.

All species on the district’s threatened, endangered and sensitive species list were considered in this analysis. Of these, five sensitive animal species are present or have potential habitat within the project area and have been evaluated (see Table 35). Listing status refers to a species’ Forest Service designation as a sensitive species.

Table 35. Sensitive wildlife species on the Elk Park project area

Species Name	Scientific Name	Listing Status
Birds		
Northern goshawk	*Accipiter gentilis*	SEN
Amphibians		
Northern leopard frog	*Rana pipiens*	SEN
Insects		
Spotted skipperling	*Piruna polingii*	SEN
Mountain silverspot butterfly	*Speyeria nokomis nitocris*	SEN
Blue-black silverspot butterfly	*Speyeria nokomis nokomis*	SEN

Northern Goshawk

Data Sources: Goshawk surveys were completed for the project area in 2006 using Region Three protocols. During the survey no goshawks were seen or heard, however a new nesting pair was discovered during spotted owl surveys. The F. Thomas PFA was created around the new nest. BBS data (Sauer et al. 2005) for Arizona from 1966-2000 shows a significant ($p = 0.03$), positive population trend of 32.3% per year. The goshawk is listed as G5, N4, and S3 on the NatureServe (2002) database.

Most of the ponderosa pine, ponderosa pine/Gambel oak and mixed-conifer habitats on the forest have been surveyed according to approved protocols for the northern goshawk. Some surveys may have been conducted during non-breeding or low breeding years thereby reducing survey success rates. Additionally, much of the available habitat not associated with proposed projects (i.e. wilderness) has not been surveyed. Therefore, the number of goshawk territories is likely underestimated on the forest.

Goshawks are relatively abundant and widespread, and although population trends are difficult to determine, there is no hard evidence of a considerable decline overall, but populations could be declining in some areas (NatureServe 2002). On the Coconino National Forest, some northern goshawk territories have been monitored nearly every year since 1989, with an average of 43 territories monitored from 1991 to 2001. The occupancy rate of territories has declined over these last eleven years; however, this does not signify a corresponding trend in population numbers. This decrease in PFA occupancy could be an artifact of finding more nesting sites and establishing more PFAs, and then monitoring most if not all PFAs when the goshawks may be moving around and breeding in different areas in some years. It is likely that nonbreeding goshawks would not be observed. During the later years of this time period, precipitation amounts have been below average, which may have affected the density of prey species. Climate may very well play an important role in whether or not northern goshawks breed in a given year, and would also influence nesting success of northern goshawks.

Goshawk territories have been established based on the results of surveys. Some goshawk nesting areas were known prior to 1991, but survey efforts increased in the early 1990s. In 1987, 11 territories were known on the forest. Some level of monitoring has occurred since 1991

Occupied is defined as one goshawk sighting seen in a post-fledgling family area (PFA). Monitoring efforts to determine occupancy vary by PFA and by year. In most cases, occupancy was determined with two visits to previous nest stands within a PFA, one during the courtship period and one during the fledgling period, broadcasting goshawk vocalizations. For this strategy

the likelihood of detection would be high if goshawks had been breeding and using known nest sites/stands. Goshawks using unknown alternate nest locations may not have been detected resulting in an underestimation for rates of occupancy and breeding. In other cases the entire PFA was monitored using Southwestern Region protocol recommendations, thereby increasing the success rate of locating birds.

In 2001, there were 66 known goshawk territories on the Coconino National Forest. Of those territories, 57 produced young at least once from 1991-2001. Additionally, there are an unknown number of nonbreeding adults (males are 3 years old, and females are 4 years old, on average when first recruited into the breeding population) and juveniles. Therefore the total population for the forest may be larger than monitoring results indicate.

The 1982 population estimate for this species from the Analysis of the Management Situation (USDA 1982) was unknown. The document states that there was no population data for goshawks although the population trend in 1982 was thought to be decreasing. The 1990 joint management objective for the Coconino National Forest and the Arizona Game and Fish Department was to assess the status of the species and its habitat, and to work toward increasing habitat, populations, and/or distribution over time (USDA and AGFD 1990).

Data collected on the forest are not designed to detect changes in population trend. The goal of monitoring is to gain information of territory occupancy and reproduction. Total number of territories has increased and the statewide BBS data indicates a significant increase, but some indicators of occupancy and productivity appear to be declining on the forest, although year-to-year variability is high. At this time, the population status is considered to be inconclusive on the Coconino National Forest. Monitoring and surveys are ongoing.

Life History and Affected Habitat: Goshawks primarily eat small mammals and medium-sized birds such as squirrels, rabbits, woodpeckers, and jays (Reynolds et al. 1992).

The northern goshawk is a Forest Service Sensitive species. The 1987 Forest Plan emphasized even-aged management and horizontal vegetative diversity in the ponderosa pine type. In 1996, the Forest Plan was amended to shift from even-aged to uneven-aged forest management and vertical vegetative diversity. This amendment changed habitat management specifically for goshawks and Mexican spotted owls, and adjusted old-growth direction (USDA 1996). There is an ongoing shift in management with an increasing emphasis on ecosystem restoration.

This species is dependent on the forest’s ability to provide a continuous flow of habitat structural types over time, which provides for habitat characteristics for nesting and a wide variety of prey species. The Forest Plan was amended in 1996, in part, to provide guidelines for management of goshawk habitat. To develop this habitat, the Forest Plan provides general guidance on desired forest condition where 40% of the forested landscape is in large trees (greater than 18 in. DBH; VSS 5 and 6) in small patches scattered throughout the landscape. The remainder of the forested landscape should be 10% openings (grass-forb, shrub; VSS 1), 10% seedling-saplings (VSS 2), 20% young forest (VSS 3), and 20% mid-aged forest (VSS 4), again in groups, creating a mosaic of trees in various size (age) classes. These structural stages (VSS 1 through 6) are dynamic, continually growing from one stage to another and therefore constantly changing over time.

In addition to VSS guidelines, the current Forest Plan prescribes the following vegetation management objectives for the goshawk habitat found in the project area:

- Ponderosa pine habitat: Leave at least 2 snags and 3 logs/acre.
- Leave one group of reserve trees/acre (3-5/group) if opening is >1 acre.

The prey base for the goshawk also benefits from patches of forest that have an understory of herbaceous and shrub species. The Management Recommendations for the Northern Goshawk in the Southwestern United States (Reynolds et al. 1992) provides a detailed description of the desired forest conditions for the goshawk in the Southwest. According to the Forest Plan, goshawk guidelines apply to all forest and woodland habitat on the Coconino National Forest; however, within Mexican spotted owl protected and restricted areas, Mexican spotted owl guidelines take precedence.

Improving the age class distribution of ponderosa pine was a major goal of the original Forest Plan. Existing data at the time showed that the vast majority of the pine type was in the mid-seral stage, with a limited amount in older age classes. Vegetation management projects have been designed to improve this age class distribution, however, a combination of factors led to disproportionate harvest of trees in the older, larger, age classes, especially early in the implementation of the Forest Plan. About 20% of the ponderosa pine type outside of Wilderness areas has been treated since 1987, but the mid-seral stage continues to dominate forest structure (70% or more of the acres), and on average, pine forests have become denser. Although the emphasis has shifted from even-aged to uneven-aged management and forest restoration, few projects have been implemented with the new guidance relative to available habitats on the forest.

Since 1989, approximately 50,339 acres of land have burned in wildfires on the forest (M. Suida, database query). In the ponderosa pine cover type, approximately of 35,000 acres have burned since 1989, of which, about 16,000 acres were stand-replacing fires (F. Thomas, personal communication). This created early seral stage classes in a small (<3%) amount of the ponderosa pine, with some acres burned so severely that they will remain nonstocked for the foreseeable future.

The age class distribution of ponderosa pine has remained essentially the same, dominated by mid-seral stage stands. Some early seral-stage habitat has been created, mostly by wildfire. Natural regeneration of ponderosa pine is limited across the forest, but is better on limestone soils, which occur primarily on the southern half of the forest. Because this species is dependent on the forest's ability to provide a continuous flow of habitat structural types over time to provide nesting and foraging habitat, the habitat trend for goshawks should improve as vegetation management projects are implemented with the newer standards and guidelines. The activities proposed in this project will not change the overall amount of ponderosa pine cover types on the forest.

Environmental Consequences

This project proposes to thin ponderosa pine using a modified restoration model in order to mitigate the severity and intensity of a wildfire, should one occur, in the project area and to restore fire adapted ecosystems.

The following evaluation criteria were used to compare the environmental consequences for the action alternative:

- Breeding season restrictions on prescribed burning and mechanical treatments. The goshawk breeding season is March 1 to September 30.
- No roads are proposed within the PFA.
- Prescribed burning and thinning will maintain at least 2 snags and 3 logs per acre.

Direct, Indirect and Cumulative Effects of Alternative 1

Under the No Action alternative, current management plans would continue to guide management of the project area. There would be no direct effects from thinning, burning, or road management. The potential for adverse effects associated with a catastrophic wildfire would remain the same and likely increase through time. If a wildfire were to occur, nesting, foraging and roosting habitat could be destroyed.

Direct and Indirect Effects of Alternative 2

It is estimated that there may be up to 20% loss of snags and 50% loss of downed logs during broadcast burning (Randall-Parker and Miller 2000) although many will be protected using appropriate ignition and piling techniques, and lining of most snags and large logs. In addition, just before burning, trees may be felled as turkey nesting structures and will replace logs burned up during prescribed fire to meet forest plan guidelines. Felling trees just before they are prescribed burned will ensure their longevity. These trees will be too green to burn and will only be scorched by fire increasing their resistance to fire and ensuring their longevity.

Reduction of snags and logs would have a negative impact on numbers of prey for northern goshawk. The impact of this effect is expected to lessen in the short-term as turkey nesting logs and snags fall and become logs, increasing the amount of prey habitat. The number of snags is expected to increase in the future as other trees grow, age, and die. Under this alternative, the fire hazard potential within the PFAs and foraging areas is reduced.

Alternative 2 will maintain canopy cover values, where existing, as identified in desired conditions in both foraging areas and PFAs. The F. Thomas PFA will maintain an average 50% canopy cover and nest sites will maintain a 60% canopy cover where existing.

By taking into account the variability of the groups and clumps within a stand, the Elk Park project will meet the Forest Plan general guidance for forest conditions where 40% of the forested landscape is in large trees and the remainder is in young and mid-aged forests. Point data, rather than stand data, was analyzed to better describe within stand variability and to determine how well treatments would meet the desired VSS distribution for goshawks (see Table 36). Point data was used as a proxy for groups/clumps, which represent small patches of forest scattered throughout the landscape.

The analysis summary in Table 36 shows less than the desired 20% distribution of VSS 3 and 6 immediately after treatments. However, the project area would be closer to attaining the desired distribution of forest structure. After forty years, the amount of large (VSS-6) trees is actually predicted to exceed the desired forest distribution.

Table 36. Desired and estimated VSS distribution

	VSS-1&2 (0-5" DBH)	VSS-3 (5-12" DBH)	VSS-4 (12-18" DBH)	VSS-5 (18-24" DBH)	VSS-6 (>24" DBH)
Desired % of Landscape (+/- 3%)	20%	20%	20%	20%	20%
Existing Condition	6%	34%	38%	16%	6%
Immediately after treatment	21%	18%	27%	22%	12%
40 Years after treatment	20%	22%	14%	21%	23%

Prescribed burning would not be allowed within the F. Thomas PFA during the goshawk breeding season of March 1 to September 30. Smoke from prescribed and maintenance burning may impact individual foraging goshawk but those effects are expected to be of short duration and low intensity. The majority of prescribed burning occurs in the fall. The only known goshawk nest within the project is on the southwest edge of the project area and prescribed burning outside of the PFA is unlikely to occur during the breeding season for goshawk, March 1 to September 30. If burning occurs during the breeding season the prevailing winds for the project area are out of the southwest and will blow smoke away from the nest, though burning during the nesting season would be rare it may occur in September.

A noise study on goshawks conducted by Grubb et al. (1998) found that logging trucks did not elicit a discernible response when they passed within 500 meters (1,642 ft) of active nests. Noise from mechanical treatments are not likely to affect nesting goshawks, because timing restriction will restrict mechanical treatments within 1/3 mile of active nests or within the PFA. Noise from mechanical treatments may impact foraging goshawks.

Cumulative Effects of Alternative 2

The area of analysis includes the project area plus a 1 mile buffer.

Part of the Seruchos and Newman Canyon PFAs are within the cumulative effects boundary. The proposed haul routes do not pass within ½ mile of either PFA, and both are down wind of the project area and are not expected to be affected by smoke from prescribed fire within the project area. The Mountainaire Fuels Reduction project is adjacent to the project area and includes thinning and burning treatments within a small portion of the Seruchos PFA. The BAE for Sensitive Species for the Mountainaire project determined that project activities may impact individuals, but is not likely to result in a trend toward federal listing or loss of viability, the affects of the Elk Park project are not expected to contribute to the loss of viability or towards federal listing.

The Flagstaff community is expected to continue attracting recreational visitors to the forest that may disturb goshawks. Growth within the current boundary of the community are expected to increase and contribute to that potential disturbance.

Determination: Given the above model results for habitat quality, the proposed activities for the Elk Park Fuels Reduction and Forest Health project are not expected to negatively contribute to forest population trends. The potential for recreational disturbance from the Flagstaff community is expected to continue. The action alternative for this project may impact individuals, but is not likely to result in a trend toward federal listing or loss of viability.

Northern Leopard Frog

Data Sources: The Northern leopard frog occurs in the northeastern and north central quarters of Arizona, usually in montane streams and wetlands that have aquatic vegetation but also in wet meadows at higher elevations. In Arizona, *R. pipiens* has been found in the lakes, earthen tanks, springs, creeks, and rivers of the Colorado Plateau in the northeast portion of the state. During these surveys, Arizona Game and Fish biologists visited 477 localities and conducted 566 surveys within the Arizona range of this frog, and found it at 8% of the historical localities visited. Although Arizona Game and Fish biologists found 29 new sites of occurrence, few of these populations are large. Within Arizona, there are probably fewer than five metapopulations, many of which are small.

The northern leopard frog is known primarily from the Beaver Creek, Mogollon, Peaks and Mormon Lake Ranger Districts (AZGFD 1994). This leopard frog is generally restricted to permanent waters. There are no known existing locations of this species within the project area, though potential habitat exists at Hoxworth Springs. Nearby historic locations include Upper and Lower Lake Mary and Marshall Lake. Upper Lake Mary has a sizeable crayfish population, which is detrimental to leopard frogs. Lower Lake Mary has experienced drastic fluctuations in water levels and is currently little more than a pond.

Life History and Affected Habitat: This highly aquatic amphibian exists chiefly in mixed oak/pine and pine forest. All leopard frogs are highly aquatic and are almost always associated with permanent water sources, preferably with emergent and submergent aquatic vegetation (Sredl 1992; Stebbins 1985; Schwalbe 1988). Because of dams, diversions, groundwater pumping, and introductions of non-native organisms that have significantly altered riparian areas, stock tanks have become very important habitats for this species, there are no stock tanks in the project area. Sredl et al. (1995) did not present any local habitat descriptions for this species other than to say that leopard frogs have been recorded on the forest in lakes, springs, stock tanks, streams and rivers. However, some bank vegetation and aquatic plants are common elements associated with perennial waters where leopard frogs are found on the Coconino. These components provide cover for adults, tadpoles, and eggs, as well as habitat for insect prey.

Leopard frogs as a group are habitat generalists that can adapt to a variety of wetland situations. Therefore, potential habitat for this species can include those aquatic systems (within the historic range of the frog) that are damaged or degraded from natural perturbations or chronic stressors (such as improper livestock grazing) but have the appropriate hydrological and ecological components, which are capable of being restored to suitable habitat. Aquatic habitats may become unsuitable for leopard frogs due to increased amounts of sediments, longer or more frequent periods of intermittency, reduced flows, dewatering of ponds, bank chiseling or the presence of nonnative predators. Habitats likely to be occupied include:

1) Currently suitable habitat where the frog has been documented within the last 10 years, but is apparently now absent or

2) Suitable habitat that is

(a) Within 1 mi overland of occupied habitat,

(b) Within 3 mi along an ephemeral or intermittent drainage from occupied habitat, or

(c) Within 5 mi along a perennial stream from occupied habitat.

Leopard frogs in Arizona have been in decline for at least the past decade. Several possible explanations have been offered for this decline, but a definitive answer has yet to be found. Factors that have been implicated include acid rain and air pollution (Windes 1990), increased U-V radiation (Blaustein et al. 1994), competition from exotic predators such as bullfrogs (Hayes and Jennings 1986), crayfish and predatory fish (Sredl and Howland 1994), overgrazing of riparian and adjacent areas (Clarkson and Rorabaugh 1989; Windes 1990), and water manipulation resulting in habitat fragmentation and degradation (Sredl and Howland 1994; Lind et al. 1996). In addition, chytrid *Batrachochytrium dendrobatidis* has been implicated as a potential cause of amphibian declines (Berger et al. 1998). Chytrid fungus is an additional stressor, resulting in periodic die-offs that increase the likelihood of extirpation and extinction (USDI 2002).

On the Coconino northern leopard frog habitat may overlap with Chiricahua leopard frog habitat below about 6000 ft. Threats to local populations of northern leopard frogs include changes in wetlands, especially the alteration of marshy ponds to reservoirs and natural local extinctions as ponds dry up during years of low precipitation. Other threats include stocking of predatory fish, alteration of riparian vegetation by crayfish and livestock grazing, and predation and competition by introduced bullfrogs and crayfish.

Environmental Consequences

The following evaluation criteria were used to compare the environmental consequences for the action alternative:

- No documented reports of this species in the project area.
- Habitat and perennial waters will not be altered or disturbed by mechanized equipment.
- Treatments will utilize Best Management Practices (BMP).

Direct, Indirect and Cumulative Effects of Alternative 1

Under the No Action alternative, current management plans would continue to guide management of the project area. There would be no direct effects from thinning, burning, or road management. The potential for adverse effects associated with a catastrophic wildfire would remain the same and likely increase through time. If a wildfire were to occur excessive erosion could affect down stream habitat.

Direct and Indirect Effects of Alternative 2

Prescribed burning is conducted within a prescription that is designed to reduce the intensity and severity over a wildfire. During prescribed fires there is normally enough debris left to slow runoff and reduce sediment flows that could result in increased sedimentation or turbidity. Thinning treatments proposed for these alternatives may increase the available water to springs and tanks, but will not be measurable.

Cumulative Effects of Alternative 2

The area considered for cumulative effects is a one mile buffer around the project area. Continued drought and growth within the Flagstaff urban area may impact ground water and spring levels within the project area. The continued implementation of the Mountainaire project is not likely to have an impact to leopard frogs within the analysis area. Habitat will continue to be influenced by

recreation, domestic and wild ungulates, crayfish and potentially other exotic or nonnative animal species

Determination: Based on the above discussion, implementation of Alternative 2 will have no impact on the species.

Mountain Silverspot Butterfly, Blue-black Silverspot Butterfly, and Spotted Skipperling

Data Sources: Within the project area the best potential habitat for the mountain silverspots and spotted skipperling is Hoxworth Springs. The habitat of the spotted skipperling consists of moist meadows and streamside in low to mid elevation mountains (Opler and Wright 1999, Pyle 1981, Wallesz 1999). There are no perennial streams within the project area. There is approximately one acre of moist meadows/grassy spring within the project area. Although little information is available concerning the specific threats to these species, habitat alteration and loss of riparian habitat are the primary concerns.

Life History and Affected Habitat: Scattered populations of these species occur throughout the southwest in wet meadows, grassy springs in mountainous woody areas, seeps, or riparian canyons. Habitat is the upper Sonoran to Canadian zone (Scott 1986). Violets are larval host plants for the silverspot butterflies however the blue black silverspot is more associated with desert landscapes. The spotted skipperling, in southeast Arizona, has been known to take nectar avidly along cool, deep canyons and along forested road margins. *Dactylis glomerata* (Poaceae) is a strongly suspected food plant. There is a single rainy season brood. It is known to occur along the Mogollon Rim (Bailowitz and Brock 1991). These three species were added to the Regional Forester's Sensitive species list in 1999. Egg and larval timeframes for these species are not known.

Environmental Consequences

The following evaluation criteria were used to compare the environmental consequences for the action alternative:

- Affected habitat within the project area.

Direct, Indirect and Cumulative Effects of Alternative 1

Under the No Action alternative, current management plans would continue to guide management of the project area. There would be no direct effects from thinning, burning, or road management. The potential for adverse effects associated with a catastrophic wildfire would remain the same and likely increase through time. If a wildfire were to habitat could be destroyed.

Direct and Indirect Effects of Alternative 2

Only prescribed burning is proposed for the potential habitat of these species (Hoxworth Spring). Prescribed burning in moist meadows is normally unsuccessful and extremely spotty. Prescribed burning may result in short term low intensity effects to these species. Prescribed fire may damage habitat for these species in the short term but actually stimulate the habitat in the long term. Mechanical treatments are not proposed for this species habitat.

Cumulative Effects of Alternative 2

The area within a one mile radius of the project area will be considered for cumulative effects. Habitat for these species primarily occurs in the springs located at Babbitt Springs and Lake No 1. Mechanical treatments are not proposed in these habitats so there are no cumulative effects

associated with mechanical treatments. Prescribed fire may occur adjacent to Lake No 1, effects to habitat will be short term and of low intensity. The Mountainaire determination of affect for these species was may impact individuals but is not likely to cause a trend toward federal listing or loss of viability.

Continued drought and grazing may result in habitats becoming drier and a loss of larval hosts. Additionally, wild ungulates and unregulated OHV use may destroy habitat, however cross-country use of OHVs is expected to cease by 2009 with the implementation of the national Travel Management Rule.

Determination: Based on the above discussion I find that implementation of Alternative 2 may impact individuals, but is not likely to result in a trend toward federal listing or loss of viability.

Management Indicator Species

Management guidance for management indicator species (MIS), other wildlife and fish resources, and diversity of plant and animal populations, is found in several key documents. The 1982 National Forest Management Act Regulations (planning regulations) at 36 CFR 219 set forth a process for developing, adopting, and revising land and resource management plans for the National Forest System (36 CFR 219.1) and identifies requirements for integrating fish and wildlife resources in forest land management plans (36 CFR 219.13).

The Forest planning regulations were amended on January 5, 2005 (70 Fed. Reg.1023). The Department of Agriculture issued a final rule to remove the 2000 planning regulations at 36 CFR 219 (a) in their entirety. Regulation 36 CFR 219.14(f) provides clarification and the forests' MIS obligations. For forests, like the Coconino, that developed their forest plan under the 1982 NFMA regulations, the responsible official may comply with any obligations relating to MIS by considering data and analysis relating to habitat unless the plan specifically requires population monitoring or population surveys. On the Coconino, population data is required for elk, mule deer, pronghorn and turkey. The appropriate scale for MIS monitoring is the area covered by the forest plan, 36 CFR 219.14 (f). The new planning regulations are intended to provide flexibility for MIS monitoring, which will allow for monitoring of habitat conditions as a surrogate for population trend data. In 36 CFR 219.14, it clarifies that MIS monitoring is appropriate at the times and places appropriate to the specific species and is not required within individual project or activity areas (70 Fed. Reg. 1021-1091).

Within the project area, there are five management areas (MA), as described in Chapter 1. A total of ten MIS species are associated with these MAs, however only seven were analyzed for this project (Table 37). The effects of project activities on Mexican spotted owl, red squirrel and mule deer were not analyzed because the specific habitat component within the MA they were chosen to represent are not present within the project area (see Table 38).

The discussion of environmental effects to MIS is organized by species rather than by management area. The MIS status of northern goshawk is independent of its sensitive species status. Therefore, potential impacts to habitat and trend for this species is included in the MIS section.

The "Management Indicator Species Status Report for the Coconino National Forest" (USDA 2002) is a working draft assessment of MIS on the Coconino National Forest. This report is used extensively to summarize population and habitat trends for MIS analyzed in this EA.

Table 37. Management indicator species analyzed for the Elk Park project

Species	Representative Habitat Component	Management Area	Monitoring Requirement*
Turkey	Late seral ponderosa pine	3, 4	Population
Goshawk	Late seral ponderosa pine	3, 4	Habitat
Pygmy nuthatch	Late seral ponderosa pine	3, 4	Habitat
Elk	Early seral ponderosa pine; mixed conifer and spruce-fir	3, 4, 6, 9	Population
Abert squirrel	Early seral ponderosa pine	3, 4, 6	Habitat
Hairy woodpecker	Snag component of ponderosa pine; mixed conifer and spruce-fir	3, 4, 6	Habitat
Pronghorn antelope	Early and late seral grasslands	9	Population

*Coconino Forest Plan, Table 14, pp. 211-214

Table 38. Management indicator species not analyzed

Species	Representative Habitat Component	Management Area
Mexican spotted owl	Late Seral Mixed Conifer, Spruce Fir	3, 4
Red squirrel	Late Seral Mixed Conifer, Spruce Fir	3, 4
Mule deer	Early Seral Aspen and Pinyon-Juniper	6

The “Habitat Quality Index Model” (version 190), developed by the Southwestern Region, was used to evaluate the present habitat quality of the project area for pre-treatment and the anticipated post-treatment habitat quality for each alternative. The idea behind the Habitat Quality Index model is that for a particular habitat type, ponderosa pine, mixed-conifer, desert grassland, etc., per season has a certain value for cover and for forage. Consequently, a cover and a forage value can be assigned to a habitat type per season. These values are called habitat quality indices (HQI). It is important to understand that these indices are not absolute “truth” values but should be interpreted as relative values for comparing differences between management alternatives, differences between time periods, or differences between landscapes.

Turkey

Turkey is an indicator species for late seral ponderosa pine. In Arizona the turkey is found scattered throughout the State in most areas where ponderosa pine occurs. Turkey are widespread in game management unit (GMU) 6A, which includes the project area. Turkey are known to breed, forage and roost within the project area. Roost trees have been identified and will not be cut during project implementation.

Key habitat attributes include: availability of roost trees in summer and winter range which consist of groups of large yellow pines; uneven-aged overstory structure; nesting areas; mast from ponderosa pine, pinyon pine, juniper and oak; riparian areas around springs and seeps, and small openings for seedhead and invertebrate production. Mast production is vital to how well turkeys overwinter, which is tied to the amount and timing of precipitation.

Habitat Trend: The age class distribution of ponderosa pine has remained essentially the same since 1987; dominated by mid-seral stage stands, with some loss of old-growth and older trees.

The loss of older trees was mainly concentrated on slopes less than 40% which were accessible to logging before the 1990s. During this time period, trees established from good seed crops from the early 1900s aged and their contribution to overall mast production increased, even though overall abundance of older trees was reduced. Roost, nesting and brood areas on slopes greater than 40% has remained stable and relatively unchanged during this time.

Population Trend: Although late seral ponderosa pine habitat has declined some since Forest Plan implementation, and turkey population trends in the early 1990s probably declined, the most recent population data shows that populations are increasing (USDA 2002).

Environmental Consequences

The following evaluation criteria were used to compare the environmental consequences for the proposed action.

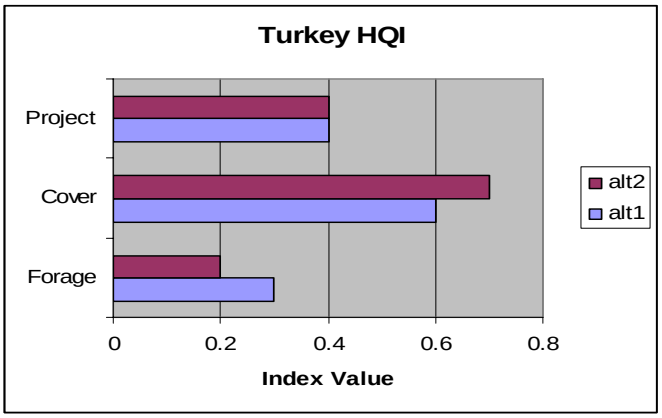
- Roost trees
- Nesting habitat
- Disturbance
- Mast production
- Habitat Quality Index (HQI) modeling

Direct, Indirect and Cumulative Effects of Alternative 1

Under the No Action alternative, current management plans would continue to guide management of the project area. There would be no direct effects from thinning, burning, or road management. The potential for adverse effects associated with a catastrophic wildfire would remain the same and likely increase through time. If a wildfire were to occur, nesting, foraging and roosting habitat could be destroyed.

Alternative 1 represents the existing habitat conditions for turkey. The results of HQI modeling are displayed in Figure 15. The overall existing habitat quality for the project is 0.4, which roughly translates to moderate to poor overall conditions for turkey.

Figure 15. Comparison of alternatives for turkey habitat quality



Direct and Indirect Effects of Alternative 2

HQI modeling predicts that the overall habitat quality for turkey will not change. Modeling indicates a slight decrease in forage and a slight increase in available cover after treatment. The net effect, results in no change to the overall habitat quality for turkey.

Vegetation modification treatments improve vegetative structural stage diversity of ponderosa pine trees. Thinning treatments promote development of larger, mature trees, which in turn promote development of roost tree groups for turkeys. Existing large “yellow pines” suitable for roosting or identified as roosts will not be cut. Long-term modeling shows an increase in turkey roosting habitat as trees grow into the larger size classes.

As part of the project design features (see Chapter 2), heavy fuel loading at the base of known roost trees will be removed prior to broadcast burning in order to prevent unnecessary mortality of roost trees. Additionally slash piles will not be located within the drip line of known roost trees. Burning techniques will minimize heat effects to the feeder roots and cambiums of mature trees. These design features will protect roost trees from potential damaging effects from fire and heat. Thinning and broadcast burning activities will not occur from April 15 through June 30 in identified nesting areas to avoid any disturbance to nesting and brooding turkeys.

The Standards and Guidelines for the Coconino National Forest Plan describe management practices for turkey nesting and roosts on page 126. Alternative 2 will adhere to these Standards and Guidelines by:

- Deferring timber harvesting and slash treatment activities in turkey nesting areas from April 15 through June 30.
- Creating nesting structures within ½ mile of dependable water in actual or potential turkey nesting areas.
- Retain and/or develop an average of at least two turkey roost tree groups per section, in actual or potential turkey habitats.
- Retain and/or develop an average of at least four turkey roost tree groups per section in identified key turkey winter range.

Timber harvesting and slash treatment within turkey nesting areas will be limited to July 1 through April 14. Alternative 2 differs from Forest Plan guidelines on how turkey nesting structures are created. Guidelines in the Forest Plan propose patches of untreated slash, 0.25 acre in size, to facilitate turkey nesting. Untreated slash increases the intensity and severity of a wildfire. Burning “red slash” moves a fire into the overstory increasing the potential for a crown fire, which results in greater spotting distances and soil sterilization. Untreated “red slash” will increase flame lengths and increase the rate of spread should a wildfire occur in the project area. For the above reasons, leaving untreated slash within the project area will not meet the Purpose and Need for Action. Additionally, slash provides only temporary nesting habitat for turkey. Slash typically “melts away” within five years, and no longer provides nesting habitat for turkey. Alternative 2 proposes to replace slash, as suggested in the forest plan, with 2-3 logs, 12 in. or greater diameter mid point, arranged perpendicular to each other. These logs will provide nesting and loafing habitat much longer than slash. These logs will be positioned, with direction from the District Biologist, during thinning activities and then scorched with fire while they are still green. This will help ensure there longevity. Maintenance burning will take precautions to prevent there destruction. These log structures will be tagged with metal wildlife signs.

Prescribed burning will occur outside of the turkey nesting season of April 15 through June 30. Effect of prescribed burning may result in additional disturbance during prescribed fire

preparation and ignition. In the short term smoke may irritate turkey but is not likely to result in any long term damage. Since burning normally occurs in the fall and winter months, burning will reduce residual mast and forage species during their dormant periods, but increases in the growth of mast producing species is likely during the spring and summer growing season following a prescribed burn.

Treatments proposed in Alternative 2 should benefit turkey because:

- Roost trees and large “yellow pines” suitable for roosting will be retained.
- Nesting habitat will increase by creating nesting structures within 0.25 mile of water.
- Oak trees will not be targeted for treatment, and residual pines and oaks should benefit from reduced competition resulting in greater mast production.
- Springs within the project area are not proposed for treatment.
- The creation of small openings and interspaces resulting from group and clump creation.

Cumulative Effects of Alternative 2

The area of analysis includes the area that is bounded by buffering the analysis area by 1 mile. Historical silvicultural practices that emphasized large tree removal combined with the suppression of fire have resulted in the existing conditions. Currently, the greatest threat to turkey habitat is catastrophic fire. Livestock and wildlife grazing occurs throughout the analysis area. Grazing utilization standards are designed to maintain or improve forage condition across the allotments. In most areas these standards provide sufficient cover and forage for Turkey. Though development within the community of Elk Park will likely continue, thinning on private lands will have little additional effect to turkey. Thinning and fuels reduction projects within the pine type area of analysis include Lake Mary and Mountainaire. These thinning and burning project will likely result in positive effects to turkey by increasing mast and facilitating tree growth. Activities resulting from these projects include prescribed fire and/or mechanical treatments, which may result in short-term disturbance and impacts (as described above) from smoke.

The appropriate scale for MIS monitoring is the area covered by the Forest Plan, 36 CFR 219.14 (f). The Forest Plan requires population trend monitoring for turkey. Based on the discussion above Alternative 2 is not expected to change the forest population trend for turkey.

Turkey is a management indicator of late seral ponderosa pine habitat which occurs in Management Areas 3 and 4. There are approximately 67,524 acres of late seral ponderosa pine habitat on the forest and 2,500 acres within the cumulative effects area. The Elk Park Fuels Reduction and Forest Health Project may contain approximately 3.7% of the forests’ turkey indicator habitat. Implementation of Alternative 2 is not expected to change the forest habitat trend for turkey.

Northern Goshawk

The northern goshawk is an indicator species for late seral ponderosa pine habitat. The MIS status of northern goshawks is independent of its sensitive status. Therefore, impacts to potential habitat and population trends for northern goshawk are described here. See the “Sensitive Wildlife Species” section of this chapter for additional discussion of northern goshawk distribution, forest populations and life history.

Population Trend: The forest-wide population trend is inconclusive. Although the forest has some information on territory occupancy and reproduction, these data are not designed to detect

changes in population trend. The total number of territories has increased and statewide breeding bird survey data indicates a significant increase, but some indicators of occupancy and productivity appear to be declining on the forest (USDA 2002).

Habitat Trend: The forest-wide habitat trend for late-seral ponderosa pine has declined. The age class distribution of ponderosa pine has remained essentially the same, dominated by mid-seral stage stands, with some loss of old-growth and some early seral-stage habitat created by wildfire (USDA 2002).

Environmental Consequences

The following evaluation criteria were used to compare the environmental consequences for the proposed action.

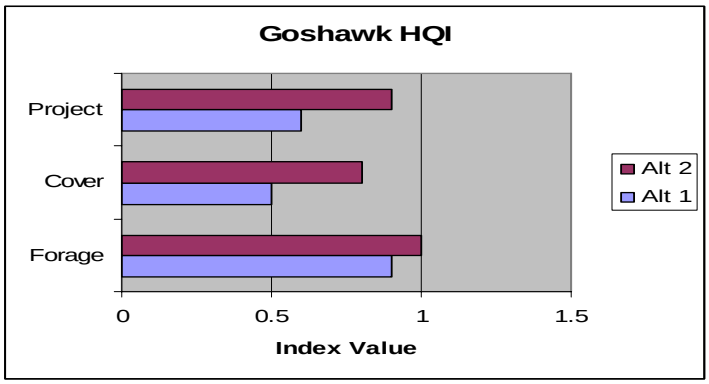
- HQI Modeling
- The analysis and determination of affect for goshawk in the Sensitive Species section above.

Direct, Indirect and Cumulative Effects of Alternative 1

Under the No Action alternative, current management plans would continue to guide management of the project area. There would be no direct effects from thinning, burning, or road management. The potential for adverse effects associated with a catastrophic wildfire would remain the same and likely increase through time. If a wildfire were to occur nesting and roosting habitat could be destroyed.

Alternative 1 represents the existing habitat conditions for goshawk. The results of HQI modeling are displayed in Figure 16. The overall habitat quality for the project is 0.6, which roughly translates to moderate to good overall habitat conditions for goshawk.

Figure 16. Comparison of alternatives for goshawk habitat quality



Direct and Indirect Effects of Alternative 2

HQI modeling suggests that the overall habitat quality for goshawk will improve with implementation of Alternative 2. Modeling indicates a slight increase in forage and a three point increase in the quality of cover after treatment. The net effect, results in a four point increase in the overall habitat quality after implementation of Alternative 2.

Cumulative Effects of Alternative 2

The area of analysis includes the area that is bounded by buffering the analysis area by 1 mile. Historical silvicultural practices that emphasized large tree removal combined with the suppression of fire have resulted in the existing conditions. Currently, the greatest threat to goshawk habitat is catastrophic fire. Livestock and wildlife grazing occurs throughout the analysis area. Grazing utilization standards are designed to maintain or improve forage condition across the allotments. In most areas these standards provide sufficient cover and forage for goshawk prey. Though development within the community of Elk Park will likely continue, thinning on private lands will have little additional effect to goshawk. Thinning and fuels reduction projects within the pine type area of analysis include Lake Mary and Mountainaire. These thinning and burning project will likely result in positive effects to goshawk by: increasing mast for prey, creating an uneven-aged forest structure, and facilitating faster tree growth and health. Activities resulting from these projects include prescribed fire and/or mechanical treatments, which may result in short-term disturbance and impacts (as described above) from smoke.

The appropriate scale for MIS monitoring is the area covered by the Forest Plan, 36 CFR 219.14 (f). The Forest Plan requires habitat trend monitoring for goshawk. Goshawk is a management indicator of late seral ponderosa pine habitat which occurs in Management Areas 3 and 4. There are approximately 67,524 acres of late seral ponderosa pine habitat on the forest and 2,500 acres within the cumulative effects area. The Elk Park Fuels Reduction and Forest Health Project may contain approximately 3.7% of the forests' goshawk indicator habitat. Implementation of Alternative 2 is not expected to change the forest habitat trend for goshawk.

Based on the discussion above Alternative 2 is not expected to change the forest population trend for goshawk.

Pygmy Nuthatches

The pygmy nuthatch is an indicator species for late-seral ponderosa pine habitat. In Arizona the pygmy nuthatch is commonly found above the Mogollon Rim and on the sky islands of the southern deserts in ponderosa pine habitats.

The Arizona Partners in Flight Prioritization Ranking for the pygmy nuthatch is 21, based on intermediate distributions and moderate threats on the breeding and wintering ranges. Birds with scores of 20 or higher were selected initially for consideration as priority species; however, the pygmy nuthatch was not selected as a habitat representative (Latta et al. 1999).

The pygmy nuthatch is generally associated with mature ponderosa pine forest, where it prefers open, park-like stands of yellow pines. It is also found in dense pine forest, as long as large trees and snags are present. This nuthatch requires dead trees or dead-top trees where it builds nests in cavities. Pygmy nuthatches usually excavate their own nest cavities near the top of the snag, where the wood is well rotted, or in the underside of a dead branch about 5 to 60 ft. above the ground. It occasionally nests in aspen snags.

This nuthatch searches for food in the tops of pine trees for insects and conifer seeds. Its diet consists of about 80% insects and spiders (DeGraaf et al. 1991 *in* USDA 2002). In winter, groups of these birds roost communally in tree or snag cavities, an adaptation that provides added protection from cold weather.

Habitat Trend: The pygmy nuthatch is tied to old ponderosa pine within younger stands, stands of old growth ponderosa, old large oak trees and cavities. All of these habitat characteristics probably declined during the Forest Plan implementation period.

Old ponderosa pines were selected for harvest far out of proportion to their abundance on the landscape, especially early in the Forest Plan implementation period. In the latter half of the implementation period, harvest of old ponderosa pine has been reduced. However, Miller and Benedict (1994 *in* USDA 2002) predict that not enough large trees remain on the great majority of the landscape to provide recruitment snags for maintaining cavity nesting birds in the future.

Overall, snags in the ponderosa pine type on the forest are being lost faster than they are being replaced, and large snags are lost at a disproportionate rate to small snags, resulting in a downward trend. Enforcement efforts have not been effective enough to slow the firewood theft of old oaks and large pine snags, which is a major cause of their decline.

Population Trend: Despite concerns about habitat trends for pygmy nuthatches, especially future trends for snag recruitment, data from the Coconino National Forest, as well as statewide data, indicate that pygmy nuthatch populations are stable on a gross, long-range scale. Dramatic population fluctuations occur on a short-term scale i.e. 1 to 3 years (USDA 2002).

Environmental Consequences

Snags and large trees >24 in. DBH, as well as “yellow pines” occurring in pine/oak habitats are not proposed for treatment in this project.

The following evaluation criteria were used to compare the environmental consequences for the proposed action.

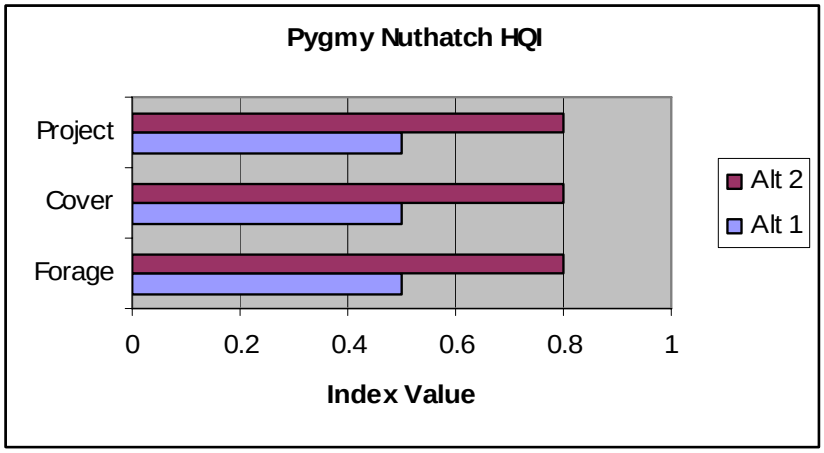
- Habitat Quality Index modeling

Direct, Indirect and Cumulative Effects of Alternative 1

Under the No Action alternative, current management plans would continue to guide management of the project area. There would be no direct effects from thinning, burning, or road management. The potential for adverse effects associated with a catastrophic wildfire would remain the same and likely increase through time. If a wildfire were to occur, nesting, foraging and roosting habitat could be destroyed.

Alternative 1 represents the existing conditions for the project area. The HQI rating for Alternative 1 is 0.5 (medium quality) for habitat across the project. Figure 17 is a comparison of the HQI ratings for each alternative.

Figure 17. Comparison of alternatives for pygmy nuthatch habitat quality



Direct and Indirect Effects of Alternative 2

The treatments proposed in Alternative 2 should positively affect nuthatch habitat within the project area. The HQI value for year-round forage and cover are three points greater than Alternative 1, the existing condition. This means that the activities proposed in the action alternative may increase forage, cover and overall habitat values for pygmy nuthatch. Overall, implementation of Alternative 2 will move the project area from moderate to good habitat for pygmy nuthatch.

Prescribed burning activities may directly affect nuthatch by disturbing them during prescribed burning activities or from intense smoke. These effects are expected to be of short duration and low intensity and will not affect the current population or habitat trends for pygmy nuthatch.

Cumulative Effects of Alternative 2

The area considered for cumulative effects is a one mile buffer of the project area. The Mountainaire and Lake Mary Fuels Reduction projects are adjacent to the project area and include thinning and burning treatments. The effects of the activities proposed for these projects are similar to those proposed of the Elk Park project and cumulatively are not expected to affect the current forest or population trends for the pygmy nuthatch.

The appropriate scale for MIS monitoring is the area covered by the Forest Plan, 36 CFR 219.14 (f). The Forest Plan requires habitat trend monitoring for pygmy nuthatch. Pygmy nuthatch is a management indicator of late seral ponderosa pine habitat which occurs in Management Areas 3 and 4. There are approximately 67,524 acres of late seral ponderosa pine habitat on the forest and 2,500 acres within the cumulative effects area. The Elk Park Fuels Reduction and Forest Health Project may contain approximately 3.7% of the forests' pygmy nuthatch indicator habitat. Implementation of Alternative 2 is not expected to change the forest habitat trend for pygmy nuthatch.

Based on the discussion above, Alternative 2 is not expected to change the forest population trend for pygmy nuthatch.

Elk

Elk was selected as a big-game indicator species for early-seral stage ponderosa pine, mixed-conifer and spruce-fir habitat types. In Arizona, the elk occupy many habitats above the Mogollon Rim, primarily in the ponderosa pine and mixed conifer habitat types. Elk are found throughout the project area nearly year round (hence the local name of the area, Elk Park). During periods of deep snow, elk leave the project area for mild winter habitats to the south and east.

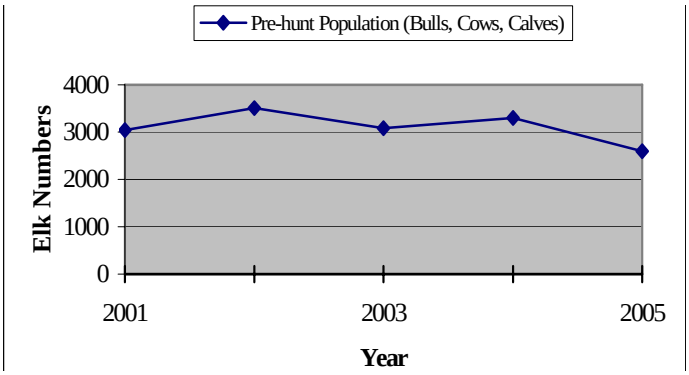
Habitat Trend: Early in Forest Plan implementation, elk showed a positive response to habitat changes in the timber, particularly the heavy thinning when mixed with cover. Mitigation that resulted in provision of many developed waters, and seeding many acres with palatable forage species such as orchard grass, greatly benefited elk.

Early seral stages of ponderosa pine have not increased to any large degree, although there has been some increase in early seral stage mixed conifer and spruce-fir, largely due to wildfires. While these habitats are important, elk are generalists and use a wide variety of seral stages and habitats. Aspen regeneration as a result of wildfires has provided forage for elk.

Population Trend: Habitat conditions were favorable for elk in the late 1980s and early 1990s. As populations increase, concern about habitat impacts resulted in cooperation between Arizona Game and Fish Department and the Forest Service to decrease elk numbers. The observed decline in the latter half of the period resulted.

The Coconino National Forest MIS Status Report (USDA 2002) and more recent data from game management units on the forest indicate a relatively stable population trend for the three main elk herds on the forest (see Figure 18). These individual herd trends are similar to the forest-wide trend, although GMU 7 shows a general increasing trend.

Figure 18. Number of elk on the Coconino National Forest (all GMUs) from 2001 to 2005



Environmental Consequences

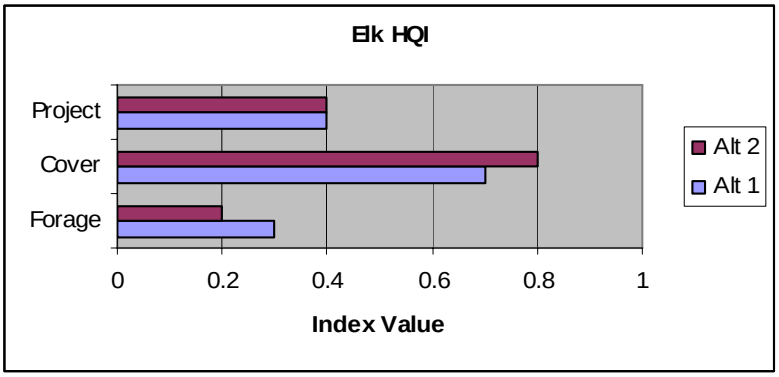
The following evaluation criteria were used to compare the environmental consequences for the proposed action.

- Habitat Quality Index modeling

Direct, Indirect and Cumulative Effects of Alternative 1

Under the No Action alternative, current management plans would continue to guide management of the project area. There would be no direct effects from thinning, burning, or road management. The potential for adverse effects associated with a catastrophic wildfire would remain the same and likely increase through time. If a wildlfire were to occur thermal and hiding cover could be destroyed.

Figure 19. Comparison of alternatives for elk habitat quality



Alternative 1 represents the existing conditions for the project area. The HQI rating for Alternative 1 is 0.4 (medium to poor quality) for overall habitat conditions across the project. Figure 19 is a comparison of the HQI ratings for each alternative.

Direct and Indirect Effects of Alternative 2

HQI modeling indicates that the overall project habitat quality for elk will not change with the implementation of Alternative 2. Modeling indicates a slight decrease in forage habitat and a slight increase in available cover habitat. The net effect results in no change to the overall habitat quality for elk with the implementation of Alternative 2.

Prescribed burning is intended to reduce the amount of ground fuels present in the project area. Prescribed fire should increase the diversity and productivity of the forest floor thereby increasing the amount of available forage for elk. Unfortunately, HQI modeling does not recognize the potential for increased forage production as a result of burning. Though, interspace and small openings will be created within the forest canopy, elk cover across the project is not expected to be affected. The topography within the project area consists of wide grassy drainage bottoms with moderate short slopes, open ridge tops with many small side drainages that provide excellent hiding and thermal cover. Small trees, VSS 1 and 2, provide hiding cover for elk and will make up approximately 1,200 acres of the project area. Canopy cover within spotted owl PACs and Target/Threshold stands, approximately 1,000 acres, will average >50%. Additionally, outside of this owl habitat within groups and clumps canopy cover will vary between 30-70% across approximately 5,000 additional acres. Modest estimates show approximately 35% of the project area as thermal and hiding cover for elk, occuring primarily in spotted owl habitat, goshawk family areas and within side drainages.

Cumulative Effects of Alternative 2

The area considered for cumulative effects is a one mile buffer of the project area. The Mountainaire and Lake Mary Analysis are adjacent to the project area and include thinning and burning treatments. The effects of the activities proposed for these projects are similar to those proposed of the Elk Park project and cumulatively are not expected to affect the current forest population trends for elk. Continued human population growth within the Elk Park and Lake Mary community may impact elk by increasing disturbance from recreationist, but is not expected to affect the early-seral stage ponderosa pine and mixed-conifer habitats, that elk represent, within the project area.

The appropriate scale for MIS monitoring is the area covered by the Forest Plan, 36 CFR 219.14 (f). The Forest Plan requires population trend monitoring for elk. Based on the discussion above Alternative 2 is not expected to change the forest population trend for elk as recent monitoring from Arizona Game and Fish Department shows a stable to slightly decreasing population trend. The population trend is consistent with the Department and Coconino National Forest management goals to reduce elk populations to mid 1980s levels over concerns of resource damage by elk. Elk populations are managed by the Arizona Game and Fish Department through legal hunts and do not appear to be appreciably affected by forest thinning. Based on the above discussion implementation of Alternative 2 is not expected to change the forest population trend for elk.

Elk are a management indicator of early seral ponderosa pine habitat which occurs in Management Areas 3 and 4. Alternative 2 is not expected to change the forest habitat trend for elk as modeling does not show an overall difference in the habitat quality for elk. There are approximately 39,299 acres of early seral ponderosa pine on the forest and approximately 1,900 acres within the cumulative effects area. The Elk Park Fuels Reduction and Forest Health Project contains approximately 4.8% of the forest’s early seral ponderosa pine habitat. Based on the above discussion implementation of Alternative 2 is not expected to change the forest habitat trend for elk.

Abert Squirrels

In Arizona, Abert squirrel commonly occupy ponderosa pine habitats. Abert squirrel are common within suitable habitats on the project area. The Abert squirrel is an indicator species for early-seral stage ponderosa pine forests although this species uses intermediate to older aged forest (trees 9-22 in. DBH), where groups of trees have crowns that are interlocking or in close proximity (USDA 2002).

The Abert squirrel is an obligatory herbivore on ponderosa pine, and is dependent upon ponderosa pine for food, cover, and nest sites. They prefer trees 18-22 in. DBH that are in groups. Interlocking crowns provide the squirrel with travel ways above ground where they can escape from predators. Home range size depends upon site condition, season, food availability, and mating activity.

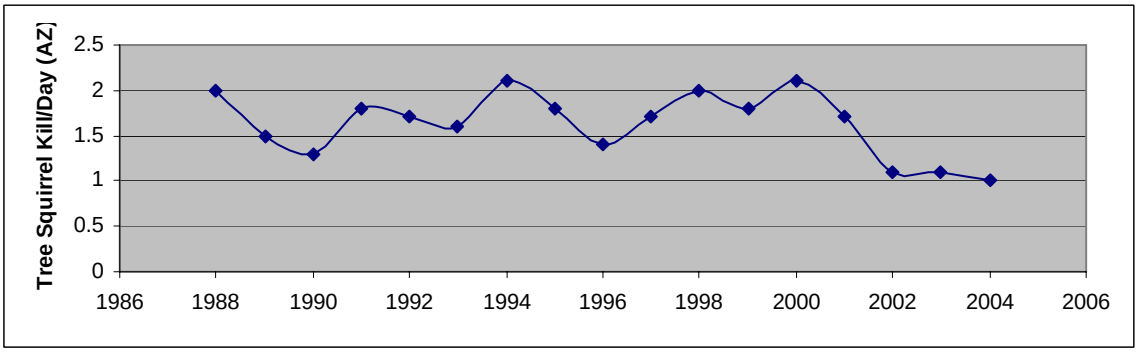
These squirrels forage on buds, flowers, herbs, fungi, acorns, and especially the new needles and seeds of ponderosa pines in the summer. They do not cache food for the winter, as other squirrels, but rely on the inner bark and apical buds of pine trees, which are not very nutritious. A symbiotic relationship exists between fungi, pines, and the Abert squirrel. These squirrels disperse the spores of hypogenous fungi, increase nutrient cycling through their feeding habits, and exert selective pressure on ponderosa pine genetics. Abert squirrels are an important food resource for predators such as goshawks.

Research suggests Abert squirrels exhibit better recruitment and fitness in the ponderosa pine forest with tree clumps of ≥ 5 interlocking canopy trees per clump, 9 clumps/acre, and basal area of 150 ft^2/acre (USDA 2002). They also recommend maintenance of ≥ 8 trees/acre that are 18+ inches in diameter. They showed that interlocking canopy trees are positively related to squirrel recruitment, and basal area is positively related to squirrel fitness. Abert squirrels also prefer dense stands with moderate to high crown cover for nesting, and nest trees are located within groups of trees with interlocking crowns (USDA 2002).

Habitat Trend: Although identified as an indicator for early seral ponderosa pine habitat, Abert squirrels use a variety of age classes, and research from several locations has shown strong habitat associations with mature ponderosa pine. The age class distribution of ponderosa pine has remained essentially the same, dominated by mid-seral stage stands, with some loss of old-growth and older trees. The net result is a decrease in the distribution and number of old ponderosa pine trees within the pine matrix. Some early seral-stage habitat has been created, mostly by wildfire. Regeneration of ponderosa pine is limited, but is better on limestone soils, which occur primarily on the southern half of the forest.

Population: Population trend for Abert squirrel on the Coconino National Forest is inconclusive since there is little forest-specific data (USDA 2002). Data compiled from Arizona Game and Fish Department surveys for the state of Arizona shows some variability, but an overall stable trend for number of squirrels killed per hunter day from 1988-1999. The Department uses hunter harvest information game surveys rather than survey count data for tree squirrels; for small game populations, AGFD does not quantify populations, since breeding populations are unaffected by hunting, and because determining the size of small a game population is very difficult. Figure 20 displays the most recent data for tree squirrels, which also includes red squirrels but the vast majority of tree squirrels harvested are tassel-eared squirrels.

Figure 20. Tree squirrel harvest by year in Arizona



Environmental Consequences

The following evaluation criteria were used to compare the environmental consequences for the proposed action.

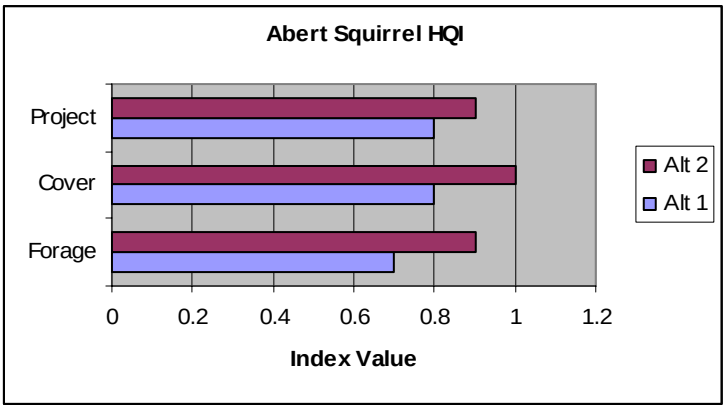
- Habitat Quality Index modeling

Direct, Indirect and Cumulative Effects of Alternative 1

Under the No Action alternative, current management plans would continue to guide management of the project area. There would be no direct effects from thinning, burning, or road management. The potential for adverse effects associated with a catastrophic wildfire would remain the same and likely increase through time. If a wildlfire were to occur, cover, nesting and forage habitat could be destroyed.

Alternative 1 represents the existing conditions for the project area. The HQI rating for Alternative 1 is 0.8 (high quality) for year round habitat across the project. Figure 21 is a comparison of the HQI ratings for each alternative.

Figure 21. Comparison of alternatives for Abert squirrel habitat quality



Direct and Indirect Effects of Alternative 2

Treatments proposed in Alternative 2 will increase the HQI indice for year round forage and cover by two points over the existing condition. Overall the HQI for the project area would increase from 0.8 to 0.9. An index value of 0.9 indicates that the habitat quality for Abert Squirrel will meet nearly all the habitat requirements for Abert squirrel. Implementation of Alternative 2

should improve habitat conditions for Abert squirrel over the existing conditions and provide very good habitat conditions for Abert squirrels.

Prescribed burning is intended to reduce the amount of ground fuels present in the project area. Prescribed fire should increase the diversity and productivity of the forest floor and stimulate growth of mast producing species such as gamble oak, thereby increasing the amount of available forage for squirrels.

Though small openings and interspaces will be created within the forest canopy, squirrel cover across the project area is not expected to be affected. In fact, habitat quality modeling indicates that cover habitat will actually improve; see Figure 21 above. Alternative 2 proposes to mimic pre-settlement structure by leaving trees in groups and clumps. Within groups and clumps canopy cover will vary between 30-70% across approximately 5,000 acres and will be >50% in Mexican spotted owl activity centers and some goshawk habitats.

Cumulative Effects of Alternative 2

The area considered for cumulative effects is a one quarter mile buffer of the project area. The Mountainaire and Lake Mary Analysis are adjacent to the project area and include thinning and burning treatments. The effects of the activities proposed for these projects are similar to those proposed of the Elk Park project and cumulatively are not expected to affect the current forest population or habitat trends for Abert squirrel. Continued human population growth within the Elk Park and Lake Mary community may impact Abert squirrel by increasing disturbance from recreationist, but is not expected to affect the early-seral stage ponderosa pine habitats, that Abert squirrel represent, within the project area.

The appropriate scale for MIS monitoring is the area covered by the Forest Plan, 36 CFR 219.14 (f). The Forest Plan requires habitat trend monitoring for Abert squirrel. Abert squirrel are a management indicator of early seral ponderosa pine habitat which occurs in Management Areas 3 and 4. Alternative 2 is not expected to change the forest habitat trend for Abert squirrel as modeling shows a slight improvement in overall habitat quality for Abert squirrel.

There are approximately 39,299 acres of early seral ponderosa pine on the forest and approximately 1,500 acres within the cumulative effects area. The Elk Park Fuels Reduction and Forest Health Project contains approximately 3.8% of the forest's early seral ponderosa pine habitat. Based on the above discussion implementation of Alternative 2 is not expected to change the forest habitat trend for Abert squirrel.

Based on the discussion above and the modeling results that show an improvement of habitat conditions for Abert squirrel, implementation of Alternative 2 is not expected to change the forest population trend for Abert squirrel.

Hairy Woodpeckers

The hairy woodpecker is an indicator species for the snag component of ponderosa pine, mixed conifer, and spruce-fir. In Arizona the hairy woodpecker favors high elevation forested landscapes in more mature habitats.

The Arizona Partners in Flight Prioritization Ranking for the hairy woodpecker is 16, based on intermediate distributions and moderate threats on the breeding and wintering ranges. Birds with scores of 20 or higher were selected initially for consideration as priority species. With a score of 16, the hairy woodpecker is of low concern (Latta et al. 1999).

The hairy woodpecker inhabits forest, open woodland, swamps, well-wooded towns and parks, and open areas with scattered trees. It is most abundant in mature woods with large old trees

suitable for cavity nesting, and is also common in medium-aged forests. Hairy woodpeckers prefer woods with a dense canopy (Bushman and Therres 1988 *in* USDA 2002). They use tree cavities for roosting and winter cover, and may excavate new cavities in fall to be used for roosting (Sousa 1987 *in* USDA 2002). Overall, they appear to be minimally impacted by forest fragmentation, though a few studies have reported a decline in numbers as forest patch size decreases; the presence of suitable cavity trees is a more important consideration (Bushman and Therres 1988 *in* USDA 2002).

Hairy woodpeckers nest in holes in live or dead trees or stubs, 5–60 ft (average 30 ft) above ground. In most areas, they favor dead or dying parts of live trees, especially where fungal heart rot has softened the heartwood. Snag (>10 in DBH) density of 2/ac is assumed optimal for reproduction, but may not be adequate for foraging (Sousa 1987 *in* USDA 2002). Hairy woodpeckers usually excavate a new nest hole each year.

Population: Overall, data from the Coconino National Forest, as well as statewide data, indicate that hairy woodpecker populations are stable, or slightly increasing, on a long-range scale. Minor population decreases occur on a short-term scale (1 to 3 years), but are generally followed by a recovery (USDA 2002).

Habitat: Habitat trend in ponderosa pine cover type for snags is declining, but the trend in mixed conifer and spruce-fir is increasing (USDA 2002).

Environmental Consequences

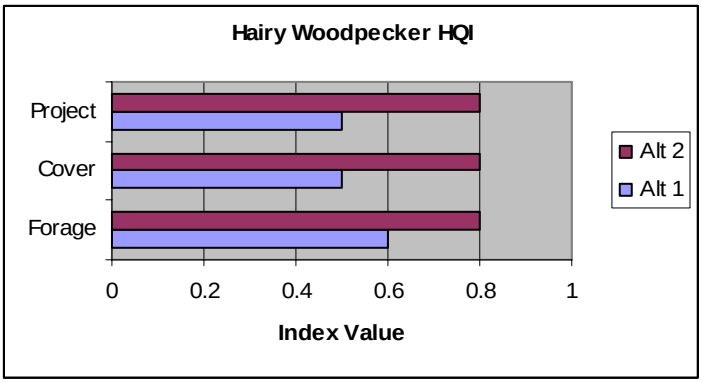
The following evaluation criteria were used to compare the environmental consequences for the proposed action.

- HQI modeling
- Prescribed burning
- Snag removal

Direct, Indirect and Cumulative Effects of Alternative 1

Under the No Action alternative, current management plans would continue to guide management of the project area. There would be no direct effects from thinning, burning, or road management. The potential for adverse effects associated with a catastrophic wildfire would remain the same and likely increase through time. If a wildlfire were to occur, cover, nesting and forage habitat could be destroyed.

Figure 22. Comparison of alternatives for hairy woodpecker habitat quality



Alternative 1 represents the existing conditions for the project area. The HQI rating for Alternative 1 is 0.5 (moderate quality) for year round habitat across the project. Figure 22 is a comparison of the HQI ratings for each alternative.

Direct and Indirect Effects of Alternative 2

The treatments proposed in Alternative 2 may improve hairy woodpecker habitat within the project area. The HQI value for year round forage for Alternative 2 is two points greater than the existing conditions. This means that the activities proposed in Alternative 2 may improve the year round forage habitat for hairy woodpecker. Year round cover for Alternative 2 is three points greater than the existing condition. This means that the activities proposed in Alternative 2 may improve the year round cover habitat for hairy woodpeckers. Overall implementation of Alternative 2 will improve project habitat quality from moderate to high.

Prescribed burning activities may directly affect hairy woodpecker by disturbing them during prescribed burning activities or by burning snags. Prescribed burning may also create additional snag that may eventually be used by hairy woodpecker for nesting and foraging.

Cumulative Effects of Alternative 2

The area considered for cumulative effects is a half mile buffer of the project area. The Mountainaire and Lake Mary Analysis are adjacent to the project area and include thinning and burning treatments. The effects of the activities proposed for these projects are similar to those proposed of the Elk Park project and do not target the removal of snags.

Continued human population growth within the Elk Park and Lake Mary community may impact hairy woodpecker by increasing disturbance from recreationist, but is not expected to affect the snag component of ponderosa pine habitats, that hairy woodpecker represent, within the project area.

Illegal fuelwood harvest that targets snags greater than 12 in. DBH may affect cover, nesting and foraging habitat for hairy woodpecker. Removal of these important habitat features may limit the distribution of hairy woodpeckers. Snags are not targeted for removal in any alternative.

The appropriate scale for MIS monitoring is the area covered by the Forest Plan, 36 CFR 219.14 (f). The Forest Plan requires habitat trend monitoring for hairy woodpecker. Hairy woodpeckers are a management indicator of the snag component of ponderosa pine habitat which occurs in Management Areas 3 and 4. Implementation of Alternative 2 is not expected to change the forest habitat trend for hairy woodpecker as modeling shows an improvement in overall habitat quality for hairy woodpecker and snags are not targeted for removal.

Hairy woodpecker is the indicator species of the snag component of ponderosa pine, mixed conifer and spruce-fir habitats on the forest. Only ponderosa pine habitats occur within the cumulative effects area. There are approximately 769,062 acres of ponderosa pine habitat on the forest. Within the cumulative effects area for this project there are approximately 7,600 acres of ponderosa pine habitats. The cumulative effects area contains approximately 1% of the indicator habitat for hairy woodpecker. Implementation of Alternative 2 is not expected to change the forest habitat trend for hairy woodpecker.

Based on the discussion above and the modeling results that show an improvement of habitat conditions for hairy woodpecker, implementation of Alternative 2 is not expected to change the forest population trend for hairy woodpecker.

Pronghorn

Antelope are an indicator species for early and late seral grassland. Pronghorn are grassland and opening dependent species. Throughout their range, they use areas where slopes are less than 30%, precipitation of about 10 to 15 in. per year and water every 1 to 4 miles. Pronghorn tend to like areas recovering from wildfire. Low vegetative structure, averaging 10 to 15 in. in height is preferred. Vegetation greater than 30 in. in height is not used much. Within the Elk Park project area, pronghorn use the open bottoms, which dissect the project area and typically run in an east-west direction.

Habitat Trend: The amount of habitat has generally remained stable, with the exception of about 4% increase in seral grasslands due to fuelwood treatments and fire. Habitat trend is stable to declining due to tree encroachment, fire suppression, long-term climatic trends, short-term drought, and ungulate grazing. Establishment of juniper and ponderosa pine seedlings and saplings in meadows and previously created openings decreases quality. Openings have been maintained and created through activities such as fuelwood treatments, wildfires, restoration treatments and meadow maintenance.

Population Trend: Forest-wide pronghorn trend is declining, although not equally on the forest (USDA 2002). GMU 7 appears to be maintaining at the breakeven point, while other GMUs remain below the break even point of 20-35 fawns per 100 does in many years. Arizona Game and Fish Department survey data suggest declining trends in number of observed animals in all but GMU 7. Largely because of the concern with recruitment, an Antelope Management Plan for Anderson Mesa (2002) was developed to improve conditions for this species in GMU 5A and 5B. The plan addresses, prioritizes and has an associated implementation plan for grazing, fences, vegetative treatments, drought relief, research and monitoring.

Environmental Consequences

The following evaluation criteria were used to compare the environmental consequences for the proposed action.

- Habitat modification
- Percentage of indicator habitat within the cumulative affects area.

Direct, Indirect and Cumulative Effects of Alternative 1

Under the No Action alternative, current management plans would continue to guide management of the project area. There would be no direct effects from thinning, burning, or road management. The potential for adverse effects to the mountain meadows within the project area associated with a catastrophic wildfire would remain the same. If a wildlfire were to occur within pronghorn indicator habitat, pronghorn would likely benefit from nutritious forage that would begin to grow with one year of a fire.

Direct and Indirect Effects of Alternative 2

Alternative 2 proposes 246 acres of prescribed fire within mountain meadows. Prescribed fire should increase forage production and nutrition within the mountain meadow habitat within one growing season. Immediately after burning forage will be reduces to patches of unburned forage within the mountain meadows. The effects from smoke and fire may cause animals to temporarily move to other habitat. The effects from smoke and fire will be isolated, of low intensity and short duration, less than one day.

Pronghorn normally give birth in May and June. Prescribed burning normally occurs in the fall when fawns are large enough to avoid fire or impacts from smoke. Fall burning will allow mountain grassland habitat one growing season to recover before pronghorn fawn. Though fawn cover may not be sufficient by the first growing season, burning will likely be patchy and adjacent areas will provide sufficient fawn cover.

Cumulative Effects of Alternative 2

The area considered for cumulative effects is a one mile buffer of the project area. The Mountainaire and Lake Mary Analysis are adjacent to the project area and include thinning and burning treatments. Only prescribed burning is proposed with pronghorn indicator habitat. The effects of the activities proposed for these projects are similar to those proposed in the Elk Park project and do not target the modification of pronghorn indicator habitat.

Continued human population growth within the Elk Park and Lake Mary community may impact pronghorn by increasing disturbance from recreationist, but is not expected to affect the mountain grassland habitat, that pronghorn represent, within the project area.

The appropriate scale for MIS monitoring is the area covered by the Forest Plan, 36 CFR 219.14 (f). The Forest Plan requires population trend monitoring for pronghorn. Pronghorn are a management indicator of the early and late seral grasslands, which occur in Management Area 9 (mountain grassland), within the project area. Implementation of Alternative 2 is not expected to change the forest population trend for pronghorn because mountain meadows within the cumulative effects area are proposed for burn only treatment which are likely to improve conditions for pronghorn.

Pronghorn is the indicator species of early and late seral grasslands on the forest. There are approximately 115,767 acres of grassland habitat on the forest. Within the cumulative effects area for this project there are approximately 750 acres of mountain grassland habitats. The cumulative effects area contains approximately 0.6% of the indicator habitat for pronghorn. Implementation of Alternative 2 is not expected to change the forest habitat or population trend for pronghorn.

Migratory Bird Species

President Clinton signed Executive Order 13186 on January 10, 2001, placing emphasis on conservation of migratory birds. This order requires that an analysis be made of the effects of Forest Service actions on species of concern listed by Partners in Flight (PIF); the effects on important bird areas (IBA) identified by Partners in Flight (Latta et al. 1999); and the effects to important overwintering areas.

Within the project area there are pine and high elevation grassland habitat types. The Anderson Mesa IBA covers approximately 1,600 acres of the project area. And there are no important over wintering areas within the project area.

Species of Concern Listed by Partners in Flight

Pine habitat types occur within the project area. Ponderosa pine and ponderosa pine/gamble oak are the dominant vegetation types in the analysis area, accounting for approximately 96% of the total project area. Mechanical thinning and prescribed fire are proposed within the pine habitat type. Four species have been identified as species of concern in pine habitats. They are northern goshawks, olive-sided flycatchers, Cordilleran flycatchers, and purple martins. Northern goshawks are discussed in detail under the Sensitive species section of this report and will not be discussed here.

High elevation grassland habitat types occur with the project area as well; this habitat is closely associated with the subalpine-montane meadows community described in Latta et al. (1999). Montane meadows account for less than 4% of the project area. Prescribed burning is proposed within montane meadow habitat type.

The following tables summarize the PIF priority species that occur within the analysis area by habitat type and also includes an analysis of effects for each alternative.

Table 39. Pine habitat priority migratory bird species

Priority Species	Vegetation composition/ structure	Abiotic/landscape factors	Special Factors	Status in the project area	Alt. 1 Effects	Alt. 2 Effects
Olive-sided Flycatcher	-Ponderosa pine, Douglas-fir -Multi-level, mature forest, fairly open canopy, “clumpiness” -Dead branches for foraging -Live mature pines for nesting -Snags important	-May occur on higher areas of slopes -Often occur at edge of early post-burned areas for foraging and singing -Most common in patchy areas of closed and open habitats; patch size does not seem to be important -Most common where tall conifers overlook ridges and canyon tops	-Prefers forest edges and openings -Arrival on breeding ground generally (may be as late as June)	Known to be declining throughout its range. BBS data indicates that this species exists in low numbers, but is stable to slightly increasing within the analysis area.	No Effect	Beneficial effects from the creation of interspaces and openings and forest structure in groups and clumps, retention of snags and large trees. Alternative 2 will not change the existing forest trend for this species.
Cordilleran Flycatcher	-Ponderosa pine, Douglas-fir, maple, oak, aspen -Dense canopy closure -Mid-late successional	-Drainages to create a cool microclimate	Snags and downed trees for nesting -Rare cowbird host	Considered to be on the increase, but at risk due to concerns about loss of suitable habitat and habitat components such as snags, downed logs, and loss of closed canopy. Within the analysis area, it is expected that this species is static to increasing.	No Effect	Implementation of Alternative 2 will create more openings and interspaces with trees left in groups and clumps. Group and clump formations should favor cordilleran flycatcher habitat which favor mid to late seral successional habitats. Alternative 2 will not change the existing forest trend for this species

Priority Species	Vegetation composition/ structure	Abiotic/landscape factors	Special Factors	Status in the project area	Alt. 1 Effects	Alt. 2 Effects
Purple Martin	-Ponderosa pine. -Open canopy. -Open midstory cover. -Open understory cover. -High snag density.	-Large snags, cavities. -Open space for flying. -Snags need to be close to or in open areas. -Just above and below the Mogollon Rim. Mormon Lake area.	-Often prefers habitat near open water. -Prefers tall snags adjacent to open areas.	This species has nearly been extirpated from ponderosa pine forests since fire suppression has resulted in much denser conditions and logging has reduced the number of snags and large old trees. BBS data indicates that this species is static to slightly declining in the analysis area.	No Effect	Within the project area cavities in large tall snags may be limiting for this species. Thinning and burning activities designed to open the understory may benefit this species particularly near Hoxworth Spring. Alternative 2 will not change the existing forest trend for this species

Table 40. High elevation grassland habitat priority migratory bird species

Priority Species	Vegetation composition/ structure	Abiotic/landscape factors	Special Factors	Status in the project area	Alt. 1 Effects	Alt. 2 Effects
Ferruginous Hawk	-Scattered, isolated junipers for nesting -Sparsely vegetated grassland -Nest on elevated areas	-Elevation: 4,900 to 6,200 ft. -Nest sites in isolated junipers, ledges, knolls, rock outcrops or pillars, cliffs faces. -Nests are placed in open with grand view -Shows no preference for shading.	-Occur where larger populations of prairie dogs, ground squirrels, rabbits, and pocket gophers exist -High sensitivity to human disturbance around nests	No known nesting in the project area. The vegetation composition desired by this species does not occur within the project area. The project is on the upper elevation described for this species. Only gophers and rabbits occur within the project area.	No Effect	Implementation of Alternative 2 proposes prescribed burning in mountain meadows which are not considered this species priority habitat. Burning is not expected to affect this species prey or nesting habitat. Alternative 2 will not change the existing forest trend for this species.
Swainson's Hawk	-More grass and less small woody shrubs than Ferruginous Hawk habitat -Sparse shrublands, small, open woodlands -Nest trees include: cottonwood, catclaw acacia, tall cholla, juniper -Nest in small trees in smaller clumps, wind breaks, woody washes esp. when adjacent to red-tailed hawks	-Elevation 4,900 to 7,000 ft, locally to 9,500 ft. in the White Mountains -Prefer large expanses of grasslands with interspersed trees or large shrubs -Primarily a tree nester, but also nest on utility poles, windmills	-Eat grasshoppers during migration and on wintering grounds Foods: lizards, snakes, birds, ground squirrels, voles, pocket gophers -Non-breeders hunt communally and eat primarily insects -not as sensitive to human activity as ferruginous hawk.	No known nesting in the project area. The vegetation composition desired by this species is limited within the project area. Voles, insects and gophers occur within the project area. global decreases in this species numbers are expected to result in static to decreasing numbers of Swainson's	No Effect	Implementation of Alternative 2 proposes prescribed burning in mountain meadows which are not considered this species priority habitat. They prefer larger grasslands. Burning is not expected to affect this species prey or nesting habitat. Alternative 2 will not change the existing forest trend for this species.

Priority Species	Vegetation composition/ structure	Abiotic/landscape factors	Special Factors	Status in the project area	Alt. 1 Effects	Alt. 2 Effects
Burrowing Owl	-Grasses and plant communities in early successional stage -Rock outcrops that attract burrowing mammals to provide burrows	-Elevation 4,900 to 7,000 ft. -Little to no slope -Dry, open, shortgrass, treeless plains, often associated with burrowing mammals -Need perches: fencepost, mounds, power lines, etc. -Early successional stage (grassland)	-Limited to areas with active small and/or burrowing mammals -Food: insects (grasshoppers, crickets, beetles) and small mammals, herps, birds	Habitat is limited within the project area as the largest burrowing mammals are gophers; although prairie dogs have been seen within 2 miles of the project area. Perches and prey are plentiful within the project area.	No Effect	Implementation of Alternative 2 proposes prescribed burning in mountain meadows which are considered habitat for this species. Burning is not expected to affect this species prey or nesting habitat. Alternative 2 will not change the existing forest trend for this species.
Grasshopper Sparrow	-plains lovegrass, sacaton sp., black grama, vine mesquite, little bluestem, agave Taller 30-50 cm mixed tall bunchgrass and turf grass or sodgrass	Elevation 4900-6500ft. Moderately open grassland with patchy bare ground, flat to gently rolling hills. Some shrubs. Need low perches and tall grass during breeding.	Feed on grasshoppers and other insects during breeding season. –feed on grass seed in winter. – sing two entirely separate songs.	The vegetation composition desired by this species does not occur within the project area. The project is on the upper elevation described for this species.	No Effect	Implementation of Alternative 2 proposes prescribed burning in mountain meadows which do not contain the vegetation composition preferred for this species. Burning is not expected to affect this species prey or nesting habitat. Alternative 2 will not change the existing forest trend for this species.

Cumulative Effects of All Alternatives

The area considered for cumulative effects is a one quarter mile buffer of the portion of the Anderson Mesa IBA that overlaps the Elk Park project area. The adjacent Lake Mary Fuels Reduction project included thinning and burning treatments and the effects of these activities are similar to those proposed in the Elk Park project. Grazing and fire suppression are two activities in the area that play the strongest roles in affecting habitat for these species. Although this area has not been grazed for a number of years, cattle grazing is a permitted activity. Both flycatchers are rare cowbird hosts and breeding individuals could be negatively affected by cowbird parasitism during years cattle and cowbirds are in the area. Wildlife and domestic grazing can negatively impact shrub and willow communities. Fire functions to maintain openings and vigor and abundance of understory species. Fire would also decrease competition for water in the vicinity of Hoxworth spring favoring maintenance of riparian habitat and shrubs. Late succession species like northern goshawks and cordilleran flycatchers would respond favorably to continued fire suppression due to increased densities of trees and canopy cover.

Disturbance to migratory birds from recreational activities is low to moderate. Recreationists occasionally use the project area, primarily during the weekends from May thru September. Areas adjacent to springs are particularly popular and may increase disturbance to high elevation riparian species. Continued human population growth within the Elk Park community may impact priority species by habitat loss and encroachment from further development within the Elk Park community.

Important Bird Area

The Anderson Mesa IBA spans approximately 207,051 acres of the Mormon Lake Ranger District. This IBA includes every habitat that is found on the Mormon Lake district. There are 1,600 acres of the Anderson Mesa IBA that overlap the east side of the Elk Park project area. Of this 1,600 acres, habitat consists of mountain meadows (126 acres), private land (111 acres), and ponderosa pine (1,363 acres).

Environmental Consequences

The following evaluation criteria were used to compare the environmental consequences for the proposed action.

- Habitat modification
- Percentage of IBA habitat within the cumulative affects area.

Direct, Indirect and Cumulative Effects of Alternative 1

Under the No Action alternative, current management plans would continue to guide management of the project area. There would be no direct effects from thinning, burning, or road management. The potential for adverse effects to the mountain meadows, and ponderosa pine habitats within the project area associated with a catastrophic wildfire would remain the same. If a wildlfire were to occur within the mountain meadow habitat, it would likely benefit by increasing the vigor of grasses that would begin to grow with one year of a fire. If a wildfire were to occur within the pine type cover, nesting and forage habitat for a wide variety of birds could be destroyed.

Direct and Indirect Effects of Alternative 2

Alternative 2 proposes prescribed fire within the entire 126 acres of mountain meadow habitat portion of the IBA . Prescribed fire should increase grass vigor, forage production and nutrition

within the mountain meadow habitat within one growing season. Immediately after burning, forage will be reduced to patches of unburned islands within the mountain meadows. The effects from smoke and fire may cause animals to temporarily move to other habitat. The effects from smoke and fire will be isolated, of low intensity and short duration (less than one day).

Alternative 2 proposes mechanical treatment and prescribed burning within the entire 1,363 acres of ponderosa pine habitat portion of the IBA. Mechanical treatments will reduce the potential for catastrophic wildfire and will create a forest structure where trees are left in groups and clumps with interspaces and opening that will provide a diversity of forest structures. Low intensity prescribed fire will be used to reduce ground fuels. Low intensity prescribed fire will increase the nitrogen cycling within soils and stimulate new growth.

Cumulative Effects of Alternative 2

The area considered for cumulative effects is a one quarter mile buffer of the portion of the Anderson Mesa IBA that overlaps the Elk Park Fuels Reduction and Forest Health Project. The Lake Mary Analysis includes thinning and burning treatments. The effects of the activities proposed for this projects is similar to those proposed in the Elk Park project. Continued human population growth within the Elk Park community may impact the Anderson Mesa IBA by habitat loss and encroachment from further development within the Elk Park community.

Of the 207,051-acres Anderson Mesa IBA, 1,600 acres or 0.7%, is within the Elk Park Fuels project area. Based on the discussion above, implementation of Alternative 2 may affect, but is not likely to adversely affect the Anderson Mesa IBA.

Historic Resources

The purpose of this section is to describe the affected environment as it relates to cultural resources and to describe the direct, indirect, and cumulative effects of the No Action and Proposed Action alternatives on historic and prehistoric sites. The following information has been summarized from the Heritage specialist report and Cultural Resources Clearance Report, located in the project record.

The archaeological analysis for this project is based on previous research and inventory of 28 projects conducted in the project area between 1974 and the present. Approximately 1,977 acres (or 29%) the project area has been surveyed for heritage resources. All know sites were revisited and fuel loading inventories and National Register eligibility determinations were made for each site.

The following Native American Indian groups were notified of the project in two Coconino National Forest Annual Consultation letters dated February 19, 2002 and June 5, 2003 as well as the forest's Schedule of Proposed Actions and quarterly updates: Dine' Medicine Man's Association, Fort McDowell Yavapai Nation, Hopi Tribe, Hualapai Tribe, Havasupai Tribe, Navajo Nation, Pueblo of Zuni, San Carlos Apache Tribe, San Juan Southern Paiute Tribe, Tonto Apache Tribe, Yavapai-Apache Nation, Yavapai-Prescott Tribe, and White Mountain Apache Tribe. No replies about tribal concerns about this project were received. Additional meetings with the Hopi and Yavapai-Prescott Tribes on April 4 and April 25, respectively, and a follow-up e-mail reply from the Yavapai-Apache Nation on June 11, 2002 also resulted in no concerns expressed for this project.

The Elk Park project is located in an area of moderately low archaeological site density. Within the entire project area there are 11 known archaeological sites, 7 of which are eligible for the National Register of Historic Places. Six of the National Register eligible sites identified are

historic (cabins, a logging camp and a ranch), and one site is a prehistoric rock shelter. No areas of traditional cultural importance or areas of specific tribal concern are known or were identified for this part of the forest, neither during previous consultation nor during previous research into tribal uses of the forest.

The archaeological resources in the project area have high levels of dead fuels growing in and around National Register eligible sites and structures. The fuel loading of these archaeological sites were evaluated. Of the seven National Register eligible sites, 100% were identified as fire intolerant; burnable materials are associated with all of the eligible sites. This fire intolerance, in combination with moderate fuel loading within and around the sites, has the potential to contribute to adverse fire effects on heritage resources from prescribed fire and wildfire as well as potential ground disturbing suppression actions.

The desired condition for heritage values within the Elk Park project area is to reduce fuel loading in or around all eligible archaeological sites in order to preserve fire sensitive components on these sites.

Environmental Consequences

Direct and Indirect Effects of Alternative 1

The direct effect of no action is the continued threat of wildfire on the integrity of the 11 archaeological sites in the project area. The majority of these sites are historic in nature and their associated features and artifacts can be damaged through fire.

In addition to damage by wildfire, suppression tactics such as bulldozer control lines and other heavy equipment could potentially damage these National Register eligible sites through ground disturbing activities. This is particularly true in an area of wildland-urban interface where all available fire suppression resources are used to protect homes and private properties. Additionally, erosion after an intense wildfire is more damaging due to complete loss of ground cover than after a low intensity prescribed fire that typically does not consume all ground vegetation.

Cumulative Effects of Alternative 1

Continued fuel loads through time will make fires more intense in the area and contribute to the increasing possibility of damage to archaeological properties through tree mortality, intense heat from wildfires and associated emergency suppression actions.

Direct and Indirect Effects of Alternative 2

Mechanical thinning and prescribed fire in the areas outside of archaeological sites will assist in the reduction of fire threats to heritage resources. National Register eligible historic properties would be protected from wildfires and associated suppression efforts.

Consultation with the Arizona State Historic Preservation Office (SHPO) for this project’s affects to heritage resources and compliance with Section 106 of the National Historic Preservation Act resulted in a “No Adverse Effect” determination based upon the following mitigation measures: during project implementation, all sites will need to be excluded and protected from burning activities and ground disturbing activities; it will be necessary to remark sites for avoidance before implementation; sites will need to be lined and monitored during burning activities.

All sites in the project area will be protected from catastrophic wildfire and associated suppression activities, and post-fire erosion. There is a possibility of an increase in site visitation

due to thinning and burning in the areas surrounding the archaeological properties. Sites may become more vulnerable to vandalism and looting due to increased traffic in the area. Archaeological site conditions should continue to be monitored throughout and following project implementation.

Cumulative Effects of Alternative 2

Thinning and burning areas surrounding sites and thinning through all of the sites could help reduce the threat of fire damage to these resources in the foreseeable future (20 years) and long-term (50-100 years). In addition to sites within the project area, hundreds of other important archaeological properties will be protected from fire through other fuels reduction projects on the forest.

With the future implementation of the Travel Management Rule, some system and user-created roads may be closed to motorized travel, thus limiting human access to the sites. Additionally, long-term monitoring of these sites by forest archaeologists will assist in mitigating any visitation and vandalism issues.

Recreation, Scenery, and Transportation

The purpose of this section is to describe the affected environment as it relates to social components of the project area and to describe the direct, indirect, and cumulative effects of the No Action and Proposed Action alternatives on recreation, scenery, and roads. The following information has been summarized from the Recreation and Engineering specialist report [PRD 81], located in the project record.

Affected Environment

Recreation

Public recreational use of the analysis area is mostly in the form of driving for pleasure, hunting, camping, wildlife viewing, OHV driving, and hiking. With mostly rolling ponderosa pine forest land, and without major natural or other attractions to the area, it receives relatively low amounts of recreational use, except during hunting season.

There are no system trails in the area, although a few non-system “social” trails are located near the private land at Elk Park Meadows.

There are several locations within the area where resource damage or impacts due to off-road driving has occurred, mostly in the draws passing through the analysis area.

A significant cave is located within the project area, and has a special order in place to restrict access in order to protect cave resources. Other caves and blowholes associated with the limestone topography of the area are located in the vicinity, too, although there is not a complete inventory of these resources for the area.

Both visitors and residents using the area appreciate the natural-appearing scenery that exists there, particularly along roads and where private land interfaces with the national forest.

Because of the growth of the local area and state, and expected increases in use of the area, maintaining and enhancing recreational values is desired, including for scenery management. This may be accomplished by managing for a landscape that mimics pre-settlement vegetation conditions, including with large yellow pines, open parks, varying ages and densities of trees, varying the distance between trees, and allowing “undesirable” trees to remain, too, including

double and triple-boled trees, leaning trees, etc. Slash would be removed or burned within about one year.

Transportation System

The current inventoried transportation (road) system contains 19.5 miles of road, of which 19.1 miles are open to motor vehicles. This results in an open road density of 2.42 miles per square mile. Additional inventory work could add to the data for user created or non-system roads inventory within the Elk Park Meadows project area boundary, which may result in a higher road density. There are no maintenance levels 3 (passenger cars roads) within the interior of the analysis area; the roads within the project area interior are all maintenance level 2 (high clearance vehicle) roads. Many of these system roads began as user created roads or temporary logging roads and were incorporated into the roads system in the 1980s. The existing roads can be generally described to be in fair to poor condition with inadequate drainage, are often poorly located, and many are causing resource damage. A road use permit has been issued to the Elk Park Meadows Road Association for the maintenance of FSR 132D.

A current issue for transportation in the area is that there is no legal access for hauling across two areas:

- The private land to the west of the analysis area, along FR132. This has been a problem in the past with other agency activities in the area, and remains so today, including for any planned activities in the area all the way to Mormon Mountain.
- There is no legal access through the Elk Park Meadows private subdivision. As part of this project's proposed action, a re-route of FSR132B is planned around the area.

Most non-system roads in the area are user created by ranchers, wood gatherers, hunters or those who drive for recreation, including off highway vehicles (OHV). The greater availability of 4 wheel drive vehicles today has resulted in a greater increase of user created roads in the last few years. This trend is expected to increase in the future.

At present, the Coconino National Forest is open to off-road travel unless posted closed. An effort is underway to change the forest policy to "closed unless posted open" under the new national Travel Management Rule (36 CFR 212). When enacted, this will have influence over the current road system.

The current road system provides a variety of services for not only citizens living adjacent to or within the project boundary but other visitors to the area. These services include firewood gathering, hunting, hiking and a place to exercise, and dispersed camping.

The planned road system for the Elk Park Meadows analysis area would consist of the minimum network of roads that is necessary to satisfy both the current and foreseeable future needs of the agency and users. The remaining system would be located out of meadows when possible; in areas where it is not possible to relocate the road, the roads would be reconstructed to keep resource and habitat damage to a minimum. Social or non-system roads would be decommissioned unless use of these roads allows the agency to accomplish other project goals, such as removing a system road from a meadow. The Forest Plan guideline for open road network density in the ponderosa pine/mixed conifer zone is 2 miles per square mile.

Special Areas

Lower Lake Mary Seasonal Bald Eagle Closure: Approximately the south half of Sec 20, T20N, R8E, on the south side of Lower Lake Mary is closed to entry from January 1 to August 31 to protect bald eagle winter habitat (Order No. 04-05-01-W).

Cave Resources Special Protection Closure: Entry is prohibited in all cave resources within T19N, R8E on the Mormon Lake RD to protect cave resources (Order No. 04-141).

Scenery Management

The project area is generally the forested, natural appearing scenic setting that is prized by residents and visitors to the greater Flagstaff area, with special concern for the mountainous aspects and backdrops of the area. Like much of the Peaks and Mormon Lake Ranger Districts, the area is commonly and regularly used by the public for many different kinds of recreational purposes, and most participants care about the scenery in the area.

Historic descriptions and photos of the forested area near Flagstaff, which would have represented the project area, describe a relatively open landscape dominated by large “yellow pine” parks with intermingled mixed conifer and aspen stands at higher elevations, in canyons and on north facing slopes. Research suggests that a more open forest with less ground litter and more big trees, typical of the historic forest, is often more appealing to most people than the typical denser, younger stands that are found on the Colorado plateau today. The scenic attractiveness of the forested areas, with the San Francisco Peaks and other mountain backdrop, produce the desired satisfaction, stress reduction, and general feeling of well-being the national forests are meant to provide.

Historic conditions prior to the intensive management that followed European settlement represent the most scenic condition, and the highest level of scenic integrity that has existed on the Colorado plateau since historic times. What we know and understand about historic scenic conditions gives us a baseline for comparison with modern conditions, and helps us understand the scenic potential of the area.

Overall, existing scenic integrity for the area could be defined as “moderate”, meaning the landscape appears slightly altered but with the natural appearing landscape dominant. Alterations to the natural appearing landscape within the project boundary (including private lands) includes roads and trails, power lines, and residential developments and all of the evidence of human occupation and activity that are typical for such an area.

Over the past several years, increased recreational use of areas adjacent to high use access roads and residential developments has resulted in increasing visible evidence of human activity such as fire rings, compacted bare ground, litter, and additional unauthorized roads and OHV tracks. These additional elements in the landscape detract from its natural appearance and degrade the area’s scenic integrity in these areas, resulting in a “low” to “moderate” scenic integrity rating that generally equates to a “modification” visual quality objective (VQO) for the specific areas that are affected.

Most of the project area located away from the residential areas and high use forest roads is less impacted, and has “moderate” scenic integrity that equates to the prescribed “modification” VQO defined in the Coconino NF Land Management Plan for the affected area.

Even though the current landscape looks unaltered and natural to the casual observer and meets the original VQO set forth in the Forest Plan, the existing scenic condition falls short of the potential scenic quality that was inherent in the historic ponderosa pine forest, with its open meadows strung along the major drainages in the area, and the open “parks” that were (are) dominated by large, yellow barked trees.

Land Uses

The Forest Service does not have a right of way in the area of private land on the west end of FSR132, both at Lake Mary Meadows and through the block of private land approaching FH3.

The Forest Service does not have a right of way along FSR132B or FSR9420G where they pass through Elk Park Meadows. FSR296 has been used as an access route around Elk Park Meadows and Lake Mary Meadows, but it passes through the block of private land at the west end of FSR132 approaching FH3. The Forest Service constructed a bypass around this latter parcel of land in the 1980s, which may be desirable for use for this project.

Environmental Consequences

Direct and Indirect Effects of Alternative 1

Failure to implement the project would allow existing recreational uses and roads management to continue as they do today. With the threat of catastrophic wildfire increasing due to un-managed vegetation, though, overall recreation values could be severely impacted and diminished if radical, less desirable changes in the forest structure of the area were to occur. Fires of greater intensity or scope, including stand replacing fires, can result in changes to the landscape, its character, and visual quality that reduce or essentially eliminate the quality of recreational settings and experiences that are desirable for recreational driving, outfitting and guiding, day hiking, and mountain biking. Areas currently used for dispersed camping or other recreational uses such as rock climbing would likely be less appealing for these activities after such a fire. The effects of less intensive fires, similar to the effects of initial prescribed and maintenance burning, would result in a similar diminishment of the quality of recreational opportunity, but for a shorter, more temporary, duration.

Scenery Management

The No Action alternative will result in a landscape that will continue to meet visual quality objectives defined in the Forest Plan but will continue to fall short of meeting the long-term scenic potential of the area as a whole. Visitors to National Forest lands within the area will see a mostly natural appearing landscape with minor evidence of human activity, aside from the existing road system. The existing vegetative pattern of variable density ponderosa pine stands with large areas dominated by “over stocked” small diameter pine trees will continue to define the areas’ landscape character.

The No Action alternative results in a vegetative pattern that tends to decrease the viability of larger, older trees and to favor conditions that result in dense stands of small diameter trees; therefore reducing scenic quality. Crowding by smaller trees for moisture and nutrients will tend to accelerate mortality in the larger trees from insects and disease as well as to put them at risk of mortality by wild fire. The long-term result will likely be a decrease in the number and extent of large “yellow pine” across the landscape, a trend already affecting parts of the area east of Flagstaff area where drought and bark beetles have killed hundreds of the oldest and biggest pine trees over the past few years. The ability of the landscape to reach the maximum inherent scenic potential that existed historically will be compromised with this alternative. Continuation of the present condition of vegetation in the East side area risks losing considerable scenic value due to increased risk of wildfire, insect infestation and disease. The “No Action” alternative would be less disruptive to the scenery in the short term but is likely to result in a much less desirable scenic landscape in the long term compared to the Proposed Action.

Direct and Indirect Effects of Alternative 2

Implementation of the proposed action would maintain desirable forest characteristics for recreational activities for the future. While there would be temporary impacts during the first few

years of the vegetation treatments and burns, these impacts would be considered transitory in nature, and necessary in order to maintain desirable characteristics.

Recreation

Mechanical treatments will limit the amount of recreational driving opportunities within areas that are closed to logging during implementation and will likely have temporary effects on the quality of the experience for some forest visitors. The immediate and substantial change in appearance of treated stands results in an effect on the visual quality of the recreational driving experience, as described under scenery management effects.

Initial and maintenance prescribed burning will have little effect on recreational driving. Temporary road closures and smoke during burns present short-term disturbance to driving opportunities and the quality of those opportunities. The effect, however, is insignificant as it is very localized with hundreds of miles of forest roads nearby unaffected and will last only a short duration with no permanent effects.

Since no roads will be closed or obliterated through this project, other than those roads already closed or obliterated, there will be no effect to the number of roads available for recreational driving opportunities. The roads in the project area will continue to connect to several open roads adjacent to the project area providing ample recreational driving opportunities.

Mechanical treatments to stands in the areas open to dispersed camping will likely result in immediate changes to the quality and quantity of camping opportunities for both short-term and mid-term. The disturbance from mechanical thinning (temporary and skid road construction and use, tree removal, ground vegetation disruption, slash piles, etc.) can disrupt both the aesthetic and physical qualities that make a campsite desirable, including for persons seeking shade, cover, etc. While sites could be rendered unusable by mechanical treatments, these effects will not be permanent, with use picking up again in the mid to long-term. As initial ground disturbance heals, slash piles are burned and the beneficial effects of treatments become evident, the sites will likely be desirable again. In addition, there are other opportunities for dispersed camping outside the project area and within a short distance.

Direct effects of initial and maintenance burning on dispersed camping would be minimal and short-term. Generally campers in areas to be burned are asked to leave for the duration of the burn for their safety. Smoke from burning could cause discomfort to campers in the project area during burning but usually disperses within 24 hours. For the duration of a few months after initial and maintenance burning, ash on the forest floor is likely to make camping less pleasurable as it tends to blow in light breezes and stick to surfaces like shoes, tents and clothing. This effect on the quality of the dispersed camping experience, however, would be short-lived as subsequent moisture and vegetation growth makes the activity less evident.

It is likely that, in the short term (up to 1-2 years after mechanical treatment and initial prescribed burning activities) that dispersed camping use will be displaced to other sites both inside and outside of the project area by the treatment activities. As a result of this displacement, use of existing sites that are not planned for treatment within the project area and sites outside the project area may see increases in use. This use is likely to lead to some effects to these sites from the increased use. However, as the overall amount of dispersed camping use to be displaced is relatively low, the associated effects of displace to other sites can also be seen as insignificant.

Mechanical treatments in stands where social trails exist will have immediate effects on the trails and the quality of recreational experience derived from them. The disturbance from mechanical thinning (temporary and skid road construction and use, tree removal, ground vegetation disruption, slash piles, etc.) while temporary can obscure sections of trails making them hard to

follow and in some cases unusable. The duration of this effect is likely to last a few years, until treatments are completed and subsequent prescribed burning occurs, or if the trails are opened again.

Initial prescribed burning and maintenance burning will have little direct effect on social trails as the trails are often used as a burn block line (boundary for a controlled burn) and are unaffected by heat and flame.

While the direct effect of mechanical treatments may be to only a short segment of trail--often less than 10 ft.--treatments can have the indirect effect of making an entire trail system unusable. With many short segments disturbed or disrupted, the system in turn becomes discontinuous. More importantly, disruption of a trail system by mechanical treatments can displace use to other areas not yet treated or not planned for treatment. These trail systems are user-created and have evolved through use without being planned, developed or authorized by the Forest Service, and so their disturbance and even obliteration by mechanical treatment can serve to curb use of eroding and other problematic sections of trail. While the de facto closure can have benefits, the displaced use could evolve in more sensitive locations like goshawk PFAs and MSO PACs.

There are no significant indirect effects on OHV and motorcycle use from initial prescribed burning and future maintenance burning.

Transportation System

Implementation of the proposed action would require the use of existing system roads in the area, the re-opening of some closed and/or obliterated roads, and establishment of temporary roads in order to accomplish vegetation treatment goals. In the short-term (during implementation), this use could adversely impact the roads system, but with the regular maintenance of main roads and re-closing or rehabilitating temporary roads, expected impacts could be minimized, and the desired roads system would be maintained and possibly enhanced in the area after the project is completed.

With the threat of catastrophic wildfire reduced in the area, and thus reduced potential impacts on the existing roads system, the temporary impacts of management activities should prove beneficial in the long-term for the roads in the area.

Special Areas

Lower Lake Mary Seasonal Bald Eagle Closure: Effects discussed in Wildlife section.

Cave Resources Special Protection Closure: Implementation of the proposed action will not affect the subject cave if mitigation measures are implemented (see “Design Features” in Chapter 2).

Scenery Management

This alternative will result in a landscape that will experience short-term disruptions of existing scenic quality, but which will meet all visual quality objectives within a relatively short time (within two growing seasons or less). It will result in a more diverse vegetative mosaic, including large trees, which will generally be less dense and more open, and therefore more interesting to the typical person viewing it. Within the 150-foot area immediately adjacent to Elk Park Meadows, more trees may be left based on landowner input (USDA 1987, p. 206-75).

Cumulative Effects

The actions considered in this discussion are those that have occurred in the recent past (10 years), as well as those reasonably foreseeable land management actions, and the cumulative effects of those actions and this proposal. Management activities that occurred prior to this time

helped create the current condition described under the affected environment section. For this discussion, actions to consider are those that occur in areas immediately within or adjacent to the project area. These include, affect and are affected by:

- Ongoing dispersed camping within the project area, and on lands surrounding the project area.
- Ongoing dispersed recreation (day use) in and around the project area including mountain biking, hunting, recreational driving, hiking, horseback riding, etc.
- Ongoing latent community use and social trail use in and around the project area, including access to general forest areas.
- Upcoming local, regional and national motorized access and Travel Management Rule policy changes for off-road vehicle use.
- Areas where special restrictions are in place, such as for bald eagle and cave protection.
- Road decommissioning (obliteration) and closing in the project area

Recreation

Although it is difficult to estimate where displaced campers may go, it's predicted that major forest roads outside of the treatment areas may see increased use, although this should not be a significant displacement, since there is not a significant amount of overnight camping in the project area now. As the current and historic camping use in the project area has been dispersed in nature, it is reasonable to assume that displaced campers will continue to seek this type of use here and in other areas.

Ongoing statewide and national policy development for the management of off-road and trail motorized use (the Travel Management Rule) will affect the project area in coming years. Analysis is ongoing to establish policy to eliminate cross-country travel in most areas and designate routes open to motorized use. Such an action would likely further limit OHV and motorcycle opportunities in the project area, while at the same time providing for enhanced opportunities on district, forest, and region wide basis as designated system motorized routes become established.

If the no-action alternative were selected, the continuation of dispersed camping in the project area may lead to deleterious trends, including the continued potential of a human-caused wildfire. The cumulative effects of a wildfire would likely be more extensive than those of prescribed or management ignited fire, as wildfires tend to burn with greater intensity. The area affected by a fire would likely be less desirable for recreational activities, affecting the setting and users' experience. The area would likely be closed until it was safe to re-enter and rehabilitation work was completed. Should a high intensity fire occur, many recreation activities might be displaced to the surrounding landscape, adding impacts to surrounding lands and increasing competition and possibly conflict between users.

Transportation System

The management objective for transportation system planning in the area for the last decade or more has been to scale down the number of roads in order to provide a balanced system that meets practical transportation needs and management desires for natural, wildland settings near major communities. While these are seemingly contradictory goals, this has basically worked in other areas, as initial road densities (for both system and non-system roads) in other areas were (or are) higher than forest plan specified densities (approximately 2 miles of road per square mile

of national forest land), but are less than that now with road decommissioning projects undertaken. With downward trending in road maintenance funding, and public desires for wildland settings “out their back doors”, the result has been in identifying core arterial roads through much of this and other areas, with few collector and local roads leading from these roads

The 2002 Flagstaff and Lake Mary Ecosystem Analysis (FLEA), which encompasses the project area, calls for a basic system of roads that are compatible with today’s maintenance capabilities (funding) of the agency and other resource objectives, and prescribes the closing or decommissioning (obliterating) of the remaining un-needed roads that exist in the area. Very little of this work has been accomplished to date due to a lack of funding.

The Travel Management Rule analysis has begun for the forest and project area, and is meant, over a four year period, to identify a desired road and motorized trail system and get rid of un-needed roads. The Elk Park Meadows project area is included in this study and the existing roads system in the area is expected to change in the future as a result of this analysis, with fewer miles of road ultimately existing in order to attain a manageable and sustainable roads system.

Economics

The purpose of this section is to describe the affected environment as it relates to economic components of the project and to describe the direct, indirect, and cumulative effects of the No Action and Proposed Action alternatives on the local and regional economy.

This economic analysis quantifies projected costs and describes effects to the various types of employment and active industries in the area, the impacts that could be experienced by full-time and part-time residents, and consideration of the visiting public. The Recreation, Scenery, and Transportation section of this chapter describes impacts of this project on the social environment, such as recreation and scenery resources. In this section, the economic consequences of the Proposed Action and No Action alternatives are compared in the arena of the Flagstaff economy. There were no public or internal significant issues identified regarding economic concerns.

Affected Environment

Flagstaff is the largest city and regional hub of Northern Arizona. It also serves as the seat for Coconino County. The local population in Flagstaff is 61,270 while Coconino County holds 129,570 residents (2004 data). Principle economic activities in Coconino county include government jobs; the leisure and hospitality (tourism) sector; and trade, transportation and utilities jobs. While some natural resource-based industries still exist, numbers have been in steady decline over the past few decades. According to 2001 data for the city of Flagstaff, only 4 logging establishments (out of 116 in Arizona) are in operation with few employees. New scientific and high-tech research and development industries have recently located to Flagstaff.

Additional social and economic information can be found in the community profile for Coconino County created by the Arizona Department of Commerce located at:
http://www.azcommerce.com/doclib/COMMUNE/Coconino%20County.pdf

Additional Information specific to Flagstaff can be found in the Flagstaff Community Profile at:
http://www.azcommerce.com/doclib/COMMUNE/flagstaff.pdf

Environmental Consequences

Direct, Indirect and Cumulative Effects of Alternative 1

Under this alternative, there would be no economic benefits or gains nor would the Forest Service incur any costs: there is no cost of not treating the area. Notably, the area of Elk Park Meadows has not experienced a significant fire for at least 100 years, as discussed in the Background section of Chapter 1, and therefore is at an elevated risk to wildfire. The public at large has become increasingly aware of the effects realized from wildfires in recent years, and the potential loss of life and property.

There is increased potential for a stand-replacing wildfire without treatment. The Coconino County and Flagstaff community profiles show strong links to tourism, which could be negatively affected by large fires either in the short-term during times of heavy smoke, or in the long-term with the degradation of outdoor recreation experiences and opportunities. The exact effect of large fires near Flagstaff is unknown and would depend on the location and extent of the fire; however, in the 2006 Brin's Fire example[5], 4,317 acres of forested land burned resulting in $6,400,000 of fire suppression expenses, excluding damage to private property, costs of insurance, and the inconvenience of evacuation. The Brin's Fire resulted in the closure of US Highway 89A for an extended time period, impeding travel between Sedona and Flagstaff during peak tourist season. Similarly, if a wildfire were to occur in the Elk Park Meadows project area in the summer months when risk is at its peak, the potential closure of the Lake Mary Road could also obstruct Flagstaff tourism.

No treatment may affect local logging businesses, but would not be a financial detriment to Flagstaff or Coconino County, due to the industry's small contribution to these diverse economies. Ultimately, no treatment would leave the forest in its current condition and local residents may have a reduced feeling of safety and well being in relation to risk of wildfire.

Wildlife habitat provides revenues to the State of Arizona through hunting permits. A stand replacing fire could detract from wildlife populations and negatively affect the number of permits issued for the area where the fire occurred. The authority to change hunting restrictions or units rests with the Arizona Game and Fish Department. A reduction in outdoor recreation opportunity could affect local community income in the form of gas, hotel, grocery, outdoor equipment, and other related economic investments.

Direct and Indirect Effects of Alternative 2

The Proposed Action maintains the natural landscape that supports Flagstaff and Coconino County's tourism industry by providing opportunities for outdoor recreation and scenic backdrops to popular highways, parks, and home sites. Changes in tourism affect hotel, restaurant and outdoor equipment businesses, gas stations, grocery stores, retail stores, and the community tax structure. Elk Park Meadows accommodates a significant part-time seasonal population, with many property owners only visiting during the summer months. There is likely to be a no impact from this project on current property values, based upon other recent fuels reduction/forest health projects on the Coconino National Forest (e.g., Fort Valley and Kachina Village). Reducing fire risk around the community of Elk Park Meadows could influence homeowner's insurance premium rates.

[5] http://www.sedonafire.org/brin.htm

Recent large fires within the region, resulting from overly dense forests, drought, and climatic stress have raised the awareness of the community concerning healthy forests. The Proposed Action would allow for a reduction in tree densities across a larger landscape, which would improve forest health and reduce the risk of wildfire, in turn increasing the public's perception of safety and well being.

The Forest Service would implement activities with allocated project funds. Local communities do not fund costs of implementation nor does the Forest Service have authority to charge fees or assessments on private land. The Responsible Official considers the costs of implementation when determining a course of action.

Table 41 lists estimated costs of implementation based on recent, similar projects. Implementation of activities would likely be a combination of work done by Forest Service employees and contracted work done by private enterprise under the direction of the Forest Service. Activities to be accomplished through private contracts may contribute slightly to jobs in the agricultural sector of the Flagstaff economy but would not cause a significant change.

Table 41. Projected responsible parties and implementation costs of the proposed action

Activity	Private Contractor	Forest Service	Cost ($/unit)	Total Cost
Thinning and removal of trees greater than 9" DBH, including related road work (temporary road construction/maintenance)	X	X	$150 per acre	4,739 x $150 =$710,850
Thinning and removal of trees less than 9" DBH (e.g., pre-commercial thinning)	X	X	$300 per acre	4,739 x $300 =$1,421,700
Slash pile burning in wildland-urban interface		X	$50 per acre	4,739 x $50 =$236,950
Intial broadcast burning		X	$200 per acre	6,462 x $200 =$1,292,400
Maintenance broadcast burning		X	$30-$40 per acre	6,462 x $35 =$226,170
FSR 132B relocation and reconstruction	X	X		$110,000
Noxious weed treatment to remove/contain spreading in certain areas		X	*See* Table 46 in Appendix C	$3,425

This scenario could change depending on Forest Service staffing and budgets, and economic and market trends in timber removal and utilization. Current timber markets are variable and previous timber sales contracts on the Fort Valley and Kachina Village projects did not solicit any bids, whereas the Woody Ridge project did. Therefore, all activities listed in Table 41 could be implemented through a stewardship contract and the entire cost of implementation would be borne by the Federal government.

Cumulative Effects of Alternative 2

This project was evaluated economically at the county level, since Elk Park Meadows is a community located outside of Flagstaff's city limits. It is being planned in tandem with other fuel reduction and thinning projects, has the potential to provide local employment opportunities, and may offer revenue in the logging sector. A majority of current projects, such as Fort Valley, Kachina Village, Woody Ridge, and Mountainaire have been consecutively planned over the last few years. The Eastside, Jack Smith/Schultz, and Mund's Park fuels reduction projects are scheduled to be completed in the near future. While planning efforts for Elk Park may be completed by 2007, implementation will take longer to complete.

On average, it takes one year to prepare a contract for mechanical treatments. Contracts are awarded the following year and implementation often begins that same budget year. Contracts are three-year contracts, but are often completed early. This estimate can be longer if wildlife timing restrictions are in place. It is possible that prescribed fire in burn-only treatment portions of the project area can begin immediately after a decision, but slash pile burning and additional prescribed fire follow mechanical treatment.

It is estimated that contracts will be offered for future fuels reduction projects through the next decade. The amount of timber offered through these projects may help stabilize local operators in the short-term (10-15 years) and may also lead to increased investment in utilization opportunities for materials removed from these areas.

Environmental Justice

Executive Order No. 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" requires agencies to address environmental justice concerns within the context of existing laws, including NEPA. One goal of environmental justice is not to shift risks among populations, but to identify potential disproportionately high and adverse effects to such populations and to identify alternatives that may mitigate these impacts.

After considering the environmental, economic, and social impacts of this project, the Forest Service determined that none of the alternatives considered in this analysis would have a disproportionate impact on any minority or low-income population in the immediate area, within surrounding counties, or in the northern Arizona region.

Thinning ponderosa pine, broadcast burning, and relocating a portion of FSR 132B would not prevent access into the project area nor prevent minority or low-income individuals from collecting firewood or other special forest products within the area. Conversely, not treating the area (No Action) would not alter this access. There is increased potential for a stand-replacing wildfire under Alternative 1, which could temporarily halt firewood collection. However, understory vegetation would likely improve after the event of a fire, unplanned or planned, and could increase the quantity and availability of other forest products traditionally collected in the area.

Other Required Disclosures

NEPA at 40 CFR 1502.25(b) 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."

Consultation with the U.S. Fish and Wildlife Service and the Arizona State Historic Preservation Office has been initiated or completed, as required under the following acts and laws:

- Fish and Wildlife Service, under the Endangered Species Act regulations, for projects with threatened or endangered species and habitat.
- State Historic Preservation Office under the National Historic Preservation Act for causing ground-disturbing actions in historical places.

The Forest Service does not need to consult with the National Marine Fisheries Service because there are no threatened or endangered marine mammals or anadromous fish species within the project area. The Forest Service does not need to consult the USFWS under the Fish and Wildlife Coordination Act because no water is proposed to be impounded or diverted.

See Chapter 1, “Applicable Laws, Regulations, and Agency Policies” for a list of other Federal laws and executive orders pertaining to this project-specific environmental analysis.

Chapter 4. Monitoring

Soils: Project implementation monitoring of soils would occur in order to ensure prescribed soil management practices are implemented as designed. Monitoring will be documented through existing administrative processes e.g., conducted by Timber Sale Administrator or Contracting Officer's Representative as part of contract compliance checks.

Soil Disturbance	Measured Soil Properties	Visual Evidence
COMPACTION	More than 15% increase in bulk density	Coarse platy structure, relative difficulty digging, ruts without berms
DISPLACEMENT	Removal of forest floor and more than 1” of the surface mineral layer. Occurs in excess of 20% of the area.	Soil in piles, subsoil at surface
EROSION	Disturbance exceeds tolerable	Rills, deposition

Sensitive Plants: Monitor the effects of treatments on the habitat and populations of Flagstaff pennyroyal, especially in the stands identified in Table 4 (see “Mitigation Measures” in Chapter 2,) where noxious or invasive weeds occur within stands containing Flagstaff pennyroyal.

Noxious Weeds: Monitor the effects of mechanical harvesting and prescribed burning after implementation to assess the needs for noxious or invasive weed treatments. Monitor the effects of noxious or invasive weed treatments after implementation. See Appendix C.

Air Quality: Any prescribed burn planned by the Forest Service must be approved by ADEQ on a daily basis. ADEQ will not allow more acres burned per day, per air shed, than is acceptable with current air quality forecasts. The Forest Service burn boss is responsible for monitoring smoke plume trajectories to assure impacts are within predicted values. The Forest Service burn boss will make changes as needed when unpredicted weather threatens stronger impacts.

Wildlife: In protected and restricted habitat where treatments are planned, pre and post-treatment micro-habitat monitoring will occur as specified in the MSO recovery plan.

Historic and Cultural Resources: Activities associated with thinning and fire treatments will be managed to avoid historic sites and ensure no effect to historic resources. It will be necessary to remark sites for avoidance before implementation. The District will monitor known sites throughout and following project implementation to ensure they have been avoided, and such inspections will be reported in writing to the forest archeologist. Should any additional prehistoric or historic archaeological sites be encountered during the course of this project, they are to be avoided and immediately reported to a District or Zone Archaeologist.

Chapter 5. Consultation and Coordination

Preparers and Contributors

Forest Service Interdisciplinary Team and Consulting Members

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Experience:	20 years archeology experience with the Forest Service and private contracting

Henry Provencio, Wildlife Biologist, Peaks and Mormon Lake Districts

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Experience:	32 years fire and fuels experience for the Forest Service, 10 years experience in fuels analysis

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Contribution:	Geographic Information Systems support
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The Forest Service contacted or consulted with the following local, State, and Federal agencies, tribes, organizations, and individuals prior to developing this draft environmental assessment:

Local, State, and Federal Agencies

Arizona Game and Fish Department
Arizona State Historic Preservation Office
Arizona State Land Department
Coconino County Board of Supervisors
Coconino County Planning Department
Coconino County Public Works
National Park Service, Flagstaff Area Monuments
USDA Forest Service, Rocky Mountain Research Station
U.S. Fish and Wildlife Service

Tribes

Dine' Medicine Man's Association
Fort McDowell Yavapai Nation
Havasupai Tribe
Hopi Tribe
Hualapai Tribe
Navajo Nation
Pueblo of Acoma
Pueblo of Zuni
San Carlos Apache Tribe
San Juan Southern Paiute Council
Tonto Apache Tribe
White Mountain Apache Tribe
Yavapai-Apache Nation
Yavapai-Prescott Indian Tribe

Organizations and Individuals

Center for Biological Diversity
Ecological Restoration Institute
Forest Guardians
Greater Flagstaff Forests Partnership
Highlands Fire Department
Muleshoe X Cattle Company
Northern Arizona University School of Forestry
Pacific Legal Foundation
Ponderosa Fire Advisory Council
Residents and property owners of Elk Park Meadows
Residents and property owners of Lake Mary Meadows
Southwest Forest Alliance
Sierra Club, Plateau Group
Wild Watershed

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Appendix A: Proposed Forest Plan Amendment

Forest Service Direction for Amending Forest Plans

Forest Service requirements for amending forest plans are included in agency regulations and policies. These require that proposed activities be consistent with forest plans and that activities which may be in conflict with a forest plan either be modified (so as to be consistent), rejected, or that the forest plan be amended (36 CFR 219.8(e)(3)). The Forest Service is authorized to implement amendments to forest plans in response to changing needs and opportunities, information identified during project analysis, or the results of monitoring and evaluation.

The process to consider forest plan amendments, determine significance, document rationale, and compile an approval document is contained in Forest Service Manual (FSM) 1926 and Forest Service Handbook (FSH) 1909.12, Chapter 20. Forest plan amendments may be adopted following proper public notification, comment, and appeal opportunities (either separately or contemporaneously with another project decision), evaluation and documentation of rationale including the need for change, and preparation of an approval document (FSH 1909.12, sec. 25.3 and 25.4).

An assessment of a proposed amendment's significance in the context of the larger forest plan is an integral part of documenting the rationale. It is important to note that the definition of significance for amending a forest plan (FSM 1926.52) is not the same significance as defined by NEPA. Under NEPA, significance is determined by whether a proposal is considered to be a "major federal action significantly affecting the quality of the human environment" (40 CFR 1502.3) or whether the relative severity of the environmental impacts would be significant based on their context and intensity (40 CFR 1508.27).

In contrast, Forest Service policy defines significant changes to a land management plan as one in which 1) changes would significantly alter the long-term relationship between levels of multiple-use goods and services originally projected or 2) changes may have an important effect on the entire land management plan or affect land and resources throughout a large portion of the planning area during the planning period.

Analysis of Proposed Amendment to the Coconino Forest Plan

Existing Condition

The majority of overstocked ponderosa pine within the Clark PAC ranges in size from 12 to 16 in. DBH. The current Forest Plan standard and guideline (p. 65-2) for harvesting trees within Mexican spotted owl PACs states:

> *"Harvest conifers less than 9 inches in diameter only within those protected activity centers treated to abate fire risk as described below.*
>
> --*Use combinations of thinning trees less than 9 inches in diameter, mechanical fuel treatment and prescribed fire to abate fire risk in the remainder of the selected protected activity center outside the 100 acre "no treatment" area."*

Need for Change

Harvesting ponderosa pine up to 16 in. DBH will decrease competition between trees for moisture, nutrients, and sunlight, increase overall tree health, growth, and vigor, promote the development of larger diameter trees, improve health and longevity of existing old trees, promote faster development of old growth forest structure, improve owl forage and nesting habitat and

reduce the potential effects of wildfire within this PAC. If the harvesting of trees is limited to 9 in. DBH, an insufficient number of pines would be removed, resulting in no significant improvements to forest health, growth, and vigor, owl habitat, fire regime condition class, or reduction in fire hazard within the Clark PAC.

Proposed Plan Amendment

A forest plan amendment would be necessary to allow harvesting of ponderosa pine up to 16 in. DBH in the Clark PAC (outside of the 100-acre no-treatment buffer). The following language (**in bold text**) is proposed to be added to the text on page 65-2 of the forest plan (forest-wide direction for Mexican spotted owl):

> *"Harvest conifers less than 9 inches in diameter only within those protected activity centers treated to abate fire risk as described below,* ***except for the Clark PAC where trees less than 16 inches diameter will be harvested****.*
>
> --*Use combinations of thinning trees less than 9 inches in diameter* ***(or less than 16 inches in the Clark PAC)****, mechanical fuel treatment and prescribed fire to abate fire risk in the remainder of the selected protected activity center outside the 100 acre "no treatment" area."*

Significance

For this project, the following criteria were used to help evaluate and analyze the significance of the proposed forest plan amendment. A response to each of these criteria is provided afterwards.

1. Timing. Refers to when the change in the forest plan would take place relative to the planning period and scheduled revisions of the plan.

The Coconino Forest Plan (1987, as amended) is nearing the end of its first planning period. The proposed management direction would be in place until efforts to revise the plan are complete (estimated to be 2009). This forest plan amendment is being proposed at an opportune and appropriate time and the new direction would likely be incorporated directly into the new Forest Plan.

2. Location and size. Refers to the location and size of the area affected compared to the size for the overall planning area.

The Coconino National Forest includes 1,821,495 contiguous acres in north central Arizona. There are approximately 124,000 total acres of Mexican spotted owl PACs set aside across the forest. The 6,731-acre Elk Park project area represents approximately 0.3% of the total forest acres. Mechanical treatments are proposed for 390 acres of the Clark MSO PAC, which represents approximately 6% of the Elk Park project area, 0.3% of all MSO PACs on the forest, and 0.00025% of the total forest acres.

3. Goals, Objectives, and Outputs. Refers to how, or to what degree, the amendment would affect the long-term relationship between levels of goods and services projected by the forest plan.

The proposed treatments will help reduce catastrophic wildfire hazard, re-introduce fire's natural role into the ecosystem, and help ponderosa pine progress towards desired forest structure, including Mexican spotted owl nesting habitat needs, as stated in the existing Forest Plan. Outputs identified in the current Forest Plan are not anticipated to change as a result of the proposed treatments for the Clark PAC and the long-term relationship between levels of goods and services projected by the Forest Plan will not be affected.

4. Management Prescription. Refers to whether the change would apply only to a specific situation or to future situations across the planning area.

This amendment would apply only to the Clark PAC and would not affect nor is it intended to set precedent for treatments in other MSO PACs on the forest. The proposed thinning of trees up to 16 in. DBH is driven by the current condition of ponderosa pine and risk of wildfire in this particular area. The change in management prescription does not, of itself, change the desired condition for Mexican spotted owl nesting habitat; it will merely assist in achieving the desired condition in a different way. The proposed treatments will reduce wildfire hazard and improve ponderosa pine forest structure, thereby improving Mexican spotted owl nesting habitat. The desired condition of the overall forest landscape would not be altered through implementation of this amendment.

The proposed Forest Plan amendment is consistent with 36 CFR 219.6(a)(2), 36 CFR 219.8(e)(3), 36 CFR 219.13(a)(1) and FSH 1909.12 Section 25.4. This amendment would only apply to the Clark Mexican spotted owl protected activity center, as analyzed under the Elk Park Fuels Reduction and Forest Health project. Reformatting of the Forest Plan is not necessary in conjunction with this amendment. Based upon this analysis, the proposed amendment would not result in a significant change to the Coconino Forest Plan.

Appendix B: Projects Considered in Cumulative Effects Analyses

The following tables identify past, present and reasonably foreseeable activities and natural events that could be considered in a cumulative effects analysis. Foreseeable future projects are listed if there is currently a proposed action available or other document or map that outlines the activity, even if the plan is only conceptual. Information from these lists of activities and/or natural events are carried forward into each resource cumulative effects analysis based on that resource's spatial and temporal parameters. Not all of these activities or events are applicable to each resource cumulative effects analysis.

The tables were created by reviewing the latest Schedule of Proposed Actions (SOPA), the Flagstaff Center Decision Records Index, district outyear plans, and the Coconino County Capital Improvement Plan (2002-2006 Work Plan).

Table 42. Past actions/projects

Project Name	Location	Description/Effects	Status
Commercial thinning	75% of the project area and adjacent stands	Reduced density of mid-aged and mature sawtimber and yellow pines. Decreased crown canopy closure. Decreased crown canopy closure. Contributed to increased regeneration and an even-aged forest structure	1960-70s
Pre-commercial thinning	50% of the project area and adjacent stands	Reduced density of young forest. Decreased crown canopy closure. Some improvement to forest health and fire hazard.	1970s
Reforestation	<5% of the project area	Open draws/meadows and stump fields planted with ponderosa pine	1979
Lake Mary Allotment	Within project area and Walnut Creek watershed	28,659-acre grazing allotment that has been in non-use status since 2001/used as a grass bank. (Area historically grazed by sheep and cattle since c. 1870)	Grazed prior to 2001
Mint Springs Analysis	South of Mormon Lake (Walnut Creek watershed)	Thinned trees >5" DBH and pre-commercial thinned 3,894 acres; broadcast burned 12,000 acres; enhanced 36 acres of aspen; closed 8.8 mi. of road and obliterated 21.3 mi. road within the Mint Springs analysis area.	Work began 1998; treatments completed 2006
Arizona Trail: Railroad Springs to Pinegrove TH	Within Walnut Creek watershed	Construct a segment of the Arizona Trail beginning 3 mi. south of Mormon Lake, traveling north to Pinegrove trailhead along west side of lake.	Completed 2002
Pinegrove Campground Construction	Adjacent to FH3; S. of Upper Lake Mary	Replace existing facilities and construct a new amphitheatre. Improved developed recreation management.	Completed 2002
Campbell Mesa Road Obliteration	Within Walnut Creek watershed	Closed and/or obliterated 40 mi. of road on Campbell Mesa (area south of I-40, north of FR303 and Walnut Canyon NM, east of Country Club (Flagstaff) and west of the Nat'l Monument entrance road	Completed 2002

Project Name	Location	Description/Effects	Status
Lake Mary Watershed Maintenance	NW and SW of Elk Park Meadows	Thinned encroaching ponderosa pine in 3 meadows, across 70 acres, to restore condition and function of meadows.	Completed 2002 - 2003
Hoxworth Meadow Restoration	SW of Elk Park Meadows	Removed encroaching ponderosa pine on 27 acres to restore meadow habitat.	Completed 2004
Bear Park Urban Fuels Reduction	Southern section of Walnut Creek 5th code watershed	Thinned unhealthy ponderosa pine that were densely spaced, dead top or otherwise considered a fire threat across 55 acres immediately adjacent to private land.	Completed 2004
Lake Mary Watershed Stream Channel Restoration	Priest and Howard Draws (Walnut Creek watershed)	Restore stream channel gradient and re-vegetate to control erosion; obliterate 3.2 mi. of forest system road and improve FR235 to trailhead; construct 2 mi. trail along Priest Draw; remove stunted seedling trees from meadow areas.	Completed 2004
Lake Mary Meadows II Fuel Reduction	NW of Elk Park Meadows	Thin encroaching ponderosa pine in 3 meadows, across 300 acres, to restore meadows, reduce fuel condition class, and reduce yellow pine competition.	Completed 2005
Skunk Hollow Thinning Project	Northern section of Walnut Creek watershed	Thin trees on 831 acres; includes piling slash and burning piles.	Completed 2005
Priest Draw Aspen Protection	Central section of Walnut Creek watershed	Fence 10 acres of aspen (3 separate enclosures) and thin encroaching pine within these areas.	Completed 2005

Table 43. Current projects and ongoing activities/natural events

Project Name	Location	Description/Effects	Status
Drought	Regionally	Insufficient precipitation for normal plant growth. Vegetation is negatively affected in general. Lakes and other riparian areas are generally low to completely dry.	Arizona is currently experiencing a drier than normal average for the past 10 years, with some intermittent wetter than normal years
Dispersed recreation	Forest-wide, including the Walnut Creek watershed	The ROS classes for the area are Roaded Natural and Semi-Primitive Motorized. Recreational use is considered low, with some hunting, OHV driving, and dispersed camping occurring. Affects localized soil conditions (compaction), visual quality (littering), and wildlife (user-created trails). Use likely to increase as suburban populations grow.	On-going
Firewood gathering	Forest-wide, including the Walnut Creek watershed	Removal of dead/down vegetation is authorized through a special use permit. People gather firewood in many areas. Effects to vegetation and soil can occur from driving vehicles off road or from trampling in areas where the firewood is gathered. Illegal firewood cutting reduces density of large diameter pine and oak trees, snags, and logs.	On-going; use varies by year but majority of use occurs Oct 1 -Dec 15
Existing roads	Within Walnut Creek watershed	There are 19.5 miles of Level 2 Forest System roads within the project area, resulting in an open road density of 2.42 miles /mi^2. Generally, these roads are in fair to poor condition, have inadequate drainage, and are most often poorly located. There are additional user-created roads within the area. People may occasionally turn off an existing forest system road and travel cross-country, but this is rare because rocky/rugged conditions generally limit off-road use.	On-going
Pine Grove Seasonal (Motorized) Closure	Area immediately south of Upper Lake Mary	Area closed to motor vehicles from 8/15 to 12/31 annually. Roads within the area are closed, but roads along the perimeter are open to motorized travel.	On-going since 1991
Mormon Lake and Fulton Canyon Protection	Within Walnut Creek watershed	Motor vehicle closure area between FH3 and Forest Road 90 to protect Mormon Lake and Fulton Canyon	On-going since 2000
Lake Mary Fuels Reduction	Southwest of Lake Mary; adjacent to project area	Thin 1,970 acres of ponderosa pine between 1and 12” DBH and broadcast burn a total of 2,935 acres. Reduced density of young forest. Some improvement to forest health, vigor, structure, growth, visual quality, and fire hazard.	Thinning completed 2002; 642 acres burned in 2005 and 2006

Project Name	Location	Description/Effects	Status
Walnut Canyon Grazing Allotment	South of Walnut Canyon National Monument (Walnut Creek watershed)	Re-authorize grazing on the allotment for up to 350 cattle from Jun. 1 through Oct. 31 (1,761 head months); permanently withdraw 7,387 acres from grazing; construct 5 wetland exclosure fences around Prime, Fisher/Fry, and Youngs Lakes and Dry and Lost Tanks (6 total mi. of fence). Install ¼ mi. pipeline/drinker from Babbitt Spring and exclude cattle from spring. Close roads 9479K, 9479J, and 9479M to Prime Lake and roads 9480Q, 9480R, and 9480S to Youngs Lake. Route travel around Prime Lake via road 129A. Improvement in condition of wetlands and vegetation are expected.	New allotment management plan finished 2006. Improvements scheduled to begin 2007
Mormon Lake Basin Fuels Reduction	SW of Mormon Lake Community	Thin ponderosa pine on 2,388 acres and broadcast burn 2,831 acres; convert 2 user-created roads to trails; maintenance burn every 5-10 yrs after first burn.	Implementation to began 2006
Skunk Canyon Prescribed Fire	T20NR7E Sect. 2,3,10,11 (Walnut Creek watershed)	Broadcast burn 831 acres in former Skunk Hollow thinning project area over next 5-6 yrs. Conduct maintenance burns every 4-15 yrs. as needed afterward.	Implementation to began 2006

Table 44. Reasonably foreseeable future projects

Project Concept	Location	Description	Strategy
Mountainaire HFRA (Fuels Reduction)	Portion of project within western section of Walnut Creek watershed	Mechanically thin 13,363 acres; restore 2,805 acres of savannah/grassland (remove trees < 24”DBH); broadcast burn 15,109 acres; designate open 47.7 mi. open road system and decommission 55.7 mi. roads; designate dispersed camping in southern project area. Reduces density of young and mid-aged forest and creates openings. Improvement to forest health, vigor, structure, growth, visual quality, fire hazard, and wildlife habitat.	Implementation expected to begin summer 2007
City of Flagstaff Lake Mary Well	0.25 mi. north of Upper Lake Mary Dam (Walnut Creek watershed)	Install approximately 1,500 feet of underground electric line and construct a 10’ x 10’ control building	Implementation likely to begin spring 2007
FH 3 (Lake Mary Road) Reconstruction Federal Highway Administration (FHWA)	Portion of project within Walnut Creek watershed	Widen 4.6 miles of FH3 from Mormon Lake Ranger Station to Flagstaff City limits; replace existing guardrail between MPs 338 and 328; construct turn lane additions to Lake Mary Boat Launch (MP 332) and Pine Grove Campground (MP 326); replace worn surfacing and provide ADA-access at the Mormon Lake Scenic Overlook parking area (MP 320).	Implementation likely to begin spring of 2008
National Travel Management Rule Implementation	Forest-wide	Designate a system of National Forest system roads, trails, and areas open to vehicle use. Motor use off designated roads and trails and outside of designated areas would be prohibited under 36 CFR 261.13. The number of NFS roads and trails open to motorized vehicle use within the project and watershed areas are likely to decrease.	Publish motor vehicle use map by end of 2009; prohibition of cross-country begins afterwards

Appendix C: Noxious or Invasive Weed Best Management Practices and Treatments

Preventing the introduction and spread of noxious weeds is one objective of integrated weed management programs on the Coconino National Forest. The Final Environmental Impact Statement (FEIS) for Treatment of Noxious or Invasive Weeds, Coconino, Kaibab and Prescott National Forests, and Coconino, Mohave and Yavapai Counties, Arizona (2005) amended the Coconino National Forest Plan. Appendix B of that document includes specific design features, best management practices, required protection measures and mitigation measures to manage noxious or invasive weeds.

The following list of integrated best management practices for weeds, and recommended management activities was adapted from the FEIS and is designed to mitigate identified risks of weed introduction and spread specific to the Elk Park project area. Only those measures applicable to this project are included in this list.

Table 45. Noxious/invasive weed best management practices

Objective	Best Management Practice
Incorporate weed prevention and control into project layout, design, alternative evaluation, and project decisions.	Environmental analysis for projects and maintenance programs will need to assess weed risks, analyze potential treatment of high-risk sites for weed establishment and spread, and identify prevention practices (C*ompleted during NEPA analysis in the Botany Specialist Report and incorporated into this Environmental Assessment.)* Determine prevention and maintenance needs, including the use of herbicides if needed, at the onset of project planning. (*This practice was completed during NEPA analysis in the Botany Specialist Report and incorporated into this Environmental Assessment.)* Include weed surveys at the project planning stage as outlined in "General Weed Management Practices" (*Completed during NEPA analysis in the Botany Specialist Report and incorporated into this Environmental Assessment.)* For timber sale purchaser road maintenance and decommissioning, use standard timber sale contract clauses such as WO-C/CT 6.36 to ensure appropriate equipment cleaning. Incorporate during implementation. For new and reconstruction of roads conducted as part of public works (construction) contracts and service contracts include contract language for equipment cleaning such as is in WO-C/CT 6.36. Incorporate during implementation.
Avoid or remove sources of weed seed and propagules to prevent new weed infestations and the spread of existing weeds.	Before ground-disturbing activities begin, inventory and prioritize treatment of invasive weeds in project operating areas and along access routes, or within reasonably expected potential invasion vicinity. *(Surveys conducted by field crews prior to NEPA analysis.)* Do a risk assessment accordingly; control weeds as necessary. (C*ompleted during NEPA analysis in the Botany Specialist Report and incorporated into this Environmental Assessment*.)

Objective	Best Management Practice
	After completing the practice above, reduce the risk of spreading and creating weed infestations. Plan operating areas and access routes to avoid heavy infestation areas, plan closure of access routes at finish of project, and/or begin project operations in uninfested areas before operating in weed-infested areas. Locate and use weed-free project staging areas. Incorporate during implementation. Ensure that all outside (rental, other agency or unit) equipment is free of weed seed and propagules before it is accepted by the contracting officers representative. Wash vehicles and equipment before entering project area, focusing especially on areas such as undercarriages,tires and wheel wells that may harbor seeds and fragments of noxious or invasive weeds. Incorporate during implementation. Remove mud, dirt, and plant parts from project equipment before moving it into a project area. Determine the need for, and when appropriate, identify sites where equipment can be cleaned. Clean all equipment before entering National Forest System lands. This practice does not apply to service vehicles traveling frequently in and out of the project area that will remain on a clean roadway. Incorporate during implementation. If operating in areas infested with weeds, clean all equipment before leaving the project site. To minimize time spent cleaning equipment, time all work in infested areas last and concurrently. Designate a parking lot where project vehicles working in the infested area may be parked for the duration of the project. This area should be monitored in followup mitigation and should be near a “clean” vehicle/equipment lot. Identify sites where equipment and vehicles can be cleaned before leaving the site at the end of the project. Incorporate during implementation.
Retain native vegetation in and around project activity and minimize soil disturbance.	Minimize soil disturbance to no more than needed to meet vegetation management objectives. Incorporate during implementation. Minimize soil disturbance with appropriate logging techniques. The amount of disturbance from logging techniques varies with equipment and methods. Incorporate during implementation.
Where project disturbance creates bare ground, establish vegetation to minimize favorable conditions for weeds.	Treat disturbed soil (except surfaced projects) in a manner that optimizes native plant establishment for that specific site. Incorporate during implementation. Examples of revegetation techniques include but are not limited to topsoil replacement, native seedbank promotion, planting, seeding, fertilization, and/or weed seed-free mulching as necessary. Use local native material where appropriate and feasible (or specifically identify why not used). Use certified weed-free and weed seed-free hay or straw. Incorporate during implementation.

Objective	Best Management Practice
	Use local seeding guidelines to determine detailed procedures and appropriate mixes. To avoid weed contamination, a certified seed laboratory needs to test each lot against the Forest noxious or invasive weed list, and provide documentation of the seed inspection test. Seed lots labeled as certified weed seed-free at time of sale may still contain some weed seed contamination. Incorporate during implementation.
Manage fire as an aid in control of weeds to prevent new weed infestations and the spread of existing weeds.	Pre-inventory project area and evaluate weeds present with regard to the effects on the weed spread relative to the fire prescription. *(Surveys conducted by field crews prior to NEPA analysis. Evaluation completed during NEPA analysis in the Botany Specialist Report and incorporated into this Environmental Assessment.)* Burn noninfested areas first before entering weed infested sections of the burn. Clean all equipment when project is completed. Or treat and burn all infested areas first to remove seed source then clean equipment and proceed to uninfested areas. Incorporate during implementation. Time burns to promote native species and to hinder weed species germination. Incorporate during implementation. Mitigate the effects of pile burning by monitoring pile sites after burning and controlling noxious and invasive weeds on slash pile sites as necessary.
Avoid or remove sources of weed seed and propagules to prevent new weed infestations and the spread of existing weeds.	Treat weeds on contracted projects, emphasizing treatment of weed infestations on existing landings, skid trails before activities commence. Incorporate during implementation. Use standard timber sale contract clauses such as WO-C/CT 6.36 to ensure appropriate equipment cleaning. Incorporate during implementation.
Retain native vegetation in and around project activity and minimize soil disturbance.	Minimize period from end of logging to site preparation, revegetation, and contract closure. Incorporate during implementation. Recognize the need for prompt growth of native vegetation, long-term restoration and weed suppression where forested vegetation management has created openings. Incorporate during implementation. Allow natural seedbank to provide vegetation if possible, next preference is for native seed grown from local collections. All seed must be certified weed seed-free for all species on the forest noxious or invasive weed list. The Forest will provide a current list to potential seed suppliers to facilitate the certification process. Incorporate during implementation.
Minimize roadside sources of weed seed that could be transported to other areas.	Avoid acquiring water for dust abatement from weed-infested areas. Incorporate during implementation.

Objective	Best Management Practice
	For road maintenance and decommissioning include contract language for equipment cleaning such as in WO-C/CT 6.36. Incorporate during implementation. Schedule and coordinate all earth-moving or soil-disturbing activities (such as pulling of noxious or invasive weed-infested roadsides or ditches) in consultation with the local weed specialist. Do not blade or pull roadsides and ditches that are infested with weeds unless doing so is required for public safety or protection of the roadway. If the ditch must be pulled, ensure the weeds remain onsite. Blade from least infested to most infested areas. When it is necessary to blade weed-infested roadsides or ditches, schedule the activity when seeds or propagules are least likely to be viable and spread. Minimize soil surface disturbance and contain bladed material on the infested site. Incorporate during implementation.

These stands were selected for treatment based on the management objectives in the noxious or invasive weed FEIS (BMPs listed earlier) and on the threats to Flagstaff pennyroyal, a Southwestern Region Sensitive plant (see Chapter 2, Table 4). Other infestations will be treated by mitigation using the Best Management Practices outlined earlier.

Table 46. Proposed treatments for selected noxious or invasive weed locations within the project area

Location/Site	Species	Treatment (Proposed Action)	Size (acres)	Control Method*	Timing	Responsible Party	Treatment Costs	Total Cost	Notes
362/1	Musk thistle	Burn	0.2 (two infestations, reported at 0.1 acre each)	Hand pull	Visit infestation before implementation and eradicate Monitor post-treatment	FS Field Crew FS Field Crew	1 person day @ ~ $250/day ½ day/yr @ $250/day for 2 yrs	$500	Estimate assumes one person locates and eradicates any existing plants Monitor to assure species is eradicated
361/3	Diffuse knapweed	Mechanical	0.1	Biocontrol insects**	Visit location before management activity and assess acreage	FS Field Crew	1 person ½ day @ $250/day	$700	* Manually control infestation during this visit if the acreage is small, then reassess feasibility of biological control agent

Location/Site	Species	Treatment (Proposed Action)	Size (acres)	Control Method*	Timing	Responsible Party	Treatment Costs	Total Cost	Notes
					Locate appropriate release sites, introduce biocontrol insects to infestations after treatments, and release insects. Monitor after introduction for two years		1 person ½ day @ $250 plus insects $1 per bug and 200 bugs per site 1 person ½ day @ $250/ yr for 2 years		Within limited spray zone***
360/1	Dalmatian toadflax	Mechanical	0.1	Biocontrol insects**	Locate appropriate release sites, introduce biocontrol insects to infestations after treatments, and release insects. Monitor after introduction for two years	FS Field Crew	1 person ½ day @ $250 plus insects $1 per bug and 200 bugs per site 1 person ½ day @ $250/ yr for 2 years	$575	Within limited spray zone***
360/3	Dalmatian toadflax	Burn	1	Biocontrol insects**	Locate appropriate release sites, introduce biocontrol insects to infestations after treatments, and release insects. Monitor after introduction for two years	FS Field Crew	1 person ½ day @ $250 plus insects $1 per bug and 200 bugs per site 1 person ½ day @ $250/ yr for 2 years	$575	Within limited spray zone***

Location/Site	Species	Treatment (Proposed Action)	Size (acres)	Control Method*	Timing	Responsible Party	Treatment Costs	Total Cost	Notes
360/3	Dalmatian toadflax	Mechanical	0.1	Biocontrol insects**	Locate appropriate release sites, introduce biocontrol insects to infestations after treatments, and release insects. Monitor after introduction for two years	FS Field Crew	1 person ½ day @ $250 plus insects $1 per bug and 200 bugs per site 1 person ½ day @ $250/ yr for 2 years	$575	Within limited spray zone***
362/1 and 373/7	Dalmatian toadflax	Burn only		Biocontrol insects**	Monitor release sites before and after burning	APHIS or FS Field Crew	1 person ½ day @ $250 for two years (before and after burning)	$500	

** Estimates assume that biological control insects must be purchased. Insects either may be available at no charge by collecting from local insectaries or supplied to the Forest at no charge from APHIS. Local insectaries are becoming established within the project area and nearby.

*** The noxious weed FEIS established limited spray zones of 1 mile around private property, recreation sites, etc. In these areas, non-herbicide treatments of noxious or invasive weed infestations should be considered before herbicides are applied in these areas. Therefore, I have proposed manual and/or biological control for the project area.

Glossary

B

Best Management Practices (BMP): A combination of practices that are the most effective and practical means of achieving resource protection objectives (primarily water quality protection) during resource management activities.

C

Canopy Cover: The percent of ground area that is covered with tree crowns.

Condition Class: The condition classes for the fire regime are Condition Class I where vegetative structure, composition, and fire effects are within the natural range of variability, Condition Class II where there is a moderate departure from the natural historical regime of vegetation characteristics, fuel composition, and fire effects, and Condition Class III where there is a severe departure from the natural historical regime of vegetation characteristics, fuel composition, and fire effects.

Consultation: A formal process for consultation on the potential effects on threatened, endangered, or proposed species that occurs between the agency proposing an action (U.S. Forest Service) and the regulating agency (U.S. Fish and Wildlife Service).

Critical Habitat: That portion of a wild animal's habitat that is critical for the continued survival of the species ("Critical" is a formal designation under the Endangered Species Act.)

Cumulative Effects: 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 (40 CFR § 1508.7).

D

Decision Notice: A decision document prepared for an environmental assessment that explains the rationale for the decision.

Developed Recreation: Recreation that requires facilities that result in concentrated use of an area. Examples are campgrounds and ski areas. Facilities might include roads, parking lots, picnic tables, toilets, water systems, ski lifts, and buildings.

Direct Effects: The effects caused by the action and occur at the same time and place (40 CFR § 1508.8).

Dispersed Recreation: Recreation use that occurs outside of developed sites and requires few, if any, improvements other than roads and trails. Representative activities are hiking, backpacking, driving for pleasure, viewing scenery, snowmobiling, cross-country skiing, hunting, off-road vehicle use, and berry picking.

E

Ecosystem Management: The use of an ecological approach that blends social, physical, economic, and biological needs and values to assure productive, healthy ecosystems.

Effects: The results expected to be achieved from implementation of actions relative to physical, biological, and social (cultural and economic) factors resulting from the achievement of outputs. Examples of effects are tons of sediment, pounds of forage, person-years or employment, and income. *See* direct effects, indirect effects, and cumulative effects.

Environmental Assessment (EA): A "concise public document [that] briefly provides sufficient evidence and analysis for determining whether to prepare an EIS or a finding of no significant impact…and shall include brief discussions of the need for the proposal…alternatives…the environmental impacts of the proposed action and alternatives…[and] a listing of agencies and persons consulted." (40 CFR 1508.9).

F

Finding of No Significant Impact (FONSI): A document briefly presenting the reasons why an action will not have a significant effect on the human environment and for which an environmental impact statement will not be prepared (40 CFR 1508.13).

Fire Hazard Rating: A relative measure of how virulently a wildfire could burn under the 90th percentile weather conditions that occur from April through July 7. Criteria used to determine fire hazard ratings include: canopy cover, tree stems per acre, height to the bottom of the live crown, dead and down fuel loading, slope steepness, and aspect.

G

Game Species: Any species of wildlife or fish for which seasons and bag limits have been prescribed and which are normally harvested by hunters, trappers, and fishermen under State or Federal laws, codes, and regulations.

Grasslands: Lands where the vegetation is dominated by grasses, grass-like plants, and/or forbs. Nonforest land is classified as grassland when herbaceous vegetation provides at least 80 percent of the canopy cover excluding trees.

Group: Groups are generally clusters of 2-12 trees (possibly up to 40) that may have interlocking crowns and are externally-defined by interspaces surrounding them.

H

Headcut: The vertical break in slope at the uphill end (head) of a gully.

Headwall: The edge over which water plunges into a gully.

I

Impaired Soil Condition: Indicators signify a reduction in soil quality. The ability of the soil to function properly has been reduced and/or there exists an increased vulnerability to irreversible degradation. An impaired category should signal land managers that there is a need to investigate the ecosystem further to determine the cause and degree of decline in soil functions. Changes in management practices or other preventative actions may be appropriate.

Important Bird Area (IBA): an internationally recognized place on the landscape that provides exceptionally valuable or essential habitat for one or more species of birds, including breeding, wintering or migratory habitat.

Indirect Effects: Effects caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR § 1508.8).

Inter-tree Competition: refers to density-related scarcity of one or more environmental factors necessary for growth, such as moisture, nutrients, and sunlight (Long 2005).

Interdisciplinary Team (IDT): A group of individuals with skills from different disciplines. An interdisciplinary team is assembled because no single scientific discipline is sufficient to adequately identify, analyze, and resolve issues or problems.

Interspace: Interspaces are grassy, non-forested areas of varying sizes which occurred naturally between groups of trees prior to fire suppression.

Issue: A subject, question, or conflict of widespread public discussion or interest regarding management of National Forest System lands.

M

Management Area (MA): As defined in the "Coconino National Forest Plan." An area that has common direction throughout and that differs from neighboring areas. The entire forest is divided into management areas where common standards and guidelines apply.

Management Indicator Species: Any species, group of species, or species habitat element selected to focus management attention for the purpose of resource production, population recovery, maintenance of population viability, or ecosystem diversity (FSM 2605).

Mitigation Measures: Actions that are taken to lessen the severity of effects of other actions.

N

Nutrient Cycling: This function is assessed by evaluating the vegetative community composition, litter, coarse woody material, root distribution and soil biotic crusts. These indicators are directly related to soil organic matter, which is essential in sustaining long-term soil productivity. Soil organic matter provides a carbon and energy source for soil microbes and provides nutrients needed for plant growth. Soil organic matter also provides nutrient storage and capacity for cation and anion exchange.

O

Old-Growth: Stand of timber that is past full maturity and well into old age and is the last stage in forest succession.

Overstory: That portion of trees, in a stand of trees of more than one story, forming the upper or uppermost canopy layer.

P

Plunge pool: A spot at the base of a waterfall where the descending force of the water strikes the bottom and carves out a basin.

Prescribed Fire: Fires set under conditions specified in an approved plan to dispose of fuels, control unwanted vegetation, stimulate growth of desired vegetation, and change successional stages to meet range, wildlife, recreation, wilderness, watershed, or timber management objectives.

Proposed Action (PA): In terms of the National Environmental Policy Act, the project, activity, or action that a Federal agency proposes to implement or undertake. The PA is sent to the public and interested agencies for their review and comment.

Protected Activity Center (PAC): An area established around a Mexican spotted owl nest or roost site, for the purpose of protecting the area. Management of these areas is largely restricted to managing for forest health objectives.

R

Raptor: Any predatory bird such as a falcon, hawk, eagle, or owl.

Revegetation: Re-establishing and developing plant cover. This may take place naturally through the reproductive processes of existing flora or artificially by planting.

S

Satisfactory Soil Condition: Indicators signify that soil quality is being sustained and the soil is functioning properly and normally. Ability of the soil to maintain resource values, sustain outputs and recover from impacts is high.

Sensitive Species: Plant and animal species identified by a regional forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density, or significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (FSM 2670.5(19)).

Seral: One stage in a series of steps in the process of ecological succession.

Snag: Standing dead tree from which the leaves or needles have fallen.

Soil Hydrology: This function is assessed by evaluating or observing changes in surface structure, surface pore space, consistence, bulk density, infiltration or penetration resistance using appropriate methods. Increases in bulk density or decreases in porosity results in reduced water infiltration, permeability and plant available moisture.

Soil Stability: Erosion is the detachment, transport, and deposition of soil particles by water, wind or gravity. Vascular plants, soil biotic crusts, and litter cover are the greatest deterrent to surface soil erosion. Visual evidence of surface erosion may include rills, gullies, pedestalling, soil deposition, erosion pavement or loss of the surface "A" horizon. Erosion models are also used to predict on-site soil loss.

Stand: A stand is a community or group of trees that grow together at a particular place that share unique vegetal characteristics which are distinguishable from adjacent stands, thus forming an individual management or silvicultural unit (Nyland 1996).

Stand Density Index (SDI): SDI is a relative measure of stand density based on the number of trees per acre and the mean diameter (Reinke 1933). SDI expresses the actual density in a stand relative to the theoretical maximum density possible for trees of that diameter and species. The maximum SDI for ponderosa pine is 450.

Succession(al): An orderly process of biotic community development that involves changes in species, structure, and community processes with time.

Suitability: "The appropriateness of applying certain resource management practices to a particular area of land, as determined by an analysis of the economic and environmental consequences and the alternative uses foregone. A unit of land may be suitable for a variety of individual or combined management practices." (36 CFR 219.3)

T

Threatened and Endangered Species (TES): Species identified by the Secretary of the Interior in accordance with the 1973 Endangered Species Act, as amended.

Threatened Species - Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Endangered Species - Any species that is in danger of extinction throughout all or a significant portion of its range.

Proposed Species - Any species of fish, wildlife, or plant that is proposed in the Federal Register to be listed under Section 4 of the Endangered Species Act (50 CFR 402.02).

U

Understory: The trees and other woody species growing under a more or less continuous cover of branches and foliage formed collectively by the upper portion of adjacent trees and other woody growth.

Unsatisfactory Soil Condition: Indicators signify that degradation of soil quality has occurred. Impairment of vital soil functions results in inability of the soil to maintain resource values, sustain outputs and recover from impacts. Soils rated in the unsatisfactory category are candidates for improved management practices or restoration designed to recover soil functions.

Uneven-aged: An age arrangement in which the trees differ markedly in their ages. An uneven-aged stand, ideally, contains at least three age classes.

V

Vegetative Structural Stages (VSS): VSS is a six-class vegetation scheme historically used in the Southwestern Region to describe the developmental stages of a forest ecosystem, from seedlings (VSS 1) to old forest (VSS 6).

W

Wildfire: Any wildland fire that requires a suppression action. This includes all fires not meeting the requirements of a prescribed fire.