United States Department of Agriculture

Forest Service

Southwestern Region

Eastside Fuel Reduction and Forest Health Project

Final Environmental Assessment

Coconino National Forest

Peaks and Mormon Lake Ranger Districts

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Document Structure

The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the Proposed Action. The document is organized into five chapters with appendices:

- Purpose and Need: 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 chapter also details how the Forest Service informed the public of the proposal and how the public responded.
- Alternatives: This chapter provides a more detailed description of the agency's proposed activities. This discussion also includes mitigation and monitoring measures. Finally, this chapter provides a summary table of the environmental consequences associated the Proposed Action and with no treatment.
- Affected Environment and Environmental Consequences: This chapter describes the environmental effects of implementing the Proposed Action. This analysis is organized by resource area. Within each section, the affected environment (existing conditions) is described first, followed by the effects (environmental consequences) of no treatment that provides a baseline for evaluation and comparison of the Proposed Action that follows.
- Project Coordination: This chapter provides a list of preparers and agencies consulted during the development of the environmental assessment.
- References: This chapter provides a scientific bibliography of studies that support the environmental analysis.
- Appendices: The appendices provide more detailed information to support the analyses presented in the Environmental Assessment.

Background

Greater Flagstaff Forests Partnership (GFFP), a nonprofit organization based in Flagstaff, and the Coconino National Forest have established a cooperative agreement to work collaboratively to demonstrate new forest management approaches in improving and restoring ecosystem health of the ponderosa pine forests surrounding the greater Flagstaff area. This collaborative effort aims to involve the greater Flagstaff community to develop community-based solutions to local forest health and fuel reduction concerns. The Eastside Fuel Reduction and Forest Health project is the fifth large-scale project that GFFP has assisted the Coconino National Forest with project planning and design.

The Peaks and Mormon Lake Ranger Districts have worked collaboratively with GFFP over the past year to jointly develop proposals to treat the eastern Flagstaff vicinity. Since November 2004, the Forest Service and GFFP have conducted numerous field trips and meetings to discuss project goals, existing and desired future conditions for the project area, and the Proposed Action.

The Purpose and Need for Action in this document is derived from the Project Initiation Letter, Need for Change Report, and comments from the GFFP Board of Directors on a Draft Proposed Action developed by GFFP and the Forest Service Interdisciplinary Team (IDT). During

development of the Proposed Action, the Forest Service looked at environmental analysis options for the project. In April 2006, the Peaks and Mormon Lake Ranger Districts decided that the project was an ideal candidate for analysis under the Healthy Forests Restoration Act (HFRA). The Purpose and Need for Action and the Proposed Action for this project have been prepared in accordance with HFRA requirements. See *Appendix B – Healthy Forests Restoration Act Authorities for the Eastside Fuel Reduction and Forest Health Project* for more information.

Scope of the Project

The Proposed Action analyzed in this document applies only to Coconino National Forest lands within the project area. While the Proposed Action will reduce fuel loading in most areas, the risk of fire will only be reduced up to private land boundaries and cannot reduce the threat to structures within private lands. To reduce fire threat within private lands, those areas would need to be assessed and treated in tandem with actions proposed in this project. Environmental effects of the Proposed Action will be analyzed in this Environmental Assessment. These effects will only be analyzed for impacts to National Forest System lands and not to private property.

Project Area

The Eastside Fuel Reduction and Forest Restoration Project area is located in the Wildland-Urban Interface (WUI) and associated landscapes surrounding Flagstaff. The project area extends south of Flagstaff from Forest Highway 3 to the Walnut Canyon National Monument access road and east and north of Flagstaff including the lands surrounding the communities of Doney Park, Cosnino and Timberline. The north boundary of the project includes areas at the base of Mount Elden from the Elden Environmental Study Area to the Elden Lookout Road. The project also includes a detached area at the top of Mount Elden at the Electronics Site at Devils Head.

The project encompasses approximately 22,000 acres of lands around Flagstaff and surrounding communities. It includes parts of Sections 29, 31-34, T23N, R8E; Sections 33-36, T22N, R7E; Sections 3-5, 8-11, 14-17, 20-22, 25-29, 31-33 and 35-36, T22N, R8E; Sections 30 and 31, T22N, R9E; Sections 1-2, 25, and 35-36, T21N, R.7E; Sections 1, 3, 6, 9, 11-17, 21-27, 29, and 31-33, T21N, R8E; Sections 5-8, and 18, T21N, R9E; and Sections 1-3, and 10-12, T20N, R7E, G&SRBM, Coconino County.

See Figures 1-1 and 1-2 for map of the project boundary.

Forest Plan Management Areas

The Coconino National Forest Plan (hereafter referred to as the Forest Plan) sets out broad management goals, objectives, standards and guidelines to guide management actions on the Coconino National Forest. The Forest Plan uses Management Areas to guide management of the National Forest System lands within the Coconino National Forest. Each management area provides for a unique combination of activities, practices and uses. The project area includes twelve Management Areas. The Forest Plan contains a detailed description of each management area. Table 1-1 lists the acreages under some of the Management Areas within the project area. Additionally, Management Areas under the Flagstaff/Lake Mary Ecosystem Analysis (USDA Forest Service 2002) include the Lake Mary Watershed Management Area (9,975 acres) and the West Management Area (5,370 acres).

Table 1-1. Management Areas located within the project area.

MANAGEMENT AREA	DESCRIPTION	ACRES
003	Ponderosa Pine and Mixed Conifer < 40% Slopes	13,155
004	Ponderosa Pine and Mixed Conifer > 40% Slopes	269
005	Aspen	15
006	Unsuitable Timber Land in Ponderosa Pine	2,404
007	Pinyon Juniper <40% Slope	1,657
008	Pinyon Juniper >40% Slopes	42
009	Mountain grassland	7
010	Grassland and Sparse Pinyon/Juniper above the Rim	1,194
013	Cinder Hills	1,267
018	Old Caves and Mt. Elden ESA	1,196

Purpose and Need for Action

The Forest Plan provides a framework that guides development of Desired Future Conditions at the site-specific project level, such as the Eastside Fuel Reduction and Forest Health Project.

The process for developing Desired Future Condition (DFC) and Need for Change statements began with Forest Service IDT members collecting and modeling data to determine the existing conditions in the project area. The team then began reviewing Forest Plan direction related to management of the project area. The team reviewed all Forest Plan standards and guidelines and determined whether they are standard operating procedures for implementing activities or if they are intended to guide management practices towards a desired future condition of the forest. Standards and guidelines in the latter category were used as sideboards when the team developed DFC statements.

Many of these standards and guidelines are quantitative in nature and describe in detail a specific distribution of environmental resources. In contrast, other direction is couched in broad, qualitative terms and allows IDT and GFFP partners to interpret and clarify this direction as it pertains to this project.

As the team started discussing and developing desired future conditions for the project area, it considered goals for the entire project area in addition to discrete areas deemed important for biological or social needs. The DFC statements the team developed generally reflect Forest Plan language, however in many situations where direction was vague or overly broad, the team further defined their vision for the eastern Flagstaff landscape in qualitative and quantitative terms. In many circumstances, the team also developed appropriate timeframes to meet these DFCs and considered the difference in conditions over time. Need for Change statements articulate the difference between the existing and desired future conditions.

All of this information was captured in a Final Report of the Need For Change Analysis (February 2006). While the Need for Change Report is broad in nature and covers many different resource areas within the project area, this Eastside Fuel Reduction and Forest Health Project Environmental Assessment only includes findings of that report related to forest restoration and fire hazard reduction activities. Other projects may be developed based on findings of the Need for Change analysis in separate NEPA documents in the future. The following section briefly

describes the existing conditions, desired future conditions, and the need for change for Fire-Adapted Forest and Grassland Structure and Wildfire and Fuels Risk planning goals.

Fire-Adapted Forest, Woodland and Grassland Structure

Existing Conditions

Disruption of the historic fire regime has resulted in changes in age and size class diversity, altered site structure, changes in successional dynamics, and decreased horizontal heterogeneity. Past logging practices have removed the majority of old forest trees, while fire suppression and climatic events favored denser ponderosa pine, pinyon pine and juniper regeneration. The resultant forest structure within the project area is even aged and average, approximately 80-90 years in age.

Site Density

Currently, 43 % of the forested Forest Service lands within the project area have site densities resulting in increased competition between trees for moisture, nutrients, and sunlight; decreased tree vigor; increased susceptibility to successful bark beetle attack and mortality; decreased diameter growth; decreased "yellow" ponderosa pine and Gambel oak longevity; decreased natural regeneration; and decreased understory productivity and diversity. 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.

Average canopy cover measured at the site level ranges from 10% to 80%. The average basal area ranges from 52 to 198 ft^2 per acre.

Grasslands in the project area consist of meadows that vary in size from just a few acres to much larger areas. Many natural meadows are located in frost pockets or have soil or moisture conditions that are not conducive to conifer growth. A wide variety of species of grasses and forbs characterize the vegetation, which varies according to soil moisture and temperature.

Age, Size and Species Diversity

Vegetative Structural Stage (VSS)[1] is one way to measure size and age class distribution within a site. Percentages of VSS are calculated for ponderosa pine across all management areas. VSS is not calculated for pinyon/juniper, grassland or oak cover types. Currently, 62% of ponderosa pine forested Forest Service land within the project area is young to mid-aged forest (VSS 3 and 4) and 34% is in the mature/old forest structural stage classes (VSS 5 and 6). Grass, forb and shrub and seedling/sapling classes (VSS 1 and 2) represent less than 5% of the project area. While VSS

[1] Vegetative Structural Stage (VSS) classifications include:

VSS 1 = Openings	**VSS 4 = 12-17.9" DBH**
VSS 2 = Seedlings/saplings	**VSS 5 = 18-23.9" DBH**
VSS 3 = 5-11.9" DBH	**VSS 6 = 24" and greater DBH**

6 sites represent the old forest structural stage and include a large trees component, VSS 6 sites are not necessarily considered old growth areas. Old growth areas have specific habitat component requirements that VSS 6 sites may be deficient in.

Spatial Arrangement

Historically, ponderosa pine forests of northern Arizona were characterized by frequent, low-intensity surface fires occurring every 3 to 15 years. Historic fires maintained an open canopy structure and a variable, patchy tree distribution across much of the forest by killing smaller trees (Moir et al. 1997, Covington et al. 1997). Ponderosa pine forests were uneven-aged and consisted of fewer, larger, and older trees interspersed with grassy openings. In spite of the disruption to the historic fire regime, an open, park-like forest structure and variable, patchy tree distribution still exists in some areas due primarily to lower moisture and poorer soil conditions. Closed canopy stand structure, occurring on 10% of the forested acres, has resulted in decreased understory productivity and diversity, increased inter-tree competition, decreased tree growth and vigor, increased susceptibility to insects and disease, increased fuel continuity, increased crown fire potential, and increased fire size and intensity (Long 2003).

Table 1-2. Existing and desired Vegetative Structural Stage (VSS) values for ponderosa pine sites.

Vegetative Structural Stage	Existing Distribution	Desired Distribution
VSS 1 - Grassy Openings	**2%**	**10%**
VSS 2 - Seedlings/saplings	**2%**	**10%**
VSS 3 - 5-11.9 inches	**28%**	**20%**
VSS 4 - 12-17.9 inches	**34%**	**20%**
VSS 5 - 18-23.9 inches	**24%**	**20%**
VSS 6 - 24 inches and greater	**10%**	**20%**

Table 1-3. Forest density and composition values.

Measure	Desired Future Conditions
Canopy Cover	**Northern Goshawk Foraging Areas** > 40% *(as measured at the clump and group level)* **Northern Goshawk Post-Fledging Family Areas** > 50% *(as measured at the clump and group level)* **Mexican Spotted Owl Protected Habitat**[2] >50% *(as measured at the site level)* **Mexican Spotted Owl Restricted Habitat** 40-50% *(as measured at the site level)*
Total basal area (ft^2 /acre) for all tree species	Meadows and Grasslands 0-40 Northern Goshawk Foraging Areas 20-100 Mexican Spotted Owl Protected Habitat 150 Mexican Spotted Owl Restricted Habitat 80-150 (basal area includes all species)
Maximum Stand Density Index	Northern Goshawk Foraging Areas and Mexican Spotted Owl Restricted Habitat 0-35% Northern Goshawk Post Fledging Family Areas (PFAs) 0-45%

[2] Desired Future Condition for canopy cover in MSO Restricted and Protected Habitat was determined from a critical habitat primary constituent element (PCE) related to forest structure. Canopy cover is described as shade canopy created by the tree branches covering 40% or more of the ground (USDI, 2004).

Measure	Desired Future Conditions
Opening Size	Northern Goshawk Foraging Habitat ¼ to 4 acres Northern Goshawk Post Fledging Family Areas ¼ to 2 acres Mexican Spotted Owl Restricted Habitat ¼ to 2 acres

Desired Future Conditions

The desired future condition includes a multi-aged and diverse forest structure that supports frequent low intensity fires. The structure is maintained by fire and natural processes.

Many of the forest and grassland structure values are guided by Forest Plan direction for wildlife species. Management direction for the Mexican spotted owl and northern goshawk guides vegetation treatment to maximize habitat components for these species. By managing for nesting, roosting, and foraging habitat characteristics desired by these two species, forest structure components should provide sufficient habitat for many other species including Management Indicator Species (MIS). Table 1-3 describes desired future conditions for forest density and is organized by habitat designations. Those areas outside of MSO habitat and northern goshawk PFAs are termed northern goshawk foraging areas.

Site Density

Site densities are at levels where there is decreased competition between trees for moisture, nutrients, and sunlight; increased tree vigor and diameter growth; decreased susceptibility to successful bark beetle attack and mortality; and increased yellow ponderosa pine and Gambel oak longevity. Openings will be provided to promote regeneration.

Canopy cover ranges from 30-50% and improves understory productivity and diversity of species while still providing sufficient canopy densities to meet wildlife habitat needs in most areas. Competition among trees is limited and growth rates for trees are improved, especially around larger trees.

Age, Size and Species Diversity

The forest structure distributes tree age and size classes more evenly among VSS classes as listed in the Forest Plan. The desired values stem directly from Forest Plan direction for northern goshawk management. Forested sites will exhibit uneven-aged structure to provide improved site successional dynamics in the ponderosa pine cover type.

This VSS distribution may not be achievable in Management Area 6 areas since low soil productivity or other factors may prevent larger size classes and canopies from forming. Treatment in Management Area 3 lands may have to compensate for vegetative growth patterns in these MA 6 areas.

Sites have an uneven aged site structure with multiple age classes. This allows for the continuous replacement of trees in an area over time. The resulting uneven age structures are more resilient to fire or insect and disease attacks.

There is limited competition to Gambel oak and an increasing amount of large oak trees greater than 10 inches DRC. The oak component exists at levels needed for wildlife habitat.

Spatial Arrangement

Tree distribution is variable and patchy. Groups or clumps of trees exist in many areas with variable canopy cover to allow for wildlife and prey species habitat, tree regeneration, and understory diversity. Groups of trees are located in areas where historic evidences of trees exist or where best site structure exists at the time of implementation. A diverse age and size class occurs in some clumps. Interlocking crowns occur in some clumps to provide habitat for wildlife species.

In some places, forested lands exist as grassy openings that range from 0.5 - 4 acres in size to provide regeneration areas for trees as well as provide understory diversity.

Need for Change

Comparison of the existing condition of the project area and the desired condition indicates a need for:

- Site density values and structural arrangements that meet the desired future conditions for forests, woodlands and meadows;
- Restored historic vegetative structural patterns in forests and grassland areas;
- Clumped and grouped spatial arrangement of trees;
- Reduced threat from bark beetle attack through improved tree vigor and resistance;
- An uneven-aged forest structure; and
- Openings that provide for understory diversity and early VSS class initiation.

Wildfire and Fuels Risk

Existing Conditions

Within the project area, the Side Fire occurred in 1996 and the Radio Fire occurred in 1977. These two large wildfires demonstrate the probable result of wildfires in the project area if left untreated. The area's natural fire regime consists of frequent (every 3-15 years) surface fires. The lack of fire has allowed dense vegetation and surface fuels to accumulate. It has also allowed species composition and site structure to change (i.e. ponderosa pine has shaded out oak trees). It has also allowed trees and shrubs to encroach on meadows and drainage bottoms.

The natural fire regime historically allowed for a balance of species well suited to the soils and climate of the area. Urban development has required the agency to aggressively suppress all wildfires in the area, disrupting the natural fire regime. Urban development has also made it

difficult to execute sufficient prescribed burning to maintain a desirable low fuel load and balanced species mix throughout the area.

Fire Hazard Ratings

One method to evaluate the risk of wildfire in 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[3]. It is a relative measure to demonstrate fire resilience between sites. It is a good indicator of how effectively and safely fire suppression crews can attack a wildfire and bring it under control.

The same criteria used to determine the fire hazard ratings of previous Greater Flagstaff Forests Partnership (GFFP) projects will be used for this project to maintain consistency and allow direct comparison between project areas. These criteria include canopy cover, tree stems per acre, height to the bottom of the live crown, dead and down fuel loading, slope steepness, and aspect. Because slope steepness and aspect will not change with treatment, their effects on fire behavior influence how much other criteria are altered in project design.

Canopy cover (percent of potential open space occupied by the collective tree crowns in an area) directly effects how easily a fire is able to transition into a crown fire by containing and accumulating heat below the crown layer. High canopy cover can prevent necessary heat dispersal. Canopy cover also affects how easily a crown fire can sustain itself and spread as a crown fire. The number of tree stems per acre also affects how easily a fire is able to transition into a crown fire. The height to the bottom of a live crown directly effects how easily a ground fire "torches" trees, produces firebrands, and transitions into a crown fire.

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 areas. The existing fire hazard makes it difficult for initial attack operations to control a wildfire starting under severe weather conditions that occur in April, May, June, September, and October. Table 3 describes existing values of some of these fire hazard rating criteria.

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[3] Fuel moisture and weather characteristics used to model fire effects include:

1-Hour fuel Moisture: 2%

10-Hour fuel Moisture: 3%

100-Hour fuel Moisture: 4%

20-Foot Wind Speed: 20mph

Air Temperature: 85 degrees F

Table 1-4. Fire hazard rating criteria.

Measure	Current Value	Desired Value
Height to Live Crown	1 – 20 feet	20+ feet
Dead and down fuel	1 – 22 Tons per Acre	5 – 7 Tons per Acre
Canopy Cover	10 – 80 %	40 – 50%
Stems per Acre Ponderosa Pine	10 – 500	Less than 300
Fuel type	Ponderosa pine, pinyon/juniper, grassland.	Same, but with reduced encroachment
Flame lengths	2.5 – 8	Less than 3.5
Fire Regime Condition Class	1 – 3	1 - 2

Current fire hazard ratings of the project area:

Extreme	472 acres
Very High	1,189 acres
High	2,943 acres
Moderate	9,746 acres
Low	6,965 acres

The pinyon/juniper cover type within the project area (located just east of the Cosnino road) contains a high number of dead standing pinyon trees. This area has a heavier dead and down fuel load than much of the rest of the project area. Due to the recent "bug-kill" it also has a heavier load of dead standing fuel. It has a moderate canopy closure, low crown base-height, and a lower average tree height. These factors result in fire hazard ratings of moderate to high.

However, the fine fuel component (grasses and long-needles) which allows a wildfire to ignite easily and spread rapidly is generally absent from this area of pinyon/juniper. Needles are short and the litter layer is compact and discontinuous. Where the standing and down fuel load is greatest grasses are generally absent, even after prolific grass production in 2005.

Wildfires occurring in this area of pinyon/juniper can be expected to spread slowly in all but the most severe fire weather. They would be expected to burn intensely with short-range spotting and a slower spread rate than the ponderosa pine and even the pine/oak woodlands.

Flame Lengths

Flame length is a measure of fire intensity and anticipated tree mortality from wildfire. Expected flame lengths within the area range from 3 to 8 feet. Critical flame lengths are the threshold distances where ground fire can move into the canopy of a site. Critical flame lengths in the area range from 2 to 9 feet. The current difference between expected flame lengths and critical flame lengths is short. A smaller difference allows a ground fire to transform into a crown fire easily since there is little distance to buffer the canopy from high ground flames. 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 is able to transition into a crown fire.

Across much of the project area the current fuel conditions would likely generate dangerous fire behavior and undesirable fire effects when a wildfire occurs. Although it would be difficult to initiate a crown fire within many sites, once a 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 sites. Initial attack forces would have difficulty in controlling a wildfire occurring in much of the area under severe weather conditions.

Human use (presence of roads, trails, and dispersed camping) of the area has also increased the risk of a human-caused fire ignition.

Desired Future Conditions

A low or moderate fire hazard rating would exist across a majority of the project area. Some sites might remain with moderate to high rating after treatment to accommodate other resource needs such as providing adequate habitat for wildlife species. However, most areas within a mile of private property will have a low or moderate rating, especially those areas in the direction of the prevailing wind.

Dead and down fuel loading would support habitat needs but remain low enough to support low to moderate intensity burns on a regular basis. Expected flame lengths would be less than 3 feet. Crown base heights would be high and flame lengths required to initiate a crown fire would be above 15 feet in most areas.

Need for Change

Comparison of the existing condition of the project area and the desired condition indicates a need for:

- Low and moderate fire hazard ratings in ponderosa pine forests;
- Conditions in ponderosa pine forests resulting in ground fire flame lengths of 2-3 foot and low probability of transforming to a crown fire;
- Fuel loads 5-7 tons per acre in ponderosa pine forests;
- Conditions leading to crown base heights 20 feet or greater in ponderosa pine forests;
- Conditions where prescribed surface fires can be safely executed in ponderosa pine forests; and
- Conditions in pinyon/juniper woodlands that reduce the risk of fire spreading to other areas.

Proposed Action

The Proposed Action was designed by the Forest Service ID Team members and GFFP partners to best meet the Need for Change for Action of the project while meeting requirements of the Forest Plan and other guiding documents such as the *Integrated Treatment of Noxious or Invasive Weeds EIS.*

This action proposes to meet the purpose and need by thinning approximately 7,841 acres of forest and meadow lands mechanically and by hand in the project area. It also proposes prescribed burning on approximately 20,176 acres. The existing road system would be used, only 4.5 miles (consisting of 12 segments) of temporary road would be constructed for hauling access. These segments would be obliterated after thinning activities are complete. In summary, the Forest Service would:

- Thin approximately 7,841 acres to achieve a residual average canopy cover of 30-50%, depending on resource objectives. Thinning would reduce wildfire risk and restore forest structure and diversity;
- Conduct initial prescribed burns on approximately 20,176 acres in lieu of or after thinning to reduce fuel loads and reintroduce low to moderate intensity surface fire; and
- Conduct additional maintenance burns on 20,176 acres after initial prescribed burns to maintain fuel loads.

Chapter 2 includes a complete description of Proposed Action activities, specific mitigation measures and design features, and monitoring activities.

Decision Framework

Based on the analysis in this Environmental Assessment, the Peaks and Mormon Lake District Ranger will decide how to best reduce fuel loading and restore fire-adapted lands in the project area in accordance with Forest Plan direction and the desired future conditions. The responsible official will decide how to implement the Proposed Action or a modified version of it. The decision will include:

- The location, design, and scheduling of the proposed mechanical treatment, burning, and other activities;
- The estimated timber volume, if any, to make available from the project area at this time;
- Access management measures; and
- Mitigation measures and monitoring activities.

Relationship to Forest Plan

The Forest Service has two types of decisions: programmatic (e.g., the Forest Plan) and project level which implements the Forest Plan. The Eastside Fuel Reduction and Forest Health Project EA is a project-level analysis; its scope is confined to addressing the significant issues and possible environmental consequences of the project. It does not attempt to address decisions made at a programmatic level.

The Forest Plan embodies the provisions of the National Forest Management Act of 1976, its implementing regulations, and other guiding documents. The Forest Plan sets forth in detail the direction for managing the land and resources of the Coconino National Forest. Where appropriate, the Eastside Fuel Reduction and Forest Health Project EA also tiers to the Forest Plan Final Environmental Impact Statement (USDA Forest Service 1987), as encouraged by 40 CFR 1502.20.

Figures 1-1 and 1-2. Project area Location and Site maps with project boundary.

Public Involvement

The proposal was listed in the Coconino National Forest's Schedule of Proposed Actions in the Spring of 2006. The proposal was provided to the public and other agencies for comment during scoping in May of 2006. To meet HFRA requirements and better inform the public of project progress and management intent, the Districts hosted two public meetings during the scoping period near the Doney Park community and Lake Mary Road (FH3) neighborhoods. As mentioned previously in the Background section of this Chapter, the Districts also worked closely with Greater Flagstaff Forests Partnership (GFFP) on all phases of planning and design for this project. See *Appendix B – Healthy Forests Restoration Act Authorities for the Eastside Fuels Reduction and Forest Health Project* for more information on collaboration with GFFP.

Using the comments from the public, other agencies, and GFFP, the interdisciplinary team developed a list of issues to address.

Scoping

The Council on Environmental Quality (CEQ) defines scoping as "...an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a Proposed Action" (40 CFR 1501.7). Among other things, the scoping process is used to invite public participation, to help identify public issues, and to obtain public comment at various stages of the environmental analysis process. Although scoping is to begin early, it is really an iterative process that continues until a decision is made.

In May of 2006, a scoping letter notifying the public of a 30-day comment period was released to the public. This letter included the Purpose and Need for the project, the Proposed Action, monitoring measures, and design features that were built into the Proposed Action to reduce or eliminate any negative environmental effects. This included federal and State agencies, Native American groups, municipal offices, businesses, interest groups, and interested individuals.

Approximately 20 individuals attended the public meetings on June 20, 2006 and June 22, 2006. A total of nine written public comments were received in response to the mailing and public meetings. Copies of these letters and the District's response to these comments are found in *Appendix A - Responses to Scoping Comments.*

Issues

Scoping and public involvement activities are used to identify issues about the effects of the Proposed Action. A list of issues and reasons regarding their categorization is located in the Comment Analysis Report in the Project Record. The following issues are addressed through the Proposed Action, project design features, monitoring activities, and effects analysis located in Chapter 3.

Noxious and Invasive Weed Management

- Control measures and monitoring activities should not be limited to bio-control applications.
- A detailed list and description of treatment activities should be included.
- Describe the effects of thinning and burning on invasive weeds.

Thinning Activities

- Treatment should emphasize the retention of pinyon pines over juniper trees.
- Treatment should only focus on WUI areas or areas with fire hazard ratings from High to Extreme.
- Clarify tree arrangement structure and clump and group descriptions.
- Thinning should occur in certain areas on Campbell mesa near trails.
- Oak should be protected from thinning treatments.
- Thinning and burning may affect the visual and noise reducing attributes of trails around Faye canyon.

Old Growth Management

- Treatment activities do not comply with Forest Plan or HFRA requirement.

Archaeological Resources

- Clarify how thinning and burning will effect archaeological sites.

Rare Plants

- Disclose how thinning will impact *Hedeoma* and *Clematis* communities.

Prescribed Burning Activities

- Burning should be planned to protect oak and mountain mahogany species.
- Burning activities should be coordinated with the National Park Service in the Walnut Canyon area

Large Tree Management

- Effects analysis should disclose number of large trees that would be removed.
- Large tree management rationale and criteria may not protect all large trees deserving protection.
- Identify large trees proposed for thinning during the NEPA planning process.
- A thinning diameter cap should be implemented to retain large trees in the area.

Haul Routes and Mechanical Machinery Access

- Project should refrain from using existing road closures areas to haul or skid trees.

Applicable Laws and Executive Orders

Shown below is a partial list of federal laws and executive orders pertaining to project-specific planning and environmental analysis on federal lands. Disclosures and findings required by these laws and orders are contained in Chapter 3 and will be addressed in the final decision for this project.

Multiple-Use Sustained-Yield Act of 1960

National Historic Preservation Act of 1966 (as amended)

Wild and Scenic Rivers Act of 1968, amended 1986

National Environmental Policy Act (NEPA) of 1969 (as amended)

Clean Air Act of 1970 (as amended)

Endangered Species Act (ESA) of 1973 (as amended)

Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 (as amended)

National Forest Management Act (NFMA) of 1976 (as amended)

Clean Water Act of 1977 (as amended)

American Indian Religious Freedom Act of 1978

Archeological Resource Protection Act of 1980

Executive Order 11593 (cultural resources)

Executive Order 11988 (floodplains)

Executive Order 11990 (wetlands)

Executive Order 12898 (environmental justice)

Executive Order 12962 (aquatic systems and recreational fisheries)

Executive Order 13186 (Migratory Birds Treaty Act)

Project Record Availability

Additional documentation, including more detailed analyses of project-area resources, may be found in the project record located at the Peaks Ranger District, 5075 N. Hwy 89, Flagstaff, Arizona, 86004. Certain documents are referenced throughout this EA. These records are available for public review pursuant to the Freedom of Information Act (5 U.S.C 552).

Chapter 2 - Alternatives

This chapter describes the Proposed Action and alternative management strategies considered by the Forest Service for the Eastside Fuel Reduction and Forest Health Project. It includes a discussion of how the Proposed Action was developed, an overview of mitigation and monitoring measures, and a comparison of the Proposed Action with the effects of not treating the area.

Some of the information used to compare the Proposed Action with no treatment at the end of Chapter 2 is summarized from Chapter 3. Chapter 3 contains the detailed scientific basis for establishing baselines and measuring the potential environmental consequences of the Proposed Action.

Alternative Development Process

The Forest Service interdisciplinary team (IDT) used information from scoping, including issues identified for the project (see Chapter 1), in conjunction with the field-related resource information to develop management options. Any alternatives considered in full detail needed to meet the stated purpose and need to be considered in detail and meet HFRA planning requirements.

Forest Plan Consistency

The Proposed Action is consistent with the Coconino Forest Plan. All applicable forest-wide and management area standards have been incorporated. The Forest Service uses many mitigation and preventive measures in the planning and implementation of land management activities. The application of these measures began during the planning and design phases of the project. Additional direction comes from the Regional Guide, and applicable Forest Service manuals and handbooks.

Alternatives Considered but Eliminated from Detailed Study

The Center for Biodiversity proposed an alternative that had a 16-inch upper diameter limit for mechanical thinning. This comment shares some similarity with requests from Friends of Walnut Canyon, which advocated for a 12-inch upper diameter limit.

The Forest Service held numerous meetings regarding large tree management with GFFP in collaboration to attempt to resolve some large tree management issues. Much of this history is documented in *Appendix B – Healthy Forests Restoration Act Authorities for the Eastside Fuel Reduction and Forest Health Project.*

These issues associated with diameter limits were not developed into alternatives considered in detail. Because this authorized fuel reduction project proposed is planned in the Wildland/Urban Interface (WUI) no farther than 1½ miles from the boundary of an at risk community, and the Proposed Action implements the recommendations of the Community Wildfire Protection Plan as noted in section 104, subsection d of the Healthy Forests Restoration Act, the Districts are not required to study, develop, or describe any alternative to the Proposed Action in this

Environmental Assessment pursuant to Section 102(2) of the National Environmental Policy Act of 1969 (42 U.S.C. 4332(2)).

While recommendations from the Center for Biodiversity and Friends of Walnut Canyon regarding large tree diameter limits will not be considered in detailed study, Chapter 3 does disclose the environmental effects of thinning some large trees to meet ecological objectives. In addition to the HFRA direction listed in the preceding paragraph, these proposal will not be considered in detail because:

- The district has sufficiently provided large tree management direction in the Proposed Action that limits that amount of large trees to be harvested;
- Comments did not disclose how a large tree diameter limit better meets the intent of the CWPP as required under HFRA; and
- A large tree diameter cap would not meet the Purpose and Need for Action which details a need for a sustainable, uneven-aged forest structure. See the Vegetation Section in Chapter 3 for further information on the effects of a diameter limit on uneven-aged project objectives.

The Districts' response to additional respondent comments regarding large tree concerns is located in *Appendix A – Responses to Scoping Comments.*

Effect of No Action

Chapter 3 includes an analysis of no treatment or no action to disclose the existing and projected future conditions against which the Proposed Action is compared. No action assumes the landscape would remain subject to natural or ongoing changes only. No thinning or prescribed fire activities would occur in the project area at this time. This analysis and decision does not preclude activities in other areas at this time, or preclude other project activities in the project area some time in the future.

Managing resource areas in their current state does not meet the purpose and need for action, nor would it move the project area towards the desired future conditions.

Proposed Action

The Proposed Action is designed to best meet the Need for Change for Action of the project while meeting requirements of the Forest Plan and other guiding documents such as the *Integrated Treatment of Noxious or Invasive Weeds EIS.*

The following table provides a brief overview of proposed management activities and how they meet the need for change statements discussed in the previous Purpose and Need for Action section. A more detailed description of management activities is described in the remaining sections of this document.

While some vegetation treatments can maximize effectiveness of both fuel and fire risk needs as well as forest structure needs, other treatments emphasize one resource area over another. For example, in areas within close proximity to private lands, treatments are designed to best reduce the threat of wildfire. In contrast, treatments in Mexican spotted owl Restricted Habitat—while

still reducing fuels and fire hazards—will emphasize the maintenance of important wildlife habitat and forest structure attributes. For many situations, treatment methods serve multiple resource area needs.

Summary of Management Actions

Table 2-1. Proposed Action management activities and rationale.

Management Activity	Purpose and Need for Action
Mechanical thinning on approximately 3,819 acres. **Hand thinning on approximately 3,404 acres.** **Aspen Restoration with fence protection on approximately 10 acres.**	**Wildfire and Fuels Risk** - Low and moderate fire hazard ratings in ponderosa pine forests - Conditions leading to 2-3 foot flame lengths and low probability of fires transitioning to a crown fire in ponderosa pine forests - Conditions leading to crown-base heights 20 feet or greater in ponderosa pine forests. (VSS's 4, 5, 6) - Conditions where low to moderate intensity surface fires can be maintained or introduced in ponderosa pine forests - Aspen restoration, and protection, by removing encroaching ponderosa pine and fencing for browse protection **Fire-adapted Forest and Grassland Structure** - Canopy cover, basal area, trees per acre, and Stand Density Index values that meet the desired future conditions for forests and woodlands - Restored historic vegetative structural patterns in forests and grassland areas. - Clumped and grouped spatial arrangement of trees - Reduced risk and improved resistance to bark beetle attack - An uneven-aged forest structure - Openings that provide for understory diversity and early VSS class initiation

Management Activity	Purpose and Need for Action
Hand and mechanical thinning at the Elden Electronics Site on approximately 21 acres	**Wildfire and Fuels Risk** - Reduce wildfire threat to electronics sites - Conditions leading to 2-3 foot flame lengths from a surface fire - Conditions where low to moderate intensity surface fires can be maintained or reintroduced
Meadow and Grassland Thinning on approximately 220 acres.	**Fire-adapted Forest and Grassland Structure** - Restored historic vegetative structural patterns in meadow and grassland areas.
Fuel Break Construction on approximately 377 acres (6.9 miles)	**Wildfire and Fuels Risk** - Conditions in pinyon/juniper woodlands that reduce the risk of fire spreading to other areas.
Initial prescribed burning on approximately 7,841 acres after thinning. **Initial prescribed burning on approximately 12,356 acres without thinning.**	**Wildfire and Fuels Risk** - Low and moderate fire hazard ratings in ponderosa pine forests. - Conditions leading to 2-3 foot flame lengths in ponderosa pine forests. - Conditions where low to moderate intensity surface fires can be maintained or reintroduced in ponderosa pine forests. - Fuel loads 5-7 tons per acre in ponderosa pine forests.
Maintenance burning on approximately 20,197 acres Maintenance burn acreage is a combination of prescribed burn only and mechanical, hand thinning, fuel break, and meadow and grassland thinning treatments.	**Wildfire and Fuels Risk** - Conditions leading to 2-3 foot flame lengths in ponderosa pine forests. - Conditions where low to moderate intensity surface fires can be maintained or reintroduced in ponderosa pine forests. - Fuel loads less than 7 tons per acre in ponderosa pine forests.
Construction and decommissioning (after use) of 4.5 miles (12 segments) of temporary roads.	- Provide access for thinning operations and skid trails.

Figures 2-1 and 2-2. Proposed Action maps (north and south halves).

Mechanical and Hand Thinning Activities

Approximately 3,819[4] acres will be mechanically thinned and approximately 3,404 acres will be hand thinned within the area. These treatments are displayed in Figures 2-1 and 2-2. These areas will be thinned to density levels and structural arrangements that are derived from the Forest Plan and the Eastside Project Need for Change Report.

All thinning treatments are designed to enhance or lead towards an uneven-age site structure. Treatments will reduce expected flame lengths, lower fire hazard ratings, and increase crown base heights by removing some ladder fuels. The resulting structure will provide a more heterogeneous forest structure; more age and size class diversity; habitat including hiding and thermal cover for wildlife species; and increased resiliency to environmental stress factors such as insect and disease outbreaks. Table 2-2 displays forest density objectives and acreages by thinning treatment type.

The two mechanical treatment types proposed are designed according to Forest Plan direction for northern goshawk and Mexican spotted owl since each species has different forest structure and density needs. See Figure 2-3 for wildlife habitat designations within the project area.

Mechanical Thinning – Northern Goshawk Foraging Habitat

These treatments are designed to move sites toward the desired future conditions for northern goshawk foraging habitat. Treatments will:

- Occur on approximately 3,411 acres;
- Focus on uneven-aged management and smaller diameter tree thinning;
- Occur in areas that are in close proximity to communities or biologically important areas;
- Create larger openings (up to 4 acres) to provide for future tree regeneration and understory development, and maximize the reduction in fuels and fire hazards ratings over a longer period of time than Mexican Spotted Owl Restricted Habitat Thinning treatments; and
- Leave a canopy cover of 40% averaged across tree clumps and groups.

Figure 2-3. Wildlife habitat designations within the project area.

[4] These acreages do not account for any deferrals due to layout, inoperability, financial efficiency, wildlife cover, etc. Actual number of acres would be lower after review from implementation staff and layout.

Mechanical Thinning – Mexican Spotted Owl Restricted Habitat

These treatments are similar to northern goshawk foraging habitat thinning treatments but designed for Mexican spotted owl restricted habitat areas. Treatments will:

- Occur on approximately 408 acres;
- Focus on uneven-aged management and smaller diameter tree thinning;
- Not occur in Mexican spotted owl Target/Threshold areas;
- Create smaller openings (up to 2 acres) to provide for future tree regeneration and understory development; and
- Leave a canopy cover of 40% averaged across Restricted Habitat sites.

Hand Thinning

Trees up to 12 inches in diameter at breast height (DBH) will be thinned in areas where access for mechanical equipment is limited or where the impacts of mechanical thinning cannot be sufficiently mitigated to achieve resource objectives. Specifically, many areas are proposed for hand thinning where mechanical thinning may affect archaeological sites and rare and sensitive plant species or exacerbate noxious and invasive weed problems.

In coordination with the Summit Fire Department, the Coconino National Forest reviewed certain areas along private property boundaries where Prescribed Burn Only Treatments were proposed due to the open nature of the sites. Denser clumps of trees in these areas could pose a fire hazard if these clumps are located on or near a private property boundary. These areas will be hand thinned up to 12 inches to reduce ladder fuels.

Selected clumps and groups of trees will also be hand thinned along recreation trails to improve visual resources and reduce fuels. See the *Project Design Features* section for details on these specific hand thinning activities.

Implementation of hand thinning treatments may be aided by and coordinated with local fire departments such as Flagstaff Fire and Summit Fire.

Table 2-2. Forest densities by thinning type.

Treatment Type	Acres	After Treatment			
		Stand Density Index	Trees per Acre	Basal Area (sq. ft./acre)	Canopy Cover %
Mechanical Thinning – Northern Goshawk Foraging Habitat	3,411	60 – 100 (80)	20 - 60 (40)	40 - 60 (50)	35 – 45 (40)
Mechanical Thinning – Mexican Spotted Owl Restricted Habitat	408	90 – 140 (90)	30 – 70 (50)	60 - 80 (70)	40 – 50 (45)

Treatment Type	Acres	After Treatment			
		Stand Density Index	Trees per Acre	Basal Area (sq. ft./acre)	Canopy Cover %
Hand Thinning	3,404	30 – 200 (120)	40 - 100 (115)	40 - 140 (100)	30 - 60 (45)

*Values for canopy cover, basal area, SDI and trees per acre are ranges derived from Forest Service site exam data and Forest Vegetation Simulator models. The mean values in parenthesis are values averaging across all sites with similar canopy cover objectives.

**This table does not include acreage or post-treatment density values for Elden Electronics Site, fuel breaks, and mountain meadow and grassland treatments.

Forest Structure and Composition

This section describes forest structure needs in the project area. While both mechanical thinning types remove trees to achieve wildfire and fuel risk needs to some extent, specific habitat and forest structure needs will influence thinning treatments.

Table 2-2 describes forest density values after the proposed thinning treatments. Canopy cover values will be averaged differently in treatment types. The number of trees remaining and basal area will be influenced by existing age and size class distribution and the size and locations of openings in the area.

Site Density

Canopy cover, basal area, trees per acre, Stand Density Index, and age class are identified as primary measures to display differences in thinning treatments since they are common to numerous resource areas in determining treatment effectiveness. After thinning, canopy cover and basal area values will range between 25-60%[5] canopy cover and 40-120 basal area in the project area, depending upon VSS class, existing conditions and wildlife, fuels, and forest structure needs.

Age, Size, and Species Diversity

Treatments will be implemented to achieve desired VSS distribution across the landscape. VSS distribution is currently determined on a site-level basis. While this provides a good indicator of the dominant tree size within a site, it is not a good indicator of how other tree size classes are distributed within a site or across a project area. For example, a VSS 4 site has 12-18 inch trees contributing the most basal area in the site than any other size class. It is likely that numerous clumps of smaller diameter trees and openings in this site exist as well. To achieve the desired

[5] While most stands in VSS 4, 5, and 6 will retain a minimum canopy cover of 40% after mechanical thinning, some stands are currently below 40% and are relatively open with little canopy. These areas may or may not reach desired canopy cover values due to poor growing conditions and other environmental factors. Treatments in these stands will remove some ladder fuels and small diameter trees but will have little impact on reducing canopy cover values.

VSS classes, treatments are designed to meet VSS distribution across the project area and not within individual sites.

Thinning treatments will focus on removing smaller diameter trees to meet wildfire and fuels risk and forest structure needs. These treatments maximize the retention of large, mature trees to increase fire-resilience, develop old growth, and promote a more sustainable forest structure. Treatments will create or lead to the development of an uneven aged forest structure. In rare situations, trees larger than 16 inches DBH may be removed to meet ecological objectives. Appendix B describes these situations and the rationale for removal of large diameter trees.

Spatial Arrangement

Tree arrangement after thinning will mimic historic patterns (not necessarily densities) of tree distribution across the landscape. This historic pattern includes a variation in tree spacing, clump or group sizes, and canopy gaps that provide a mosaic pattern of individual and clustered trees interspersed among openings or meadow areas. To better define clumps and group structure and the openings between and among them, the following parameters provide some guidance on clump and group management.

In northern goshawk habitat:

- Canopy cover will be measured at the group level.
- Canopy cover within the groups will be 40% or greater.
- Each site will retain a minimum of 40% of the area in groups.
- Twenty percent of the area will be in openings, with emphasis on regeneration.

In Mexican spotted owl habitat:

- Canopy cover will be measured at the site level.
- Each site will retain a minimum of 40% canopy cover, averaged across the site.

Clumps

Clumps are aggregates of 3-20 trees (but often contain 3-8 trees) with unequal distances between trees. Trees are typically close to one another (within 20 feet) and arranged in a clustered pattern, with crowns usually interlocked. Most trees (or stumps from an historical perspective) within a clump would be of similar size (diameter) and age. The distance from the drip line of one clump to the next is often greater than the distance between trees within the clump. Clumps are typically even aged.

Groups

Individual trees and clumps by themselves do not always provide a structure that is desirable from a wildlife perspective. Groups often contain more value and functionality due to the collective worth of individual trees or clumps within them.

Groups are aggregates of trees that are larger in area than clumps and may even contain numerous clumps. Groups can range in density from 10 trees up to a few acres of trees. A group may contain numerous clumps and other individual trees that form a cluster or pattern of trees over the landscape that is distinguishable from other groups or clumps.

Group boundaries, while not clearly delineated on the ground, are delineated by openings that surround them. Similar to clumps, the distance from the drip line of groups is often greater than the distance between trees within the group. Age and size classes may be diverse within a group.

Openings

Openings will be created or enhanced in forested sites and will range in size and shape, depending on wildlife habitat needs and Forest Plan requirements.

This mixture of openings and tree patterns will achieve numerous fuel reduction and spatial distribution needs in the area. Openings will promote understory vegetation productivity and diversity, increase tree regeneration, and break up fuel loads, while clumps of trees can help maintain important wildlife habitat features such as interlocking canopies, prey species habitat, and thermal and hiding cover.

Northern goshawk foraging areas will include the largest openings (up to 4 acres). Mexican spotted owl Restricted Habitat may include openings up to 2 acres.

Old Growth

The proposed thinning treatments will maintain and contribute towards the development of old growth structure and composition in the project area. Old growth allocations are based on forested acres within "ecosystem management areas" or 10k blocks, as directed by the Coconino National Forest Plan (1996 p. 70-1). There are portions of seven 10K blocks within the project area. All 10K blocks will meet or exceed the minimum Forest Plan standard of 20% allocation.

Approximately 13,622 acres (5,494 acres in the project area) of the forested lands have been designated as old growth existing or development areas to meet Forest Plan guidance for Vegetation Structural Stage (VSS) distribution and old growth management. Areas were selected using both intensive survey (within the project area and previous project allocations) and extensive survey (aerial photo interpretation, field knowledge, and field checks), outside the project area, based on existing forest structure, age class, and habitat features. While these areas will meet old growth structural objectives sooner than other areas, all treatment areas will also be managed to increase tree growth and ensure the development of old growth areas over time.

Sites designated as old growth development areas will reach old growth structural conditions in different time intervals and will exhibit different forest structures over time. Some old growth areas may be more even-aged, with numerous large ponderosa pines and fewer VSS classes. Other areas may have a multi-storied tree component. All treated old growth development areas will contain openings of various sizes to increase regeneration and understory productivity and diversity. Many of the old growth development areas designated within the project area also serve as key habitat areas for the northern goshawk, Mexican spotted owl, and Management Indicator Species. See Figure 2-4 for a display of existing old growth sites (374 acres) and sites identified for old growth development.

Meadow and Grassland Thinning

Meadows and grasslands will be hand thinned or mechanically thinned to remove stocked "plantations" and remove encroaching trees to restore historic meadow and grassland structure. Areas would be thinned to tree densities[6] based on historic, pre-settlement evidences in the field.

While site boundaries are fairly accurate in delineating forest structure or topographical differences between sites, actual thinning boundaries that mark forested areas from meadow or grassland areas would be identified in the field and guide management direction. Sites identified for meadow and grassland thinning may not receive uniform treatment.

Figure 2-4. Existing old growth and designated old growth development areas.

[6] The number of historic (pre-settlement) evidences per stand will dictate the number of trees retained in the area. Yellow pines will not be removed nor counted as historic evidences. While the number of leave trees will follow historic numbers, the location of these leave trees is not tied to limited distances from historic evidences. Trees will typically be left from larger, healthy trees regardless of proximity to historic evidences.

The number of remaining trees in meadows and grasslands after treatment would be based on the number of evidences of pre-settlement trees. Remaining portions of sites that have similar forest structure values to adjacent forested sites would receive thinning treatments similar to those proposed for the adjacent sites.

Mount Elden Environmental Study Area

Hand thinning and prescribed burning treatment along the south and southeastern base of Mt. Elden will be conducted to reduce fuels while maintaining or enhancing and rejuvenating the cliffrose (*Purshia mexicana var. stansburiana*) populations in the area.

Prescribed fire in some areas will be avoided in older, decadent cliffrose populations.

Implementation will be closely planned and coordinated with Arizona Game and Fish Department to manage for this species. Activities beyond thinning and burning (such as raking, seeding, herbivory exclusions, and monitoring) may require additional funds to ensure implementation.

Mount Elden Electronics Site

Thinning treatments to reduce fuel hazard would be conducted on approximately 21 acres within and surrounding the electronics site. A combination of hand thinning, piling and burning on steep slopes, and mechanical thinning on lesser slopes within and surrounding the site itself will be used to reduce risks at this important communication site. Visual considerations will be incorporated into all treatments to maintain screening of the towers to the greatest extent possible.

Fuel Break Construction

Approximately 377 acres (6.9 miles) will be thinned mechanically or by hand if necessary to remove fuels in the pinyon/juniper woodlands near the Turkey Hills vicinity at the eastern edge of the project area. The fuel break will vary in width according to vegetation patterns and the fuel reduction needs to reduce the risk of fire starting in the woodlands spreading to other areas. Fuel breaks would generally be 300 feet wide and extend inwards towards the woodlands away from communities in the Cosnino area, and may be extended by the fuel zone needs when vegetative conditions require expansion for a complete group or clump treatment.

Treatment would involve thinning and pile burning most trees in the area except all yellow pines, pines greater than 16 inches DBH, and 5-10 large pinyon pine or junipers per acre.

Prescribed Burning

All areas proposed for mechanical and hand thinning would be burned after thinning to remove activity-created slash, duff, and needle cast. After this initial burn, maintenance burning would be conducted periodically (every 4-15 years) 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.

In addition to burning areas mechanically and hand thinned, approximately 12,356 acres would receive a burn-only treatment. Many of these areas are deferred from mechanical entry due inoperable slopes or are forested lands that already meet or are close to meeting objectives for forest structure.

Some areas would be burned under conditions (cooler or moister weather patterns) that would result in lowest fire hazard reduction while maximizing survival of yellow pines. Fuel consumption in these areas may not be as high as other areas. This technique would often be employed where hazard to pre-settlement trees is high while fire hazard to the urban interface and communities is low or moderate.

Slash Treatment

A variety of slash treatment techniques will be employed that best meet fuel reduction objectives while addressing soils, weeds and rare plants, and vegetation needs.

Slash treatment in many areas would consist of machine piling and burning, depending on soil, vegetation, and smoke impacts. Whole trees may also be skidded and de-limbed at landings. Whole tree skidding would not be appropriate in areas that have sensitive plants populations and high densities of residual trees. Slash that remains where trees are cut would be machine piled and then burned after the slash cures. Chipping may occur on site and chips would be removed as an alternative to piling and burning in accessible sites.

Slash in hand thinning areas would be hand-piled and burned.

In areas where the initial fuel loading combined with thinning slash does not create broadcast burning problems (less than 5 tons per acre), or in areas with sensitive soils or plant species, slash may be lopped and scattered to a 1-foot height. This slash would be consumed by prescribed fire after thinning is completed. This treatment would be focused specifically near the southwest portion of the project area where pile burning could negatively impact *Hedeoma diffusum* populations.

Slash would be left in some areas to provide hiding cover to wildlife species. See the *Project Design Features* section for more detail.

Temporary Road Construction

To aid in thinning operations, approximately 12 segments of temporary road totaling 4.5 miles would need to be constructed to remove trees after thinning. These segments would be decommissioned after treatment and reseeded. See Figure 2-5 for locations of these temporary roads and proposed slash and/or log hauling routes.

Various techniques will be used to decommission roads, depending on the requirements to ensure long-success of the closure and rehabilitation of the area. These techniques include scarifying roads with heavy equipment, reseeding, and barricading with rocks or activity generated slash.

Figure 2-5. Proposed temporary road locations and haul route locations.

Project Timeframes and Longevity

Because of major differences in land capability in the project area, vegetative responses to various management practices will vary as well. Major differences exist between lands classified as unproductive timber land and those classified as commercial timber land. The differences are based on potential natural vegetation, soil type, and biological growth potential. Unproductive timber lands are within the ponderosa pine vegetative types and are unsuitable because they do not meet minimum standards for productivity or there is not a reasonable assurance that such lands can be adequately restocked. These lands are not environmentally or economically feasible for regeneration and are currently unstocked or understocked with the likelihood to remaining in this condition indefinitely. Timeframes for achieving VSS distribution in MA 6 areas will be much longer than other areas.

The processes of fuel reduction and forest restoration are ongoing events. Restoration of fire-adapted ecosystems will not be conducted in a single treatment; rather numerous treatments would be required over time to restore lands in an adaptive and gradual manner. Under this proposal, where thinning is needed, mechanical treatment would occur first, followed by prescribed fire and subsequent maintenance burns. Thinning treatments in most areas will be effective for 20-30 years before additional thinning may be required. Prescribed burn only treatments can occur at anytime as weather conditions and budget allow.

On lands classified as commercial timberland (MA3) the desired VSS distribution would not be achieved immediately after treatment, but could be achieved within 50 years with additional treatments and burning on a regular basis. Regeneration will likely occur in openings within 10-20 years and initiate VSS 1 and 2 classes. It would take approximately 90 years for the current age structure to reach minimum age requirements for old growth, as defined in the Forest Plan.

It is important to make a distinction between *commercial timber lands* and *timber sales.* Commercial timber land is a classification the Forest Service uses to identify lands that could be suitable for commercial logging purposes. The classification by itself does not necessitate the use of timber sales to accomplish treatment needs. Due to the types of treatment needs and size of trees in the project, minimal treatment is anticipated to be accomplished through traditional timber sales, unless values and markets for small wood products increase substantially before implementation. However Stewardship contracting may be used, which is akin to a traditional timber sale. Stewardship contracts incorporate many of the same provisions as the traditional timber sale, with the big differences being in how the wood and wood value is conveyed. Exceptions could include some small cutting units in the southwestern portion of the project area near Skunk and Faye Canyons, the Timberline unit, and a small area of the Elden base area near Mt. Elden road. Most hand or mechanical treatments will be accomplished through Service and Stewardship Contracting or implemented by Forest Service personnel.

Project Design Features

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

Soils and Watershed

- ❑ Best Management Practices (BMPs) will be incorporated into activities as a means to prevent or reduce the amount of pollution generated by non-point sources to a level compatible with water quality goals. Best Management Practices will be incorporated into applicable thinning, burning, and road management activities and are located in the Project Record. Appendix D lists and describes specific BMPs for the project area.

Wildlife Habitat

Mexican Spotted Owl

- ❑ Survey MSO Restricted Habitat in the project area the year of implementation or one year prior to implementation.

- ❑ In Restricted Habitat where treatments are planned, conduct pre- and post-treatment monitoring to determine effectiveness of treatments in meeting habitat objectives for; snag basal areas; live tree basal areas; volume of down logs over 12 inches in diameter; and basal area of hardwood trees over 10 inches in diameter at root collar.

- ❑ Designate Target/Threshold areas to comply with Mexican spotted owl recovery plan direction and amended Forest Plan language. No mechanical or hand thinning is planned in this site (Site 314/0003). Prescribed burning in this site will be conducted to minimize loss of critical habitat components.

Bald Eagle

- ❑ No thinning in Site 271/05 from October 14 - April 15 to reduce potential disturbance to roosting eagles.

Northern Goshawk

- ❑ Manage northern goshawk, Mexican spotted owl, and other species' habitat according to Forest Plan standards and guidelines, and specifically, guidance by the Flagstaff Lake Mary Ecosystem Amendment (Forest Plan Amendment 17, 2003).

- ❑ Prescribed burn plans for the nest areas within PFAs will minimize smoke impacts to nesting birds and minimize loss of nest trees.

Turkey

- ❑ There are 2 turkey roosts identified within the project area that will not be thinned.

Wildlife Cover

- Maintain hiding cover at least 200 feet wide around known dependable waters in the area.
- Designate a 200 foot thinning-deferral buffer around the Walnut Canyon rim. See Figures 2-1 and 2-2 for locations of this deferral area.
- Designate a 200 foot thinning-deferral buffer in Faye Canyon as a wildlife corridor to emphasize maintaining wildlife habitat attributes for resident songbirds, raptors, and other wildlife.

Snags and Logs

- After burning each designated prescribed burning block, trees may be felled (approximately 12 inches DBH in size) to replace logs burned during the prescribed fire to meet Forest Plan guidelines.
- Snags 18 inches in diameter and larger and 3 logs (12 inches mid-point diameter) per acre will be fire lined before broadcast burning.
- Identify recruitment snags from live trees that exhibit defects ideal for wildlife. For example, trees with forked or spiked tops, lightning strikes, mistletoe brooms, or fading crowns.

Burning

- Restrict prescribed burning from March 1 to August 31 in all of Locations 317 and 120; Sites 314/2-5; Sites 315/2-7, 11-15, and 19-20; and Sites 316/2, 3, 6 and 7 to reduce impacts to owls and other wildlife using Walnut Canyon.
- Restrict prescribed burning from March 1 to August 31 in Sites 297/1, 2, 11-16, 21 and 22 unless monitoring shows the Mount Elden MSO Protected Activity Center is unoccupied or owls are not nesting.

Vegetation

- Trees greater than 24 inches DBH will not be thinned. Refer to Appendix B for a detailed discussion on large tree management.
- No mature yellow pines will be thinned, regardless of size. Old yellow-barked pine trees will have duff raked away from the bases where high litter depth (greater than 6 inches) may result in girdling and mortality.
- One group of reserve trees, with 3-5 trees per group, will be left per acre in openings greater than one acre in size.
- No oaks will be thinned. Oak mortality will be mitigated in burn plans by raking duff from the base of large oaks (greater than 10 inches DRC) and not placing slash piles near oaks.

- Best locations for openings intended for regeneration (VSS 1 and 2) include but are not limited to: soils identified with TES that would promote the best revegetation/regeneration; areas with dwarf mistletoe infection; areas with existing openings, areas with excess numbers of trees with similar diameters; and places where cutting would enhance wildlife habitat values. See Appendix B for criteria regarding opening locations and large tree management concerns.

- Openings will be irregular in shape to mimic natural conditions, and will be no greater than 200 feet in width.

Scenery Management Considerations along Roads, Trails and in Special Areas

- On-site consultation with the Forest landscape architect will occur during layout activities to ensure visual concerns are met in sensitive areas (Mt. Eldon electronics site, fuel break, Arizona Trail, and Campbell Mesa and Faye Canyon trail systems.

- Consideration will be given to scenery management when thinning is implemented along the Arizona Trail, Campbell Mesa trails, and other system trails and roads, including areas where recreation outfitter and guides are permitted. Thinning will be varied using a combination of moderate and light thinning applications, and may include small clump and group deferrals and ladder fuel thinning. Slash and treatment areas will be treated or rehabilitated promptly for the protection of scenic values.

- Visual and noise buffers will be left in place to address concerns expressed by the outfitter guide permittee. Visual and noise buffers will be left along Lake Mary Road and a visual screening strip will be left in between the key permittee trails and the community. The district silviculturist and fuels specialist will work with the permittee to identify areas along the trail system where forest will be left in dense conditions. No more than 20% of Location 318 will be left in these patches.

- Mitigation measures will be included in mechanical thinning operations to minimize impacts on any Forest Service system trail. If necessary to skid across existing Forest Service system trails or planned trails, contractors will be required to cross the trail at a 90 degree angle at strategic locations and would need to repair the trail to its original condition when finished in that cutting unit.

- Skidding along Forest Service system trails would be highly discouraged, but would be accommodated on a site-by-site basis if absolutely necessary, and requires that the trail would be repaired to its original condition after thinning treatment. Thinning will be varied using a combination of moderate and light thinning applications and may include small clump and group deferrals.

Slash Treatment

- Piles shall be located to minimize burning or damage to standing live trees, snags, down logs, sensitive plants or physical improvements such as fences, poles, signs, and cattleguards.

- 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.

- Large logs (greater than 12 inches) that exist on the landscape prior to treatment will not be piled during slash treatment.

Sensitive Plants

- Slash piles, fire lines, temporary road routes, and landing sites will not occur within identified populations of Flagstaff pennyroyal (*Hedeoma diffusum*) and Arizona leatherflower (*Clematis hirsutissima*).

Noxious or Invasive Weeds

- Best Management Practices (BMPs) as outlined in the Three Forest Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds (Appendix B) will be incorporated into the project. An example of a BMP is cleaning of equipment before entering treatment areas (not roadways) to prevent introduction of invasive weeds. Appendix E includes specific weed treatment measures and monitoring requirements.

- A variety of treatment methods may be incorporated into the project as needed. These include manual, mechanical, cultural, biological and herbicide treatments. Appropriate mitigation such as limiting the amount of soil disturbance in archaeological sites during manual/mechanical control and establishment of limited no-spray zones will be incorporated into treatments.

- Limited spray zones for herbicide treatment as addressed in the *Three Forest Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds* will be incorporated into weed treatments in areas near communities. Limited spray zones would be established adjacent and within one mile of communities, recreation sites, trailheads, and scenic overlooks. Sites where other treatment methods will be effective due to species, population size or site factors will be targeted for all integrated weed management methods except herbicides. Exceptions to the limited spray zones are authorized for certain deep-rooted perennial species that cannot reach treatment objectives using manual techniques (such as camelthorn).

- To promote native species and hinder weed species germination, early spring burning is preferred (before May 31) to minimize Dalmatian toadflax reproduction and enhance *Hedeoma diffusum* habitat. Late fall burning is the second most preferable treatment window using a low intensity burn.

- After initial burning, monitoring will occur to assess needs for release of biological control insects targeting such species as Dalmatian toadflax and diffuse knapweed. If needed, this follow-up treatment activity has been cleared through the *Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds*. Monitoring and release of biological control will follow basic procedures established by APHIS following release.

Transportation System

- Dust abatement mitigation will be implemented along FR 301 and adjacent haul routes if needed to reduce dust associated with log hauling operations.

Recreation

- For public safety, camping will be prohibited within active thinning and burning areas. Thinning activities should be avoided (cutting and hauling) on the following holiday weekends: Memorial Day, Fourth of July, and Labor Day.

Cultural Resource Protection

- Historic and pre-historic cultural resources will be protected during project implementation. All ground-disturbing activities including vehicular use are prohibited within sites. The team archaeologist will flag sites prior to implementation and monitor the sites during burning activities. All sites may be hand thinned to blend in surrounding area treatments.

- Areas where temporary roads will be constructed and where road decommissioning will occur will be inventoried prior to implementation.

- Prescribed fire will be allowed to burn through fire tolerant archaeological sites. Archaeological sites with fire intolerant artifacts or features will be excluded from prescribed burning and protected.

Interagency Coordination

- Walnut Canyon National Monument lies adjacent to the southeast corner of the Eastside project boundary. The Forest Service and Park Service will closely coordinate fuels management and forest health treatments along the Walnut Canyon National Monument boundary and the 1,000 feet wide entrance road corridor. Forest Service implementation along the Monument boundary is limited to prescribed burning. The District recognizes that the Park Service recently completed a Fire Management Plan, with separate public involvement, environmental, and cultural resource protection compliance, for manual thinning and prescribed fires within Walnut Canyon National Monument and entrance road corridor. Interagency coordination may include but is not limited to simultaneous implementation on both sides of the Eastside-Monument boundary, particularly for prescribed fires. Mutual objectives of the Eastside Proposed Action and Park Service Fire Management Plan include: (1) restore ponderosa pine stand structure to conditions that reduce the risk of severe wildfire; (2) protect identified sensitive cultural and natural resources; (3) maintain seamless vegetation cover and wildlife habitat along the boundary; (4) ensure scenic quality and the desired experience for monument visitors and forest users; and (5) reduce ground disturbance and smoke from prescribed fires. The District and the Park Service will notify each other of upcoming implementation activities as early as possible in their respective work plans, and meet as needed to coordinate projects. Although not guaranteed, notification two growing seasons in advance of prescribed fire is highly desirable to allow time to complete manual thinning around sensitive resources, and for slash generated from treatments to cure. To maintain

seamless vegetation character and visual quality, prescribed fires could incorporate adjacent areas within the Monument. Joint prescribed fire perimeters would be determined by natural topographic gradients, drainage features, or existing man-made fuel breaks and extend into the Eastside project area beyond sight distance along the Monument boundary and entrance road corridor. The Park Service is responsible for preparatory work to protect the boundary fence and other facilities within the Monument.

A portion of the entrance road to the Monument, from Forest Road 303 to Interstate 40, has been identified as the primary haul route for product removal for mechanical projects accomplished under Timber Sale or Stewardship Contracting for the Eastside project area south of Interstate 40. The entrance road is the primary route for visitors to the Monument and timber sale and/or stewardship contracting clauses regulating the haul will be necessary to abate concerns about visitor experience and safety. It is estimated that approximately 250 log truck hauls would be required to remove this material. Timber sale/Stewardship contracts will include clauses to regulate haul on the entrance road. Clauses may include timing restrictions for seasonal and daily hauling periods, weather-related restrictions, enhanced traffic control at the intersection of the entrance road and Forest Road 303, speed control, signing, and repair of road surfaces or other damages beyond normal wear. Due to the varying nature of operations among various contractors it is not possible to determine the rate or duration of haul for a given contract. An estimated maximum haul/day would be 10 log trucks for an approximate duration of 25 days. A lesser operation would have fewer trucks per day, but extend duration. Time of day restrictions could also extend duration. Contracts will be designed to minimize duration of haul to the greatest extent possible. During contract preparation the Forest Service will confer with the Park Service to determine specific clauses and other mitigation to be included in the contract, depending on circumstances at the time of implementation.

- Before treatment, the Forest Service will work with researchers at Northern Arizona University to line and protect three research plots located on Campbell Mesa and in the Fort Valley Experimental Forest.

Community Wildfire Protection Plan

The project area falls within the boundary of the greater Flagstaff Community Wildfire Protection Plan (CWPP). The development of the CWPP for Flagstaff and Surrounding Communities (January, 2005) was coordinated by Greater Flagstaff Forests Partnership (GFFP) and Ponderosa Fire Advisory Council (PFAC). This plan is a collaborative planning and implementation tool that helps mitigate immediate fire hazards to communities at risk and restore fire-adapted ponderosa pine forests in the area. It provides a broad operating framework for treatment within the area. The Proposed Action and associated project design features will closely follow CWPP treatment guidelines for tree selection, cutting techniques, slash treatment, pile burning, broadcast burning, and maintenance treatments. Treatments may vary from CWPP recommendations when site-specific information has provided finer scale data that indicates a difference in treatment needs from the larger scale data used in the CWPP. Appendix C describes the CWWP and the relationship of the project with the CWPP in greater detail.

Monitoring

Implementation monitoring will assess if the project was implemented as designed and if it complies with Forest Plan direction. Routine implementation monitoring is a part of the administration of all project contracts and involves input from Forest Service specialists.

The project will include the following implementation monitoring items:

- Archeological monitoring for site damage and vandalism will be conducted after implementation.
- Habitat monitoring of MSO Restricted Habitat to determine effectiveness of treatments in meeting habitat objectives.
- Fuels monitoring will occur after burning operations to determine if expected fire effects and fuel levels are achieved.
- Noxious or invasive weed monitoring will occur to assess needs for biological control of species. See Appendix E – Best Management Practices and Recommended Activities for more information on specific noxious weed monitoring measures.

Other monitoring activities that the GFFP Monitoring and Research Team develop may be conducted as part of this project if funding and/or volunteer assistance is provided by GFFP or other interested parties.

Comparison of Management Practices

This section compares outputs, objectives, and effects of the Proposed Action and the effect of no action for the Eastside Fuel Reduction and Forest Health Project. The discussions of effects are summarized from Chapter 3, which should be consulted for a full understanding of these and other environmental consequences. Tables 2-3 and 2-4 provide an overview comparison of information from the Proposed Action and no treatment.

Table 2-3. Comparison of management practices

Practice	No Action	Proposed Action
Mechanical thinning	0	3,819 acres
Hand thinning	0	3,404 acres
Mechanical and Hand thinning – Mt. Elden	0	21 acres
Meadow and Grassland thinning	0	220 acres
Fuel break construction	0	377 acres (6.9 miles)
Initial Prescribed burning	0	20,197 acres
Maintenance Prescribed Burning	0	20,197 acres
Temporary road construction and decommisioning	0	4.5 miles 12 segments

Table 2-4. Comparison of management effects

Environmental Effects	No Action	Proposed Action
Silvicultural Effects		
Canopy cover	9,404 acres **0-39% cc** 5,263 acres **40-59% cc** 1,692 acres **60%+ cc**	13,578 acres **0-39%** 2,454 acres **40-59% cc** 327 acres **60%+ cc**
Acres of Uneven Age Class	3,274	7,461
Acres of Even Age Class	7,602	3,415
Competition to yellow pines and oaks	Continuing at current levels and increasing over time w/ increased densities	Decreasing on over 7,223 acres for approximately 20-40 years
VSS Class distribution (acres)	VSS 1 – 6% VSS 2 – 1% VSS 3 – 25% VSS 4 – 56% VSS 5 – 12% VSS 6 – <1%	VSS 1 – 20% VSS 2 – 0% VSS 3 – 9% VSS 4 – 43% VSS 5 – 28% VSS 6 – <1%
Acres with percent maximum SDI >35%	7,904	1,590
Openings – size and acres	Few openings greater than ½ acre on over 14,300 acres	20% openings ½ to 4 acres in size on over 7,223 acres (associated with thinning treatments)
Understory development	Continuing at current levels and decreasing over time w/ increased densities	Increasing on over 7,841+ acres for 20-40 years Also, additional acres improved due to precribed burning.
Total trees removed for uneven-age management and canopy cover objectives	0	1,258,200
Trees 16-20 inches DBH removed for uneven-age management and canopy cover objectives	0	9,550
Estimated residual number of trees greater than 16 inches DBH after treatment	256,800	247,250
Aspen restoration and protection	15	10/ with fence protection
Fire and Fuel Effects		
Fire Hazard Rating (number of acres with a Low rating)	8,256	15,724
Height to Live Crown (VSS 3 – 6)	1’ – 44’	5’ – 44’
Tree Mortality from fire	9 – 99%	4 – 31%
Fuels (tons/acre)	1 – 12 tons/acre	3 – 7 tons/acre
Critical Flame lengths	1’ – 17’	8’ – 17’
Probability of Exceeding Emission Standards (if burned)	Likely	Unlikely

Environmental Effects	No Action	Proposed Action
Visual and Scenic Resource Effects		
Visual Quality Obejective met	Yes	Yes
Watershed and Soil Effects		
Soil Quality and Productivity	No Impact	Minor Impacts
Sedimentation and runoff potential	No Potential	Little Potential
Wildlife Effects		
Fire Hazard Rating in MSO Restricted habitat (number of acres with low rating)	324	562
Acres of Wildlife Cover in Fire Management Analysis Zone	11,393	10,821
Acres of Wildlife Cover Outside Fire Management Analysis Zone	652	652
Estimated Loss of Snags	0%	20%
Prey base habitat for northern goshawk and Mexican spotted owl linked to understory diversity	Moderate	High
Rare Plants		
Direct effects to *Hedeoma diffusum* and C*lematis hirsutissima var. arizonica*	No effects	Project design features mitigate impacts to both species
Effects on habitat and plants from uncontrolled wildfire	Uncontrolled wildfire could damage habitats and populations.	Reduced risk of uncontrolled wildfire prevents damage to habitat and populations.
Noxious or Invasive Weeds		
Spread/control of noxious or invasive weeds	Noxious weed populations would continue to expand.	BMPs and other treatment measures will eradicate, maintain, or control populations.
Effects on noxious or invasive weeds from uncontrolled wildfire	Uncontrolled wildfire would increase the risk of severe ground disturbance and increase noxious or invasive weed invasions.	Reduced risk of uncontrolled wildfire would decreases the risk of noxious or invasive weed invasions in severely disturbed areas.

Chapter 3 – Affected Environment and Environmental Consequences

This chapter provides information concerning the affected environment of the Eastside Fuel Reduction and Forest Health Project area, and potential consequences to that environment. It also presents the scientific and analytical basis for the comparison of the Proposed Action and no treatment. All effects, including direct, indirect and cumulative effects, are disclosed. Effects are quantified where possible, and qualitative discussions are also included. The means by which potential adverse effects will be reduced or mitigated are described (see also Chapter 2 and Appendices D and E).

The discussions of resources and potential effects take advantage of existing information included in the Coconino Forest Plan's FEIS, Eastside Project Need for Change Report, and project-specific resource reports and related information in the Project Record. Where applicable, such information is briefly summarized and referenced to minimize duplication. The planning record for the Eastside Fuel Reduction and Forest Health Project includes all project-specific information, including resource reports, watershed analyses, and other results of field investigations.

Vegetation

Affected Environment

The project area consists of a total of 33,608 acres, with 21,227 acres of National Forest System land and 12,388 acres of private land or State land. Vegetation cover types on National Forest System lands within the project area are displayed in Table 3-1. Predominant cover types include ponderosa pine (16,776 acres), pinyon/juniper (3,604), and grasslands (697 acres). There are several tanks and ephemeral streams throughout the project area which support perennial riparian vegetation. The Rio de Flag flows through the project area with portions on National Forest System lands.

Historically, ponderosa pine forests of northern Arizona were characterized by frequent, low-intensity surface fires occurring every 2 to 12 years. The historic fire regime maintained an open canopy structure and a variable, patchy tree distribution across much of the forest by thinning smaller trees (Moir et al. 1997, Covington et al. 1997). Ponderosa pine forests were uneven-aged and consisted of fewer smaller diameter trees and a greater number of larger, older trees interspersed with grassy openings. After Euro-American settlement, several conditions, including fire exclusion, livestock grazing, high-grade timber harvesting, and climatic events, favored dense ponderosa pine regeneration (Long and Smith 2000). As a result, the current forest structure is predominately even-aged and consists of dense, overstocked sites of ponderosa pine with a closed canopy. Changes in the historic fire regime have resulted in increased site densities, changes in age and size class diversity, altered site 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, and increased fire size and intensity (Long 2003).

Table 3-1. Vegetation cover types located within the project area.

Cover Type	Acres
Grassland/Meadows	697
Right of Ways	114
Pinyon/Juniper	3,604
Ponderosa Pine	16,776
Mixed Conifer	21
Oak Woodland	15
Total	**21,227**

The soils on a majority of the project area consists of sandy loam and cobbly, clay loam soils. Over 90% of Forest Service lands within the project area have a high regeneration potential, while over 80% has a moderate to high revegetation potential. Approximately 87% of federal lands in the project area have a slight to moderate erosion hazard. Nearly half of these have a moderate to severe windthrow hazard.

Geographic Areas

Due to the large size of the project there is a wide variety of geographic features and soils which affect the growing conditions and vegetation type. A general overview of the different geographic areas within the project area follows.

Limestone

This is the area to the northeast of Lake Mary Road, west of Walnut Canyon National Monument, south of Flagstaff, and north of Walnut Canyon. The area is characterized by limestone soils. Growing conditions are fair to poor. There are also several draws which run through the area and are classified as meadows. There is also a small area of mixed conifer in Fay Canyon. There are several pockets of aspen growing in the southern most area of Walnut Canyon within the project area.

Campbell Mesa

This is the area east of the Country Club area of Flagstaff, north of Walnut Canyon National Monument, and south of I-40. This is a drier site area with poorer growing conditions. This is in the transition zone between pine/oak to pinyon/juniper cover type. Site conditions are fairly open with some dense pockets.

Turkey Hills

This is the area around Turkey Hills, including areas along Townsend-Winona road, and areas of Doney Park near Slaton Ranch road. This is in the transition zone between pine/oak to pinyon/juniper cover types. The soils are cinder based. Growing conditions are moderate to poor. There are sites with high amounts of oak, particularly on north facing slopes. Site conditions vary from open to dense.

Cosnino

This is the area on the far eastern edge of the project in between I-40 and Townsend-Winona Road. There has been a high mortality of the pinyon pines in this area. Management activity in this area will be focused on fuels reduction around private property.

Timberline

This is the area north of Doney Park and all around the Timberline community. The western edge of the area lies on the toe slopes of the San Francisco Peaks. Further to the east there is a transition into the cinder soils and dryer site conditions. Site conditions range from open to dense. Growing conditions are moderate to poor moving from west to east.

Elden Base

This is the area all along the foot of Mount Elden and the north edge of the city. Site conditions are fairly dense with some open areas. Vegetation is predominately pine/oak cover type. There is also an important forage component in this area, particularly cliff-rose. Growing conditions are moderate. There are some aspen sites at the base of Mount Elden on its western side.

Forest Structure

Existing and desired Vegetative Structural Stages (VSS) by acres and percent of forested Forest Service land within the project area are illustrated in Figure 3-1. Approximately 3% of National Forest System lands in the project area are classified as grasslands/meadows and another 17% classified as pinyon/juniper. Neither grassland/meadow or pinyon/juniper cover types are included in the vegetative structural stage calculations and are not illustrated in Figure 3-1.

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 Forest Service 1993). VSS classes were determined by calculating the basal area within each diameter class. The VSS class with the highest calculated square foot basal area is the assigned structural stage for the site. The grass/ forb/shrub stage (VSS 1) consists of non-stocked openings and trees 0-1 inch diameter at breast height (DBH). The seedling/sapling stage (VSS 2) consists of trees 1-5 inches DBH. The young forest stage (VSS 3) consists of trees 5-12 inches DBH. The mid-aged forest stage (VSS 4) consists of trees 12-18 inches DBH. The mature forest stage (VSS 5) consists of trees 18-24 inches DBH. The old-growth forest stage (VSS 6) consists of trees greater than 24 inches in diameter and meets old growth definitions in the Coconino National Forest Plan.

Canopy cover is the percentage of the ground area that is directly covered with tree crowns. Canopy cover values were obtained from the Forest Vegetation Simulator. Sites are considered "open" if canopy cover ranges between 0 to 39%. Sites are considered "moderately closed" if canopy cover ranges between 40 to 59%. Sites are considered "closed" if canopy cover is 60% or greater (refer to page 28 for discussion of group and clump relationships to general canopy cover measurements).

Existing crown canopy covers by acres and percent of forested National Forest System lands within the project area are illustrated in Figure 3-2. The majority, 57%, of the forested Forest Service land within the project area is considered to have an "open" canopy structure, whereas 42% is "moderately closed" or "closed."

Figure 3-1. Existing Vegetative Structural Stages (VSS) percent of ponderosa pine sites on National Forest System lands within the project area

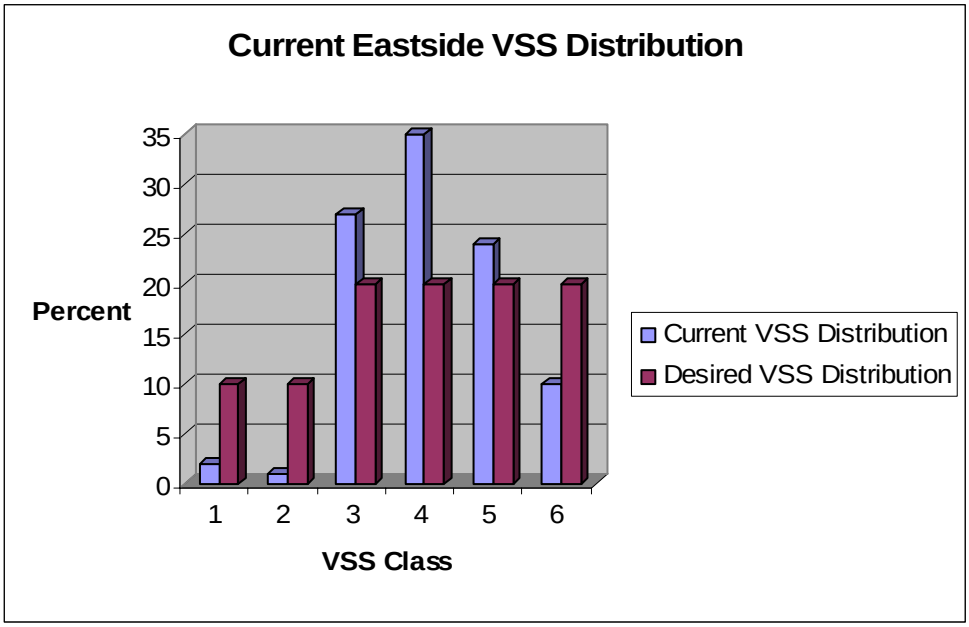
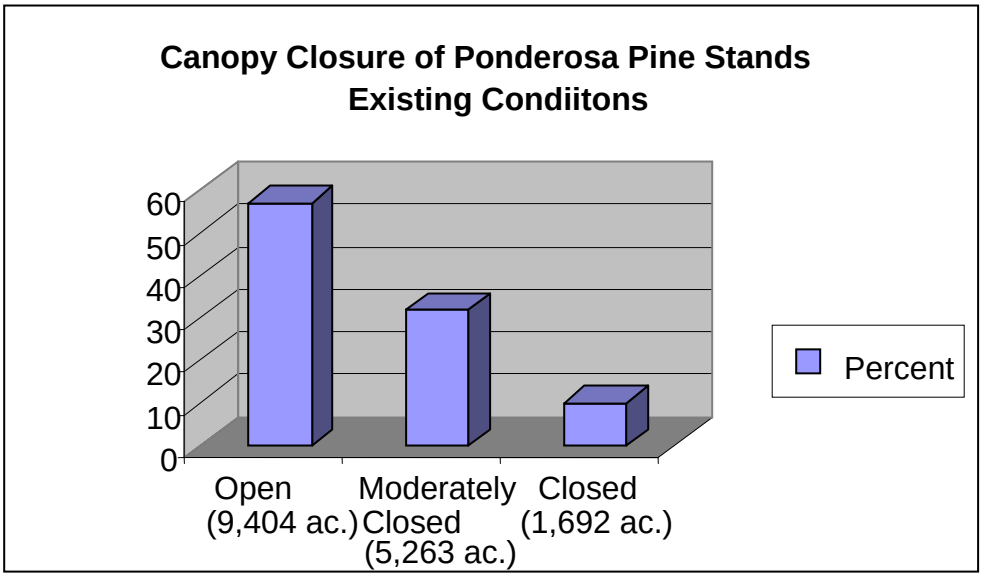


Figure 3-2. Existing crown canopy cover by acres and percent of forested National Forest System lands within the project area.



Site Density

Average trees per acre, basal area, canopy cover, and quadratic mean diameter by Vegetative Structural Stage (VSS) are displayed in Table 3-2. Because values can range dramatically within VSS classes, the values in Table 3-2 are expressed as ranges, with a weighted average in parentheses to provide a more accurate picture of site density conditions. Across the majority of the project area, site densities range from 50 to 150 trees per acre with basal areas ranging from 50 to 85 sq ft per acre.

High site densities result in increased competition between trees for moisture, nutrients, and sunlight; decreased tree vigor; increased susceptibility to successful bark beetle attack and mortality; decreased diameter growth; decreased old growth 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.

Table 3-2. Forest structure and site density values by VSS class.

VEGETATIVE STRUCTURAL STAGE	ACRES	TREES PER ACRE	BASAL AREA (SQ FT / AC)	CANOPY COVER (%)	QUADRATIC MEAN DIAMETER (INCHES)
1	363	ND	ND	ND	ND
2A	246	ND	ND	ND	ND
3A	878	46-169 (103)	22-58 (43)	16-38 (28)	5-12 (9)
3B	2756	115-670 (270)	58-114 (83)	41-59(49)	5-12 (8)
3C	868	164-950 (469)	113-219 (161)	60-85 (72)	6-11 (8)
4A	3103	34-150 (76)	32-65 (51)	21-39 (32)	8-15 (12)
4B	2015	81-389 (136)	72-114 (82)	41-57 (47)	6-15 (11)
4C	824	99-550 (272)	82-284 (170)	47-90 (71)	7-14 (11)
5A	3810	20-79 (51)	31-69 (46)	20-39 (28)	9-18 (14)
5B	194	41-160 (104)	76-103 (87)	41-53 (47)	10-18 (14)
6A	1423	19-135 (59)	29-65 (45)	19-36 (27)	8-21 (13)
6B	298	96	73	41	12

*ND = No Data

One area with high site density is Location 318 in the Limestone area. Unlike the rest of the Limestone area, Location 318 has not been pre-commercially thinned since the 1960's. This has resulted in extreme unnaturally dense sites which have been rated as an extreme fire danger. As a result, trees are in poor health and a higher than normal incidences of snow-bend is occurring. There is limited grass and forb production. A thirty-acre fire which occurred in this area in the Fall of 2002 resulted in 80 to 90% mortality.

Forest Health

There is only one area with severe dwarf mistletoe infection (*Arceuthobium vaginatum subsp. cryptopodum*) in the project area. This area is centered around Site 297/01 on the western side of Mount Elden. Dwarf mistletoe does occur in small pockets in other parts of the project area but at low infections levels and not considered a threat to those sites.

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 feet 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 in the area.

High site densities and Stand Density Index (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 sites of higher densities.

Much of the project area occurs in the pine to pinyon/juniper cover type transition zone. This transition zone is characterized by drier sites and poorer soils. The recent and ongoing drought has precipitated an epidemic bark beetle infection which has caused widespread mortality in the ponderosa and pinyon pine within the project area, particularly in the Cosnino, Campbell Mesa, Doney Park and Timberline areas. In some areas mortality has been as high as 80 to 100%.

Species Diversity

Aspen

Aspen stands comprise approximately 10 acres within the project area. Approximately 5 acres are located within ponderosa sites at the base of Mt. Elden. These aspen stands are relatively young in age and are currently exhibiting reduced crown canopies, high tree mortality in the overstory, encroachment of ponderosa pine, and browsing damage from elk. Another 5 acres is located in or adjacent to Walnut Canyon in the southern most portion of the project area. The aspen in this area appears to be relatively healthy. Portions are located in rocky areas and are free of browsing evidence but are experiencing overstory encroachment. Another aspen area is located in the bottom of Walnut Canyon.

Aspen stands were historically characterized by fires of moderate frequency and intensity occurring every 50 to 100 years (Long 2003). Aspen communities are a critical element within the forests of northern Arizona. Lower elevation aspen clones (less than 7500 feet elevation) represent ecologically unique sites that contribute to increased biological diversity. Both higher and lower elevation sites have been in a gradual state of decline over the past 50 years due to fire suppression and extreme browsing pressure from elk. However, aerial and ground detection surveys have determined an alarming rate of decline in aspen clones across northern Arizona over the past few years due to defoliation by a severe frost event that occurred in early June of 1999. Many small, lower elevation clones are nearing 100% mortality. Monitoring plots located in aspen stands across the Coconino National Forest exhibit a combination of symptoms including reduced canopies, branch dieback, increased mortality, and either

non-existent aspen regeneration success or elk browsing damage approaching 100 percent. Elk browsing is compounding the decline of aspen clones across the region by preventing successful regeneration of aspen and causing a shift in age-class distributions. Mortality of mature aspen in many lower elevation sites coupled with continued browsing damage by elk is expected to result in an eventual type conversion from aspen to ponderosa pine at a landscape scale.

Gambel oak

Gambel oak occurs through out the project area in varying degrees of density. It generally does not occur in the pinyon/juniper cover type. The sites containing 10 sq ft basal area of Gambel oak or greater (Restricted Habitat) are located in the northern, western, and southern portion of the project area within the ponderosa pine cover type. Due to the proximity of the project area to Flagstaff, Doney Park, Timberline 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. The majority of oak within the project area are less than 10 inches diameter at root collar (DRC).

Riparian species

Cottonwood (*Populus spp*) and willows (*Salix spp.)* occur along the bottom of Walnut Canyon on the southernmost part of the project area and possibly in Fay Canyon and along the Rio de Flag.

Understory Vegetation

Data was not collected on understory biomass 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 site densities, increased canopy covers, and increased forest floor depth (Covington et al 1997). Visual assessments conducted within the project area concur with current research findings in that understory productivity is low, especially in areas with "closed" and "moderately closed" canopies.

Grasslands and Meadows

Approximately 697 acres within the project area are classified as meadows by Terrestrial Ecosystem units. Grasslands and meadows have been experiencing pine encroachment for over 100 years due to fire suppression. In some areas, encroaching pine trees have reached diameters greater than 16 inches DBH, but due to poor site productivity, tree heights are much lower than those normally associated with trees of these diameters.

Environmental Consequences

Effect of No Action

Forest Structure

Trees would grow into larger diameter classes and VSS classes at a much slower rate due to high site densities and high competition between trees, resulting in stagnation of VSS classes and slower development of old growth forest structures. A comparison of the VSS class distribution between no treatment and the Proposed Action is shown in Table 3-3. Trees reaching maturity and changing their appearance from black bark to yellow bark will still occur biologically at approximately 150 to 200 years old, but they will have smaller diameters than usually associated 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 pine and oak trees, resulting in decreased growth, vigor, and longevity. There will be few replacement trees of large diameter size in yellow pines for 50 to 100 years.

Crown canopy covers by acres and percent of project area are displayed in Figure 3-4. More than half of the ponderosa pine sites in the project area have open canopies (<40% canopy closure) and/or openings within the sites. Many of these open canopied sites will continue to be open due to a combination of limited regeneration potential, poor soils, limited moisture, fire, and periodic bark beetle mortality. Within these sites, there may be clumps or groups that have dense conditions which could result in decreased growth, vigor, longevity, higher instances of bark beetle mortality, and crown fire mortality.

In over 40 years with no treatment, closed canopy conditions would increase to 40% of the project area, while open crown canopy conditions would decrease to 24%. See Table 3-4. Closed crown 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 an increased risk of bark beetle attack.

Site Density

Table 3-5 displays the estimated site conditions projected over 40 years, including trees per acre, basal area, and quadratic mean diameters. Nearly 40% of the project area would have basal area values in excess of 150 square feet per acre within 40 years. Canopy cover values would also continue to increase over time, with nearly 40% of the project area exceeding 60% canopy cover in 40 years. As a result of these high site densities, quadratic mean diameter would continue to increase at a slower rate. Trees would move into larger diameter classes and VSS classes at a slower rate. Trees per acre would decrease over the next 40 year period due to competition-based mortality.

Forest Health

Dwarf mistletoe infection would continue to spread throughout infected sites, expanding at a rate of 1-2 feet 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. 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.

Increasing site 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 site 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

Aspen

The aspen stands located within the project area would continue to suffer from conifer encroachment and elk browsing, resulting in decreased regeneration, decreased growth, decreased health and vigor, increased mortality, and eventual conversion of aspen to ponderosa pine or grassland. The long-term

effects of no treatment within the aspen stands would be an eventual type conversion from aspen to ponderosa pine or grassland and a further loss of genetic diversity between aspen clones.

Oak

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

Riparian Species

Riparian species located within the project area would continue to suffer from conifer encroachment and elk browsing, resulting in decreased regeneration, decreased growth, decreased health and vigor, increased mortality, and eventual conversion of aspen to ponderosa pine or grassland. The long term effects of no treatment within the riparian areas would be an eventual type conversion from aspen to ponderosa pine or grassland and a further loss of genetic diversity with in the project area.

Understory Vegetation

Understory productivity and diversity would continue to decrease over the next 40 years as site densities 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. As grassland and meadow areas continue to experience pine encroachment and increasing densities, understory productivity and diversity would decrease in these areas as well.

Grasslands and Meadows

Grasslands and meadow areas would continue to experience pine encroachment. As pine increase in density over time, grasslands and meadows would experience decreased understory productivity and diversity and loss of functionality in terms of hydrology, biodiversity, horizontal heterogeneity, and wildlife habitat diversity.

Proposed Action

Forest Structure

Vegetative Structural Stages by percent of project in the ponderosa pine type area under the Proposed Action are illustrated in Table 3-3. The acres of VSS 1 and 2 will increase as the result of creating 20% openings in the mechanical, hand, and restricted thinning areas.

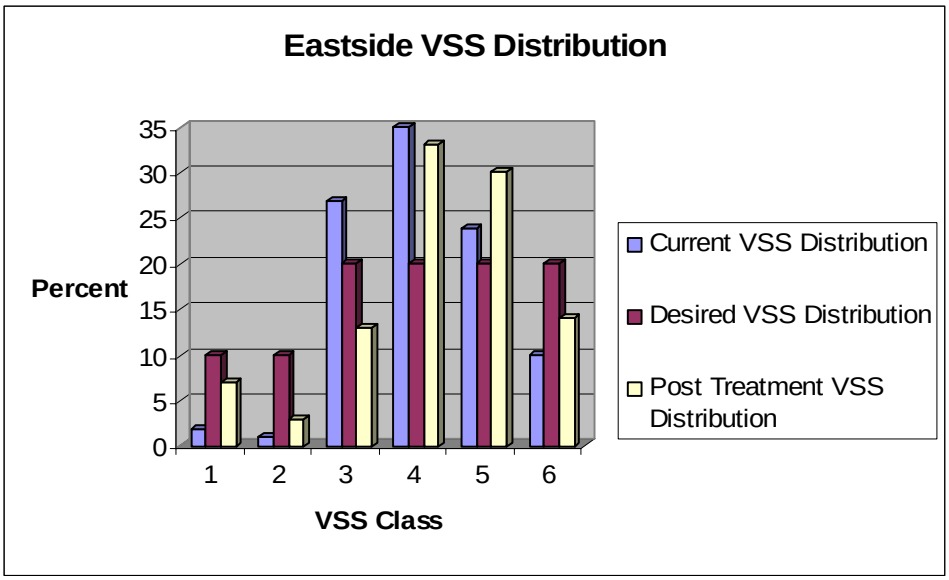
There will be a significant decrease in VSS 3 and slight decrease in the VSS 4 classes. The bulk of the densest sites in the project area are in VSS 3 and 4 classes and this is where the majority of the proposed thinning will be occurring. As a result of thinning in the VSS 3 and 4 classes, there will be an increase in the VSS 5 and 6 classes.

Table 3-3. VSS Percentages of ponderosa pine cover type across project area (including non-thinned sites).

VSS	1	2	3	4	5	6
Existing Percentage	2	1	27	35	24	10
Post-Treatment Percentage	7	3	13	33	30	14
40 Year Post-Treatment Percentage	1	6*	4	27	29	33
40 Year No Treatment Percentage	1	2	12	26	27	32
Desired Future Condition Percentage	10	10	20	20	20	20

*Within the 7023 acres, where 20% openings are prescribed, additional regeneration is expected to be occurring within the VSS 4, 5, and 6 stands, and so VSS's 1, 2, and 3 are underrepresented in the 40 Year Post Treatment Percentages.

Figure 3-3. VSS distribution in the ponderosa pine cover type showing current, post treatment, and desired distribution.



After 40 years, the percent of VSS 4, 5, and 6 sites is slightly more than with no treatment. A larger difference in the distribution will be noted in the VSS 1, 2, and 3 sites. In 40 years after the proposed treatments, 7% of the sites will be in VSS 1 & 2 stages and 4% in the VSS 3 stages, whereas without treatment, only 3% of the site will be in VSS 1 & 2 stages and 12% in the VSS 3 stage.

While the amount of VSS 5 and 6 sites after 40 years will be similar in the Proposed Action and no treatment, the Proposed Action will create sites which are more open, have greater understory grass and forb production, less susceptible to insect and disease outbreaks, and are less likely to suffer mortality from wildfires.

According to the Coconino National Forest Plan (USDA Forest Service 1996), the recommended VSS distribution for the Northern goshawk is:

VSS 1 GRASS/FORB/ SHRUB	VSS 2 SEEDLING/ SAPLING	VSS 3 YOUNG FOREST	VSS 4 MID-AGED FOREST	VSS 5 MATURE FOREST	VSS 6 OLD GROWTH FOREST
10%	10%	20%	20%	20%	20%

The Proposed Action does not immediately result in the desired VSS distribution as outlined in the Coconino National Forest Plan. Current research has shown that obtaining the recommended VSS distribution for the Northern goshawk is not a matter of simply harvesting (Parker and Hummel 2002). In order to obtain the recommended VSS distribution for the northern goshawk, additional treatment would be required within 20-40 years. The following activities would need to be analyzed under separate, future NEPA documentation but would aid in achieving the desired future conditions for goshawk management:

- Harvesting and prescribed burning within some mature sites 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 sites and regeneration, create spatial diversity, and maintain health in order for groups to grow into larger VSS classes.

Under this scenario, treated areas would progress towards the desired future forest conditions described in the Forest Plan. With these additional treatments, the recommended VSS distribution for northern goshawk could be reached in approximately 100 years.

Large Tree Management

Two respondents suggested diameter limits as means to retain larger diameter trees in the project area. Both 12-inch DBH and 16-inch DBH diameter limits were proposed. The following sections address the environmental effects of the proposed diameter limits from forest structure, density, and health viewpoints.

Forest Structure and Site Density

Retaining all trees greater than 12 or 16 inches DBH within the project area would result in higher residual site densities and canopy covers, increased inter-tree competition, and decreased tree growth and vigor. Additional effects include increased mortality to existing, old trees in sites that contain a large component of large trees. The presence of larger, black-barked pine trees around the drip lines of old, yellow pines would result in continued competition between trees for moisture, nutrients, and sunlight. Old yellow pines could experience decreased vigor and longevity. As a result, old trees could experience increased susceptibility to successful bark beetle attack and mortality and increased risk of mortality due to crown fire, resulting in slower formation of old growth structures within these sites.

With or without a diameter limit, ponderosa pine trees will begin to turn yellow at approximately 150 years of age. However, due to higher residual densities in these sites resulting from a diameter limit, yellow pines could have smaller diameters than we normally associate with old trees due to decreased growth rates. VSS 6 areas currently approximate 10% of the project area and are severely lacking across the entire forest due to past logging practices. Old-growth forest is not only characterized by a certain number of large diameter trees, it is a system with structure and function. It is important to maintain and create old-growth ecosystems because their structures represent what is likely to be the most biologically diverse portion of the successional sequence (Hunter 1990). Because of their biological diversity, old-growth forest structures provide habitat for a diverse array of wildlife species. As old-growth forest has decreased in abundance over the past century, so have wildlife species populations that depend upon old-growth forest structures, such as the Mexican spotted owl.

Additional effects of a diameter limit include a decreased number and size of openings for natural regeneration. Experience with past and ongoing thinning projects, such as the Woody Ridge and Fort Valley projects, has demonstrated difficulties with the creation of openings across 20% of the project area without the removal of larger trees. A decrease in openings could result in decreased horizontal and vertical heterogeneity and further deviation from the historic, patchy tree distribution that occurred pre-settlement. A lack of openings of adequate size would result in a decreased amount of regeneration due to the shade-intolerance of ponderosa pine. Without regeneration and the formation of grass/forb/shrub and seedling/sapling vegetative structural stages (VSS 1 and 2) across the project area, the Forest Plan VSS distribution and a sustainable, uneven-aged forest structure would not be attained.

Forest Health and Species Diversity

Retaining larger diameter dwarf mistletoe-infected trees in the overstory would perpetuate the spread of infection to smaller trees in the understory. With increased canopy covers, increased site densities, and a lack of openings or the creation of smaller openings resulting from a diameter cap, dwarf mistletoe infection would continue to spread throughout infected sites, expanding at a rate of 1 -2 feet 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, resulting in increased risk of 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.

Competition between pine and oak for moisture, nutrients, and sunlight would remain high, resulting in decreased oak growth and vigor. Large oak would experience decreased longevity. Oak of all sizes would be more susceptible to disease and insect attack and mortality.

Large Trees Proposed for Removal

Based on FVS outputs, it is estimated that a total of approximately 1,258,200[7] trees will be thinned to meet canopy cover and uneven-aged management goals. Of these trees to be thinned, approximately 8,988 trees are greater than 16 inches DBH. The number of trees thinned greater than 16 inches DBH represent 0.7% of the total number of trees to be thinned. Because of modeling limitations or a lack of data, FVS cannot estimate the number of trees greater than 16 inches DBH to be removed to meet other project objectives such as the creation of openings, thinning around oak clumps and yellow pine groups, and meadow and grassland thinning. In order to estimate the number of trees greater than 16 inches DBH to be thinned to create openings or to enhance oak growth, detailed stem maps of the locations of these trees would be required. Most of these trees would range between 16-18 inches DBH. The proposed diameter limits would not allow managers to achieve a sustainable, uneven-aged forest, as described in the Purpose and Need for Action of this project.

Appendix B includes a detailed discussion of rationale and criteria for the removal of large trees in the project area. This large tree management rationale aims to prevent the thinning of any large trees except for ecological needs, some of which are directly linked to the Purposed and Need for Action of this project.

Old Growth

Portions of seven 10K areas are included in the project area. Under the Proposed Action, 13,622 acres have been identified as potential developing or recruitment old growth areas, including areas allocated in previous analysis. Within the project area 5,494 acres will be designated as Developing Old-Growth, in addition to the 374 acres of existing old growth. Table 3-3.1 is a summary of old growth allocation in the 10K's: See the Vegetation specialist Report for a detailed acreage breakdown and analysis of each 10K, PR # 195.

[7] Stand exam data was collected using variable radius plots for trees greater than 5 inches DBH and 1/100-acre fixed area plots for trees less than 5 inches DBH. One limitation of variable radius plots is a tendency to overestimate the number of larger trees because the probability that a tree will be counted as "in" the plot is directly proportional to the diameter of the tree. FVS simulations use this data to output model estimates of trees thinned. These numbers are only estimates and should not be interpreted as the actual number of trees removed. Rather, they provide a context for comparing the number of trees removed, including large trees versus no treatment.

Table 3-3.1. Summary of Old-growth allocation.

10K	10K Total Acres	10K Forested Acres	20% of Forested Acres 10K	Project Forested Acres/(% of 10K)	Current Existing or Designated Old-growth 10K	Designated Old-growth, Project Area/(% of 10K)/ Project %	Total Old-growth allocated – 10K	Balance Of Acres
221	16,059	1,379*	276	1,379/ (100%)	0	555 (40%)/ 40% Project	555	+279
217	8,629	6,790	1,358	6,521/ (96%)	365	1,526(22%)/ 23% Project	1,891	+533
316	37,605	4,440	888	1,206/ (27%)	500	388 (9%)/ 32% Project	907	+19
505	11,173	9,399	1,880	1,427/ (15%)	1,841	683 (7%)/ 48% Project	2,524	+662
209	16,123	13,028	2,606	3,160/ (24%)	899	749 (6%)/ 24% Project	2,610	+4**
213	14,350	13,499	2,700	3,358/ (25%)	214	724 (5%)/ 53% Project	2,700	0 Plus**
212	12,208	12,176	2,435	1,584/ (13%)	0	869 (7%) 55% Project	2,435	0 Plus

*Forested acres based on Ponderosa Pine. Remaining acres are Pinyon/Juniper Woodland (PJ) or non-forested. PJ Old-growth not allocated with this action. No treatments in Proposed Action affect PJ old growth.

**Remaining allocation currently being assessed under Jack Smith/Shultz Project.

Four of the 10K areas (10K # 221, 10K # 217, 10K # 316, and 10K # 505) meet or exceed 20% allocation, when allocations for the Eastside project are combined with allocations made under previous analysis, with the following adjustment. An additional site was allocated in the Woody Ridge EA area as it had greater potential to meet old growth requirements versus selecting additional sites within the Eastside project area. A recent treatment under the Woody Ridge Timber Sale was field verified to be consistent with promoting and advancing the site toward old growth. The Woody Ridge EA will be appended with a letter to the file to document the additional allocation.

The three remaining 10K's (10K # 209, 10K # 212, and 10K # 213) require additional allocation to meet 20 percent guidelines. Two of these 10K's (10K # 209 and 10K # 213) are currently under analysis through the adjoining Jack Smith/Schultz Fuel Reduction and Forest Health project. There is currently enough intensive survey information to conclude that the balance of required old growth allocation will meet or exceed the 20 percent standard and guidelines for these areas when that analysis is completed in early 2007.

The remaining 10K (10K # 212) only has a small portion within the project area (approximately 1584 acres of forested land out of 12,176 acres of forested land for the 10K). However, extensive analysis of the area outside the project confirms that that portion of the 10K in the Eastside project area contains most of the better growing sites, and thus approximately 55 percent of the forested acres within the Eastside project have been allocated for this 10K. The remaining forested acres in this 10K are in the cinder hills volcanic field a large portion of which includes the Cinder Hills Off Highway Vehicle (OHV Area) Recreation Area. We have made allocation to the greatest extent possible outside of the OHV area, thus leading to the substantial over allocation within the project area. A detailed acreage assessment is included in the Vegetation Specialist Report, PR # 195.

Developing Old-Growth sites have been arranged spatially across the project area and contain a degree of connectivity between sites. Old-growth forest structures in treated sites will develop at a faster rate, as evidenced by the increase in mature forest over 40 years following treatment. Trees reaching maturity and changing their appearance from black bark to yellow bark (old trees) will still occur biologically at approximately 150 to 200 years old, but they will have larger diameters, in comparison with no treatment. Across the project area there are a number of sites that will contain components of old growth at the group or clump level as the site moves toward an uneven aged structure.

Mechanical Thinning

The site structure that will be created in the mechanical thinning will emphasize the creation and retention of groups and clumps. Groups and clumps will be defined by the interspaces in between them.

It is estimated that the distanced between groups and clumps will be 60 to 100 feet. The size of the clumps will be from 1/10th acre to ½ acre in size. Approximately 40% of the site acres will be covered in groups and clumps, 40% of the site acres will be interspaces used to define the clumps, and the remaining 20% of site acres in openings targeted for VSS 1 and 2 recruitment. These interspaces, in addition to the openings, will likely become an important habitat component of the site as these areas will contain the bulk of the grass and forb production. Canopy cover within the clumps will range from 40-100%.

In 40 years after the Proposed Action, thinned sites will be much more heterogeneous with well defined clumps. While certain sites will grow into VSS6 sites without treatment, their canopy cover values will be higher, which will lead to the creation of more homogeneous conditions. The higher canopy cover will decrease the amount of grass and forb production and result in less seedlings and saplings.

There are three sites each of VSS 4A and 5A with open canopies (less than 40% canopy cover) that will be treated. These sites are being treated because they are adjacent to private property and have been identified as a potential fire threat.

Crown canopy covers by percent within the ponderosa pine cover type under the Proposed Action are illustrated in Figure 3-4 and Table 3-4. "Open" crown canopy conditions will increase from 57% to

83% after implementation of the Proposed Action, while "closed" crown canopy conditions will decrease from 10% to 2%. "Moderately closed" crown canopy conditions will also decrease from 32% to 15%. Because all of the thinning treatments involve the creation of openings and do not utilize spacing guidelines (clump and group structure will be emphasized, not individual tree spacing), the residual forest structure will be more variable and patchy. Thus, canopy cover will be higher within pine groups, with interspaces between groups. Small openings and more open crown canopy conditions will result in increased sunlight to the forest floor and an increase in grasses, forbs, shrubs, and seedlings/saplings, especially in the openings.

The effects of thinning will be relatively short-lived. Forty years after implementation of the Proposed Action, "open" crown canopy conditions will exist in 40% of the areas, while "moderately closed" crown canopy conditions exist in 43% of the areas. Future treatment at that time would be needed to maintain desired forest structure and density characteristics.

Table 3-4. Current, post treatment, and predicted average canopy cover in 2046 of ponderosa pine sites.

Tree Canopy	Current 2006	Post-Treatment	No Treatment 2046	Post- Treatment 2046
Open	57%	83%	24%	40%
Moderately Closed	33%	15%	37%	46%
Closed	10%	2%	40%	14%

Mechanical Thinning in MSO Restricted Habitat

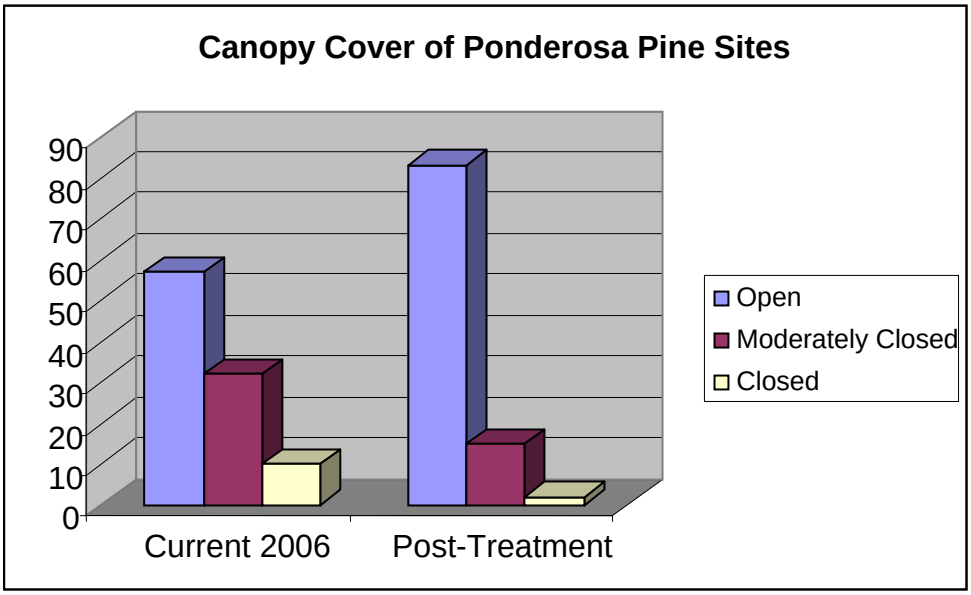
Sites within pine/oak that could attain the type of forest structure sought by spotted owls for roosting and nesting habitat and having at least 10% of the site basal area consisting of oak greater than 5" diameter at root collar (DRC) in oak are classified as restricted habitat for the Mexican Spotted Owl. Thinning will occur in three restricted sites. These sites will be thinned to retain 40% canopy cover as measured across the site. These sites will have higher average canopy cover than other sites, slower rates of individual tree growth. These sites will be more susceptible to insects and diseases.

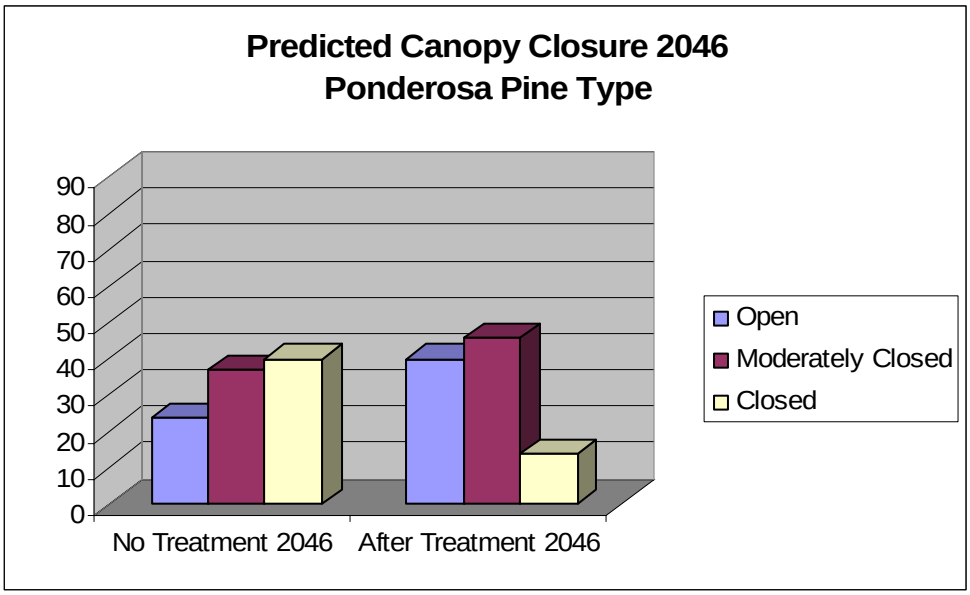
Table 3-5. Average of ponderosa pine site indices for fire risk reduction area by year.

Year	Trees/ Acre	Trees/ Acre Hand Thinning	Tree/ Acre Mech. Thinning	Basal Area	Basal Area Hand Thinning	Basal Area Sq. Ft./Ac. Mech. Thinning	Quadratic Mean Diameter (QMD)	QMD Hand Thinning	QMD Mech. Thinning
Existing Condition	214	567	241	85	144	109	11.3	8.3	10.4
Post Treatment	139	116	77	70	104	54	11.8	12.4	12.8
40 Years Post Treatment	123	105	72	107	141	93	15.6	15.5	17.4
40 Years No Treatment	188	486	211	126	182	157	14.8	10.3	13.5

*Mechanical Thinning values include MSO restricted sites. Data was developed from site simulations using the Forest Vegetation Simulator. Values include all tree species.

Figure 3-4. Canopy cover of ponderosa pine sites within the project area, pre- and post-treatment.





Hand Thinning

In the hand thinning treatments it will not always be possible to create the 20% openings and well defined groups and clumps due to the size limitation (typically 12 inches DBH) of stems removed.

Table 3-5 displays the average trees per acre, basal area, and quadratic mean diameter of the sites which would be thinned by hand up to 12 inches DBH. Hand thinning would remove the majority of trees up to 9 inches DBH and thin a few selected trees from 9 to 12 inch DBH. The majority of these areas are being thinned by hand because of access issues and the desire to avoid reopening roads which have been successfully closed. Quadratic mean diameter will increase after treatment due to the removal of smaller trees and the retention of larger trees. Over the 40 years following treatment, diameter growth will remain higher than with no treatment. The effects of thinning will last for approximately 20-40 years. Thinning will result in lower site densities, lower canopy covers, and increased diameters both after treatment and for 40 years into the future, resulting in decreased competition between trees, decreased tree stress, increased tree vigor, increased diameter growth, increased understory productivity and diversity, increased natural regeneration, and 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. However, the effects of hand thinning will begin to change in 40 years. The crown canopy will close in 40 years and additional thinning will be required in 40 years to reopen the canopy, create openings for regeneration, decrease inter-tree competition, and stimulate understory production.

Site Density

Table 3-5 displays trees per acre, basal area, canopy cover, and quadratic mean diameter for treatment projected over 40 years. After implementation, trees per acre, basal area, and canopy cover decrease significantly for all treatments except the Prescribed Burn Only treatment. After 40 years, the average number of trees per acre continues to be significantly less than with no treatment throughout all treatment areas. However, basal area will nearly return to pre-treatment levels within 40 years in the hand thinning. Decreased site densities and canopy cover 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 competition will also result in increased diameter growth for individual pine trees. The average QMD increases from 11.3 to 15.6 inches over 40 years over the entire project area, compared to an average increase from 11.3 to 14.8 inches with no treatment.

Within sites thinned mechanically, the effects of thinning on site density are projected to last over 50 years due to lower residual site densities and canopy covers post-treatment. Inter-tree competition will remain relatively low for over 40 years, resulting in significant increases in diameter growth. Trees will advance into larger VSS classes at a relatively faster rate. Understory productivity and diversity should resemble pre-settlement conditions.

Prescribed Burn Only Treatments

Under the Proposed Action, 12,356 acres will receive a Prescribed Burn Only treatment and all thinned sites will receive a broadcast burn. Broadcast burning, in conjunction with thinning 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 sites.

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. Prescribed fire may also have negative effects, such as increased tree mortality. Smaller trees (less than 4 inches in diameter) are more susceptible to crown scorch, however survival is highly dependent upon burning season (Sackett 1995). Mature "yellow" pines are also 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). Prescribed fire may also cause an increase in invasive exotic species, such as mullein, butter and eggs, and cudweed (Griffis et al. 2001, Sackett 1995).

Grasslands and Meadows Thinning

Under the Proposed Action, 220 acres of grasslands and meadows will be restored to pre-settlement densities. Reducing densities in these areas will result in increased understory productivity and diversity and restore their functionality in terms of wildlife habitat, watershed production, fire hazard, and scenic values. Pre-settlement densities are an important reference condition for thinning activities

because they are the densities that evolved in these areas over centuries with fire, drought, frost, wildlife, insects, and disease.

Mount Elden Communication Site

Twenty-one acres around the Devil's Head communications site will receive thinning to reduce fire risk to the communication site. Potential hazard trees will be removed. This is a mixed conifer site that averages over 500 trees per acre. This site will be thinned from below to 40% - 60% canopy cover. Residual basal area will be 70 – 90 sq ft.

Hitching Post Stables

Location 318 has a number trails permitted by an outfitter guide based out of the Hitching Post Stables. It contains the highest number of trees per/acre (1,000+/acre), high basal areas, high canopy closures all of which have resulted in high to extreme fire hazard ratings. Tree in this area are in extremely poor health. Crown ratios are very poor (20% or less) and trees are losing structural integrity, causing snow bend trees in throughout the sites. In the Fall of 2002, a 30-acre fire (Walnut fire) burned in this area. Mortality in the burned area was about 80%. This area has not received vegetation management in over 40 years. Utilizing hand thinning, up to 900 smaller diameter trees per acre could be cut. Due to the extreme density and poor height to diameter ratio, higher incidences of wind throw and snow bend will occur in these sites compared to other sites.

Visual and noise buffers will be left in place to address concerns expressed by the outfitter guide permittee. Visual and noise buffer will be left along Lake Mary Road and a visual screening strip will be left in between the permittee's trails and the community. The district silviculturist and fuels specialist will work with the permittee to select areas along the trail system where the permittee would prefer to leave the forest in its current condition. No more than 20% of Location 318 will be left untreated.

Elden Base Cliffrose Population

Special attention will be given to the thinning in sites which contain large populations of cliff rose. Populations will be identified before or during layout. Treatment will be designed to open up the canopy in or around existing or potential future populations. Prescribed burning may be restricted from certain cliff rose populations, particularly the older decadent populations.

Forest Health

Complete elimination of dwarf mistletoe 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 and decrease the rate of spread. 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 crown canopy cover and creating a patchy tree distribution, the proposed treatments will decrease the rate at which infection spreads. A more open, patchy forest structure would have limited the spread of dwarf mistletoe infection (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 crown canopy covers and broadcast burning will decrease the severity and spread of DM infection, the effects of the Proposed Action will be relatively short-lived. Within 40 years, canopy covers will begin to close and approach pre-treatment conditions. Additional thinning treatments will be required at this time to decrease canopy cover, maintain a patchy tree distribution, create openings in the canopy, and treat latent infection. Without treatment, DM infection would continue to spread throughout sites 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 (2000) also states that areas infected with dwarf mistletoe often have higher fuel levels, compared to uninfected areas, resulting in more intense fires. To decrease (not eliminate) the incidence and spread of DM infection within the project area, some infected, overstory, black-barked trees 16-24 inches DBH may need to be removed. Retaining infected trees in the overstory would perpetuate the spread of infection to smaller trees in the understory. An example of such a situation where this would occur would be if a site contained a 16-inch DBH black-barked pine tree that was infected with dwarf mistletoe and a 14-inch DBH pine tree free from infection. In this case, the 16-inch DBH black-barked pine tree would be removed and the 14-inch DBH tree would be retained.

Treatments for DM will take place in sites 297-01, 297-02, and sites in Location 286. Because Site 297-01 is located in MSO Restricted Habitat, canopy cover will be reduced to 40% (measured at the site level) and thinning will target the most heavily infected young trees. It is expected that this thinning will not reduce the infection rate in this site, however it will provide other forest health benefits. Thinning in Site 297-02 will follow the northern goshawk guidelines (canopy cover measured at the clump/group level). This will allow for more thinning of larger trees which could infect surrounding younger trees and regeneration. Openings would be strategically placed to treat the most severely infected groups. The goal is not to eliminate DM from this site, but to reduce the level of infection and slow the rate of spread.

Current site conditions 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. Decreasing site densities will reduce competition between trees, resulting in increased tree vigor. Individual trees will be better able to defend themselves against bark beetle attack. 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 entire project area will be broadcast burned, further reducing the risk of mortality from bark beetles and other insects

Many sites within the project area have experienced severe bark beetle attacks. The majority of sites with moderately closed to closed canopies that have been selected for treatment will have increased resistance to bark beetle attacks. Also, some sites, particularly those near private boundaries and with easy access, which have been classified as having open canopies will also be thinned. Thinning the denser clumps and around the yellow pine groups within these open sites will improve the over all resistance to bark beetle attacks.

In the mechanical and hand thinning areas, there will be an increased risk of infestation from bark beetles attracted to the freshly cut trees. This risk will decrease once slash has been treated. Bark beetle

activity will be monitored and when necessary preventative measures or mitigations will be implemented.

Species Diversity

Gambel Oak

Thinning of ponderosa pine around clumps of Gambel oak will result in decreased inter-tree competition for moisture, nutrients, and sunlight, increased growth, increased vigor, and increased 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 pine. Maintenance burning will be required on a decadal basis to prevent regeneration from eventually overtopping oak clumps. Additional thinning will also be required around oak clumps within 20 – 40 years as the pine canopy grows laterally and begins to overtop oak clumps.

Grasslands and Meadows

Under the Proposed Action, 220 acres of grasslands and meadows will be restored to pre-settlement densities. Reducing densities in these areas will result in increased understory productivity and diversity and restore their functionality in terms of wildlife habitat, watershed production, fire hazard, and scenic values. Pre-settlement densities are an important reference condition for thinning activities because they are the densities that evolved in these areas over centuries with fire, drought, frost, wildlife, insects, and disease.

Understory Vegetation

According to research conducted in ponderosa pine forests 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). Based upon research, it is therefore reasonable to assume that thinning to 50% canopy cover, followed by broadcast burning, will result in increased understory productivity. However, thinning to 30% canopy cover, followed by broadcast burning, will result in greater relative increases in understory productivity due to increased sunlight to the forest floor and increased soil temperatures.

Aspen

Removing encroaching pines in aspen stands will help improve the health and regeneration of the aspen stands. Reduced competition for space, water, sunlight, and nutrients from pine trees will improve the health vigor and survival of the existing aspen trees. Approximately 10 acres of aspen restoration, in Sites 286/002 and 318/003 have been identified for aspen restoration and protection, by removing encroaching ponderosa pine and fencing for browse protection.

Cumulative Effects

Past, present (ongoing), and future activities considered in the cumulative effects analysis are listed in Table 3-6. Prior to the 1990s, 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 1960s, the majority of the treatments in and adjacent to the project area consisted of pre-commercial 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 site 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. These treatments, in conjunction with fire suppression, have contributed to a more even-aged, homogeneous monoculture of young to mid-aged forest.

It has been 40 years since the last large-scale thinning. The timing of the thinning is historically consistent with past timber harvest and shows that this area is a historic timber producing area.

Currently, one project near the project area is proposed for 2007. The Jack Smith/Schultz Pass Project will undergo NEPA analysis in 2007. The Mountainaire HFRA Project is located adjacent to the south-western portion of the project area. Thinning within the Mountainaire Project to varying tree densities will commence as early as 2007.

Past and ongoing treatments conducted within and adjacent to the project area used in the cumulative effects analysis are displayed in Table 3-6. The first large scale thinning of this area occurred in the 1870's -1880's, then again in the 1920's, and then the last large scale commercial thinning was in the 1960's. Thus, this area has received thinning on a regular 40-year interval since European settlement.

Thinning treatments and many ongoing and proposed projects involve the creation of openings and enhancement of clumps and groups, creation of a variable density structure, and employ a diversity of thinning treatments (thin from below, uneven-aged, intermediate treatments). In combination with ongoing projects adjacent to the project area, treatment will result in a landscape which is more open, variable, groupy, and uneven-aged that may last up to 40 years into the future. 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 treatment 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. These treatments will also result in faster development of a landscape-level VSS distribution recommended for the northern goshawk by creating openings for regeneration and increasing tree growth and vigor. The creation of openings across the landscape will also result in increased understory abundance, increased diversity at the landscape scale, and increases in insects 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.

A lack of harvest of larger diameter trees (as suggested in scoping comments) would result in further departure from the uneven-aged, patchy forest structure that existed historically in the area. Sites that contain a large component of trees greater than 12 inches or 16 inches DBH would exhibit a more even-

aged or two-aged forest structure well into the foreseeable future, contributing less size class diversity, vertical stratification, and biological diversity to the surrounding landscape. Twelve inch and 16 inch diameter limits would contribute less mature and old trees to the surrounding landscape well into the foreseeable future because VSS 6 would develop at a slower rate and experience higher mortality.

Diameter limits would lead to a landscape that would be less resilient to perturbation due to decreased size class diversity. The project area would contribute less biological diversity and species richness to the surrounding landscape due to increased residual canopy covers, a lack of openings, and continued pine encroachment in meadows and grasslands.

Table 3-6. Past and ongoing treatment history in and adjacent to the project area.

ACTIVITY	WHEN OCCURRED	PERCENT OF PROJECT AREA	EFFECTS
Livestock Grazing	1870s – Present	75% and adjacent sites	Reduced understory abundance and productivity. Removed surface fuel. Disrupted the natural, surface fire regime. Contributed to increased regeneration and even aged forest structure.
Railroad Logging	1870s - 1880s	75% and adjacent sites	Reduced density of mature sawtimber and "yellow" pines. Decreased crown canopy closure. Contributed to increased regeneration and an even aged forest structure.
Sawlog Harvest	1920s	75% and adjacent sites	Reduced density of mature sawtimber and yellow pines. Decreased crown canopy closure. Contributed to increased regeneration and current even-aged forest structure.
Sawlog Harvest	1960s	75% and adjacent sites	Further reduced density of mature sawtimber and yellow pines. Contributed to current even-aged forest structure and increased fire hazard.
Precommercial Thinning	1970s	50% and adjacent sites	Reduced density of young forest. Some improvement to forest health, vigor, structure, growth, visual quality, and fire hazard.
Fire	1980s	2%	Wildfire
Commercial Thinning	1980s - 1990s	15% and adjacent sites	Further reduced density of mature sawtimber. Contributed to current even-aged forest structure.
P-J Pushes	1950s - 1960s	10%	Mechanical removal pinyon and juniper trees to improve range conditions. Varying amounts of revegation has occurred.
Salvage Cut	1987 - 1988	1%	Removed small and large sawtimber burned in wildfire. Decreased density of snags and logs.
Seed Tree/Shelterwood Seed Cut	1987 - 1999	3%	Reduced density of mature sawtimber. Decreased incidence of dwarf mistletoe infection. Increased regeneration and understory productivity.
Radio Fire	1977	5%	Wildfire

ACTIVITY	WHEN OCCURRED	PERCENT OF PROJECT AREA	EFFECTS
TSI Precommercial Thinning	1990 - Present	4% and adjacent sites	Reduced density of young forest. Some improvement to forest health, vigor, structure, growth, visual quality, and fire hazard.
Skunk Thinning	2004	903 acres within and adjacent to the Southwest corner of project area	Thin up to 9 inches DBH. Reduce density of young forest and decrease WUI fire hazard. Some improvement to forest health, vigor, structure, growth, visual quality, and fire hazard.
Dispersed Recreation	Ongoing	100% and adjacent sites	Affects localized soil condiitons (compaction), visual quality (littering), and wildlife (user trails).
Illegal Firewood Cutting	Ongoing	100% and adjacent sites	Reduces density of large diameter pine, oak, and aspen trees, snags, and logs.
Jack Smith Project	2007	5522 acres adjacent to northeast portion of project area	Reduce density of young and mid-aged forest. Decrease WUI fire hazard.
Shultz Project	2007	1700 acres adjacent to western portion of project area	Reduce density of young and mid-aged forest. Decrease WUI fire hazard.
Airport Project	Pending Land Exchange	1922 acres adjacent to southwest portion of project area	Mechanical thinning up to 12 inches DBH to variable BA 40-120 sq ft/ac. Reduce density of young forest and reduce WUI fire hazard.
Mountainaire Project	Ongoing	15,000 acres of commercial thinning to the southwest of the project.	Reduce density of young and mid-aged forest. Decrease WUI fire hazard.

Fire and Fuels

Affected Environment

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 a mile a head of an intense crown fire in some sites within the project area. 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.

Fire Hazard Ratings

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 pre-treatment 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 projects developed collaboratively with GFFP, 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 management cannot affect a change in slope steepness or aspect, their effects on fire behavior may influence how much other factors need to be reduced.

The fire hazard of the existing condition across the sites surveyed to date is listed in Table 3-7 (Totals may include some private and state land, since hazard on adjacent lands must be considered in hazard reduction treatment on FS lands).

Table 3-7. Existing condition acres by fire hazard rating

Extreme	Very High	High	Moderate	Low
472 acres	1,189 acres	2,943 acres	9,746 acres	6,965 acres

Within some sites of the project area, the higher fire hazards are driven by all six of the hazard factors listed previously. While in other sites the higher fire hazard is derived from spikes in 2 or 3 of the factors (most often crown closure, stems per acre, and crown base height). Dead and down fuel loads were severe in only a few sites. However, in some sites substantial tree mortality, stems per acre, canopy closures, or crown base height alone 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, September, and October.

Areas immediately adjacent to communities and particularly areas upwind of communities would ideally have a Low wildfire hazard rating.

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 from below increases height to bottom of 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.

By containing and accumulating heat below the crown layer, canopy closure directly effects how easily a fire is able to transition into a crown fire. 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. Uneven age thinning reduces canopy closure and stems per acre, but does not increase height to bottom of live crown as effectively as thinning from below. Uneven age thinning does result in greater age class diversity.

During severe weather conditions heat could 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 feet. Only a more open canopy and reduced crown bulk density can mitigate this fire behavior problem.

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.

Flame Length

Flame length is a reliable indicator of fire intensity and probable tree mortality. It can also indicate how effectively the Proposed Action meets other fire-related objectives. "Critical flame length" is the threshold distance where ground fire can move into the canopy of a site.

The modeling indicated a high occurrence of wildfire induced tree mortality (19 to 100 percent) among trees 8" to 26" diameter at breast height (DBH). Average critical flame length for tree torching and transitioning to a crown fire is relatively low (2' – 10'). The expected ground fire flame lengths range from 4 to 6 feet.

Table 3-8. Expected flame lengths by fire hazard rating

Extreme	Very High	High	Moderate	Low
Flame Length 6'	Flame Length 5'	Flame Length 4.5' – 5.5'	Flame Length 3.5' - 5'	Flame Length 2.5'

The fire suppression forces making the initial attack on wildfires that may occur within the project area are wildland fire engines. These initial attack forces can generally take effective

suppression action against wildfires with flame lengths less than 4 feet. Fires with flame lengths longer than 4 feet 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 in close proximity to developments.

Dead and down fuel loading directly affects flame length and duration. The longer the flame length and duration the more difficult it is to bring a fire under control. 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, thus reducing the expected flame length and duration.

Fire Regime and Condition Class

Another assessment method required of the forest service is called the Fire Regime Condition Class rating. The Fire Regime indicates how often wildfires burned across a 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 proper treatment.

Fire regimes and condition classes were assessed during the field surveys for this project. The bulk of the project area is Fire Regime I, where a fire recurrence of less than 35 years with a low percentage of overstory replacement would be expected under historical conditions. The balance of the project area is Fire Regime III, where a fire recurs generally not more than every 35 years and sometimes more than 100 years where a mixture of overstory replacement and surface fire would be expected under historical conditions.

Much of the project 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). Nearly an equal number of sites are in Condition Class 2 (a moderate departure from the natural historical regime of vegetation characteristics, fuel composition, fire frequency, severity and pattern). The balance of the sites is in Condition Class 1. A wildfire occurring under the existing Condition Classes of 2 and 3 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 thinning and prescribed burning, since the “late-open” sites have filled-in to become “mid-closed” sites.

Figures 3-5 and 3-6. Fire hazard ratings pre- and post-treatment.

Table 3-9. Current fire regime and condition class distribution.

Fire Regime 1: Frequent Fires (0-35 years), surface to mixed burn severity		
Condition Class 1	Condition Class 2	Condition Class 3
906 Acres	4,186 Acres	12,798 Acres
Fire Regime 3: Infrequent Fires (35 – 100+ years), mixed burn severity		
Condition Class 1	Condition Class 2	Condition Class 3
1,266 Acres	1,633 Acres	527 Acres

Pinyon/Juniper Cover Type

The pinyon/juniper cover type within the project area (located just west of the Cosnino Road) contains a high number of dead standing pinyon trees. This area has a heavier dead and down fuel load than much of the rest of the project area. Due to the recent "bug-kill," it also has a heavier load of dead standing fuel. It has a moderate canopy closure, low crown base-height, and a lower average tree height. These factors result in fire hazard ratings of moderate to high.

The fine fuel component (grasses and long-needles) which allows a wildfire to ignite easily and spread rapidly is generally absent from these areas. Needles are short and the litter layer is compact and discontinuous. Where the standing and down fuel load is greatest, grasses are generally absent, even after prolific grass production in 2005.

Wildfires occurring in this area of pinyon/juniper can be expected to spread slowly in all but the most severe fire weather. They would be expected to burn intensely with short-range spotting and a slower spread rate than the Ponderosa Pine and even the pine/oak woodlands.

Modeling Variables

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 can provide a better fitting 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. Fuel models must be selected for their fire behavior characteristics, not necessarily for their vegetative descriptors.

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 Flagstaff Center 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.

Weather inputs under the 90 percentile weather conditions that occur from April through July include:

1-Hour Fuel Moisture: 2%

10-Hour Moisture: 3%

100-Hour Moisture: 4%

20-Foot Wind Speed: 20mph

Air Temperature: 85 degrees F.

Field data including 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 2004 and 2005 by fuel crews. Fire regimes and condition classes were assessed during the field surveys for this project.

Environmental Consequences

Effect of No Action

Fuel treatment objectives of this project would not be met. The existing fire hazard makes it difficult for initial attack forces to control a wildfire starting in many parts of the project area under severe weather conditions that occur in April through July. The existing fire hazard would increase the possibility that a wildfire can get established and burn with sufficient intensity to exceed the capability of emergency response personnel. Wildfires in the wildland-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.

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 and fire hazard, and increase the risk of successive attacks on remaining trees. An indirect effect may be the loss of habitat and wildfire damage to the private property around Doney Park and Timberline.

Without treatment, there would be an increase in the number of acres of National Forest System lands 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.

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 the project area untreated, there is an increased risk of a crown fire starting in the Eastside vicinity and spreading as a crown fire through an adjacent area that has been treated.

Flame Lengths

When a wildfire occurs, expected flame lengths would exceed 5 feet 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) commonly range 2'-10'. Many of the sampled sites have two to six times the crown bulk density necessary to sustain a crown fire. Canopy closure exceeded 60% in many sites and would close-in to 70+% canopy cover over the course of 20 years (Refer to Table 3-11).

Wildfire-Induced Mortality

Mortality of ponderosa pine trees 8-14" diameter at breast height (DBH) would range as high as 99%. Ponderosa pine trees 16" DBH and greater could suffer mortality rates as high as 86%. Mortality of oak trees 10" diameter at root crown (DRC) and greater would be expected to reach 98% in most sites (Refer to Table 3-11).

Fire Regime and Condition Class

No action would also leave the most of the area in Condition Class 2 and 3 (a moderate or severe departure from the natural historical regime of vegetation characteristics, fuel composition, fire frequency, severity and pattern). As time passes, more of the area would transition to a Condition Class 3 (a severe departure from the natural historical regime of vegetation characteristics, fuel composition, fire frequency, severity and pattern) and further result in destructive wildfires more severe than the area's historic fire regime.

Proposed Action

The fire hazard ratings after implementation of the Proposed Action are listed in Table 3-10. Some acres are still rated with a Very High and a High hazard rating. They may have been reduced from a higher rating down to a High rating. These areas are either inaccessible, which limits thinning opportunities, or they may have been deferred to meet certain wildlife habitat requirements.

Table 3-10. Post-treatment acres by fire hazard rating

Extreme	Very High	High	Moderate	Low
0 acres	452 acres	925 acres	8,190 acres	11,748 acres

The Proposed Action addresses the purpose and need by reducing the crown bulk density (thinning), reducing the canopy closure (thinning), increasing the effective crown base height in most sites (thinning and prescribed burning), reducing expected flame length (prescribed burning), and reducing the number and shortening the distance at which spot fires would be expected to occur (thinning and prescribed burning).

The Proposed Action 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.

Hand Thinning Treatments

In areas receiving hand thinning with prescribed burning, flame lengths after treatment would range between 2.5 and 5 feet, making initial attack of a wildfire occurring under modeled conditions safer and more effective. The critical flame lengths (treetop ignition) would range between 3-10 feet. The inherent limits of hand thinning make it difficult to achieve a higher crown base height. The sampled sites would have a crown bulk density of 0.0041 to 0.0229 lbs/ft^3. The inherent limits of hand thinning make it difficult to reach a lower crown bulk density. However, across most sites that reduction and the increased canopy openness will inhibit crown fire development. The resulting canopy cover would fill-in to more than 50% over the course of 20 years.

Prescribed burning would be moderately easy to execute and maintain. 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" diameter at breast height (DBH) would not be expected to exceed 64%. Wildfire mortality of ponderosa pine trees 16" DBH and greater would not likely exceed 6%. Wildfire mortality of oak trees 10" diameter at root crown (DRC) could reach 70%, but would not be expected to exceed 50%.

Mechanical Thinning Treatments

In areas receiving mechanical thinning with prescribed burning, flame lengths after treatment would be expected to range between 1 and 3 feet, making initial attack of a wildfire occurring under modeled conditions safe and effective. The critical flame lengths (treetop ignition) would range between 8'-15'. The sampled sites would have a crown bulk density of 0.0011 to 0.0041 lbs/ft^3. This in conjunction with the canopy openness is not enough to sustain a crown fire. The remaining 30% canopy cover would fill increase to no more that 40% over the course of 20 years.

Prescribed burning would be relatively easy to execute and maintain. 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" DBH would not be expected to exceed 41%. Wildfire mortality of ponderosa pine trees 16" DBH and greater would not likely exceed 10%. Wildfire mortality of oak trees 10" DRC could reach 40%, but would not be expected to exceed 15%.

Mechanical Thinning Treatments – MSO Restricted Habitat

In areas of restricted MSO habitat receiving mechanical thinning with prescribed burning, flame lengths after treatment would be expected to range between 2.5 and 3 feet, making initial attack of a wildfire occurring under modeled conditions safe and effective. The critical flame lengths (treetop ignition) would range between 7'-9'. The sampled sites would have a crown bulk density of 0.0023 to 0.0081 lbs/ft^3. This in conjunction with the canopy openness would inhibit a crown fire. The remaining 40% canopy cover would increase to no more that 55% over the course of 20 years.

Prescribed burning would be relatively easy to execute and maintain. 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" DBH would not be expected to exceed 36%. Wildfire mortality of ponderosa pine trees 16" DBH and greater would not likely exceed 12%. Wildfire mortality of oak trees 10" DRC could reach 40%, but would not be expected to exceed 30%.

Prescribed Burn Only Treatments

In areas that receive prescribed burning only, flame lengths after treatment would be expected to range between 2.5 and 3 feet, making initial attack of a wildfire occurring under modeled conditions safe and effective. The critical flame lengths (treetop ignition) would range between 3'-10'. The sampled sites would have a crown bulk density of 0.0020 to 0.0040 lbs/Ft3. The burn-only treatment does little to reduce crown bulk density or canopy cover, but will reduce ground fuel loading and increase crown base height. These effects should inhibit the initiation of a crown fire. Canopy cover would not be significantly affected by burn-only treatments and would increase gradually over the course of 20 years.

Prescribed burning would be relatively easy to execute and maintain. 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" DBH would not be expected to exceed 58%. Wildfire mortality of ponderosa pine trees 16" DBH and greater would not likely exceed 5%. Wildfire mortality of oak trees 10" diameter at root crown (DBH) could reach 55%, but would not be expected to exceed 40%.

Meadow and Grassland Thinning Treatments

In areas proposed for meadows and grassland thinning, flame lengths after treatment would be expected to range between 0.5 and 3 feet, making initial attack of a wildfire occurring under modeled conditions safe and effective. The critical flame lengths (treetop ignition) would depend on the crown base height of the mature trees remaining within the meadow. The sampled sites would have a crown bulk density well below the level needed to sustain a crown fire. Without periodic prescribed burning, trees would begin to reinvade these areas over the course of 20 years.

Prescribed burning would be easy to execute and maintain. Should a wildfire occur after this treatment, it is unlikely that state air quality standards would be exceeded.

Mount Elden Electronics Site

Flame lengths after treatment in this area would be expected to range between 0.5 and 3 feet, making initial attack of a wildfire occurring under modeled conditions safe and effective. The critical flame lengths (treetop ignition) would depend on the crown base height of the mature trees remaining after treatment (some fir and spruce left on site will not self-prune). The fire behavior and effects of ponderosa pine would be similar to those of MSO Restricted Habitat treatments.

Prescribed burning would be relatively easy to execute and maintain. 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" DBH would not be expected to exceed 38%.

Wildfire mortality of ponderosa pine trees 16" DBH and greater would not likely exceed 11%. Wildfire-induced mortality of Douglas fir trees 8-14" DBH would not be expected to exceed 38%. Wildfire mortality of Douglas fir trees 16" DBH and greater would not likely exceed 19%. Wildfire-induced mortality of spruce trees 8-20" DBH would not be expected to exceed 80%.

Table 3-11. Probability of wildfire-induced mortality by treatment type (Pre- and Post- Treatment)

Tree Species and DBH	Treatment Type	Using BEHAVE3 Representative Site	Using Fuel Mgt Analyst Average
Ponderosa Pine up to 8" DBH	Existing Condition	99%	99%
	Mechanical Thinning	35%	41%
	Hand Thinning	35% - 99%	64%
	Burn Only	35% - 99%	58%
	MSO Restricted Habitat	35%	36%
Ponderosa Pine 10" DBH	Existing Condition	99%	99%
	Mechanical Thinning	25%	27%
	Hand Thinning	25% - 99%	35%
	Burn Only	25% - 99%	29%
	MSO Restricted Habitat	25%	28%
Ponderosa Pine 12" DBH	Existing Condition	98%	98%
	Mechanical Thinning	19%	20%
	Hand Thinning	19% - 98%	25%
	Burn Only	19% - 98%	20%
	MSO Restricted Habitat	19%	19%
Ponderosa Pine 14" DBH	Existing Condition	97%	77%
	Mechanical Thinning	14%	15%
	Hand Thinning	14% - 97%	22%
	Burn Only	14% - 97%	15%
	MSO Restricted Habitat	14%	15%
Ponderosa Pine 16+" DBH	Existing Condition	96%	86%
	Mechanical Thinning	11%	10%
	Hand Thinning	11% - 96 %	6%
	Burn Only	11% - 96 %	5%
	MSO Restricted Habitat	11%	12%
Oak 10+" DBH	Existing Condition	99%	98%
	Mechanical Thinning	27%	31%
	Hand Thinning	41%	60%

Tree Species and DBH	Treatment Type	Using BEHAVE3 Representative Site	Using Fuel Mgt Analyst Average
	Burn Only	41%	40%
	MSO Restricted Habitat	27%	40%

Table 3-12. Comparison of fire behavior characteristics by treatment type (Pre- and Post-Treatment)

Fire Behavior Characteristic	Treatment Type	Using BEHAVE3 Representative Site	Using Fuel Mgt Analyst Average
Crown Bulk Density (lbs/Ft3)	Existing Condition	NA	0.0083 lbs/Ft3
	Mechanical Thinning	NA	0.0026 lbs/Ft3
	Hand Thinning	NA	0.0188 lbs/Ft3
	Burn Only	NA	0.0032 lbs/Ft3
	Restricted MSO Habitat	NA	0.0161 lbs/Ft3
Expected Flame Length (Feet)	Existing Condition	3' - 18'	5'
	Mechanical Thinning	2' - 4'	3'
	Hand Thinning	2' - 5'	3'
	Burn Only	2' - 5'	3'
	Restricted MSO Habitat	2' - 4'	3'
Critical Flame Length (Feet)	Existing Condition	3' - 7'	6'
	Mechanical Thinning	7' - 15'	10'
	Hand Thinning	5' - 7'	7'
	Burn Only	4' - 7'	6'
	Restricted MSO Habitat	7' - 15'	8'
Expected Rate of Spread (Chains/Hr)	Existing Condition	3 - 65 ch/hr	39 ch/hr
	Mechanical Thinning	3 - 5 ch/hr	6 ch/hr
	Hand Thinning	3 - 18 ch/hr	8 ch/hr
	Burn Only	3 - 18 ch/hr	6 ch/hr
	Restricted MSO Habitat	3 - 5 ch/hr	6 ch/hr

Treatment Effectiveness

The mechanical treatments proposed would be expected to maintain these objectives for approximately 20 years by periodic prescribed burning without additional thinning treatments. Hand thinning treatments may have an effective life of only 10 years where canopy cover can not be reduced below 40%. Areas receiving prescribed burn-only treatments could maintain their effectiveness for up to 20 years only where the canopy cover is already substantially open.

Cumulative Effects

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 that are west, southwest, south, and southeast of Doney Park and Timberline. 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 2000 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. The fire effects of pre-commercial thinning in the 1970's, as well as, limited commercial thinning in the 1980's has been overcome by continued growth in those sites. Models indicate that after 2025, 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.

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 of wildfires getting 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 System lands. Also, wildfires burn less severely resulting in less resource damage to each acre burned.

The cumulative effect of this project adds such a fuel treatment to those that lie in the path of the prevailing winds around Flagstaff and its suburbs (Ft. Valley Restoration, A-1 Multi-Product, Mars Hill, Arboretum, Airport, Woody Ridge, Kachina Village, Lake Mary Fuel Reduction, Mountainaire, and Skunk Fuel Reduction). 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 the project area, the risk of a crown fire starting in it and spreading as a crown fire through adjacent areas is reduced.

These projects total in the neighborhood of 60,000 acres analyzed and 42,000 acres proposed for treatment. As more acres are treated in a similar prescription, benefits accumulate. As these projects are accomplished, it is expected that the fire hazard rating for all acres analyzed will shift as shown in Table 3-13.

Table 3-13. Cumulative change in fire hazard rating.

Expected Cumulative Change in Fire Hazard Rating Expressed as a Percentage of All Projects Analyzed To Date					
	Extreme	Very High	High	Moderate	Low
Pre-Treatment	11%	13%	21%	32%	19%
Post-Treatment	4%	4%	11%	28%	49%

The Peaks and Mormon Lake Ranger Districts anticipate two additional projects in the vicinity of the project area (Jack Smith/Schultz and Marshall). These two projects might require analysis of an additional 19,000 acres. It is difficult to speculate how many of those acres might receive thinning treatments since neither fire hazard nor equipment-access has been assessed. It is expected that most of those acres would be prescribe-burned.

The Coconino National Forest anticipates two additional project areas south or west of Flagstaff (Elk Park Meadows, Hart Prairie). These project areas would have no effect on the fire behavior or fire hazard of the Eastside project area.

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 remain as Fire Regime I (an open forest maintained by frequent mixed intensity fires) and Fire Regime 3 (a mosaic of open forest to mid-seral maintained by mixed severity fires recurring generally 35 to 100). The condition classes would move very close to a Condition Class 1, where vegetation composition, structure, and fuels would be similar to those of the natural 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 3-14. Fire regimes and condition class.

Fire Regime 1: Frequent Fires (0-35 years), surface burn severity		
Condition Class 1	Condition Class 2	Condition Class 3
11,699 Acres	5,561 Acres	630 Acres
Fire Regime 3: Infrequent Fires (35 – 100+ years), mixed burn severity		
Condition Class 1	Condition Class 2	Condition Class 3
1,757 Acres	1,142 Acres	527 Acres

Air Quality

Affected Environment

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 1990 and 1999. 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.

The prevailing winds for this project area are out of the southwest. However, as 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).

The project area is in the Little Colorado River air shed and encompasses the communities of Doney Park and Timberline. The community of Flagstaff is located immediately west of the project area. Other suburbs of Flagstaff are within 15 miles of the project area. The Forest Highway 3 corridor abuts the project on the south. Interstate Highway 40 passes through the project, as does Arizona State Highway 89 and the Townsend/Winona Road. There is a high level of recreation activity, especially in the summer months, within the vicinity of the project area.

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.

Environmental Consequences

Effect of No Action

The natural fire regime for most of the project area includes frequent surface fires that generally do not consume much of the tree canopy. These would occur at 3 to 15 year intervals. This is a necessary function of this ecosystem. The natural fire regime for the pinyon/juniper cover type is a fire recurring generally not more than every 35 years (sometimes more than 100 years) where a mixture of overstory replacement and surface fire would be expected under historical conditions.

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 cumulative effect 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 could accumulate with emissions from other wildfires and further exceed air quality standards.

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 in the untreated area would be greater than that under the Proposed Action. 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 one occurring after implementing the Proposed Action.

Proposed Action

The Proposed Action seeks to reduce the fire hazard while retaining as many nutrients on site as possible. It proposes burning the piled thinning slash as well as prescribed burning of the forest floor (20,176 acres). A direct effect 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 both wildfires (pre-treatment) and initial-entry prescribed-burning. Piles can be burned during rain and snowstorms with excellent smoke dispersion and little diurnal 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. Public notification of burning will 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 burning in the same (pre-treatment) 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. Table 3-15 displays modeled emission volumes.

Table 3-15. Comparing emissions of prescribed burning and wildfire.

Comparison of Burn Emissions	Existing Condition with Wildfire	Post Treatment with Wildfire	Pile Burn	Initial Prescribed Burn	Maintenance Prescribed Burn
Ground Fuel Consumed Tons per Acre	5	2	Not Applicable	4	1
TSP Total Emissions Tons	19	0.3	5	7	1.5
Air Quality Standards	Exceeded	Unlikely	Unlikely	Rarely Exceeded	Not exceeded

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 the Proposed Action would generally meet national and State Ambient Air Quality Standards because the agency can select the weather conditions under which it can burn and control the size of the area burned on any given day.

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, Interstate Highway 40, Arizona State Highway 89, and the Townsend/Winona Road 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. 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, Interstate Highway 40, Arizona State Highway 89, and the Townsend/Winona Road 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.

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.

Cumulative Effects

Although smoke from a wildfire occurring after treatment would be unlikely to exceed air quality standards, project-related smoke could combine with the emissions of other wildfires and the accumulation might exceed air quality standards. The Coconino National Forest averages 400 wildfires a year and 85 days a year having multiple fire-starts. This cumulative effect is not very likely under the Proposed Action 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.

As stated previously, this project lies within the Little Colorado River air shed. There are many other forest burning projects that may affect this air shed (A-1 Multi-Product, Airport, Apache Maid, Arboretum, Bald Mesa, Blue Ridge, East Clear Creek, Ft. Valley Restoration, Good Enough/Tule, IMAX, Kachina Village, Lake Mary Fuel Reduction, Mars Hill, Mint, Pocket Baker, Ritter, Rocky, Sinks, Skunk Fuel Reduction, Spearmint, Valley, Victorine, and Woody Ridge).

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. Further, these projects combine to reduce future smoke impacts. Table 3-16 displays estimates of current forest prescribed-burning with estimated capacity assuming normal weather patterns.

Table 3-16. Annual prescribed burning and estimated capability on the Coconino National Forest.

Estimation of Current Forest Annual Prescribed Burning with Capability	Initial Prescribed Burning	Estimated Burn Days	Maintenance Prescribed Burning	Estimated Burn Days	Prescribed Pile Burning	Estimated Burn Days
Current Execution	13,000 acres	37 Days	7,000 acres	8 Days	1,700 acres	17 Days
Capability With Typical Weather	17,000 acres.	50 Days	11,000 acres	18 Days	8,500 acres	43 Days

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.

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.

Wildlife

The following section summarizes existing conditions and effects to threatened, endangered, and Forest Service sensitive species (TES), management indicator species, and migratory bird priority species that may occur or may have habitat within the project area, wildlife cover and key habitat components such as snags and downed logs.

Threatened and Endangered Species

Mexican Spotted Owl

Affected Environment

Protected Habitat

One Mexican spotted owl (MSO) Protected Activity Center (PAC) is partially within the project boundary (Breezy #040548). There are a total of 11 acres of this PAC within the project boundary. Fire hazard rating for the site is moderate. The remainder of the PAC is within Walnut Canyon. There is no mixed-conifer or pine-oak habitat with slopes greater than 40% within the project boundary.

There are six PACs within one mile of the project boundary. Four of these are adjacent to the southern boundary of the project within Walnut Canyon. The remaining two PACs are in the Dry Lake Hills west and north of the project area.

Restricted

Restricted Habitat is mixed-conifer (21 acres) and a subset of ponderosa pine/Gambel oak habitat (1,941acres). Restricted Habitat within pine/oak is defined as an area that could attain the type of forest structure sought by spotted owls for roosting and nesting habitat and having at least 10% of the site basal area consisting of oak greater than 5" diameter at root collar (DBH). A few of the sites with the adequate amount of oak were not considered restricted because they are on dry, open sites with a substantial juniper component that have no potential to develop characteristics important for MSO nesting and roosting habitat. These sites are prone to bark beetle outbreaks, the pine component is single-storied with low canopy cover (23-43%), the oaks are short and flattened at the top with little opportunity to provide cavities required for MSO nesting or roosting, and site conditions are not conducive to developing necessary habitat characteristics. Therefore these sites were not included with the 1,941 acres of restricted MSO habitat identified within the project area (Figure 3-7).

All sites are multi-storied with a wide range of tree sizes. Seventeen percent of the area is a VSS 3 (diameters 5"-12") with the remainder (83%) of the area having larger trees in the VSS 4, 5 and 6 (12"-24"+) size classes. Yellow-barked and large trees > 18" diameter are scattered throughout. Oak and pine snags have been harvested for fuelwood and are in low numbers. Dead and down logs have also been reduced by past timber sales and fuelwood harvesting and are in low levels (average of <0.1 log per acre > 12"DBH and 8' long) of fallen trees. The 21 acres of mixed-conifer is multi-storied with 70% of the area Douglas-fir. The area is a VSS 4 (diameters12"-17.9") size class and has a high canopy cover.

The Restricted Habitat has an open (0-39%) to moderately closed (40-59%) canopy with few openings one-quarter acre or larger. Understory production and diversity are limited. Fire hazard ratings are low to high with less than 10 percent of the Restricted Habitat above the moderate rating.

Target and threshold habitats are managed for future nesting and roosting habitat, and are subsets of Restricted Habitat. The Forest Plan directs that target threshold habitat will be identified in restricted areas outside of the Urban Rural Influence Zone (URIZ). No sites meet threshold habitat values as defined in the Forest Plan and there are 1,046 acres of Restricted Habitat within the project, outside of the URIZ. Therefore, 105 acres (C314/S03) of target/threshold habitat has been identified within the Eastside project area. Although no thinning treatments are proposed at this time, this stand will continue to increase in toward desired basal area levels as described for target/threshold habitat. The allocation of target threshold sites within Schultz and Lake Mary Watershed Management Areas will better provide for long-term management of roost/nest habitat for the Mexican spotted owl (USFS 1986).

Designated Critical Habitat

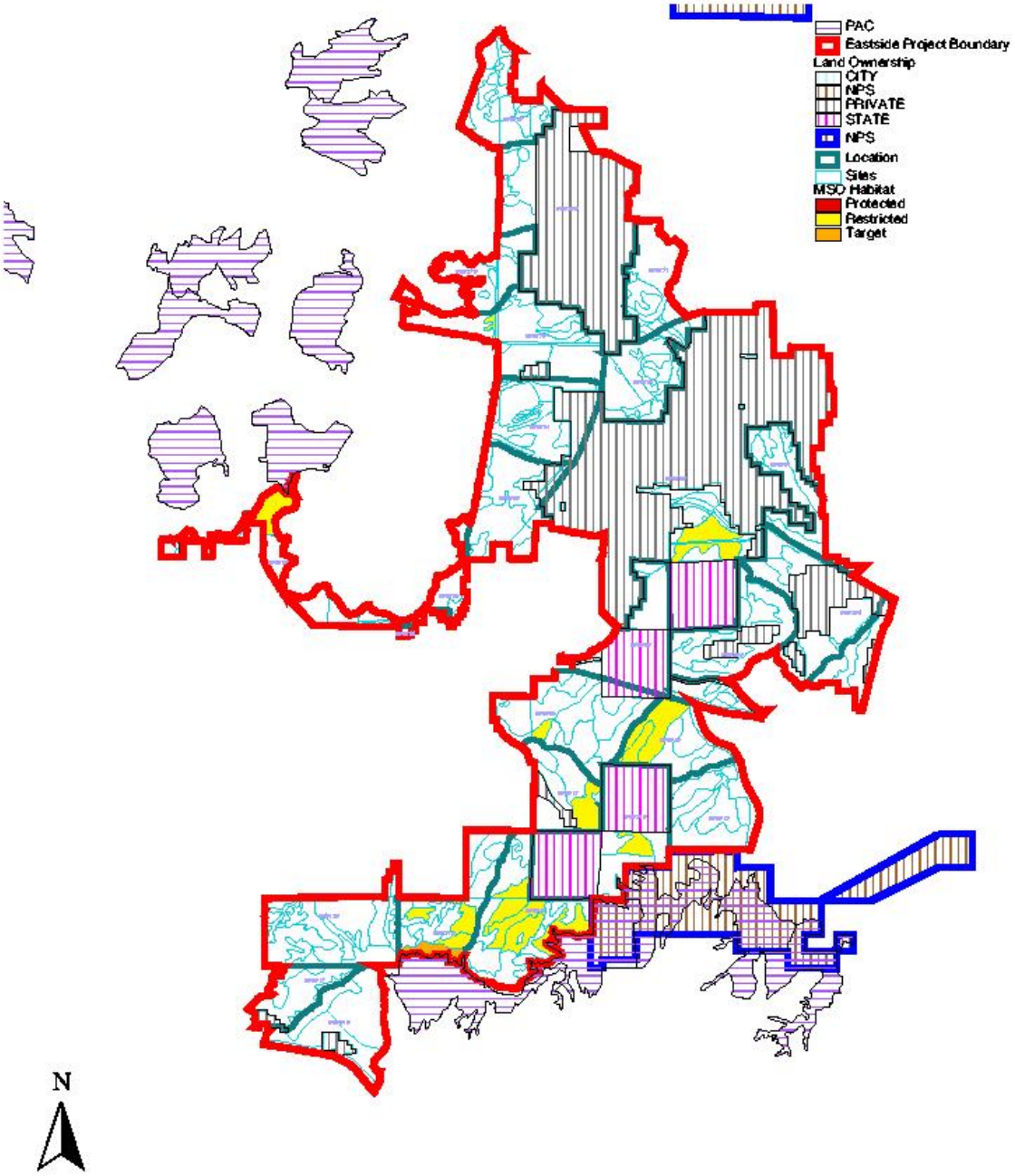
Critical habitat is designated by U.S. Fish and Wildlife Service (FWS) to prevent any further deterioration of habitat and contribute towards the species' conservation. For MSO, critical habitat includes areas within mapped boundaries of Protected or Restricted Habitat and includes one or more of the primary constituent elements as listed in the Forest Plan.

There are 4,363 acres of mapped critical habitat within the project area. Critical habitat is in Upper Gila Mountains (UGM) Recovery Units 12 and 14 located in areas surrounding Walnut Canyon and Mt. Elden. Critical Habitat within the project consists of approximately 11 acres of Protected Habitat, 1,000 acres of Restricted Habitat and 3,352 acres of other forest and woodland.

Figure 3-7. MSO Habitat within the project area.

*Map does not include the 21 acres of Restricted Habitat located at the Mount Elden Electronic site.

Eastside Fuels Reduction and Forest Health Project
MSO Habitat - August 2006



Environmental Consequences

Effect of No Action

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. There would no direct effects to MSO. Dense forest conditions would still occur and the high fire hazard potential would continue to place spotted owl habitat at risk with respect to stand-replacing fire. If a crown fire were to occur in MSO habitat, components for nesting, roosting and foraging would be reduced or eliminated. If a ground fire occurred, it is likely that ladder fuels would carry fire into the dense canopies and turn into a passive or active crown fire.

Tree densities would continue to be high, slowing their growth into larger diameter classes. Habitat for MSO prey would continue to be limited by high tree densities with closed canopies. Ponderosa pine would continue to compete with oak for moisture, nutrients and sunlight resulting in reduced tree growth, vigor and longevity of oak. A lack of treatment would not develop or maintain MSO habitat components.

Proposed Action

Protected Habitat

There would be no direct effects from thinning activities as no activities will occur in PACs. Activities associated with prescribed burning and thinning treatments conducted outside of the breeding season normally do not result in negative effects to the MSO. The project area has been surveyed according to approved protocols. Effects from proposed treatments to adult and young owls outside of PACs are unlikely.

Direct effects to MSO would be from smoke created from broadcast burning. Smoke tends to settle into low-lying areas during the nighttime, and could potentially affect owls adjacent to the project. Due to prevailing winds from the southwest it is generally PACs to the northeast of burning activities that are impacted by smoke. There is one PAC (Mt. Elden #040202) northeast of the project area. Other PACs line Walnut Canyon and smoke may drift into PACs from burning. This could occur in the spring within the breeding seasons, but effects would be short-term (3-5 days) and low intensity (drift smoke). Mexican spotted owls are known to return to PACs after fires and smoke events have ceased. Short-term impacts from smoke would be reduced by coordinating the timing and type of burning with wind direction, topography, time of year, and distance to PACs. Initial entry prescribed burning will be restricted during the breeding season in areas that may create smoke impacts to occupied PACs.

Prescribed burning or thinning activities may indirectly affect MSO by changing owl habitat structure including snags, downed logs, woody debris, multi-storied canopies, and dense canopy cover. There is the potential for owls to relocate. Ganey (2003) concludes that in some cases, it may be necessary to manage for lower basal areas and provide openings in the canopy to provide adequate sunlight to maintain oaks in well-developed sites. The proposed thinning and burning may change the structure of MSO prey species' habitat, affecting the abundance and composition of prey species. Although treatments, especially prescribed burning, may have adverse effects to prey species in the short-term (generally one year, depending on climate and moisture) by impacting individuals of prey species due to disturbance of prey species' habitat and harm from

fire, the proposed treatments may increase the diversity of vegetative conditions, and provide for a diverse prey base.

Empirical models of factors that influence availability of Mexican spotted owl's five common prey species indicate that microhabitat manipulation can influence abundance of the Mexican vole, followed by the long-tailed vole, Mexican woodrat, deer mouse and lastly the brush mouse (Ward 2001). Ward (2001) found that the total available biomass (kg) of mice and voles provided the strongest correlation with reproductive output. Model results indicated that abundance (g/ha) of the two vole species could be influenced by manipulating grass-forb height, whereas abundance of Mexican woodrats, the preferred prey, might be influenced by promoting shrub diversity and increasing large log cover. Block et al. (2005) concluded downed logs were not a strong predictor of habitat use by any of the three prey species studied, including the woodrat, in ponderosa pine/Gambel oak habitat, but found them closely associated with rocks and shrub cover.

Restricted Habitat

Approximately 429 acres of Restricted Habitat (21% of MSO habitat, 1% of Forest Service lands within the project area) will be mechanically thinned for fire risk reduction to a canopy closure of 40 to 50% and basal area of 70-92 sq. ft. / acre. Approximately 1,941 acres of Restricted Habitat (100% of MSO habitat, 9% of Forest Service lands in the project area) will be broadcast burned for fire risk reduction (Table 3-17).

All treatments follow Forest Plan standards and guidelines and the Mexican Spotted Owl Recovery Plan (USDI 1999) in Restricted Habitat. Approximately 429 acres of Restricted Habitat (21% of MSO habitat, 1% of Forest Service lands) will be thinned for fire risk reduction to a canopy closure of 40 to 50% and basal area of 70-92 sq.ft./acre (Table 3-17). A change in the number of 18-inch diameter trees would not be detectable from existing conditions. It is anticipated that this thinning treatment adjacent to the Flagstaff wildland-urban interface will be maintained over time. This Restricted Habitat would be removed from any future potential to develop into nesting/roosting habitat. However, due to the location of these sites (aspect; proximity to traveled roads and heavily used trails), it is unlikely these areas would have otherwise provide quality nesting and roosting habitat. MSO may continue to forage in those sites, if they currently do so, although to a lesser degree for the short-term due to impacts to prey species and habitat of prey species from thinning and burning activities.

No temporary roads will be needed within Restricted Habitat in order to accomplish thinning treatments.

Table 3-17. Mexican spotted owl Restricted Habitat VSS and basal areas (pre-and post-treatment).

Location / Site	Acres	Treatment Type	Existing VSS	Anticipated Post-Treatment VSS	Anticipated Post-Treatment Basal Area Ponderosa pine / all species
297/01*	172	Mechanical thin and prescribed burn	4CSS	4BSS	74/92
278/04	23	Prescribed burn – No Thin	4AMS	4AMS	68/76
206/02	128	Mechanical thin and prescribed burn	5A	5A	60/70

Location / Site	Acres	Treatment Type	Existing VSS	Anticipated Post-Treatment VSS	Anticipated Post-Treatment Basal Area Ponderosa pine / all species
206/20	108	Mechanical thin and prescribed burn	3BMS	5AMS	60/70
310/01	270	Prescribed Burn – No Thin	6AMS	6AMS	39/53
309/01	38	Prescribed Burn – No Thin	5AMS	5AMS	34/45
310/02	76	Prescribed Burn – No Thin	4AMS	4AMS	38/63
312/02	159	Prescribed Burn – No Thin	5A	5A	#46/56
316/06*	86	Prescribed Burn – No Thin	6AMS	6AMS	41/53
315/20*	65	Prescribed Burn – No Thin	5A	5A	#46/56
314/08	82	Prescribed Burn – No Thin	4ASS	4ASS	56/64
315/19*	88	Prescribed Burn – No Thin	5A	5A	#46/56
315/04*	125	Prescribed Burn – No Thin	4BMS	4BMS	71/85
315/14*	107	Prescribed Burn – No Thin	5A	5A	#46/56
314/11	36	Prescribed Burn – No Thin	3BMS	3BMS	66/98
315/03*	120	Prescribed Burn – No Thin	5A	5A	#46/56
315/13*	73	Prescribed Burn – No Thin	3BMS	3BMS	#66/98
314/02*	59	Prescribed Burn – No Thin	5A	5A	#46/56
314/03*+	105	Prescribed Burn – No Thin	3BMS	3BMS	#66/98
Mt. Elden Site	21	Mechanical/Hand Thin – Pile Burn	4CMS	4BMS	100/110 all species

* Sites that are also within the MSO designated critical habitat boundary
\+ Sites that are designated as MSO target habitat
\# No stand exam available. Basal Area was estimated based on stand exam data from similar sites.

Prescribed Burning

Approximately 1,941 acres of Restricted Habitat (100% of MSO habitat, 9% of Forest Service lands) will be broadcast burned for fire risk reduction. The 21 acres of mixed-conifer at the Mt. Elden electronic site may be pile burned prior to broadcast burning. Throughout the project, during broadcast burning activities, torching may occur within treatment areas, however a change in the site structure from this type of event would not be detectable on a site basis. Torching would mimic gap processes that occur under natural conditions. Broadcast burning would decrease woody debris by approximately 50% of existing volume, and decrease number of snags by 20% across all acres burned (Randall-Parker and Miller 2000). Woody debris and snags are habitat for small mammals.

Indirect effects of reducing woody debris due to broadcast burning will decrease prey base abundance on a short-term basis for approximately one year (Jenness 2000). This decrease in small mammal prey base could be compounded during drought years when the prey base is lower due to a lack of food for these animals. However, herbaceous vegetation typically responds favorably to broadcast burning, and an increase in forage for small mammals is expected, outside of drought conditions. This in turn will have a corresponding increase in the small mammal prey base (Jenness 2000). Lining of snags and logs in combination with burning techniques and vegetation treatments designed to protect snags will reduce the number of snags burned. Recruitment snags will be identified from live trees that exhibit defects ideal for wildlife. These

would include trees with forked or spiked tops, lightning strikes, mistletoe brooms, or fading crowns.

Under the Proposed Action, the fire hazard potential within Restricted Habitat is reduced. Table 3-18 reflects the change in fire hazard rating by acres within Restricted and Protected Habitats:

Table 3-18. Fire Hazard Change to MSO Protected and Restricted Habitat

Fire Hazard Rating	Existing PAC Acres	Post-treatment PAC acres	Existing Restricted Acres	Post-treatment Restricted Acres
Extreme	0	0	21	0
Very High	0	0	0	0
High	11	11	442	0
Moderate	0	0	1,047	1379
Low	0	0	431	562

Cumulative Effects

Historical silvicultural practices of removing large-sized trees and suppression of fires created the current forest structure. Cumulative effects were analyzed based on the likelihood of disturbances (smoke, visual and auditory) to impact owls within the project area and a one mile buffer from the project boundary. Reviews of all projects (past, present and reasonably foreseeable) that have the potential to impact owls during implementation were analyzed. Review with the fuels management specialist concluded that smoke from broadcast and pile burning in the Skunk, Schultz, and Lake Mary Project areas would have similar short-term direct (3-5 days) and low intensity (drift smoke) effects of smoke to individual MSO.

Burning inside PACs occurs outside the breeding season for all projects. Burning outside of PACs during the breeding season is conducted in a manner that minimizes smoke impacts to MSO. However, it is anticipated that burning activities on portions of the Eastside Fuels Reduction and Forest Health project could occur simultaneously with burning activities on portions of the Skunk, Lake Mary and Schultz projects. While there are numerous burning operations planned in areas adjacent to the Eastside Fuels Reduction and Forest Health project area, ADEQ standards limit the total amount of burning allowed in the airshed at a given time. Thus, smoke impacts to PACs are limited.

There is a slight chance that daytime drift smoke from the proposed Schultz Pass fuels reduction project will reach the Mt. Elden PAC. This would occur over a 1-2 day period of time per year. There is a greater chance that daytime drift smoke from Skunk project burning could move into the Walnut Canyon PACs. This would occur over a 3-5 day per of time per year. Nighttime smoke would most likely move toward Walnut Canyon and PACs located there. Within the urban interface smaller blocks are generally burned with early (9 am to 11 am) ignition and smoke production lasting until 3 pm. Smoke would not continue into the nighttime. Disturbances are localized and short-term in duration and will not affect the reproduction and overall distribution of the species.

Other cumulative effects come from vegetation modification activities such as timber sales and grazing. The Mt. Elden PAC is not grazed although portions of PACs along Walnut Canyon are grazed as part of the Walnut allotment. Restricted habitat is located within several different allotments that include, Fisher Point, Limestone and Wildcat allotments. All allotments are currently grazed, however there are areas around the Wildland-Urban Interface and cinder hills

that are not identified as allotments and therefore not grazed. Cumulative effects of prescribed burning and grazing are not expected, as generally pastures are not grazed for one season after prescribed burning to allow forage to grow and produce a seed crop. If small portions of a pasture are burned, effects to forage are mitigated through herding and salt and water placement. It is standard operation procedure to manage to allow forage to grow and produce seed crop after a prescribed fire.

Treatments in owl habitat can affect the prey base immediately by impacting individuals of prey species due habitat disturbance of prey species' habitat and harm from mechanical operations or from fire. Conversely, prey species diversity will increase with increased diversity of vegetation structural stages and improvement of understory vegetation. Over time, a more diverse prey base would enable different prey species to prosper during variable climatic conditions, thus improving food availability. In addition, vegetation treatments in adjacent projects will help improve tree vigor and growth, and vegetative structural stage diversity, thus promoting the growth of larger trees and habitat components for MSO. Cumulatively, these adjacent project activities combined with this project's activities will not affect the reproduction or overall range of the MSO.

Bald Eagle

Affected Environment

Bald eagles are primarily winter visitors to the Coconino National Forest, occupying all habitat types and elevations. Wintering eagles arrive in the fall, usually late October or early November, and leave in early to mid-April. They feed on fish, waterfowl, terrestrial vertebrates, and carrion. Eagles are often seen perched in trees or snags near water or next to roadways where they feed on road-killed animals. At night, small groups (usually 2-12) or individual eagles roost in clumps of large trees in protected locations such as hillsides or drainages. Eagles usually roost adjacent to or very near food sources.

Nesting Habitat

A small, resident population of bald eagles breeds in Arizona and New Mexico. These eagles place their nests on cliff ledges and in live trees or snags along major rivers and reservoirs. In Arizona, eagles are known to breed along the Salt, Verde, and Bill Williams rivers, on Tonto Creek, at Roosevelt Lake in central Arizona (USDA Forest Service 2001) and recently documented at Lower Lake Mary in northern Arizona. There are no nesting bald eagles within the Eastside project. The only known nesting eagles on the Coconino National Forest are along north Lower Lake Mary, south Lower Lake Mary and the Verde River 2, 4 miles and 23 miles from the southern boundary of the project respectively. There is no potential nesting habitat within the project area based on the absence of habitat and nesting structures common to nesting bald eagle sites in the southwest, which are major rivers and reservoirs and mature to over-mature cottonwood and ponderosa pine trees. Another important habitat factor is the presence of large trees, snags, or ledges for foraging perches. There are no wetlands in the project area and it is unlikely that this area will provide nest sites for bald eagles in the future.

Roosting Habitat

There is one known winter roost (Cinder Lake) within the project boundary. This is a night roost on the northeast side of a small cinder cone approximately one mile north of Old Caves Crater

and one mile southeast of the Flagstaff City Landfill. The roost is 21.1 acres and lies within in Site 271/11. There is a road that transects the roost and provides access for people using the area for target practice and illegal trash dumping. Recreational shooting has damaged several trees in the area. Although there are no other known roost locations within the immediate project area, there is potential roosting habitat.

Foraging Habitat

Eagles forage widely and opportunistically on carrion, waterfowl or fish on the Forest. Waterfowl and fish distribution are driven by the amount and timing of precipitation and fish stocking by the Arizona Game and Fish Department. Eagles are expected to use any open water that would support waterfowl. There are no significant water bodies in the project vicinity. Eagles may feed on mammalian prey in project area. The Flagstaff City Landfill provides foraging opportunities for eagles. Bald eagles have been observed perching in snags and dead-topped trees within and at the fringes of the Eastside project area.

Environmental Consequences

Effect of No Action

Habitat conditions would remain in their current condition, not withstanding natural processes. Because there would be no habitat altering activities or disturbance associated with project implementation, there would be no effect on the bald eagle. However, dense forest conditions would still occur and the high fire hazard potential would continue to place bald eagle roosting and foraging habitat at risk with respect to stand-replacing fire.

Tree densities would continue to be high slowing their growth into larger diameter classes and thereby limiting the development of larger diameter (> 18-inch) trees important for roosting and perching.

Proposed Action

Direct effects to the bald eagle would be from activities that cause disturbances (smoke, auditory or visual) to eagles within or adjacent to the project. There would be no direct effects to nesting eagles.

During the daytime, smoke from prescribed fire would travel upward 1000-2000 feet above the ground. Light drift smoke could occur within the eagle roost for three to four hours during the day with most smoke moving up and over the site. Generally, within the urban interface, smaller blocks are burned with early (9 am to 11 am) ignition and smoke production lasting until 3 pm. Smoke would not continue into the nighttime. Disturbances are localized and short-term in duration and will not affect the reproduction and overall distribution of the species.

Mechanical thinning activities are not expected to affect breeding eagles because there will be no activities within 2 miles of a nest site during the breeding season thus there would not be auditory disturbance to nesting eagles. There will be no direct effects to roosting eagles from thinning activities as timing restrictions will limit disturbance to eagles during the bald eagle wintering period (October 15- April 15).

Proposed mechanical treatments, broadcast burning and hauling of timber may cause visual or auditory disturbance to foraging bald eagles. This disturbance would be localized, of short duration and low intensity and may affect individual birds but would not affect the overall distribution or reproduction of the species.

Indirect effects to the bald eagle include affects to eagle habitat, eagle prey species, or prey species habitat. There are no anticipated adverse effects to prey species or prey species habitat. The main effects are more likely to occur when project treatments modify the number of trees in a group of suitable roost trees, as eagles prefer to roost in large trees within close proximity to other large trees.

Thinning would improve old tree longevity. Lining of yellow pines and snags will reduce potential mortality to these components from burning activities. The Proposed Action includes recruitment of trees into developing old-growth sites over 20% of the area that may be used as future winter roost sites for bald eagles.

Cumulative Effects

The area for analysis includes the area that is within one mile of eagle nests, roosts, and high use winter foraging areas (Interstate 17, Federal Highway 3).

There is an additive affect from high levels of unmanaged recreation particularly near the Cinder Lake roost location. There is a road that transects the roost and provides access for people using the area for target practice and trash dumping. Recreational shooting has damaged several trees in the area.

Short-term disturbance to foraging or roosting bald eagles during thinning and broadcast burning activities may cause eagles to forage and roost in nearby areas for the duration of the activity. Short-term (the time it takes to complete implementation) impacts can be considered cumulatively with similar impacts in the Kachina Forest Restoration, Skunk and Lake Mary projects, although implementation of these burns is not likely to occur simultaneously and do not combine to cause a negative effect. These effects, combined with APS hazard tree removal for power lines and ADOT and County hazard tree removal for highways, have reduced the number of snags and large trees for perching along high use winter foraging areas in the project area.

Cumulatively, these activities combined with this project's activities will not affect reproduction of the overall range of the bald eagle.

Black-footed Ferret

Affected Environment

Black-footed ferrets occurred historically in northern Arizona, where their range apparently overlapped that of their primary prey, the Gunnison's prairie dog (*Cynomys gunnisoni*). Wild populations of this species are believed to have been extirpated from the state early in the 20th century as a result of prairie dog control programs. (AGFD 1996, Hoffmeister 1986). The only records from the regions listed by Hoffmeister (1986) are one from the Baca's Ranch, 16 miles northeast of Springerville, Arizona and another record 7 miles northeast of Williams in 1929. Cockum (1960) also reports a documented occurrence form Government Prairie near Parks and another from 12 miles west of Winona. Ferrets have been reintroduced as an experimental nonessential population in the Aubrey Valley near Seligman since 1996 (AGFD 2003b). The

USFWS believes that undiscovered wild populations of black-footed ferrets may still exist where prairie dogs persist (USDI Fish and Wildlife Service 1998). Habitat for black-footed ferrets in northern Arizona is described as medium to large (>80 acres) prairie dog towns or complex of towns (>200+ acres). A complex consists of two or more neighboring prairie dog towns each less than 4.3 miles (7km) from each other (Mikesic and Nystedt 2001).

There are no records of black-footed ferret in the project area or vicinity. One Gunnison's prairie dog town (64 acres) occurs in Location 303, Sites 1 and 2 in the Turkey Hills portion of the project. The larger Doney Park prairie dog town is located on private property within the project boundary. The towns were surveyed in 2004 and found to be active. These sites are not considered suitable for re-introduction of black-footed ferrets due to the threats from private land ownership, including canine distemper from domestic dogs.

Environmental Consequences

Effect of No Action

There are no direct effects to black–footed ferrets as none occur in the project area.

No meadows or meadow edges will be treated and will continue to have trees encroaching these habitats over time and reducing potential habitat in meadow habitats for Gunnison's prairie dog, a primary prey species.

Proposed Action

Indirect effects to the black-footed ferret include effects to ferret habitat, ferret prey species, or prey species habitat. There are no anticipated adverse effects to prey species or prey species habitat.

Meadow thinning treatments would improve and increase available habitat for Gunnison's prairie dog, a primary prey species. The Proposed Action will increase available habitat for prairie dogs with 220 acres of meadow thinning treatments.

Cumulative Effects

The area for analysis is the project area boundary. There is no effect to the numbers, distribution or reproduction of the black-footed ferret so there is no added effect from past, present or foreseeable future projects.

SENSITIVE SPECIES

Table 3-19. Sensitive species that are present or have habitat in the project area.

SPECIES NAME	SCIENTIFIC NAME	LISTING STATUS
Birds		
Northern goshawk	*Accipiter gentilis*	S3, SEN, WSC
American peregrine falcon	*Falco peregrinis anatum*	S3, SEN, WSC
Mammals		
Navajo Mountain Mexican vole	*Microtus mexicanus navaho*	S1, SEN, WSC
Amphibians		
Northern leopard frog	*Rana pipiens*	S2, SEN, WSC

SPECIES NAME	SCIENTIFIC NAME	LISTING STATUS
Invertebrates		
Blue-black silverspot butterfly	*Speyeria nokomis nokomis*	N1, SEN
Mountain silverspot butterfly	*Speyeria nokomis nitocris*	N3, SEN
Spotted skipperling	*Piruna polingii*	N3, SEN
Early Elfin	*Incisalia fotis*	N3, SEN

Northern Goshawk

Affected Environment

The northern goshawk uses a wide variety of forest stages in ponderosa pine and mixed conifer habitat. The goshawk preys on small mammals and medium sized birds. It prefers sites of moderately closed to closed canopy cover for nesting and more open areas for foraging. All ponderosa pine and mixed conifer above the Mogollon rim is considered goshawk habitat, including associated pine or mixed conifer stringers that may extend below the rim. Nest sites are typically located in later successional stages, especially old growth (VSS 6). Reynolds et al. (1992) demonstrated that nest sites typically have a vegetative structural stage class of VSS 5B to VSS 6. Post-fledging family areas (PFAs) have patches of dense trees, developed herbaceous or shrubby understories, snags, downed logs, and small openings that provide cover and prey species. Fledglings develop their hunting skills in these areas. Foraging areas, by virtue of their size, are a mosaic of various successional stages and cover types.

Goshawk foraging use is associated with ponderosa pine vegetation. Although juniper or pinyon/juniper habitat types are not heavily used by northern goshawks, some foraging may occur those habitat types, especially in transition areas between ponderosa pine and pinyon/juniper habitats.

Threats to northern goshawks are generally related to timber management. However, fire suppression, livestock grazing, drought, and toxic chemicals may also be involved (Reynolds et al., 1992). Large-scale wildfires are also threats to northern goshawks. Declines in goshawk populations may be related to decreases in prey populations associated with changes in structure and composition of forests.

One northern goshawk post-fledgling family area (PFA) is located within the project boundary (Campbell PFA #040210). The PFA was monitored in 2004 with one goshawk sited adjacent to the PFA. Sightings were also documented in the Limestone area on State land, however follow up visits in 2004 and 2005 did not locate goshawks. All potential nesting roosting habitat in the project area and ½ mile beyond the boundary was surveyed for northern goshawks in years 2003 and 2004 according to Region 3 protocol. Two goshawk sightings were documented during that survey period although no new nesting goshawks were documented. These sightings may have been birds from adjacent PFAs foraging within the project boundary.

Post Fledgling Family Areas (PFAs)

The existing Vegetative Structural Stages (VSS) distributions within the PFA meet recommended Forest Plan guidelines although much of the PFA (58%) is classified as pinyon/juniper woodlands and these sites are not assigned a VSS class. Ponderosa pine trees are scattered throughout the pinyon/juniper although these areas do not have the capability to develop into optimal nesting sites. Much of the pine is located in drainages in what are referred to as “pine stringers.”

Canopy Cover

Canopy cover standards and guidelines for VSS 4, 5 and 6 areas within the goshawk PFA are not met. Over half of the PFA is within unproductive timber lands or transition, grassland and sparse pinyon/juniper with low canopy densities. Table 3-20 lists the ponderosa pine sites within the PFA and the habitat attributes for them.

VSS Structural Stage (VSS)

The Forest Plan states that the desired vegetative structural stage (VSS) for spruce-fir, mixed conifer, and ponderosa pine forests, within and outside PFAs is 10%, 10%, 20%, 20%, 20%, 20% for VSS 1-6, respectively. Thirty – two percent of the PFA is VSS 6 and 31 percent is VSS 5. The existing Vegetative Structural Stages (VSS) distributions within the PFA do not meet Forest Plan guidelines. VSS distribution of sites within the PFA still lacks optimal nesting sites and is void of VSS 4 structural stage, limiting opportunities to develop additional nesting sites as the VSS 5 and 6 deteriorate. Optimal nest sites for northern goshawk have a vegetative structural stage classification of VSS 5B through VSS 6 (Reynolds et al. 1992). Currently there is a lack of optimal nest sites across the project area due primarily to low densities within these VSS classes.

Table 3-20. PFA Sites, treatments and habitat attributes.

COMP/SITE	ACRES	PROPOSED TREATMENT	EXISTING VSS	EXISTING CANOPY COVER
313/01	233	Prescribed Burn – No thin	6AMS	26%
313/02	165	Prescribed Burn – No thin	PJ	
313/03	45	Prescribed Burn – No thin	PJ	
313/04	75	Prescribed Burn – No thin	5AMS	23%
313/05	117	Prescribed Burn – No thin	5AMS	29%
313/06	25	Prescribed Burn – No thin	PJ	
313/07	17	Prescribed Burn – No thin	Grassland	
313/10	72	Prescribed Burn – No thin	5A	23%

Foraging Areas

The project area is comprised primarily of ponderosa pine and pinyon/juniper vegetation types. Canopy cover outside the PFA, in foraging areas does not meet the Forest Plan guidelines. VSS distribution in the Foraging Areas is lacking in VSS 1, 2 and 6 structural stages.

Table 3-21. Canopy cover distribution of the ponderosa pine cover type in foraging areas.

VSS	Current Acres	Current Percent Acres	Current avg. VSS Canopy Cover Percentage	Forest Plan Direction For Canopy Cover percentage
4A	3,103	18		VSS 4 should average 40+%
4B	2,015	12		
4C	824	5		
4 Total	5,942	35	37	
5A	3,810	23		VSS 5 should average 40+%
5B	194	1		

VSS	Current Acres	Current Percent Acres	Current avg. VSS Canopy Cover Percentage	Forest Plan Direction For Canopy Cover percentage
5C	0	0		
5 Total	4,004	24	21	
6A	1423	8		VSS 6 should average 40+%
6B	298	2		
6C	0			
6 Total	1,721	10	24	

*There are no Forest Plan requirements for canopy cover within VSS 1-3 classes.
**VSS subclasses: (A) <40% canopy cover; (B) 40-59% canopy cover; (C) >60% canopy cover.
(See page 28 for further explanation on spatial arrangement)

Table 3-22. Existing VSS distribution outside PFAs.

VSS Class	Outside PFAs		Forest Plan Direction
	Acres	Percentage	Percentage
1	363	3	10
2	247	1	10
3	4,501	28	20
4	5,942	36	20
5	3,740	23	20
6	1,488	9	20

Environmental Consequences

Effect of No Action

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. There would be no direct effect on goshawks. However, dense forest conditions would still occur and the high fire hazard potential would continue to place goshawk habitat at risk with respect to site replacing fire. Vegetative structural stage distributions as outlined in the Forest Plan for the northern goshawk would never be attained.

Proposed Action

Post Fledgling Family Areas (PFAs)

There will be no direct effects from thinning treatments as no thinning will occur within the PFA or within a one-half mile area of the nest locations. There are potential direct effects from smoke. Smoke could affect nesting and feeding behavior. Goshawks may be flushed from nest sites and/or change their foraging behavior due to smoke accumulation. This could cause goshawks to expend more energy and/or cause them to be detectable to predators during movements. Smoke

from broadcast burning may disturb individual birds, although this would be a short-term effect and activities would be temporally and spatially separated, which would reduce overall effect. These smoke disturbances would be short-term and will not affect the overall distribution of northern goshawk.

The fire hazard potential within the PFA will not change although the resiliency of the area to withstand wildfire will improve due to the increase of crown base height and the reduced ground fuels. Fire hazard potential in foraging areas is reduced. The Proposed Action will maintain canopy cover values, where existing, as identified in desired conditions in foraging areas. The Proposed Action will maintain existing canopy cover in ponderosa pine sites in the PFA.

Prescribed Burning

Avoiding burning near goshawk nesting areas during critical periods in the goshawks life cycle is important. Smoke accumulation during times when goshawks are incubating eggs and tending nestlings and fledglings could cause adults to leave the area; this in turn could cause reproductive failure for the year. Smoke effects are short-term (1-3 days) and of low intensity (drift smoke). Impacts from smoke are reduced by the coordination of timing and type of burning with wind direction, topography, time of year and distance to the goshawk nesting area.

Prescribed burning or thinning activities may indirectly affect the goshawk by changing the goshawks habitat structure (snags, downed logs, woody debris, vegetative structural stages, and dense canopy cover). In addition the proposed activities may change the structure of goshawk prey species' habitat, affecting the abundance and composition of prey species. Although treatments, especially prescribed burning, may have adverse effects to prey species and their habitat in the short term, the proposed treatments may increase diversity of vegetative conditions, which would provide for a diverse prey base.

Snags and Logs

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 1999) although many will be protected using appropriate ignition and piling techniques, and lining of most snags and large logs. In addition, after burning, trees will be felled to replace logs burned up during prescribed fire to meet forest plan guidelines. Recruitment snags will be identified from live trees that exhibit defects ideal for wildlife. For example, trees with forked or spiked tops, lightning strikes, mistletoe brooms, or fading crowns.

Reduction of snags and logs would have a negative impact on numbers of prey items, thus prey availability, for northern goshawk. The impact of this effect is expected to lessen in the short-term as snags fall and become logs. The number of snags would continue to be in short supply, due to an existing shortage of snags. The number of snags is expected to increase in the future as other trees grow, age, and die.

Canopy Cover

The existing condition for foraging area canopy cover was determined by averaging canopy cover across sites within VSS 4, 5, and 6. Existing average canopy cover values in these VSS classes will continue to be low. The Proposed Action will meet Forest Plan guidelines by maintaining an average of 40+% canopy cover within VSS 4, 5 and 6 classes in foraging areas. Post-treatment

canopy cover will maintain 40 – 50% of the area in groups, clumps and individual trees with 40 to 100% canopy cover within the groups/clumps. Over half of the PFA is within unproductive timber lands or transition, grassland and sparse pinyon/juniper reducing the opportunity to increase canopy cover in the PFA. Existing low average canopy cover levels in these VSS classes within the PFA will continue to be low with an average canopy of 26%. The Proposed Action would offer higher quality foraging habitat over time due to the increase in the quality of prey habitat over the forty years following treatment.

Vegetative Structural Stages (VSS)

Treatments would alter VSS class distribution, changing the project area from one dominated by VSS 3 and 4 more toward the desired future condition, although still not meeting the desired future condition. Neither a lack of treatment nor the Proposed Action will result immediately in the desired VSS class distribution as outlined in the Forest Plan for the northern goshawk. Trees will grow into the larger diameter classes at a faster rate than no treatment. Within forty years the project area will meet or exceed desired future conditions for VSS 4, 5 and 6 structural stages, and VSS 1, 2, and 3 stages will improve toward desired forest structure. The Proposed Action would offer higher quality foraging habitat over time due to improved habitat conditions for prey species.

Cumulative Effects

The area of analysis is the project and a one-half mile area surrounding the boundary.

There is an added indirect effect regarding vegetation modification activities. Other projects where modification of goshawk habitat occurs within the Eastside Project area are: ADOT tree removal along North Highway 89, Coconino County tree removal along Federal Highway 3, APS hazard tree removal along powerlines and development of state and private lands. Cumulative effects are not expected to affect the reproduction or overall distribution of northern goshawks.

American Peregrine Falcon

Affected Environment

The peregrine falcon was removed from the Federal List of Endangered and Threatened Wildlife in August 1999 (USDI 1999a) and is now classified as a Forest Service Sensitive species (USDA Forest Service 1999a). The essential habitat for peregrine falcon includes rock cliffs for nesting and large foraging areas. Suitable nesting sites on rock cliffs have a mean height of 200 to 300 feet. Peregrines are located State-wide as a migrant, transient and/or wintering individual. The subspecies anatum breeds in the project area on selected isolated cliff ledges and is a permanent resident on the Coconino National Forest. There are three eyries: Elden (2), and Walnut adjacent to the project area. Although peregrines were observed near Fisher point, an eyrie was never located. It is possible these birds were from the Walnut eyrie or the pair that established a new territory in the Walnut Canyon National Monument. Peregrines forage throughout Walnut Canyon and likely forage in the project area. Peregrines prey mainly on birds found in wetlands, riparian areas, meadows, parklands, croplands, mountain valleys, and lakes within a 10 to 20 mile radius from the nest site. Prey items include bats, mammals, and birds. The peregrine breeding season is from March 1 to August 31.

The main threat to the peregrine falcon is the continued contamination of its environment by synthetic organochlorine contaminants (e.g. DDT). These contaminants result in eggshell thinning and direct mortality to this species. Other threats include disturbance from rock climbing near eyries and mortality from encounters with power lines.

Environmental Consequences

Effect of No Action

There would be no change to the prey species base and no change in falcon hunting patterns within associated forest structure. This is not a negative effect.

Proposed Action

No direct effects from thinning are expected since no thinning will take place within one-half mile of eyrie locations. There are potential direct effects from smoke but effects would be short-term (1-3 days) and low intensity (drift smoke). Timing restrictions will limit smoke during the breeding period.

Thinning and burning can affect the prey base on a short-term basis due to disturbance of prey species' habitat and fire. Conversely, prey species diversity will increase with increased diversity of vegetative structural stages and improved understory vegetation. A more diverse prey base enables different prey species to prosper during variable climatic conditions thus food availability improves. Thinning of the forest would increase sight distance for foraging peregrine falcons and facilitates good hunting conditions.

Cumulative Effects

Other projects where thinning occurs can affect the prey base on a short-term basis by impacting individuals of prey species due to disturbance of prey species' habitat and harm from fire. Projects are implemented at different times and/or different locations, thus disturbances to the prey base are minimized. Activities of these projects do not affect the reproduction or overall distribution of peregrine falcons.

Navajo Mountain Mexican Vole

Affected Environment

There are no documented populations of voles in the project area. Suitable habitat exists within the area. Navajo Mountain Mexican voles occupy meadows and riparian areas above the Mogollon Rim associated with ponderosa pine or other coniferous forests. They also occur within forested areas where tree densities are low. They rely on grasses and other herbaceous vegetation for food or cover. Suitable habitat within the project area is currently 57% of Forest Service lands [675 acres of grassy opening and meadows, and 9,404 acres of sites of "A" canopy (<40% canopy closure)].

Environmental Consequences

Effect of No Action

There would be no disturbance and no direct effects.

The area will continue to provide habitat for this species. Currently 43% of the project area is in a moderately closed to closed condition. Dense forest sites provide low quality habitat for the Mexican vole. Meadows would not be rehabilitated, thus there would not be any benefits to these species. Favorable habitat would decrease over time as conifers encroach meadows and canopy closure increases.

The existing fire hazard potential would persist; a large crown wildfire event would have the potential to affect many individuals.

Proposed Action

Disturbance during thinning and broadcast burning activities may occur to individual voles; some individuals may be lost. Such activities would occur across the project area at different times; therefore, activities would be temporally and spatially separated which reduces impacts to this species. Effects would be short-term. There would be no effects to the population viability of voles.

Broadcast burning removes cover and food of Navajo Mountain Mexican vole. Meadows and open areas would rebound after broadcast burning. Herbaceous vegetation would be more vigorous, and meadow and understory habitats would be healthier.

Benefits to voles would occur due to the reduction of dense forest canopy and increased growth in the herbaceous vegetation on the forest floor in treatment areas.

Cumulative Effects

Recreational activities will occur, such as hiking, biking, and camping, thereby eliminating these areas as habitat for voles. Recreation and road travel at current levels continues to pose an adverse affect to voles due to soil and vegetation disturbance and soil compaction. Forest and range management practices that promote herbaceous growth could lead to increased vole populations. Development of private and state land has the greatest potential impact to vole habitat. Cumulatively, these projects and activities do not affect the overall distribution of Navajo Mountain Mexican vole.

Northern Leopard Frog

Affected Environment

There are no known existing or historic locations of northern leopard frogs within or adjacent to the project. Best potential habitat is tanks and springs within the project boundary and the Rio de Flag wetlands although water dependability and quality are questionable. Potential threats to local populations of northern leopard frogs include changes in wetlands, especially the alteration of marshy ponds to reservoirs and natural local extirpations as ponds dry up during years of low

precipitation. Other threats include alteration of riparian vegetation by livestock grazing, and predation and competition by introduced bullfrogs and potential introduction of chytrid fungus.

Environmental Consequences

Effect of No Action

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. Dense forest conditions would still occur and the existing fire hazard potential would persist. Large crown-wildfires could adversely affect potential habitat by destruction of understory and overstory vegetation. As a result overland flow would increase, and soil erosion would increase with potentially high sediment loads. Water quality would be adversely affected on a wide-scale basis.

Proposed Action

There are no direct effects to northern leopard frog eggs, larvae, or adults from mechanical treatment and/or prescribed burning.

Indirect effects would result from onsite soil or ash inflow into waters. An inflow of ash and sediment into a water body could smother eggs and tadpoles and displace adults, if frogs are present. Sediment and ash inflow can also inhibit respiration in macroinvertebrates resulting in reduced density and composition of macroinvertebrates. Rinne and Neary (1996) found a 7 to 10 fold decrease in macro-invertebrate density and a 25-75% drop in diversity after a major runoff event. A reduction in the amount of prey species can ultimately affect leopard frog numbers and reproduction. Water quality could be impacted on a short-term basis. Impacts will be minimized by implementation of best management practices. A 200 feet wide buffer around all dependable waters would be maintained and would greatly reduce the amount of sediment and ash introduced to potential frog habitat.

Cumulative Effects

No cumulative effects to northern leopard frogs would occur, when added to past, present and reasonably foreseeable future activities. Implementation of Best Management Practices curtails soil erosion and minimizes the potential for inflow into potential northern leopard frog habitat.

Invertebrates

Affected Environment

Four sensitive species of invertebrates have potential habitat within the project. They are spotted skipperling, mountain silverspot butterfly, blue-black silverspot butterfly and early elfin. Three of the butterfly species inhabit moist meadows, seeps, springs, and streams within ponderosa pine and mixed conifer vegetation types, and in some cases other habitat types with riparian areas. The two silverspot butterfly species have life cycles where they utilize Viola species, adults feed on thistles. The early elfin have life cycles were they utilize Purshia species, caterpillars feed on reproductive portions of cliffrose and adults nectar at the flowers.

There are no documented populations of these butterfly species within the project area, however suitable habitat does exist at several tanks, springs and wet meadows. Best potential habitat is

Little Elden Spring and several tanks within the project boundary and possibly the Rio de Flag. Potential habitat for the early elfin is located at the base of Mount Elden, along the rim of Walnut Canyon and on many of the cinder hills where cliffrose occurs.

Environmental Consequences

Effect of No Action

Meadows would not be rehabilitated, thus there would not be any benefits to these species. Favorable habitat would decrease over time as meadows are encroached by conifers and canopy closure increases and understory productivity and diversity decreases. Existing fire hazard potential in the project area would persist.

Proposed Action

Activities would occur within and near meadows. Some individuals may be impacted by treatment activities. These activities would be minimal and short term.

Indirect effects would result from vegetation modification activities such as thinning and broadcast burning. These activities would disturb or remove understory vegetation, in effect reducing plant availability to adult butterflies and/or caterpillars. These are short-term effects and will be minimized due to activities being temporally and spatially separated. In contrast, reducing the canopy closure, removing trees in and at edges of meadows, restoring meadows and broadcast burning will encourage the development of understory vegetation, increasing availability of food and reproductive sites for these species over the long-term.

Improvement to meadows will be beneficial to these butterfly species. Reducing the canopy closure, removing encroaching trees in and at the edges of meadows will be beneficial to these species. The cliffrose populations associated with TES unit 455 along Walnut Canyon will be deferred from treatment. Cliffrose populations along the base of Mt. Elden will be conducted to reduce fuels while maintaining or enhancing and rejuvenating the cliffrose populations in the area. Protection and regeneration of cliffrose will be beneficial to the early elfin.

Cumulative Effects

The reduction of understory vegetation by ungulate grazing within the project area adds to the effect of vegetation modification. A portion of the area is currently set aside and is not being grazed by livestock, thus reducing the potential for cumulative impacts. Elk will continue to reduce vegetative understory in meadows and around waters.

Snags and Logs

Affected Environment

Snags and logs are important elements of the structure and function of ponderosa pine and are important to bird and small mammal communities. The Forest Plan standards and guidelines state to manage for a minimum of 200 snags per 100 acres across 50% of forested 10K blocks. Standards and guidelines also state to manage for a minimum of 2 snags per acre across 50% of forested land, 3 logs per acre, and 5-7 tons of wood debris per acre in ponderosa pine forests,.

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. This decrease is greatest on the northern portion of the Forest, where illegal fuelwood cutting greatly affects snag densities. Areas of a stable to slightly increasing trend are located in protected canyons, wilderness, and portions of the southern end of the Forest, but overall densities are below Forest Plan guidelines. Snags and logs are deficit across the project area.

The past outbreak of bark beetle infestations has killed trees and created, increasing snags in pockets across the project area. However, insect attacks result in rapid deterioration of snags, decreasing their longevity and value to wildlife.

Losses of snags and logs from prescribed burning will occur and is estimated to be 20% loss of snags and 50% loss of logs (Randall-Parker and Miller 2000). Randall-Parker and Miller (2000) also found that snags continue to fall and provide new logs on the forest floor at a rate of 2 logs/25 acres/year.

Environmental Consequences

Effect of No Action

The existing fire hazard potential in the project area would persist. In the event of a large crown-wildfire, widespread loss of snags and logs would occur. Generally, snags remaining after a crown-wildfire would have decreased longevity and value to wildlife. High tree densities would remain limiting growth of large diameter trees and thereby limiting replacement snags and logs.

Proposed Action

There will be a loss of snags and logs during broadcast burning, however these effects will be minimized since snags necessary to meet wildlife management objectives will be fire-lined. Loss of large logs will be minimized though ignition techniques and possibly fire-lining. Felling large trees between 12 and 16 inches after burning to replace logs consumed by prescribed burning will provide additional habitat.

Although fire can have a detrimental affect on pre-burn snags, it can cause live trees to die and become snags. With the retention of yellow pine trees and old growth recruitment, some trees would in time naturally convert to snags. This natural conversion of snags to logs would contribute to additional numbers of snags and logs on the ground. The less competition between trees for moisture, nutrients, and sunlight the larger they will grow prior to becoming snags. Larger diameter snags (>18) are necessary to meet Forest Plan guidelines. Recruitment snags will be identified and retained from live trees that exhibit defects ideal for wildlife. These include trees with forked or spiked-tops, lightning strikes, mistletoe brooms, or fading crowns.

Cumulative Effects

Past timber harvest and illegal fuelwood activities have reduced snag densities to below Forest Plan recommendations. Snags were removed during forest logging because of potential fire and safety hazards, and many foresters thought they had poor aesthetic value and were indicative of an unhealthy forest. Snags are especially vulnerable to bark beetle infestation, illegal fuelwood

cutting, and ongoing projects that remove hazard trees such as APS hazard tree removal along powerlines and ADOT tree removal along Interstate 17.

The past outbreaks of bark beetle infestations has killed trees thus creating snags, therefore increasing snags in pockets across the landscape. However, insect attacks result in rapid deterioration of snags, decreasing their longevity and value to wildlife. Some bug-killed trees will topple over and become downed logs. Bug killed logs will compensate for a portion of the loss of large logs due to burning activities.

Wildlife Cover

Affected Environment

Hiding and thermal cover are important attributes of the forest for wildlife habitat. Hiding cover is defined as "vegetation capable of hiding 90% of a standing deer or elk from human view at a distance of 200 feet or less." Tree trunks and foliage as well as shrubs and herbaceous vegetation offer hiding cover. Topographic features, such as rock outcroppings and terrain breaks, also serve as hiding cover. Thermal cover is defined as a site of coniferous trees tall enough to allow animal movement and bedding with a high degree of crown closure. Thermal cover offers protection from heat and cold. High tree crown closure also provides hiding cover from aerial predators.

The Coconino Forest Plan requires 30% cover within a 10K Block within the Urban Rural Influence Zone (URIZ) but does not apply the hiding and thermal cover guideline within the URIZ. Projects should attempt to retain 15% cover within a given section within the URIZ.

There are approximately 870 acres (4%) outside the FMAZ and 20,349 acres (96%) of Forest Service lands within the FMAZ project area.

The area outside the FMAZ within the project boundary is not completely within one 10K block. Wildlife cover was analyzed on a site basis across project acreage outside the FMAZ (wildlife cover depicted herein is an index of available cover in the project area). Table 3-23 includes current, desired and projected values of thermal and hiding cover.

Key wildlife cover areas are near Skunk and Fay Canyon and other steep slopes and drainages across the project. Walnut Canyon, which borders the southern boundary of the project, provides an important travelway and cover for black bear, deer, turkey and other big game species. This area is considered too steep to implement burning or mechanical treatments and will likely continue to provide cover. A wide area adjacent to the north rim of Walnut Canyon provides hiding and thermal cover to wildlife in this area. Movement of wildlife from the Mount Elden and San Francisco Peaks area to the east side of the project area is limited and wildlife corridors are fragmented by development.

Environmental Consequences

Effect of No Action

Current conditions exceed Forest Plan direction. A surplus of thermal and hiding cover for wildlife will be maintained across the project area. However, dense forest conditions would still occur and the existing fire hazard would continue to place wildlife cover at risk with respect to stand-replacing fire.

Proposed Action

Horizontal and vertical diversity are both important components of cover. The Proposed Action will maintain hiding cover at least 200 feet wide around dependable waters and along the travel corridor identified along the north rim of Walnut Canyon. Key wildlife areas are near Fay and Skunk Canyons and other steep slopes and drainages across the project. These areas provide cover for big game species as well as attributes for resident songbirds, raptors, turkey and other wildlife. These areas are considered too steep to implement mechanical treatments and will continue to provide cover. The Proposed Action will still provide cover and vertical diversity for most species and will meet Forest Plan direction.

The Proposed Action will reduce hiding cover across 2,220 acres (11%) of the project area. All treatments will maintain thermal cover. There will be a reduction of approximately 2,220 acres within the FMAZ and no change in hiding or thermal cover acres outside of the FMAZ. This reduction within the FMAZ will still provide adequate cover for most species and meet Forest Plan direction.

Specifically, areas hand thinned to an un-even aged with 40% or 50% canopy cover will retain both hiding and thermal cover values. Areas mechanically thinned to 40% or 50% canopy cover will lose hiding cover values but will maintain thermal cover qualities. Sites will maintain hiding cover values where steep slopes are present and provide cover effects. Grassland thinning treatments and pinyon/juniper fuelbreaks will remove both hiding and thermal cover values. Sites treated with prescribed fire only (no thinning) will maintain both thermal and hiding cover qualities.

Table 3-23. Wildlife Cover pre- and post treatment.

Measure of Change	Existing Conditions	Forest Plan Direction	Proposed Action
Percent Cover Within FMAZ	Hiding 16% Thermal 15% Combination 25% Total 56%	Hiding 0-15% Thermal 0-15% Combination 0-15% Total 0-15%	Hiding 13% Thermal 23% Combination 17% Total 56%
Percent Cover Outside FMAZ	Hiding 10% Thermal 33% Combination 32% Total 75%	Hiding 10% Thermal 10% Combination 10% Total 30%	Hiding 10% Thermal 33% Combination 32% Total 75%

Cumulative Effects

The area for analysis is the project boundary. Roads and trails within cover sites provide access to recreation activities thereby reducing the effectiveness of that cover for some species due to human disturbance.

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).

On January 5, 2005 the Department of Agriculture issued a final rule to remove the 2000 planning regulations at 36 CFR 219 (a) in their entirety, 70 Fed. Reg. 1023. Clarification for the forests MIS obligations is found at 36 CFR at 219.14 (f). 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 Forest 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. 36 CFR 219.14 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).

A working draft forest-wide assessment entitled "Management Indicator Species Status Report for the Coconino National Forest" (USDA 2002) summarizes current knowledge of population and habitat trends for management indicator species on the Coconino National Forest. Following are descriptions of each of the management indicator species identified for management areas (MA's) within the project area, and a discussion of the relationship of the effects on forest-level population and habitat trends for each of these species.

Management indicator species (MIS) for this project are evaluated based on management area types located within the project area. The management areas (MA) listed immediately below, with associated indicator species, indicated to be present within the project boundary. Table 3-25 lists MIS that were considered but dropped from detailed analysis because habitat they are indicators for does not exist in the project area. These are a subset of the Forest-wide management areas and management indicator species. Refer to the Forest Plan for a complete list of management areas and associated management indicator species. Table 3-26 describes MIS and the habitat components they are indicators for.

Table 3-24. Management areas within the project area and Associated MIS.

MANAGEMENT AREA (MA)	MANAGEMENT INDICATOR SPECIES	ACRES WITHIN PROJECT AREA ON FS LANDS
MA 3 (Ponderosa Pine and Mixed Conifer with <40% Slopes)	Abert squirrel, red squirrel, Mexican spotted owl, elk, northern goshawk, pygmy nuthatch, turkey, and hairy woodpecker	13,155 (62%)
MA 4 (Ponderosa Pine and Mixed Conifer with >40% Slopes)	Abert squirrel, red squirrel, Mexican spotted owl, elk, northern goshawk, pygmy nuthatch, turkey, and hairy woodpecker	269 (1%)

MANAGEMENT AREA (MA)	MANAGEMENT INDICATOR SPECIES	ACRES WITHIN PROJECT AREA ON FS LANDS
MA 6 (Unsuitable Timber Land in Ponderosa Pine)	Elk, mule deer, Abert squirrel, and hairy woodpecker	2,404 (11%)
MA 7 (Pinyon/Juniper <40% Slopes)	Juniper (Plain) titmouse, mule deer, and elk	1,657 (8%)
MA 8 (Pinyon/Juniper >40% Slopes)	Juniper (Plain) titmouse, mule deer, and elk	42 (<1%)
MA 9 (Mountain grassland)	Antelope, elk	7 (<1%)
MA 10 (Grassland and Sparse P/J above the Rim)	Antelope	1194 (6%)
MA 13 (Cinder Hills)	Mule deer, pygmy nuthatch, hairy woodpecker and Abert squirrel	1267 (6%)
MA 18 (Old Caves and Mt. Elden ESA	None	1196 (6%)

Table 3-25. Management Indicator Species considered but eliminated from detailed analysis.

MA	MIS Species	Habitat
MA 12	Lincoln's Sparrow	Late seral, high elevation riparian (≥7,000')
MA 12	Lucy's Warbler	Late seral, low elevation riparian (<7,000')
MA 12	Yellow-breasted Chat	Late seral, low elevation riparian (<7,000')
MA 12	Macroinvertebrates	Late seral, high and low elevation riparian
MA 12	Cinnamon Teal	Wetlands/aquatic

Table 3-26. Summary of MIS habitats with Coconino National Forest trends

Species	Indicator Habitat	Forest Habitat Trend	Forest Population Trend	Acres Habitat (Project Area)
Abert Squirrel	Early seral ponderosa pine	Stable	Inconclusive	10,443
Northern Goshawk	Late seral ponderosa pine	Declining	Inconclusive	5,725
Pygmy Nuthatch	Late seral ponderosa pine	Declining	Stable	5,725
Turkey	Late seral ponderosa pine	Declining	Increasing	5,725
Elk	Early seral ponderosa pine, mixed conifer, and spruce-fir	Stable	Stable	610
Hairy Woodpecker	Snag component of ponderosa pine, mixed conifer, and spruce fir	Pipo snags declining	Stable-to-slightly increasing	5,746
Yellow-bellied (Red-naped) Sapsucker	Late seral and snag component of aspen	Declining	Declining	10
Mule Deer	Early seral aspen and pinyon/ juniper	Aspen declining	Declining	10
Juniper (plain) titmouse	Late seral and snag component of pinyon/juniper	Stable	Stable-to-declining	1,699
Antelope	Early and late seral grasslands	Stable-to-declining	Declining	697
Mexican spotted owl	Late seral mixed conifer and spruce fir	Declining	Inconclusive	21
Red Squirrel	Late seral mixed conifer and spruce fir	Declining	Inconclusive	21

Table 3-27. Effects to MIS habitat quantity (Acres/%).

MIS Species	Current Forest-wide Habitat	No Treatment	Proposed Action
Abert Squirrel	490,000	0	-2,727/<0.5%
Northern Goshawk	193,812	0	+1,604/<0.8%
Pygmy Nuthatch	193,812	0	+1,604/<0.8%
Turkey	193,812	0	+1,604/0.8%
Elk	22,188	0	+964/<4%
Hairy Woodpecker	231,812	0	+1,604/<0.6%
Yellow-bellied Sapsucker	Undetermined	0	+10/<1%
Mule Deer	31,500+Aspen	0	+377/<1%
Juniper (plain) Titmouse	598,500	0	-377/<.06%
Antelope	161,000	0	+200/<0.1%
Mexican Spotted Owl	42,000	0	-21/<.04%
Red Squirrel	42,000	0	-21/<.04%

Abert Squirrel

Affected Environment

The Forest Plan designates the Abert squirrel as a management indicator species for early seral stage ponderosa pine forests. However, Abert squirrels use a variety of age classes and research from several locations has shown strong habitat associations with mature ponderosa pine. Recent research indicates that this species' best habitat is the intermediate to older aged forest (trees 9-22 inches DBH), where groups of trees have crowns that are interlocking or in close proximity (Dodd et al. 1998).

Squirrels favor scattered large trees and multi-storied sites mixed with poles. The project area currently exhibits areas of good quality habitat for Abert Squirrel.

The Forest-wide population trend is inconclusive since there is little Forest-specific data. Statewide information indicates a stable trend for hunter harvest of squirrels. Abert squirrels are currently found throughout the project area. Abert squirrel nesting habitat includes high canopy cover with interlocking canopies, multi-storied sites, high basal area with 18" diameter trees distributed throughout.

The Forest-wide habitat trend for early seral stage ponderosa pine trend is stable. The age class distribution of ponderosa pine has remained essentially the same, dominated by mid-seral stage sites, with some loss of old growth and older trees, and some early seral stage habitat created by wildfire.

Environmental Consequences

Effect of No Action

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. There would be no effect on Abert squirrel forest-wide habitat or population trends. However, dense forest conditions would still occur and the high fire hazard potential would continue to place squirrel habitat at risk with respect to site replacing fire. The project area would continue to be lacking in the higher basal areas that provide high quality nesting habitat. Foraging habitat would continue to be limited as tree basal areas will remain lower and densities higher reducing tree growth rates and limiting cone production.

Proposed Action

Indicator habitat quantity would be the same as existing immediately after treatment. Changes occurring in VSS structural stage reduce indicator habitat by approximately 2,727 acres (26%) across the project area. Habitat quality will be reduced although the project area will continue to provide recruitment, nesting and foraging habitat for Abert squirrels. This reduction in habitat quality is too small to alter the Forest-wide habitat or population trends.

Canopy closures and basal areas will be reduced overall but will continue to average 45% canopy cover and maintain higher basal areas within MSO habitats, steep slopes and canyons. There will not be a noticeable difference in the number of 18" trees across the landscape. Low quality nesting habitat (> 90 BA and > 30 CC) will be met over 17% of the landscape.

Cumulative Effects

There is no effect to Forest-wide habitat or population trends and there is no added effect from past, present or foreseeable projects. Past fuel reduction treatments in the urban interface has reduced habitat quality due to resulting low tree densities and lack of interlocking crowns (USDA 2002). MSO Protected Habitat and northern goshawk PFAs have similar habitat qualities as those required for higher quality Abert squirrel habitat and densities. These Protected Habitats are scattered across the landscape thereby providing habitat for squirrels within these Wildland/Urban Interface and across the landscape. Wildland/Urban Interface treatments have maintained large trees across the landscape and are reducing competition between trees for water and nutrients thereby moving toward the larger VSS size classes important for Abert squirrels.

Treatments will provide protection from stand-replacing crown fires to remaining squirrel habitat within the project area.

Elk

Affected Environment

The Forest Plan designates elk as an MIS for early seral stages of ponderosa pine, mixed conifer, and spruce-fir habitat types. Grasslands and early-seral stage woodlands are also important to this species. Elk are associated with the deciduous thickets and early-seral stages of forests that contain an interspersion of the grass/forb vegetation type. Forest-wide population trend is essentially stable. There was an increase in elk numbers in the early to mid 1990's with a gradual decline back to late 1980's levels.

The project area provides summer range for elk and is located within Arizona Game and Fish Department's Game Management Unit (GMU) 7M and 7E. Game Management Unit 7 shows a generally increasing trend in elk numbers.

The Forest-wide population trend is stable. Elk numbers on the Forest increased in the early to mid 1990's, with a gradual decline through 2001 to roughly the 1980's level.

Elk are found throughout the project area. Elk are known to winter near Turkey Hills and west of Mount Elden within the project area. Elk were documented to occur on Campbell Mesa within the project area.

The Forest-wide habitat trend for early seral stage ponderosa pine trend is stable. The age class distribution of ponderosa pine has remained essentially the same, dominated by mid-seral stage sites, with some loss of old growth and older trees, and some early seral-stage habitat created by wildfire. Early seral-stage ponderosa pine has not increased to any large degree.

Environmental Consequences

Effect of No Action

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. There would be no effect on the forest-wide habitat or population trends for elk. However, dense forest conditions would still occur and the high fire hazard potential would persist. Dense forest conditions would do nothing to reduce grazing pressure to aspen, oak meadows and riparian habitats which are documented to be impacted by elk grazing.

Proposed Action

The Proposed Action will increase the amount of early seral stage ponderosa pine through meadow thinning projects and increase mountain grassland habitat. Open canopy areas in ponderosa pine would increase by 2,878 acres increasing the habitat quality and distributing elk foraging throughout the project. This will have the added benefit of reduce grazing pressure to aspen and oak. Much of the grassland habitats would move from early seral ponderosa pine to grass/forb/shrub habitat with no change in habitat quantity and a slight increase in quality. This increase in habitat quality is too small to alter Forest-wide population and habitat trends.

Cumulative Effects

Roads and trails within elk habitat provide access to recreation activities thereby potentially disturbing elk.

Hairy Woodpecker

Affected Environment

The Forest Plan designates the hairy woodpecker a MIS for snags in ponderosa pine, mixed conifer, and spruce-fir forests for suitable nesting and feeding habitat. Hairy woodpeckers are most abundant in mature forests with large old trees suitable for cavity nesting and are also common in medium-aged forests. Hairy woodpeckers prefer forests with dense canopies (Bushman and Therres 1988). They use tree cavities for roosting and winter cover and may excavate new cavities in fall to be used for roosting (Sousa 1987). This species is experiencing loss of suitable breeding habitat in the form of snags, both range-wide and in Arizona. According to Latta et al. (1999), hairy woodpeckers are uncommon throughout their range yet common in their preferred habitat in Arizona.

Data from the Coconino National Forest, as well as statewide data, indicate that hairy woodpecker populations are stable, or slightly increasing on the Forest. Forest-wide, the snag component in ponderosa pine forest has declined, but has increased in mixed conifer and spruce-fir forest due to wildfire and insect outbreaks/disease (USDA 2002). Hairy woodpeckers are fairly common in conifer forest types within the project area.

The Forest-wide population trend is stable, or slightly increasing. Minor population decreases occur on a short-term scale of 1-3 years, but are generally followed by a recovery (USDA Forest Service 2002). Hairy woodpeckers were documented to occur throughout the project area.

The Habitat trend for snag component of ponderosa pine, mixed conifer, and spruce fir is declining. Snags in the ponderosa pine type are being lost faster than they are being replaced and large snags are lost at a disproportionate rate to small snags.

Environmental Consequences

Effect of No Action

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. There would be no effect on hairy woodpecker. However, dense forest conditions would still occur and the high fire hazard potential would persist.

Proposed Action

Management of old growth, target/threshold, Mexican spotted owl habitats, northern goshawk PFAs and snags will provide habitat for the hairy woodpecker. The Proposed Action progress sites to larger VSS classes providing for more recruitment snags. There may be some losses of snags overall, slightly reducing habitat quality across the project area. This loss of snags will not alter the habitat quality enough to render it unusable and will have no effect to the Forest-wide habitat or population trend for the hairy woodpecker.

Cumulative Effects

Private land development will reduce habitat for these species. Removal of hazard trees for powerlines and highway safety will reduce snags and reduce habitat for snag dependant species. These projects combined with the Proposed Action are not expected to reduce habitat quality enough to alter Forest-wide population or habitat trends.

Northern Goshawk

Affected Environment

The Forest Plan designates this species a MIS for late seral stages of ponderosa pine forests. 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 2001). On the Coconino National Forest, northern goshawk territories have been monitored 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 11 years; however, this does not signify a corresponding trend in population numbers. It is likely that nonbreeding goshawks would not be observed. During the later years of this time period, precipitation amounts have been below average. 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. Although the forest has some information on territory occupancy and reproduction, these data are not designed to detect changes in population trend. 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.

This species is an indicator of late seral stage of ponderosa pine forests. 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 2001).

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 BBS data indicate a significant increase, but some indicators of occupancy and productivity appear to be declining on the Forest. Monitoring and surveys are ongoing on the forest. There is one Post-fledgling family area (PFA) delineated within the Eastside project area.

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

and, with some loss of old-growth and older trees, and some early-seral stage habitat created by wildfire.

Environmental Consequences

Effect of No Action

Indicator habitat conditions for goshawks would remain in their current condition, not withstanding natural processes. There would be no effect to forest-wide habitat or population trends for northern goshawk. However, dense forest conditions would still occur and the high fire potential would continue to place goshawk habitat at risk with respect to stand replacing fire. The desired conditions for sustaining and developing late seal ponderosa pine habitat would never be attained.

Proposed Action

The Proposed Action will increase the quantity and quality of late-seral (VSS 5 and 6) goshawk indicator habitat from the existing condition. The Proposed Action moves potential nesting habitat to larger VSS classes and will provide an increase in goshawk nesting habitat quality and quantity over time (Table 3-27). The increase in the quantity of late-seral VSS 5 immediately after treatment is more a reflection of the younger trees being reduced to a point where the larger trees are dominate. The Proposed Action is expected to have no effect to the Forest-wide habitat or population trends for the northern goshawk.

Cumulative Effects

Treatments in the Eastside Project area will provide protection from stand replacing crown fires to predicted high quality northern goshawk nesting habitat not only within the project boundary but also in areas northwest of the project, specifically the Marshall Mesa area.

There is no effect to Forest-wide habitat or population trends therefore there is no added effect from past, present or foreseeable projects.

Pronghorn Antelope

Affected Environment

Pronghorn antelope is designated a management indicator species for early and late seral grassland type, which is represented by Management Areas (MA) 9, 10 and 11 in the Coconino National Forest Plan. Pronghorn were selected as indicators of grassland modification and were raised as a public issue during development of the Forest Plan (Goodwin 1980).

A number of factors have been identified that affect pronghorn including severe weather, amount and timing of precipitation, long-term climatic trends, habitat fragmentation, diet overlap with other grazers, reductions in fawn hiding cover, woody vegetation encroachment, fences, human disturbance and development, water availability, predators, parasites and diseases, and nutritional concerns (Nelson 1925, Neff 1986, Neff and Woolsey 1979, O'Gara 1986, Smith et al. 1986, Le Count 1987, Lee et al. 1998, AGFD 2002, Dubay 2002, Ockenfels 1996 in USDA 2002).

Forest-wide population estimates of pronghorn were made in the 1980's and ranged from around 1005-1700; populations were thought to be increasing (USDA Forest Service and Arizona Game and Fish Department (AGFD) 1981, USDA Forest Service and AGFD 1990, USDA Forest Service 1982; USDA Forest Service 1987b in USDA 2002). The forest-wide pronghorn antelope trend is declining, although not equally on the Forest.

The Forest-wide population trend is declining. Declining numbers of animals observed and fawn to doe ratios below a breakeven of 20-35 fawns per 100 does is documented for all GMU's on the Forest except GMU 7. Pronghorn have been reported to move through the Campbell Mesa area within the project. No fawning areas are documented in the project area. The Eastside project area is in GMUs 7E, 7M and 5BN.

The habitat trend for early and late seral grasslands is stable to declining. Although the total amount of grassland habitat has generally remained stable, habitat quality is stable to declining due to tree encroachment, fire suppression, long-term climatic changes, short-term drought, and ungulate grazing. There are seven acres of grassland habitats within the project area. Meadows and openings have been negatively affected by pine encroachment fragmenting habitat for pronghorn.

Environmental Consequences

Effect of No Action

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. Meadows would not be rehabilitated, thus there would not be any benefit to this species. Favorable habitat would decrease over time as conifers encroach meadows. There would be no effect on Forest-wide habitat or population trends. However, dense forest conditions would still occur and the high fire hazard potential would persist.

Proposed Action

Thinning of meadows and grasslands will be beneficial to this species. Openings are maintained and created providing a movement corridor through the project area. Vegetative species composition and diversity are increased and the distribution and diversity of vegetative ground cover is improved. The Proposed Action would result a small increase (200 acres) of habitat for pronghorn although there would be a small increase in habitat quality (<1% of Forest-wide habitat). This increase in habitat quality is too small to alter Forest-wide habitat and population trends.

Cumulative Effects

There is no effect to Forest-wide habitat or population trends therefore there is no added effect from past, present or foreseeable projects.

Pygmy Nuthatch

Affected Environment

The Forest Plan designates the Pygmy nuthatch a MIS for late seral stage ponderosa pine forests. The pygmy nuthatch is generally associated with mature ponderosa pine forests, where it prefers

open, park-like sites of old, yellow pines. It is also found in dense pine forests, as long as large trees and snags are present. The pygmy nuthatch is also tied to old, large oak trees and cavities. This nuthatch requires dead trees or dead-top trees where it builds nests in cavities. Both in Arizona and North America, moderate threats exist on breeding and wintering grounds. Populations are thought to be stable on the Coconino National Forest and statewide. Ponderosa pine snags, a key component for this species, are currently being lost faster than they are replaced and may affect populations of the pygmy nuthatch in the future (USDA 2002).

The Forest-wide population trend is stable, although there are dramatic population fluctuations in the short-term, and small, local populations, such as those in snowmelt drainages, may be temporarily extirpated. Pygmy nuthatches are documented to occur throughout the project area.

The Forest-wide habitat trend for late seral stage ponderosa pine trend is stable. The age class distribution of ponderosa pine has remained essentially the same, dominated by mid-seral stage, with some loss of old-growth and older trees, and some early-seral stage habitat created by wildfire. Overall snags in the ponderosa pine type on the Forest are being lost faster than they are being replaced, and large snags are being lost at a disproportionate rate to small snags.

Environmental Consequences

Effect of No Action

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. There would be no effect on pygmy nuthatch. However, dense forest conditions would still occur and the existing fire hazard potential would persist.

Proposed Action

Trees will grow into the larger diameter classes at a faster rate than with no treatment. The Proposed Action would offer higher quality nesting habitat over time due to the increase in the acres of VSS 5 and 6 sites over the forty years following treatment. Management of old growth, target/threshold, Mexican spotted owl habitat, northern goshawk PFAs and snags will provide habitat for the pygmy nuthatch. There will be no effect to the Forest-wide habitat or population trend for the pygmy nuthatch.

Cumulative Effects

Private land development will reduce habitat for these species. Removal of hazard trees for powerlines and highway safety will reduce snags and reduce habitat for snag dependant species.

Turkey

Affected Environment

The Forest Plan designates turkey as a MIS for late seral stage ponderosa pine forests, based on roost habitat requirements. Although the age class distribution of ponderosa pine has remained dominated by mid-seral stage sites, there had been some loss of old growth and older trees, resulting in a decline in forest-wide habitat trend for late seral- ponderosa pine habitat. Turkey roosts and nesting habitat occur in steep drainages and on hills. Turkey populations on the CNF declined in the early 1990s and have increased since the mid 1990s in probable response to

favorable overwintering conditions, changes in hunt design in the GMU, and contributions to overall mast production from trees from the 1919 seed year. The age class distribution of ponderosa pine has remained the same during Forest Plan implementation. Late seral stage trees have remained largely unchanged on slopes greater than 40 percent. The loss of large old trees occurred on slopes less than 40 percent during the early stages of Forest Plan implementation. The rate of loss due to timber harvest is now much reduced and harvest of trees over 24 inches DBH rarely occurs. Other factors affecting turkey populations are lack of cover in key areas (including travel corridors), water availability, and forage availability are important factors (USDA 2002).

Turkey habitat in the project area consists of ponderosa pine forest with openings and small meadows for foraging during the summer months. Ponderosa pine and Gambel oak mast are the key habitat attributes and steep drainages and hillsides provide nesting and roosting habitat. Currently, known turkey roosting areas are along Walnut Canyon and in the Turkey Hills area.

There are two documented/marked roosts in the project area. The roosts are mostly along Walnut Canyon and are associated with the pine/oak habitat. There are currently adequate numbers yellow ponderosa pine trees per acre 16" and greater which could provide roosting habitat.

Although late seral ponderosa pine habitat has declines some since the Forest Plan was initiated in 1987, and turkey population trends in the early 1990's probably declined, data from the last five years show that populations are increasing on the Coconino National Forest.

The Forest-wide population trend is increasing. The trend was variable in the early part of the Plan implementation period (late 80's and early 90's), although AGFD standard survey procedures did not provide good data due to low number of observations along survey routes. AGFD developed a better index of turkey populations in the mid 1990's. Data from 1997-2001 indicate a modestly increasing trend. For the last five years, GMU 7 shows a relatively stable trend, with all other GMUs showing a general increasing trend for both percent of archery elk hunters seeing turkeys and the number of turkeys seen per day (USDA Forest Service 2002).

The Forest-wide habitat trend in late seral ponderosa pine is stable. The age class distribution of ponderosa pine has remained essentially the same, dominated by mid-seral stage sites, with some loss of old-growth and older trees, and some early seral stage habitat created by wildfire.

Actual and potential turkey habitat within the project boundary is located primarily along Walnut Canyon and the Turkey Hills. There are two turkey roosts identified within the project area along the rim of Walnut Canyon. These roosts are not evenly distributed across the project and do not reach the desired number per section as stated in the Forest Plan.

Environmental Consequences

Effect of No Action

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. There would be no effect on turkey. However, dense forest conditions would still occur and the high fire hazard potential would persist.

Proposed Action

Turkey nesting and roosting habitat overlaps with the Walnut Canyon wildlife corridor. In these habitats, all yellow-barked ponderosa pine trees will be retained while old tree longevity is improved. Furthermore, old growth recruitment areas and target/threshold sites are identified within turkey habitat and will add to the potential of increasing numbers of turkey roost tree groups. Turkeys are known to use the rim of Walnut Canyon for roosting and feeding and loafing. A 200 foot deferral along the rim of Walnut Canyon will maintain vertical diversity providing thermal and hiding cover for turkey using this area. Forest Plan standards and guidelines will be met for turkey.

Two turkey roost tree groups per section, in actual or potential turkey habitats will be retained. Trees will grow into the larger diameter classes at a faster rate than with no treatment. The Proposed Action would offer higher quality roosting habitat over time due to the increase in the acres of VSS 5 and 6 sites over the forty years following treatment.

There will be no effect to the Forest-wide trend for turkey habitat or populations.

Cumulative Effects

There is no effect to Forest-wide habitat or population trends and there is no added effect from past, present or foreseeable projects.

Red-naped (Yellow-bellied) Sapsucker

Affected Environment

The Forest Plan designates the red-naped sapsucker a MIS for the late seral stage and snag component of aspen. Red-naped sapsuckers nest primarily in aspen, or in deciduous/mixed conifer forest, often near water. Live trees are preferred although dead trees (usually spruce or other conifers) are used at times. This species excavates a new hole each year. They extricate sap and soft cambium layer around willows, cottonwoods, aspen and walnuts. Nest trees are a minimum DBH of 10 inches with a minimum height of 15 feet. They favor groups of large aspens near heads of higher elevation canyons during the summer.

On the Forest, mid- to late-seral stage aspen are declining, due to both natural causes and management actions to regenerate sites. Some early seral stage sites are being created through wildfire and management activities, but recruitment is limited primarily due to grazing by animals. The forest-wide snag distribution of aspen has been declining through out the Forest Plan implementation period. Currently, most aspen on the Forest is in the older age classes, providing habitat for sapsuckers, but future Forest-wide trends are of concern, since aspen regeneration remains an on-going problem.

Available population data on the Forest comes from Christmas bird count, Breeding Bird Surveys, and long-term research conducted along the Mogollon Rim. Collectively, these data indicate that red-naped sapsucker populations fluctuate overtime, but are stable overall on the Coconino National Forest (USDA 2002).

Environmental Consequences

Effect of No Action

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. There would be no effect on Forest-wide trends population and habitat trends. However, pine encroachment and browsing by ungulates will continue to reduce the ability of sites to develop into mature aspen sites important to sapsuckers.

Proposed Action

Habitat conditions for the red-naped sapsucker would remain in their current condition, not withstanding natural processes. There are no treatments proposed for aspen. The Proposed Action would have no effect on Forest-wide trends population and habitat trends.

Cumulative Effects

Aspen habitat protection projects may include fencing approximately 10 acres of aspen within the project area in the near future. This will provide protection from browsing by livestock and wild ungulates and allow these sites to develop into mature aspen sites thereby providing habitat for the red-naped sapsucker.

Mule Deer

Affected Environment

The Forest Plan designates the mule deer as an MIS for early-seral stages of aspen and pinyon/juniper woodlands. Early seral stages of ponderosa pine, mixed conifer, and chaparral habitats are also important for this species. Mule deer are primarily browse on green shoots and fruits of shrubs and trees, but also feed on grasses and forbs. Mule deer populations have not done well on the CNF since Forest Plan implementation, due to many factors, such as disease, poaching, climatic conditions, and habitat changes resulting in a declining Forest-wide trend (USDA 2002).

Although age class distribution has remained relatively stable in pinyon/juniper, the vigor of understory components, such as grasses, forbs and browse species, continues to be affected in areas with numerous young pinyon/juniper trees. Creation of early seral aspen and pinyon/juniper through wildfire or management actions has not occurred at a sufficient enough scale to positively influence browse production that would benefit mule deer (USDA 2002). Consequently the Forest-wide habitat trend for mule deer has declined somewhat overall.

The Forest-wide population trend is declining. The number of deer seen per hour and the number of fawns per 100 does from 1985 through 2001 varies, but the trend is declining. In good years, fawn production has been at levels minimal to sustaining populations, but in poor precipitation and forage years, fawn production has not kept up with mortality rates.

The Forest-wide habitat trend in early seral stages of aspen is declining. Some early seral stage sites are being created through wildfire and management activities, but recruitment is limited primarily due to grazing by animals. Management activities have not en implemented to a level,

or over enough area, to prevent loss of aspen patches and provide adequate aspen recruitment. There is no aspen within the project area.

The Forest-wide habitat trend in pinyon/juniper woodlands is stable. The age class distribution has remained relatively stable. Less than 5% of pinyon/juniper on the forest has been converted to grassland through wildfire or management actions. All pinyon/juniper habitat within the project is late seral stage. There is no early seral stage pinyon/juniper habitat within the project area and therefore no indicator habitat for mule deer.

Environmental Consequences

Effect of No Action

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. There would be no loss of habitat for mule deer. There would be no effect on Forest-wide trends population and habitat trends. However, dense forest conditions would still occur and the existing fire hazard potential would persist.

Proposed Action

There are 377 acres of fuelbreak construction proposed in pinyon/juniper habitat. These treatments will move habitat from late seral stage to early seral stage pinyon/juniper increasing indicator habitat within the project area. The Proposed Action would have no effect on Forest-wide population and habitat trends.

Cumulative Effects

There is no effect to Forest-wide habitat or population trends therefore there is no added effect.

Juniper (Plain) titmouse

Affected Environment

The Forest-wide population trend is stable to slightly decreasing. BBS trend data for Arizona indicate a slightly decreasing trend between 1996 and 2000. Christmas bird count data indicate a stable to slightly declining trend for wintering juniper titmice on the Forest.

The Forest-wide habitat trend for late seral and snag components of pinyon/juniper is stable. The age class distribution of pinyon/juniper has remained relatively stable throughout the Forest Plan implementation period. A very small portion of total pinyon/juniper acres has been converted to grasslands or early seral stage pinyon/juniper through wildfire or management actions. Older pinyon pine trees are dying out in many areas due to drought and insect outbreaks, but firewood cutting has probably reduced snag densities especially close to Flagstaff.

Environmental Consequences

Effect of No Action

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. There would be no loss of habitat for Juniper titmouse. There would be no effect on

Forest-wide trends population and habitat trends. However, dense forest conditions would still occur and the existing fire hazard potential would persist.

Proposed Action

There are 377 acres of fuelbreak construction proposed in pinyon/juniper habitat. These treatments will move habitat from late seral stage to early seral stage pinyon/juniper decreasing indicator habitat within the project area. The fuelbreak will vary in width and all yellowpines greater than 16" diameter and 5-10 pinyon pine or juniper trees per acre will be retained. These trees will provide habitat within the fuelbreak for titmice. Reducing habitat quantity by 377 acres would have no effect on Forest-wide population and habitat trends.

Cumulative Effects

There is no effect to Forest-wide habitat or population trends therefore there is no added effect.

Mexican Spotted Owl

Affected Environment

The Forest-wide trend population trend is inconclusive. The Forest has monitoring data on territory occupancy and reproduction, and a demography study had a study area on the Forest from 1991-19998, but these data do not yield reliable population trend information. The demography study indicated a declining trend, but the study did not span a sufficient time period to make long-term population trend estimates, and climatic factors are thought to play a significant role in influencing survival and reproduction of owls (Seamens et. al. 2002).

The Forest-wide habitat trend for late seral mixed-conifer and spruce fir is declining. From 1989-2002, stand replacing fires have affected approximately 12% (6,000 acres) of mixed-conifer and spruce-fir on the Forest, resulting in a shift to early seral stage.

Environmental Consequences

Effect of No Action

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. There would be no loss of habitat for Mexican spotted owl. There would be no effect on Forest-wide trends population and habitat trends. However, dense forest conditions would still occur and the high fire hazard potential would persist.

Proposed Action

There are 21 acres of treatment in mixed-conifer habitat. These treatments will move habitat from late seral stage to early seral stage mixed-conifer decreasing indicator habitat within the project area. Reducing habitat quality by 21 acres (.04% of Forest-wide habitat) would have no effect on Forest-wide population and habitat trends.

Cumulative Effects

There is no effect to Forest-wide habitat or population trends therefore there is no added effect.

Red Squirrel

Affected Environment

The Forest-wide population trend is inconclusive since there is no Forest-specific data. The Heritage rating in Arizona is S5, indicating a secure population in the state. However, AGFD does not quantify squirrel populations, since breeding populations are unaffected by hunting, and because determining the size of game populations is very difficult. AGFD tracks only hunter harvest information, which shows a relatively stable number of squirrels killed per hunter day from 1988-1999. This includes both Abert squirrels and red squirrels, but the vast majority of tree squirrels harvested are tassel-eared squirrels.

The Forest-wide habitat trend for late seral mixed-conifer and spruce fir is declining. From 1989-2002, stand replacing fires have affected approximately 12% (6,000 acres) of mixed-conifer and spruce-fir on the Forest, resulting in a shift to early seral stage.

Environmental Consequences

Effect of No Action

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. There would be no loss of habitat for red squirrels. There would be no effect on Forest-wide trends population and habitat trends. However, dense forest conditions would still occur and the existing fire hazard potential would persist.

Proposed Action

There are 21 acres of treatment in mixed-conifer habitat. These treatments will move habitat from late seral stage to early seral stage mixed-conifer decreasing indicator habitat within the project area. Reducing habitat quality by 21 acres (.04% of Forest-wide habitat) would have no effect on Forest-wide population and habitat trends.

Cumulative Effects

There is no effect to Forest-wide habitat or population trends therefore there is no added effect.

Migratory Birds

Affected Environment

The Anderson Mesa IBA includes a small portion of the southern portion of the project close to Walnut Canyon. There are approximately 755 acres within the IBA and they include all of 318/02 and portions of 318/01, 03 and 317/01, 02. The diversity of available habitats is expected to provide habitat for many species of songbirds. Table 3-28 is a list of species eliminated from detailed analysis because the habitat is not found within the project area. Table 3-29 summarizes

each migratory bird species of concern by habitat, and special habitat factors for each species. Following the tables are descriptions of these species status within the project area.

Table 3-28. Migratory bird species considered but eliminated from detailed analysis.

Bird Species	Habitat
Elegant Trogon	High Elevation Riparian
McGillivray's Warbler	High Elevation Riparian
Red-faced Warbler	High Elevation Riparian
Common Black-hawk	High Elevation Riparian
Water Pipit	Alpine
Swainson's Thrush	Spruce-fir
Pine Grosbeak	Spruce-fir
Golden-crowned Kinglet	Spruce-fir
Three-toed woodpecker	Spruce-fir

Table 3-29. Priority bird species by habitat and those that are or have the potential to be found within the project area.

Bird Species	Vegetation Type	Habitat
Olive-sided flycatcher	Douglas fir, ponderosa pine	Mature pines and snags with openings and edges.
Cordilleran flycatcher	Ponderosa pine, Douglas fir, maple, oak, aspen	Middle to late successional forest with dense canopy and snags.
Purple martin	Ponderosa pine	Large snags in or near open areas.
Red-naped sapsucker	Aspen	Late seral and snag component of aspen. Tree species commonly associated with red-naped sapsuckers include aspen, cottonwood, alder, sycamore, spruce, white-fir, and Douglas –fir.
Ferruginous hawk	High elevation grassland	Varied.
Swainson's hawk	High elevation grassland	Varied
Burrowing Owl	High Elevation grassland	Take over burrows of prairie dos and ground squirrels, and dens of coyote, fox and badger. They are also known to use artificial burrows. These owls also need perches, such as mounds and fence posts.
Gray Flycatcher	Primary: pinyon pine and/or juniper, with an open overstory of ponderosa pine. Secondary: sagebrush, greasewood	Larger sites of pinyon/juniper with an open understory, some areas with sagebrush and some ground cover. Larger, taller sites of sagebrush and greasewood.
Pinyon Jay	Pinyon/Juniper where pinyon is dominant	Commonly in extensive sites of pinyon/juniper with open physiognomy. May increase as middle and understory decrease. Use extensive sites for foraging (up to 5 square miles).
Gray Vireo	Pinyon Juniper with broadleaf shrubs	Low and tall shrubs with a tree component. Drier, rocky, steep slopes.
Black-throated Gray Warbler	Mostly pinyon, also commonly occurs in Madrean oak/pine in southeastern Arizona with shrub component	In taller and denser pinyon/juniper. Prefers relatively heavy conifer cover. Forage most often in pinyon.
Juniper Titmouse	Pinyon Juniper and riparian if adjacent to pinyon/juniper	Late successional pinyon/juniper woodland. Large pinyon/juniper trees.

Habitat Types

Pine and Pine-Gambel Oak

Ponderosa pine habitat type occurs throughout the project area. Gambel oak is most prevalent in the southern portion of the project area. Four species have been identified as species of concern in pine-pine/oak habitats. They are northern goshawks, olive-sided flycatchers, Cordilleran flycatchers, and purple martins.

Aspen

Aspen habitat is limited with few acres occurring in scattered patches. The red-naped sapsucker has been listed as a species of concern in aspen habitat.

High Elevation Grassland

High elevation grassland habitat types include the meadows and grassland areas. Three species have been identified as species of concern in high elevation grasslands. They are ferruginous hawk, Swainson's hawk and burrowing owl.

Pinyon/Juniper

Pinyon/Juniper habitat is primarily located on the east of Turkey Hills on the east side of the project area. Transition, grassland and sparse pinyon/juniper are found north of Walnut Canyon Park boundary. Pinyon jay, gray vireo, black-throated gray warbler and juniper titmouse are species of concern in this habitat type.

Species

Olive-sided Flycatcher

Olive sided flycatchers prefer forest edges and natural or human-made openings in spruce-fir, mixed conifer, and ponderosa pine forest types. They nest high in coniferous trees and forage primarily on flying insects. Management recommendations include maintenance of creation of opening, management for uneven-aged forest structure, and retention of tall snags or dead-topped trees during salvage operations (Latta 1999).

Cordilleran Flycatcher

Cordilleran flycatchers breed predominately in pine, but also spruce, fir and aspen forests. They prefer mist and shaded forest. This species is a facultative secondary cavity-nester that also uses rock crevices, tree roots, and forks in small branches. Numbers of birds have been found to be positively correlated with canopy cover, within site variability of tree sizes (most abundant in sites with five to twenty percent of pine basal area comprised of one to five inch DBH stems), and snag density. Cordilleran flycatchers need snags and downed logs for nesting. This species is a rare cowbird host. Management recommendations include management for greater than or equal to 2 snags per acre, manage for greater than 383 ponderosa pine/acre with high variability in size classes, and avoid mechanical thinning of canopy and snags (Latta 1999).

Purple Martin

In Arizona pine forests, purple martins prefer areas with high snag density adjacent to or in open areas. They are secondary cavity-nesters and forage primarily on flying insects. Management recommendations include creation and retention of large snags (Latta 1999).

Red-naped Sapsucker

The red-naped sapsucker is considered a "double keystone" species for its role in excavating cavities and drilling sap wells, which are both used by a variety of other species for nesting and feeding (Natureserve 2002). The red-naped sapsucker is found foraging in coniferous forests that include aspen and other hardwoods, as well as riparian areas. The sapsucker generally nests in aspen trees or snags. This highly migratory species, travels to neotropical areas and also descends to lower elevations in winter.

Ferruginous Hawk

Ferruginous hawks historically nest in open shrublands, woodlands, and grasslands in southeastern and northern Arizona. The current distribution of breeding birds is restricted to Plains and Great Plains Basin grasslands in northern and northeastern Arizona. Ferruginous hawks range more widely in winter and are found throughout the state, often in agricultural areas and other open habitats (Latta 1999). Ferruginous hawks forage in montane grasslands in the Flagstaff vicinity. Management recommendations include the reduction of chemical control of prairie dogs, particularly in suitable nesting habitat and treatment to control exotic species encroachment of grasslands.

Swainson's Hawk

The hawks eat grasshoppers during migration and on wintering grounds. They have a wider variety of food sources than ferruginous hawks: e.g. lizards, snakes, birds, ground squirrels, voles, pocket gophers. Non-breeders hunt communally and eat primarily insects. Not as sensitive to human disturbance as ferruginous hawks.

Burrowing Owl

Burrowing owls take over burrows of prairie dogs and ground squirrels, and dens of coyote, fox and badger. They are also known to use artificial burrows. These owls also need perches, such as mounds and fence posts. They primarily eat insects and small mammals, but are known to take other small-sized species.

Black-throated Gray Warbler

Black-throated Gray Warbler is primarily associated with pinyon pine and juniper woodlands (occasionally with scattered ponderosa pine). Uses shrubby component and prefer openings between older, taller trees. Burning or mechanical thinning that creates small openings but retains larger trees would benefit this species.

Juniper Titmouse

Juniper Titmouse is a fairly common resident that uses late successional pinyon/juniper woodlands. Burning or mechanical thinning that creates small openings but retains larger trees would benefit this species.

Pinyon Jay

Pinyon Jays use mid-late successional pinyon/juniper. Maintenance of large cone bearing pinyon trees (75 years and older) in mature pinyon/juniper woodlands or pure pinyon pine woodlands as pine nuts are an important food source. Burning or mechanical thinning that creates small openings but retains larger trees would benefit this species.

Gray Flycatcher

Gray Flycatcher is most common in mid-late successional stages of pinyon pine and/or juniper with open understory sometimes interspersed with sagebrush, cliffrose and barberry. They may need some ground cover to support insect populations for foraging. Burning or mechanical thinning that creates small openings but retains larger trees and cliffrose component would benefit this species.

Gray Vireo

Gray vireo breed in open mature pinyon/juniper woodlands on canyon and steep mesa slopes from 3200-6800 ft in elevation. Prefer open pinyon/juniper woodland with a shrubby understory, especially on rocky slopes. Because of their tendency to occupy undisturbed canyon and mesa slopes they may be relatively immune to habitat-related population declines. Managing fire to maintain existing gray vireo habitat matrix and to prevent sites from becoming too dense would benefit this species. Burning or thinning that creates small openings but retains larger trees would benefit this species.

Environmental Consequences

Effect of No Action

There would be no changes in the project area. Habitat conditions for birds would generally remain the same, notwithstanding natural processes. There would be no effect on migratory birds. However, dense forest conditions would continue to place forest-dwelling migratory bird habitat at risk with respect to stand-replacing fire.

Proposed Action

Northern goshawk and Mexican spotted owl are discussed in previous pages of this report. Proposed activities may affect these species directly through habitat modification, or indirectly through changes in prey populations.

Species Richness is associated with pine and pine oak habitats. Most of the high species rich areas are associated with MSO habitat in the project and treatments are designed to maintain habitat components important for these species as well as forest-dwelling passerine birds.

Olive-sided flycatcher is associated with forest openings and edges with numerous dead trees and live, mature pines. Disturbances to individuals from thinning and burning will be short-term. This species has been linked to burned areas of ponderosa pine (Altman 1997, Blake 1982, Lowe et al. 1978 in Latta et al. 1999), and burning will likely have short-term beneficial effects by increasing insect abundance post burn. Effects from vegetation modification and burning treatments will be beneficial due to the creation of openings and more edge effect, the retention of snags and large trees.

Cordilleran flycatcher is associated with mid- to late-successional stages with dense canopy cover and drainages that create a cool microclimate. Disturbances to individuals from thinning and burning will be short-term. Through vegetation modification this project will create some open habitat, which favors early successional birds, not mid-to late successional ones like the flycatcher. However, the project area will continue to support mostly mid-successional and late-successional stages and will maintain habitat in canyons and drainages, which favors this species.

Purple martin is associated with open-canopy, open mid-story and open understory cover, and high snag density. A lack of snags likely limits the abundance and distribution of this species in the project area. The more open understory created by thinning and burning activities favors this species, and burning will likely have short-term beneficial effects by temporarily increasing insect abundance. The Proposed Action will provide slightly more open canopy habitat within the project.

Red-naped sapsucker nests in snags in mature to old aspen stands. It is worthy to note that drought conditions and ungulate grazing over the past several years have affected aspen stands in the project area. The remaining living aspen are severely stressed and are primarily seedlings. The Proposed Action will fence off ten acres of aspen within the project area in an effort to reduce livestock and wild ungulate grazing and provide young seedlings an opportunity to develop into mature aspen over time.

Swainson's hawk is uncommon during June, July and during migration. The amount of openings within the project and the two prairie dog colonies provide prey availability for Swainson's hawks. Due to the creation of openings within the project, there will be a slight increase in prey availability within the project. It is expected there will be no detectable effect to Swainson's hawk.

Ferruginous hawk is a migrant or uncommon during the winter. Due to the creation of openings within the project, there will likely be a slight increase in prey availability for ferruginous hawks. It is expected that there will be no detectable effect to ferruginous hawks.

Burrowing owl nests in burrows in dry, open grasslands. They also inhabit grass, forbs, and open shrub stages of pinyon pine and ponderosa pine habitats. There are two existing prairie dog colonies that provide potential burrows for nest sites, however, there are no known populations of burrowing owls within the project. Due to the creation of openings and grassland thinning treatments within the project, there will likely be increased prey availability for burrowing owls. Prairie dog colonies will be maintained in the Proposed Action. There will be no detectable effect to burrowing owls.

Black-throated Gray Warbler is primarily associated with pinyon pine and juniper woodlands (occasionally with scattered ponderosa pine). Uses shrubby component and prefer openings between older, taller trees. Burning or thinning that creates small openings but retains larger trees would benefit this species.

Juniper Titmouse is a fairly common resident that uses late successional pinyon/juniper woodlands. Burning or thinning that creates small openings but retains larger trees would benefit this species. Fuelbreak construction in pinyon/juniper habitat will reduce habitat for this species near private property. Snags and 5-10 pinyon or juniper trees will be retained in an attempt to maintain important habitat components on the landscape.

Pinyon Jays use mid-late successional pinyon- juniper. Maintenance of large cone bearing pinyon trees (75 years and older) in mature pinyon juniper woodlands or pure pinyon pine woodlands as pine nuts are an important food source. Burning or thinning that creates small openings but retains larger trees would benefit this species.

Gray Flycatcher is most common in mid-late successional stages of pinyon pine and/or juniper with open understory sometimes interspersed with sagebrush, cliffrose and barberry. They may need some ground cover to support insect populations for foraging. Burning or thinning that creates small openings but retains larger trees and cliffrose component would benefit this species. Treatments and deferrals are designed to maintain and enhance cliffrose populations.

Gray Vireo breed in open mature pinyon/juniper woodlands on canyon and steep mesa slopes from 3200-6800 ft in elevation. They prefer open pinyon/juniper woodland with a shrubby understory, especially on rocky slopes. Because of their tendency to occupy undisturbed canyon and mesa slopes they may be relatively immune to habitat-related population declines. Managing fire to maintain existing gray vireo habitat matrix and to prevent stands from becoming too dense would benefit this species. Burning or thinning that creates small openings but retains larger trees would benefit this species.

Cumulative Effects

The area of analysis is the project area. Ongoing recreational activities may result in disturbance of migratory birds. Private and State land development will reduce habitat for these species. Removal of hazard trees for powerlines and highway safety will reduce snags and reduce habitat for snag dependant species. Present and future activities have common objectives to improve current conditions by improving soil conditions, reducing competition of trees, managing for return of the large tree components and providing snags, logs and coarse woody debris in sufficient quantity to provide for raptor species.

Treatments in the Eastside project area will provide protection from stand-replacing crown fires to high species rich habitats.

No significant cumulative effects to migratory birds would occur from implementation of the Proposed Action when added to past, present and reasonably foreseeable future actions.

Cultural Resources

Affected Environment

The Eastside project is located in an area of high archaeological site density. Within the project area's 21,075 acres there are 701 known archaeological sites. These sites consist primarily of prehistoric artifact scatters, pithouses, and masonry structures made of basalt and dacite cobbles. There are also a number of historic sites dispersed throughout the project that are associated with railroad logging and homesteading activities.

The existing conditions and fuel loading of known archaeological sites in the project area have been evaluated with 74% identified as fire tolerant. Dead pinyon pine and other fuels throughout the project area have the potential to contribute to adverse fire effects on the other 26% of cultural resources from both prescribed and wildfire. All sites are subject to potential ground disturbing suppression actions.

The archaeological surveys addressed potential impacts resulting from the proposed undertaking including mechanical thinning, hand thinning, temporary road construction, and prescribed fire. The entire project area was either completely inventoried or sampled depending on site densities derived from forest archaeological models. Sample surveys are typically around 15 to 20 percent of the project area and complete survey is considered one-hundred percent based on pedestrian surveys of 20 meters apart. Surface artifacts and features were identified and documented by use, date, phase, and cultural affiliation. Fire fuel loading evaluations were completed for each site. These evaluations consist of assessing the amount of fuels on each site, potential residence time a fire will burn, and the fire tolerance of constructed features, and artifacts. Fire tolerance of a site is determined through examining artifact and feature materials, on site fuel loads, standing dead trees, slash piles, and the fire return interval of the area (has the site burned before historically or prehistorically and how often).

Environmental Consequences

Predicated on the fire return interval of ponderosa pine forests (Covington, 1997) and current fire effects research on heritage resources (Deal, 2004 and 1999; Jackson, 1998; Rude, In Press; and Ruscavage-Barz, 1999, et al) prescribed burning will be allowed within fire tolerant archaeological sites. These sites will not be adversely affected per the 2001 Region 3 Wildland Urban Interface Programmatic Agreement (WUI PA). Fire intolerant sites will be excluded from prescribed burning and all National Register eligible sites will be avoided by mechanical or other ground disturbing activities.

Effect of No Action

Existing fuels in and around archaeological sites will remain as they are and continue to increase. No action may result in high intensity wildfires that these sites have not been subjected to in the past resulting in possible subsurface artifact damage and potentially ground disturbing fire suppression tactics.

Fire suppression actions, particularly bulldozer operations, may damage or completely destroy surface and subsurface heritage resources resulting in the loss of those resources and their associated data. Intense wildfires may also contribute to increased erosion of sites leading to the loss of their research potential and eligibility for the National Register of Historic Places. Since most of the project area lies within the Wildland/Urban Interface, aggressive suppression actions are likely to occur, and the possibility of damage to a significant numbers of heritage resources is possible through ground disturbing fire suppression actions.

Proposed Action

Unnatural fuel loading will be reduced in and around National Register eligible archaeological sites. Wildfires and associated suppression actions along with post fire erosion impacts will be reduced through thinning and low to moderate intensity prescribed burning. Initial reduction of heavy fuels may lead to an increase in site visibility, public visitation, and possibly vandalism.

Allowing low intensity prescribed fires to burn through prehistorically/historically burned archaeological sites along with thinning will reduce current fuel loads in and around those sites. This treatment will prevent extensive heat damage during any future wildfire event thus lowering fire damage to heritage resources. Increased visibility/vandalism resulting from loss of ground cover can be mitigated through archaeological monitoring, public education and law enforcement

patrols. Additionally, ground cover will recover more quickly after a low intensity prescribed fire than after a high intensity wildfire.

If the Proposed Action is implemented, emergency fire suppression activities will be lessened and the potential for ground disturbing activities like bulldozer fire-line construction will be reduced protecting National Register eligible heritage resources per the 1966 National Historic Preservation Act as amended, the 2001 Region 3 WUI PA, 2001 and the 1987 Coconino National Forest plan.

Erosion from high intensity fires through soil sterilization and complete loss of ground cover will be reduced through selective thinning and low intensity burning that will not sterilize soil and leave portions of the existing ground cover. Fire intolerant sites will be excluded form burning and ground disturbing actions unlike in an emergency wildfire situation.

Cumulative Effects

Fire damage, suppression actions, increased visibility/vandalism, and erosion are the primary issues involving archaeological properties in the project area. Cumulative effects are minimal and can be reduced and /or mitigated through appropriate actions for this and other WUI Fuels project on the forest.

There will be no cumulative effects resulting from fire damage as current forest fuels projects allow the burning of previously burned or fire tolerant sites and exclude all fire intolerant sites from those actions. There will be no change in the current status or treatment of archaeological sites resulting from the project.

There will be no cumulative effects resulting from suppression, any more than without this project. Currently in the WUI, the forest uses aggressive suppression tactics and life and property takes precedence over all other values. The Proposed Action will reduce the need for emergency suppression actions, and in the unlikely event suppression actions are necessary, they will be minimal after treatment.

There is a possibility of increased cumulative effects with regards to the visibility/vandalism issue for archaeological properties. The Eastside project has more archaeological sites of all other WUI Fuels projects on the forest combined. Much of the Eastside area is used by local residents for recreation and the reduction of ground cover through thinning and burning has the potential to increase site visibility and vandalism issues. This situation can be mitigated through the measures previously identified.

Cumulative effects of erosion issues resulting from prescribed burning are currently unknown. However, if low to moderate intensity prescribed fires are implemented and some vegetation remains, erosion should be minimized. However, to reduce any potential threat, post fire archaeological monitoring, especially on slopes, drainages, and other high probability areas, will be implemented.

Landscape Aesthetics

Affected Environment

Most of the Eastside project area occurs within the urban interface between public and private lands primarily around the east half of Flagstaff and outlying residential areas. The National Forest System lands within the area is dissected by several heavily traveled federal, State, county, city, and residential highways and roads. The project area is generally the forested, natural appearing scenic setting prized by residences and visitors to the east side of the greater Flagstaff 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.

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 typical of the Flagstaff character type (Character Types of Arizona and New Mexico, USDA). Research suggests that a more open forest with less ground litter and more big trees, typical of the historic forest, is more appealing to most people than the typical sites found on the Colorado plateau today. 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 provides a base line for comparison with modern conditions and helps us to understand the scenic potential of the area.

Overall existing scenic integrity could be defined as "moderate" meaning that 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 cities of Flagstaff's size. Over the past several years increased recreation use of areas adjacent high use access roads and residential developments have resulted in increasing visible evidence of human activity such as fire rings, compacted bare ground, litter, and additional unauthorized roads and ATV tracks. All of these additional elements in the landscape detract from its natural appearance and degrade the areas' scenic integrity resulting in a "low" to "moderate" scenic integrity rating that generally equates to a "modification" VQO for the specific areas affected.

In contrast, most of the project area located away from the residential areas and high use Forest roads have high scenic integrity that equates to the prescribed R and PR VQO's defined in the Forest Plan for the affected area. Past management has altered the vegetative pattern from the more desirable open pine sites with more big trees to the present generally less desirable condition with more dense sites of smaller trees. Even though the resulting landscape looks unaltered and natural to the casual observer and meets the original scenic objectives (VQOs) set forth in the Forest Plan, the existing scenic condition falls short of the potential scenic quality inherent in the historic ponderosa pine forest with its open meadow strung along the major drainages in the area and the open "parks" dominated by large yellow barked trees.

Environmental Consequences

Effect of No Action

No treatment 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 System 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 sites with large areas dominated by "over stocked" small diameter pine trees will continue to define the areas' landscape character.

No treatment will result in a vegetative pattern that tends to decrease the viability of larger, older trees and to favor conditions that result in dense sites 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 project 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 no treatment. Continued management of the present condition of vegetation in the project area could see a loss in considerable scenic value due to an increased risk of wildfire, insect infestation and disease. No treatment 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.

No treatment will maintain the existing landscape character that is presently most common through out the Flagstaff character type. In the long term, this area will either be a remnant of what is now the dominant landscape character, or it will appear like other burned or partially burned landscapes. Either appearance will likely be less appealing to most people than the landscapes resulting from other local management actions, which will contrast with this area.

Proposed Action

The Proposed Action 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 2 growing seasons or less). It will result in a more diverse vegetative mosaic that will generally be less dense and more transparent, and therefore more interesting to the typical person viewing it.

There are several sites within the project area; such as trails and forested areas seen from major roads and residential areas that could suffer short term or longer term detractions from scenic quality due to depletion of the screening that presently exists with the existing thick vegetation. The proposed thinning prescriptions allow for some adjustment to allow for the strategic retention of screening elements in the landscape. Areas that might need slight adjustments to accommodate screening or other esthetic concerns include: thinning areas that could open up views of the electronic site above Mt. Elden; The Campbell Mesa area, areas adjacent the Arizona trail and the Flagstaff urban trail system, the area and trails served by the Hitchin' Post stables operation, as well as numerous subdivisions and residential areas within the project area.

Cumulative Effects

Treatment will result in landscape patterns that will blend with other local landscape patterns resulting from recent management initiatives and trends to help create a more scenic landscape character for the Flagstaff character type in the long term. The Proposed Action will generally enhance the scenic quality of the affected landscape significantly more than with no treatment.

Soil and Watershed

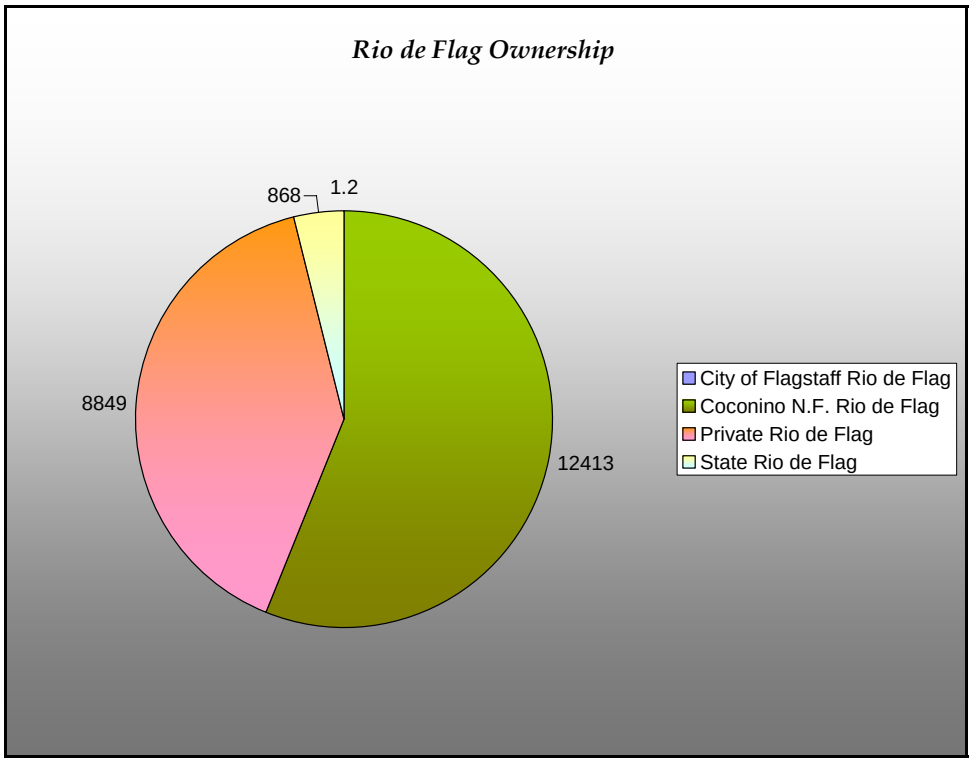
Affected Environment

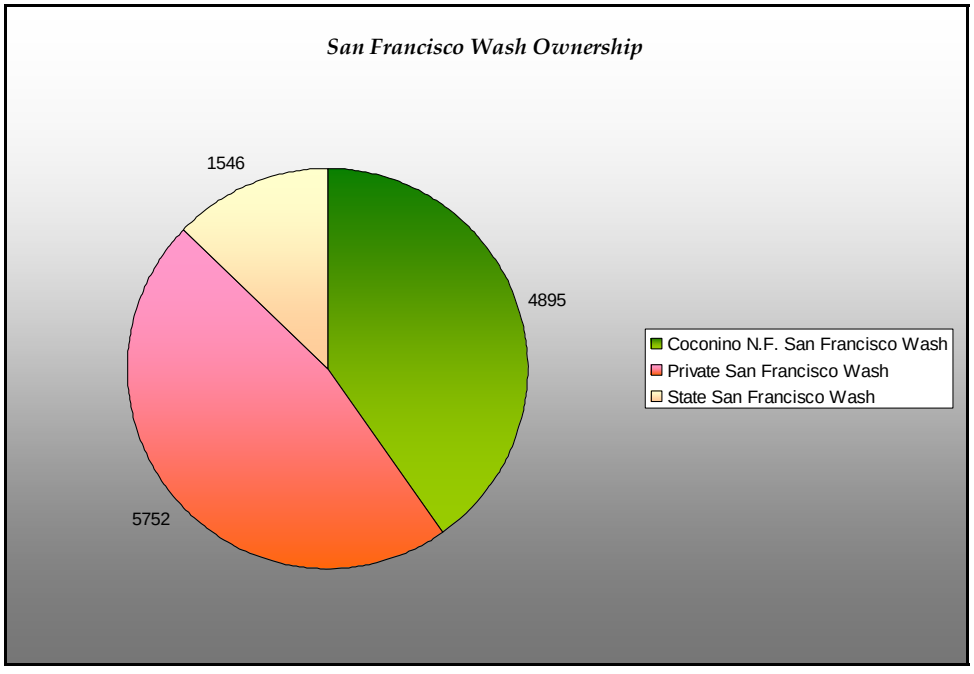
The project area is located in the Rio de Flag, San Francisco Wash, and Walnut Creek 5th code watersheds of the of the Little Colorado watershed. Elevations range from around 6,800 feet in the northern portion of the project area, to around 6,300 feet at far western portion. The following table is a summary of number of gross project acres within the watersheds and the percent of the project area within the watersheds.

Table 3-30. Watershed classifications and proposed treatments.

Watershed and Size	Project Area Acres	Coconino Acres	Treatment Acres	Mechanical Treatment	Percent Mechanical	Percent Prescribed Burn Only
Rio de Flag 5th Code Watershed 128,753 acres	22,130	12,464	11,785	2660	12%	73%
San Francisco Wash 5th Code Watershed 228,076 acres	7,299	4,896	3,370	0	0 %	69%
Walnut Canyon 5th Code Watershed 124,308 acres	4,166	3,831	3,391	968	23 %	63%

Figure 3-8. Watershed size and ownership.





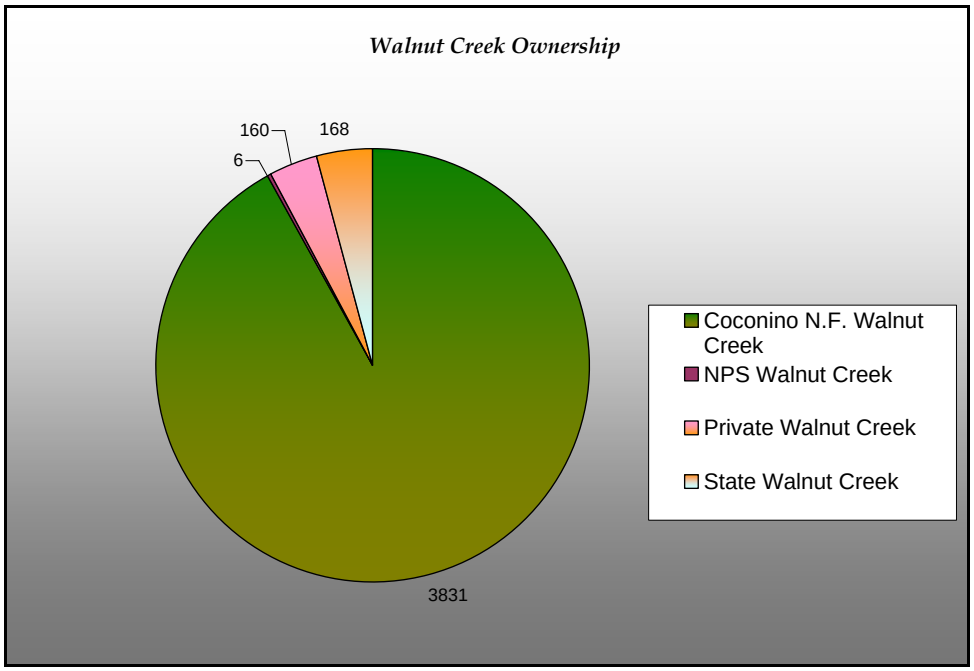
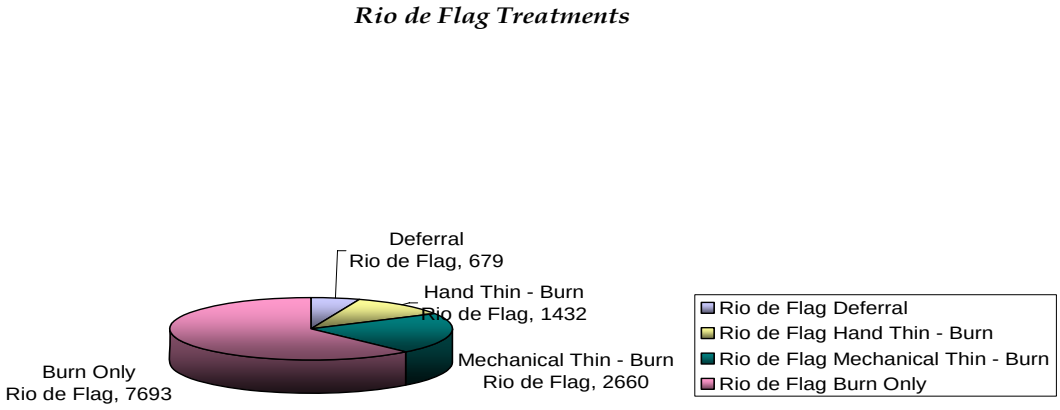
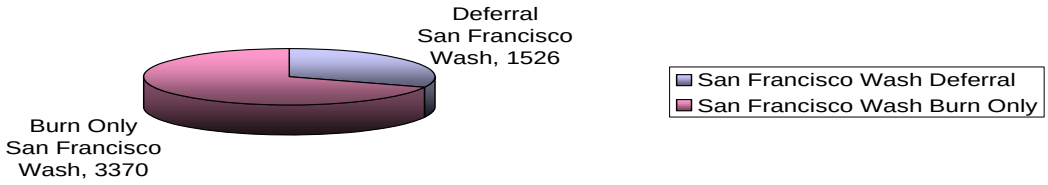


Figure 3-9. Treatments by watershed.



San Francisco Treatments



Walnut Creek Treatments

The majority of runoff 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.

Twenty-eight Terrestrial Ecosystem Survey (TES) Map units exist within the Proposed Action area. 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.

Table 3-31. Terrestrial Ecosystem Survey unit descriptions.

Map Unit/ Erosion Hazard	Size (acres) By Treatment Type	Landform
53 Slight	22 HTPB (Hand thin Pile burn) 32 MEPB (Mechanical Pile burn) 262 PB (Pile burn)	Valley plains. This component is unsuited for timber production, but is well suited to forage production. Soil condition is impaired, resulting from historic livestock grazing and current elk grazing.
441 Slight	8 MEPB 197 PB	This map unit has a low revegetation potential. These soils contain significant quantities of calcium carbonate throughout the profile or at a relatively shallow depth. A pH of 8 or more is common and may hinder revegetation efforts. Excessive ground disturbance, which may bring more calcareous soil to the surface, should be avoided. These soils have a thin cinder surface layer (5-15 cm) overlying the A horizon. This layer acts as a protective mulch, reducing raindrop impact and maximizing soil moisture by reducing evaporation losses.
450 Moderate	305 PB	This component occurs on south and north aspects and supports a pinyon/juniper woodland or ponderosa pine. This component has a moderate erosion hazard. Maintenance of vegetative groundcover is essential to prevent sheet and rill erosion. Steep slopes limit most management activities.
455 Severe	15 MEPB 16 PB	This component has a severe erosion hazard and soil condition is unsuited. Maintenance of vegetative groundcover is essential to prevent sheet and rill erosion.

Map Unit/ Erosion Hazard	Size (acres) By Treatment Type	Landform
473 Slight	317 PB	This map unit has a high revegetation potential. The moderate shrink-swell potential may limit some management activities. Quga is sparse to absent in this map unit.
490 Slight	16 PB	This component has a high revegetation potential. The low bearing strength and high shrink-swell potential of these soils may limit some management activities.
500 Severe	3,904 PB	This map unit occurs within the transition between commercial forests and woodlands. Reforestation and natural regeneration potentials are limited by dry climate. Timber production potential is low (site class III). These soils are subject to trafficability problems and soil damage (compaction, puddling and displacement) when wet. These problems can be mitigated or avoided by restricting ground disturbing activities to periods when the soils are dry.
505 Slight	193 MEPB 731 PB	This map unit occurs within the transition between commercial forests and woodlands. Reforestation and natural regeneration potentials are limited by dry climate. Timber production potential is low (site class III). These soils are subject to trafficability problems and soil damage (compaction, puddling and displacement) when wet. These problems can be mitigated or avoided by restricting ground disturbing activities to periods when the soils are dry.
513 Moderate	111 MEPB 219 PB	This map unit occurs within the transition between commercial forests and woodlands. Reforestation, natural regeneration and revegetation potentials are low due to limited soil moisture retention. Timber production potential is low (site class III). Trafficability may be a problem due to the loose, extremely cindery soil surfaces. Forage production potential is low.
523 Slight	6 MEPB 42 PB	This map unit occurs within the transition between commercial forests and woodlands. Reforestation and natural regeneration potentials are limited by dry climate. Timber production potential is low (site class III). These soils are subject to trafficability problems and soil damage (compaction, puddling and displacement) when wet. These problems can be mitigated or avoided by restricting ground disturbing activities to periods when the soils are dry.

Map Unit/ Erosion Hazard	Size (acres) By Treatment Type	Landform
524 Severe	73 PB	This map unit occurs within the transition between commercial forests and woodlands. Reforestation and natural regeneration potentials are limited by dry climate. Timber production potential is low (site class III). The low soil bearing strength and high shrink-swell potential limit most management activities. This component has a severe erosion hazard. Maintenance of vegetative groundcover is essential to prevent sheet and rill erosion.
527 Moderate	223 PB	This map unit occurs within the transition between commercial forests and woodlands. Reforestation and natural regeneration potentials are limited by dry climate. Timber production potential is low (site class III). These soils contain significant quantities of calcium carbonate at relatively shallow depths. Excessive ground disturbance, which may bring more calcareous soil to the surface, should be avoided. Shallow soils limit most management activities.
536 Moderate	269 HTPB (Hand thin Pile burn) 57 MEPB 506 PB	Elevated plain. This component has a moderate erosion hazard. Maintenance of vegetative ground cover is essential to prevent sheet and rill erosion. Natural regeneration and re-vegetation potentials are high.
537 Severe	331 HTPB 290 MEPB 475 PB	Elevated plain. This component has a severe erosion hazard. Maintenance of vegetative groundcover is essential to prevent sheet and rill erosion. Shallow soils and surface rock fragments limit most management activities. Natural regeneration, reforestation and revegetation potentials are low.
550 Moderate	350 MEPB 350 PB	Map Unit 550 – (457 acres) Landform – Elevated plain. This component has a moderate erosion hazard. Maintenance of vegetative ground cover is essential to prevent sheet and rill erosion.
551 Slight	1283 HTPB 1402 MEPB 3333 PB	Surface rock fragments may limit most management activities including revegetation and reforestation efforts. Natural regeneration potential is high. Timber production potential is moderate (site class II). Upper landscape positions are very bouldery and further limit management activities.

Map Unit/ Erosion Hazard	Size (acres) By Treatment Type	Landform
553 Slight	215 MEPB 43 PB	This map unit occurs at the low elevational range of Pipos and Fear2. Timber production potential is low (site class III). Natural regeneration, reforestation and revegetation potentials are low due to surface rock fragments. This map unit is found predominantly on the north and east sides of the San Francisco Peaks.
555 Severe	32 HTPB 74 MEPB 51 PB	Due to its northern aspect and cooler, moister conditions, this component supports a mixed conifer climax community. This component has a severe erosion hazard. Maintenance of vegetative groundcover is essential to prevent sheet and rill erosion.
558 Slight	59 MEPB 277 PB	This map unit has a cindery soil surface ranging in depth from 10 to 35 cm. Natural regeneration, reforestation and revegetation potentials are low due to limited soil moisture retention in the upper 25 cm. Timber production potential is low (site class III). Trafficability may be a problem due to the loose, very cindery soil surfaces.
559 Slight	44 PB	The soils in this map unit formed in recent deposits of basaltic cinders from Sunset Crater. Age of this material is less than 1000 years. Natural regeneration, reforestation and revegetation potentials are low due to limited soil moisture retention. Timber production potential is moderate (site class II). Trafficability may be a problem due to the loose, extremely cindery soil surfaces.
560 Slight	36 MEPB 232 PB	Natural regeneration, reforestation and revegetation potentials are moderate. These soils have a contrasting particle size at depths ranging from 25 to 45 cm. Timber production potential is low (site class III) due to limited soil moisture retention below these depths.
566 Slight	50 MEPB 316 PB	The soils in this map unit formed in recent deposits of basaltic cinders from Sunset Crater. Age of this material is less than 1000 years. Natural regeneration, reforestation and revegetation potentials are low due to limited soil moisture retention. Timber production potential is moderate (site class II). Trafficability may be a problem due to the loose, extremely cindery soil surfaces.
567 Slight	732 MEPB 895 PB	These soils are subject to trafficability problems and soil damage (compaction, puddling and displacement) when wet. These problems can be mitigated or avoided by restricting ground disturbing activities to periods when the soils are dry.

Map Unit/ Erosion Hazard	Size (acres) By Treatment Type	Landform
582 Slight	57 PB	Elevated plain. This component has a slight erosion hazard. Natural regeneration and re-vegetation potentials are high.
584 Moderate	23 HTPB	Hills / scarp slopes of plains. This component has a moderate to severe erosion hazard depending on slope. Maintenance of vegetative ground cover is essential to prevent sheet and rill erosion.
585 Slight	3 HTPB	Elevated plains. Shallow soils and surface rock fragments limit most management activities
586 Slight	65 PB	Elevated plains. These soils are subject to trafficability problems and soil damage (compaction, puddling, and displacement) when wet.
596 Moderate	46 HTPB	This component occurs on south aspects and supports a Ponderosa pine community. Steep slopes, shallow soils, surface rock fragments and rock outcrop limit most management activities. Natural regeneration, reforestation and revegetation potentials are low. This component has a moderate erosion hazard. Maintenance of vegetative groundcover is essential to prevent sheet and rill erosion.

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 inches 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 extenuation of fire frequency over the last 100 years.

Environmental Consequences

Effect of No Action

There will be no change in soil condition from current conditions. No treatment will perpetuate site conditions that are conducive to the occurrence of intense wildfire. 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 because of heavy summer precipitation. Peak discharges are likely to increase because of wildfire, and water quality is likely to decrease due to increased sediment loads.

As forest canopy and protective organic matter is consumed by severe fire, interception would be reduced and soil erosion could increase. Changes in forest canopy cover creating large openings can effect snow accumulation and melt patterns and 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.

Heating 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 one year to many decades depending on the severity of the fire and rate of recovery (Wells et al. 1979).

High degrees of soil heating can destroy soil structure, affecting soil pore size distribution and overall porosity. This reduces infiltration rates and increases overland flow. Soil water repellency is increased as organic matter is heated. The more severe the fire, the deeper the water repellant layer unless heating is so intense that surface organic matter is destroyed.

Proposed Action

The most important direct effect on soil condition from the Proposed Action will be from mechanical activities (machine piling, feller-buncher, and skidder). Ground cover will be disturbed through mechanical actions. Skid trails will tend to compact the ground and, in some cases, channel water. This is estimated to occur over < 10% of the areas that are mechanically treated. The expected duration of effects is less than 10 years. Additional loss of ground cover will occur through the burning phase of the project. The combination of thinning to open the site and burning will likely result in the promotion of herbaceous vegetation over ground litter as the major component of ground cover. Site canopy conditions and fuel loading will be reduced so that the potential effects of intense wildfire are reduced.

Provided that mitigation measures are followed, 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 all 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 5 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 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.

Notable ephemeral stream courses in the area include: Weatherford Canyon, Rio de Flag, Wildcat Canyon, Skunk Canyon, Fey Canyon, Walnut Creek and San Francisco Wash. Some potential off-site effects include sedimentation 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. Other potential effects include long term decreases in accelerated soil erosion from road closures, and reduction in the potential effects of intense wildfire within the treated watersheds. Each of these effects may have a slight influence on water quality within the respective watersheds.

Prescribed Burning

Fire effects on soil, water, and watershed resources may range widely due to variability in resource conditions, season, intensity of burning, and timing, and intensity of precipitation before and after burning. Fire may have perceived negative, beneficial, or benign effects, which may persist for short or long periods.

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 influence 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).

The proposed treatments will help to reduce the probability of intense wildfire within the treatment areas. Prescribed burning 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, and Sackett et al. 1993) shows that this bare soil is covered by litter or vegetation within one to two years. Total consumption of ground cover will be patchy and will not adversely affect overall ground cover. Pile burning of logging slash is not expected to have any significant effects on soil characteristics, Seymour and Tecle, 2003.

Meadow and Grassland Thinning

Roughly 220 acres of meadow and other grassland soil will be thinned to restore a more historic meadow structure. In most of these areas, fuels hazard reduction will also occur as overly dense thickets will be thinned.

Transportation System

The Proposed Action will require approximately 4.5 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). Potential undesirable consequences of forest roads include adverse effects on hydrology, habitat fragmentation, predation, invasion by exotic species, degraded water quality, use conflicts, destructive human actions (for example, trash dumping, illegal camping, fires), and loss of soil productivity.

Forest roads affect site productivity in the roadbed and log landing area by removing and displacing topsoil, altering soil properties (compaction), changing microclimate, and accelerating erosion. Roads my also contribute to invasion by exotic (non-native) plant and animal species dispersed by wind, water, vehicles, and other human activities, as the disturbed areas serve as an avenue for establishment of exotic species into a new landscape. Invasion by exotic species may have unwanted biological and ecological effects if those species are able to displace natives or disrupt the structure and function of an ecosystem.

Forest roads influence hydrologic processes in several ways. Compacted surfaces tend to intercept precipitation from rainfall and runoff from adjacent areas, concentrating flow, and essentially increasing drainage efficiency and runoff quantity.

Depending on the landscape position of forest roads, surface erosion from road surfaces and ditches may have the effect of introducing above background sediment input to streams. Roads adjacent to, or frequently crossing stream channels, have a higher likelihood of introducing sediment to stream channels than those located on ridgetops or midslope. Increased sediment delivery to streams after road building has been well documented in the research literature for the Pacific Northwest and Idaho Megahan and Kidd 1972, Rice and others, 1972. Rates of sediment delivery from unpaved roads are highest in the first years after building (Megahan and Kidd 1972). Inadequate maintenance of forest roads often results in them being chronic sources of sediment. It is thought that roads contribute more sediment to streams than does any other land management activity. At least in the Northwest, it is believed that most of the sediment from timber harvest activities is related to roads and road building.

The project area is relatively flat and not prone to mass soil failure as is documented in the Northwest. The basalt soils in the project area are fairly resistant to erosion, and produce little sediment from the road system, even though many of the roads are poorly maintained. No perennial streams are present in the area, and road crossings of even ephemeral stream channels are rare.

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 layout relative to stream systems, road drainage, surfacing, and cut slope and fill slope treatments. Many studies have shown that surfacing materials and vegetation measures can be used to reduce the yield of fine sediment from road surfaces.

Under the Proposed Action, 379 mechanical treatment acres (2%) and 4,882 prescribed burn acres (26%) occur on soils with severe erosion hazard, 518 mechanical treatment acres (3%) and 1,941 prescribed burn acres (10%) occur on soils with moderate erosion hazard. On soils with Slight erosion hazard, 2,733 acres (15%) will be treated mechanically and 8,135 acres (44%) will be prescribed burn. Provided that mitigation measures are followed, there will be only minor impacts to on-site soil quality and productivity from the proposed activities.

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 Weatherford Canyon 6th code watershed (44,703 acres), the Switzer Canyon 6th code watershed (40,063 acres), Wildcat 6th code watershed (8,125 acres) and the Walnut Canyon 6th code (42,064 acres). These watersheds accumulate into San Francisco Wash.

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 either watershed for many years. Within the last 10 years, few Forest Service activities have occurred in the Eastside area. These activities will be considered in terms of potential on-site cumulative effects. These projects include:

- Livestock Grazing permitted on some areas within the 6th code watersheds:

  Walnut 6th code
  - Angel – 504 Acres
  - Cosnino 4,110 Acres
  - Walnut Canyon – 18,433 acres
  - Young's Canyon – 5001 acres

  Weatherford Canyon 6th code
  - Angel – 4423 Acres
  - Black Bill – 3176 acres
  - Peaks 1,4185 – acres

  Switzer Canyon 6th code
  - Angel – 1635 acres
  - Black Bill – 940 acres
  - Cosnino – 2200 acres

  Wildcat 6th code
  - Angel – 918 acres
  - Cosnino – 4,460 acres

- Dispersed recreation.
- High densities of roads that have developed over time.
- Other activities adjacent to the project area within these two watersheds include thinning and piling in the Skunk Canyon area 2003-2005.

Grazing Allotments

Six grazing allotments occur within the project area: Angel (3,810 acres), Black Bill (4,116 acres), Cosnino (7,797 acres), Lake Mary (11,401 acres), Peaks (10,569) and Walnut (4,306 acres). The Lake Mary Allotment is not normally grazed by livestock.

Livestock Grazing is evaluated and regulated through the individual Allotment Management Plans. Rangeland Best Management Practices are prescribed through the process of developing the Allotment Management plan.

Development, Recreation and Transportation

Most of the land within the watersheds is managed by the Coconino National Forest. There are substantial Private ownerships in the Timberline and Doney Park communities. State of Arizona lands are also present, and are managed in a similar fashion to Forest lands. It is likely that private lands within the watershed will continue to develop over time. State and County laws regulate floodplain development and non-point source pollution from construction activities.

Table 3-32. Land ownership and management in project watersheds.

Watershed Size	City of Flagstaff	Coconino National Forest	National Park Service	Private	State
134,955 Acres	1,636 acres	96,757 acres	4,702 acres	23,462 acres	8,404 acres

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. he goal for managing the road system on the Coconino National Forest within these watersheds is to limit overall road densities to two miles per square mile. With the exception of private land development, few if any new roads need to be constructed for activities proposed in the watersheds. Some roads have been closed or obliterated recently and additional closures and obliterations are expected in the future. Existing open forest system roads will be maintained at levels suited to their uses and locations. As timber sales continue to decline, so will the periodic road maintenance associated with sales. Funding appropriated for maintenance of forest system roads is also declining. Some funds have and will be invested in road closures, obliteration, and drainage maintenance. Reducing the road system and maintaining open roads will reduce soil disturbance activities.

Recreational use in each watershed is moderate to high. Recreation uses will probably increase in the future. Individuals and groups use the area and activities include hiking, horseback riding, bicycling, jeep driving, off-highway vehicle driving, dispersed camping, and camping in developed campgrounds to name a few. In some places throughout the watershed, recreation uses could a loss of vegetative ground cover, soil compaction, localized erosion, increased runoff and biological pollution. The proposed changes in recreation and road management will substantially improve soil condition in areas that are currently degraded.

Assuming that soil and water mitigation measures are employed, the harvest and burning treatments proposed 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 Eastside project are minor, and will be moderated substantially by the time the project begins. Impacts from livestock grazing have been reduced over time as trends in allotment management are towards less frequent stocking, particularly on the Lake Mary allotment. The Pumphouse and Skunk treatments have had no discernable adverse effects on soil condition so contribute nothing to cumulative effects.

Treatments are designed to reduce the likelihood of landscape level wildfire and the watershed disturbing effects associated with such a fire. Improvements in road and recreation management would improve soil condition in the long term, and consequently have a positive effect on soil condition and perhaps downstream water quality.

Recreation and Transportation System

The Eastside project area encompasses nearly one half of the urban interface National Forest System lands that exist around Flagstaff, and residents and visitors recreate in the area in large numbers. 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.

Recreational use of the project area includes trail uses such as hiking, biking and exercising on both system and non-system trails, dispersed camping, recreational driving for pleasure (viewing scenery), wildlife viewing, environmental education, outfitter and guide activities, hunting, rock climbing, ATV and motorcycle riding, and equestrian activities.

Of these uses recreational driving, ATV and motorcycle use have had the most resource impacts, including extensive damage to meadows, rutting and braiding of roads due to use in wet conditions, and the development of extensive social trail and road networks. This use and impact highlights the need for more proactive management in these areas to provide good recreation opportunities while properly caring for the land.

In general, the recreation management goal in the project area has been to emphasize natural-appearing, semi-primitive forest settings near Flagstaff, focusing primarily on day use activities, and considering the needs and desires of the recreating public who are being served. Recent management of the area has downplayed emphasis on developed site facilities in the area, including little emphasis on management of National Forest System land settings that reflect possible rural or urban forest settings – the public prefers wildland, semi-primitive, natural-appearing settings for National Forest System lands in the urban interface where this project is located. The manifestation of this has been active closure and obliteration of un-needed roads in parts of the area and increased focus on trails management.

Affected Environment

Trails

There are 12 system trails throughout the area, including the statewide Arizona Trail, totaling approximately 32 miles in length, and about 25 miles of permitted outfitter and guide trails (2 stables). There are approximately 200 miles of un-planned "social" or non-system trails in the project area including motorized and non-motorized trails around subdivisions, freeride trails, etc. In general, system trails are located in primary areas of interest such as Mount Elden, Schultz Pass, Old Caves Crater, and Walnut Canyon.

Trail uses include hiking, biking, equestrians, ATV's, exercise walking, and motor cycles.

The number of miles of system trails in the project area increases each year as use of the area increases; for example, Coconino County has approached the Forest Service to prepare a trails plan for the Timberline and Doney Park area, with connecters to Flagstaff, which will increase system trails by 20 to 40 miles, if approved.

Non-system, user-created "social" trails are prevalent throughout the project area, primarily around subdivisions, and the problem is increasing each year as more people move into the area for its recreational attributes and create the trails as they use the forest adjacent to their properties. Additionally, some new uses such as "free riding" are resulting in constructed un-approved trails with structures, jumps, etc., often in sensitive areas, particularly in the Mount Elden area.

Use of many trails, including non-system trails, is high. For example, the Elden Lookout Trail receives some of the highest trail use on the district and forest as a year-round use trail, with approximately 10,000 users per year. Many of the non-system trails, e.g. ones leading from people's back yards, illegal ATV and biking trails, etc. is high, estimated to be approximately 50,000 users per year. Use is high for other trails, too, such as mountain biking use on the trails in the vicinity of Walnut Canyon and Buffalo Park.

Recreational Driving

Currently many of the roads in the project area are used for recreational driving. This type of use is defined as use of both system roads and un-planned social roads by full-sized motor vehicles for purposes other than commuter travel. For example, these activities include using roads to enjoy the forest surroundings, seek wildlife, access dispersed camping sites or rock climbing areas, or for seeking the challenge of driving rough roads in muddy conditions—the latter being the most common and most damaging type of recreational driving use in the project area. Many of the roads in the project area contain multiple track braids, low-spots and washouts which can cause some road users to attempt to avoid these spots further braiding the road, while others will drive into them for the challenge and further damage the road surface.

While the district has no road use data for the project area (traffic counts), it is reasonable to assume recreational driving use of the road network in the project area is high, similar to that of other areas of the forest, particularly around urban interfaces.

Dispersed Camping

Because of it's proximity to Flagstaff, with overnight camping banned within the Flagstaff Corporate Boundary, most of the project area does not receive significant amounts of overnight camping use. Most overnight camping in the area is incidental, short-stay (e.g. one or two nights), and primarily occurs around Timberline, Mount Elden, and Walnut Canyon.

A survey of an adjacent management area (Mountainaire) that was conducted in 2002 found that 6% of the sites were highly impacted (e.g. vegetation trampling, litter, multiple filled fire rings, etc.), 34% were moderately impacted, and 60% were slightly impacted; the condition trend is expected to be about the same for sites within the project area.

Rock Climbing

In recent years the rock climbing community, both in Flagstaff and increasingly nation-and world-wide, has discovered the numerous basalt and limestone mountains, outcrops and overhangs on the Peaks and Mormon Lake Ranger Districts. As a result, areas like Mount Elden and Walnut Canyon, once the domain of a handful of local boulderers and climbers, have now become featured areas in guidebooks and even featured in major bouldering and climbing films.

Un-managed climbing use leads to the development of social trails along outcrops and up steep slopes to access boulders and outcrops, often in locations that are sensitive to erosion and vegetation trampling. Chalk used by climbers to dry the hands and improve their grip leaves white marks on the rock, which, however is washed off by rains. Additionally, without adequate sanitation facilities on these sites, health and safety issues sometimes arise, particularly in the most popular areas during high use periods.

Several popular climbing sites and areas within the project area have seen dramatic increases in use in recent years and are now featured in several guidebooks, drawing climbers from many other areas. This increased use is estimated to be approximately twofold in the last ten years, with today's use to be an estimated 7,000 climbers each year using three primary sites (Mt. Elden West, Mount Elden South and East, and Walnut Canyon).

While much needed, no climbing management plan exists for the area(s).

All-Terrain Vehicle and Motorcycle Use

All-Terrain Vehicle (ATV) and motorcycle use is popular across the forest, and prevalent throughout much of the project area, increasing significantly in recent years. Use tends to occur more around subdivisions and developments. In recent years an extensive network of social trails has evolved in the project area from cross-country travel by ATVs and motorcycles, particularly around Timberline and Doney Park. Approximately 150 miles of ATV and motorcycle social trails were mapped in the project area in 2004, mostly in the northeast part of the area. These trails, developed from repetitive use, often cause resource damage such as vegetation trampling and erosion, as they are not planned and designed with thoughts of sustainability or using accepted trail design and construction practices. Social trails often develop when users fail to find the recreational opportunity they seek on Forest System trails. There are no designated motorized system trails in the project area.

Most of the existing motorized social trails in the project area link existing Forest roads to create longer loop riding opportunities. There are also single-track motorcycle loop trails found in the project area. While under current Forest Plan direction this use is legal and legitimate, the associated resource damage is not.

Latent Community Use

As is the case in other urban interface areas on the Forest, there is a high level of recreational use of the Forest around the Flagstaff urban interface – the forest serves as the community's backyard. Survey of the lands around the community boundary revealed the evidence of fairly intensive public use, with numerous social trails, including some used by ATVs and motorcycles, and the occasional "fort" constructed by children. Much of the use is non-motorized, pedestrian use in the form of people walking, hiking, exercising, and walking pets from their homes. This use is endemic to such areas and often not problematic to other resources such as wildlife, soil and water, etc., with some exceptions where such trails pass through sensitive wildlife habitat or are the cause of erosion problems.

A review of legal easements and public access to National Forest System indicated that while all of the existing legal access points are in use by the public, there is also access to the Forest occurring across private lands in some areas. In addition a number of existing social trails, particularly motorized social trails on the Forest are located very close to the property boundary and as a result are a nuisance use. Such use often raises dust and creates unacceptable noise levels for neighbors while leading to rutting and erosion problems.

Like most parts of the Forest, the Eastside project area includes some unique, non-traditional recreation uses, the most prominent of which is free-riding biking, and the growing sport of geocaching. There are currently a number of unauthorized constructed free-ride trails in the northern half of the project area, primarily in the Mt. Elden area. The forest is working with the Flagstaff cycling community to better understand the sport of free-riding and to address the illegal trails, which are often built in sensitive areas such as for wildlife habitat protection, or where there are soil and water issues.

The issue of trespass use of National Forest System lands exists across the project area along subdivision lines. In numerous locations along the property boundaries people have constructed unauthorized fences, out buildings, tree forts, cooking areas, etc. on National Forest System land.

Due to lack of program emphasis, these matters have not been dealt with for some years, and the problem has grown as subdivisions have increased.

Roads and Transportation System

With its close proximity to Flagstaff, the project area receives significant amounts of motorized use on the existing roads system. Many of the existing roads in the area were planned and constructed through Forest Service projects in the past, and became "system" roads, but many of the roads were not planned or constructed, and were simply the result of continuous cross-country use by the public and continue to exist on-the-ground. Some of the un-planned non-system roads are poorly located such as in the bottoms of draws with sensitive soils, or leading directly up hillsides, which often results in erosion and other environmental effects. Additionally, with a chronic lack of maintenance of all roads over the years, many of the existing roads (both system and non-system roads) are in poor condition for purposes of resource protection or public use.

The project area is moderately "roaded" in terms of road density per square mile. The terrain offers little or no natural barriers for off road travel, and so many of the existing roads were created through repetitive use. The policy concerning off-road travel has been "open unless posted closed", as long as resources are not damaged. This has allowed users to be able to drive cross-country, and has helped contribute to the large number and location of roads in the Eastside Project area.

Due to soil and vegetation disturbance caused by repeated tire tracking in combination with dry conditions, it takes a long time for grasses and forbs to cover the tracks created by off-road use, and so they remain visible for some time, encouraging others to follow, and often result in new, long-term unplanned roads existing. Many user-created roads lack proper drainage, and during wet conditions, water is retained in the tracks making roads impassible. Drivers then move over to an adjacent dry area, and then multiple tracks or a "braiding" effect is created. A high percentage of the roads within the project area are user created. Most user created roads do not comply with resource management direction, or consider resource protection in their location. Due to the high number of miles on the forest needing work, most of the maintenance level 2 roads have received minimal maintenance and resurfacing over the last 15 years

There are 245.62 miles of inventoried roads in the project area. Of those, 175.62 miles are open to vehicular traffic, resulting in an open road density of 3.32 miles per square mile. The miles of inventoried roads include the non-systems roads and all miles of the 5 different maintenance levels from the Transportation Atlas.

System Roads

After the Forest Plan was signed, the Forest Service identified the open road system that met the target densities in the Resource Access Travel Management Plan (RA/TM). The RA/TM plan gave every road in the Forest Service System a category of open (unimpeded travel). Closed (physical barrier at either end with the road in-between intact), or obliterated (ripped by mechanical means and seeded). Public input was included in the RA/TM decisions.

After the RA/TM category was established, the agency engineers assigned each Forest Service road a maintenance level.

Table 3-33 includes miles of road, by operational, or the current, maintenance level, that are in the Forest transportation system for the project area.

Table 3-33. Current road densities and maintenance levels.

Sub-Area Name	Maintenance level 1	Maintenance level 2	Maintenance level 3	Maintenance level 4 & 5
Limestone	9.96	23.29	0	0
Campbell *	36.17	1.01	5.89	2.54
Elden Base	15.77	9.50	4.39	1.21
Timberline	7.32	30.36	3.11	7.48
Turkey Hills	0.78	40.49	1.90	13.38
Total for Eastside	**70.00**	**104.65**	**15.29**	**24.61**

* These numbers reflect the 2003 decommissioning project which closed all interior roads but two.

Many of these system roads begin as user created roads and were incorporated into the roads system in the 1980s, prior to the RA/TM process. They have inadequate drainage, are most often poorly located and many are causing resource damage. Roads and off-road vehicle use affects wetland sites by compacting soils, which in-turn affects nutrient cycling, changing decomposition rates, and soil physical properties. This change in upland soil condition affects the amount of material that enters wetland sites, thus again affecting the nutrient cycling and changing decomposition rates through increased sediments.

Non-System Roads

There have been 30.17 miles of non-system roads identified at this time. This represents most of the known miles. Some additional work is still required to complete the inventory. It is not anticipated that this will result in a significant increase in the total miles for the area. These roads currently do not have maintenance levels assigned to them. If any of these roads are incorporated into the road system, road numbers and maintenance levels would be assigned at that time.

Table 3-34. Non-system road densities

Sub-Area Name	Total non-system miles by project
Limestone	.36
Campbell *	0
Elden Base	1.48
Timberline	6.53
Turkey Hills	21.80
Total for Eastside	30.17

* These numbers reflect the 2003 decommissioning project which identified and closed all interior roads but two.

Special Areas

Environmental Study Areas

The Elden Environmental Study Area is located at the base of Mount Elden, and comprises approximately 600 acres of special management area for recreational trail use and school study. It was originally established in the 1970's as a bird sanctuary. With funding tight, management of the area for intended specific purposes has been difficult, and poor trail condition, outdated study materials, etc. have resulted.

The Old Caves Crater Environmental Study Area surrounds Old Caves Crater near Doney Park, and is about 650 acres in size, also for recreational trail use and school study.

Restricted Motor Vehicle Use

The Mount Elden/Dry Lake Hills (approximately 8,500 acres) and an area surrounding the Cinder Hills OHV Area are designated in the Forest LMP for motorized use on designated routes only, with no off-road use permitted in those areas.

Motorized vehicle use is prohibited in the Campbell Mesa area (approximately 3,800 acres, Order No. 04-02-15R) and Fay and Skunk Canyons (approximately 3,500 acres, Order No. 04-150) for the purposes of providing non-motorized recreation experiences and protecting wildlife habitat.

Wildlife Habitat Protection

The area of Walnut Canyon from Fisher Point east to the Walnut Canyon National Monument boundary (approximately three miles) has been identified as important wildlife habitat and riparian area, system trails are not permitted there, and casual social use of the area is discouraged in an attempt to preclude the establishment and use of new trails in the area.

Camping Closure

Overnight camping is not permitted on National Forest System lands within the city limits of Flagstaff.

Fisher-Campbell Shooting Closure

A shooting prohibition order is in place for approximately 2,000 acres of National Forest System land surrounding Walnut Canyon National Monument (Order No. 04-98-02-R).

Special Uses

Several special use authorizations are administered in the project area, including:

Flying Heart Stables

This permit authorizes seasonal trail rides in the Sandy Seep and Mount Elden area, including from the base area near Highway 89 to Sandy Seep, on the Hart, Sunset and Elden Springs Trails.

Hitchin' Post Stables

This permit authorizes trail and dinner rides in the Walnut Canyon, Fay Canyon, and Skunk Canyon areas from the base near Lake Mary Road through Fay Canyon trail to Fisher Point, up

Walnut Canyon, etc. A permanent dinner camp is authorized for a site about one half mile northwest of the stable area.

Environmental Consequences

Effect of No Action

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.

Proposed Action

Implementation of the Proposed Action would maintain desirable forest characteristics for recreational activities for the future if management prescriptions for vegetation treatment and prescribed fire are designed and implemented to maintain desirable recreation landscape characteristics, e.g. natural appearing forest lands that are in synchronization with Recreation Opportunity Spectrum management guidelines, etc. 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 for the future.

Recreational Driving

Mechanical treatments will have no direct effect on the amount of recreational driving opportunities, but will likely have temporary effects on the quality of the experience for some forest visitors. The immediate and substantial change in appearance of treated sites results in an effect on the visual quality of the recreational driving experience. A complete discussion of these effects can be found in the Scenic Quality section of this document.

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 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.

Dispersed Camping

Mechanical treatments to sites 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.

Rock Climbing

Direct effects on rock climbing use from treatment activities will be minimal and of short duration. It is likely that treatments in climbing areas will consist of hand thinning some trees, mechanical pilling of slash, and burning. These activities will cause only temporary disturbance to rock climbing opportunities from noise and smoke and will only minimally and temporarily impact visual quality.

Trails

Mechanical treatments in sites where system 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 impact sections of trails making them hard to follow and in some cases temporarily unusable. The duration of this effect is likely to last from a few months to a few years, treatments are completed, repair work is done, and subsequent prescribed burning occurs.

Initial prescribed burning and longer-term maintenance burning will have little direct effect on system trails, as the trails are often used as burn block line by Forest Service staff and are

unaffected by heat and flame. Short-term visual effects, e.g. burned ground, will usually be gone within one growing season.

ATV and Motorcycle Use

Mechanical treatments in sites 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 obliterate 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 burn block line by Forest Service staff 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 feet—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. A critical point to remember is that these trails systems are user-created and have evolved through use without being planned, developed or authorized by the Forest Service. 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 ATV and motorcycle use from initial prescribed burning and future maintenance burning.

Latent Community Use

Treatments proposed around communities will have the immediate effect of noise and public safety hazards during mechanical treatment, and the disturbance to social trails and routes used by the public from vegetation removal, slash piles and other treatment effects. These effects, while short-lived will likely seem longer term to adjacent residents and regular forest users. Initial and maintenance burning will provide a similar, immediate nuisance effect from smoke, and a slightly longer term post-burn effect from the presence of ash, stump holes and other hazards. The burning will, however, help to alleviate some of the effects.

While some of the social trail network adjacent to communities may be obliterated by treatments and subsequent burning, this effect is not expected to be significant. First, treatments will aid in the closure of nuisance routes – those that are causing resource impacts or social impacts to adjacent homeowners. Secondly, as these are not approved nor properly located and constructed routes and have evolved from use, the post-treatment, open forest type will allow for new routes to develop over time. In effect there will be no net loss of opportunity.

Treatments and burning will likely have the indirect effect of displacing latent community use short distances spatially as users avoid slash piles, stump holes and other effects of treatment. As a result new social trail networks will likely evolve in adjacent communities.

Changes in the transportation system will have a similar indirect effect of displacing motorized uses immediately adjacent to communities to other locations. Impacts associated with this, including the development of new motorized social trails, will be monitored and mitigated as necessary. Reasonably foreseeable management actions regarding cross-country motorized travel and access and travel management will address these issues.

Where property owners have trespassed on the Coconino National Forest with structures or permanent improvements without authorization, implementation of the Proposed Action will likely cause the Forest Service to have to deal with these matters in order to conduct project activities such as thinning and prescribed burning.

Geocaching

The direct and indirect effects on geocaching from the Proposed Action can be seen as minimal. Geocaches tend to be small, often the size of a coffee can or ammunition can and are purposefully challenging to find. None of the Proposed Actions would limit the ability for new or additional geocaches to be placed. Mechanical treatments are unlikely to adversely affect a geocache. A cache could be lost during initial or maintenance burning.

Roads and 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 possible establishment of temporary roads in order to accomplish vegetation treatment goals.

In the short term this use could adversely impact the roads system, but with maintenance of main roads through the project, and re-closing or decommissioning of closed or 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

Environmental Study Areas

Implementation of the Proposed Action will help restore natural conditions in the Elden Environmental Study Area if hand thinning and burning operations are done in such a way as to protect wildlife habitat, including cliffrose for winter deer habitat.

For the Old Caves Crater Environmental Study Area, implementation of the Proposed Action will help maintain natural forest conditions. If not done properly, planned mechanical thinning operations on the predominant cinder soils in the area could adversely affect soils and scenic quality.

Restricted Motor Vehicle Use

Implementation of the Proposed Action should not have a major effect on the Mount Elden/Dry Lake Hills, Cinder Hills, Campbell Mesa, and Fay and Skunk Canyons restricted motor vehicle

use, although the opening up of sites of trees will allow easier access for persons wanting to drive off road, and thus make it somewhat more difficult to administer these vehicle restrictions.

Wildlife Habitat Protection

With no activities planned here, there will be no effects on the Walnut Canyon/Fisher Point wildlife habitat and riparian protection area.

Camping Closure

Implementation of the Proposed Action will not affect the camping closure within the city limits.

Fisher-Campbell Shooting Closure

Implementation of the Proposed Action will not affect the shooting closure in the Fisher/Campbell area.

Special Uses

Implementation of the Proposed Action on the two riding stables, and as discussed elsewhere here, e.g. in Trails above, will include temporary impacts from project activities such as thinning and burning, but the long-term goal of natural forests should maintain desirable settings for these uses. With proper mitigation, e.g. minimizing operation disturbances, timing of operations during off-seasons, dealing quickly with clean-up and pile burning, providing screening along trails and near camps and vistas, etc., permittee activities can be protected.

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, rock climbing, recreational driving, hiking, horseback riding, etc.
- Ongoing latent community use and social trail use in and around the project area, including for access to general forest areas.
- Upcoming local, regional and national motorized access and Travel Management Rule policy changes for off-road vehicle use.
- Special uses and areas within the project area, including commercial operations such as riding stables.
- Areas where special restrictions are in place, such as motorized vehicle restrictions, shooting and camping restrictions, etc.

- Road decommissioning (obliteration) and closing in the project area
- Environmental study areas

Recreation

Predominant semi-primitive non-motorized and semi-primitive motorized recreation settings, with some less highly developed settings in the area, will add to the presence of the desired wildland recreation setting in the surrounding landscape. Surrounding areas are also likely to maintain and enhance some semi-primitive settings. The exact amount is unknown, but subsequent project work in these areas is intended to continue this trend.

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. With that in mind, displaced campers are unlikely to make use of public and private developed campgrounds in the eastern Flagstaff area and Schultz Pass area, or developed campgrounds south and west of the area. Displaced campers may add to current camping impacts in these areas causing a slight increase in resource impacts.

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. Currently studies are ongoing to establish a policy structure directing National Forests to eliminate cross-country travel in most areas and designate routes open to motorized use. Such an action would likely further limit ATV 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.

The continuation of dispersed camping in the project area may lead to similar 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.

Several past projects in areas where the two outfitter/guide special use permittees operate were meant to treat vegetation that would perpetuate healthy forest conditions, while maintaining what permittees felt were desirable conditions for their businesses. One permittee, Roger Hartman of Hitchin' Post Stables, has worked with the forest since the 1970's on projects in the Fay Canyon/Skunk Canyon/Walnut Canyon area, including on reaching what he terms as agreements for managing this approximate 2500 acres of land in a "wilderness", or semi-primitive condition. The Flagstaff Timber Sale of the 1980's, the recent Skunk Thinning Project, and the APS line clearing proposal in 2004 were negotiated and agreed mitigation measures met the desires of Hitching Post Stables for "wilderness", semi-primitive settings. The Sandy Seep motorized vehicle closure near Flying Heart Stables in the 1980's met the needs of the permittee in that area.

Roads and Transportation System

During the past ten years or so, numerous roads have been closed and obliterated (decommissioned) in the Walnut Canyon area, Fay/Skunk Canyon area, and Sandy Seep area, as well as a few other locations within the project area. While this work has improved wildlife habitat, recreation experience, soil and water quality, vegetation condition, and other broad-spectrum resource benefits, it has displaced some former use activities to other areas. Such activities as ATV riding, four wheeling, fuelwood gathering, and others have been displaced to adjacent or distant areas.

The management objective for transportation system planning in the area for the last decade or more has been to scale down the road system in order to provide a balanced system that both meets practical transportation needs and management desires for natural, wildland settings near major communities. While seemingly contradictory goals, this has basically worked, as initial road densities (for both system and non-system roads) in much of the area were (or are) higher than forest plan specified densities (approximately 2 miles of road per square mile of National Forest System land) This, coupled with downward trending in road maintenance funding, and public desires for wildland settings "out their back doors", has resulted in the identification of core arterial roads through much of the area, with few collector and local roads leading from these roads

Several projects conducted in recent years within the project area boundary addressed transportation management, including in the ways discussed above, and set guidelines for the management of the road system in the area. The Forest Plan identified a number of areas where motorized vehicle traffic would be restricted to existing designated routes, including in the Sandy Seep area and along the northeast side of Doney Park, and this resulted in the closure and decommissioning of a number of miles of road along the Mount Elden base and in the Fernwood subdivision area. The Fisher-Campbell Timber Sale of the 1980's did much the same in that area north of Walnut Canyon. The Skunk and Fay Canyon Closure of the 1980's affected the area south of Walnut Canyon to Lake Mary Road in the same fashion.

Subsequent to these efforts, the 2002 Flagstaff and Lake Mary Ecosystem Analysis (FLEA), covering all of the same areas, reinforced this management direction, calling for a basic system of roads that are compatible with today's maintenance capabilities (funding) of the agency and other resource objectives, and prescribing the closing or decommissioning (obliterating) of the remaining un-needed roads that exist in the area. Some of the FLEA prescribed roads management has been accomplished in the area, including continued maintenance and minor reconstruction of main arterial roads (e.g. FR301), and a few areas have had concentrated efforts over the last five years to close and/or decommission un-needed roads (e.g. roads that led from FR301). In the FR 301/Walnut Canyon North area, significant gains have been made over the last several years to close and obliterate un-needed roads, and work in that area is expected to be completed by 2007. A similar effort may be necessary in the Timberline and Doney Park areas to get the road systems there right-sized and properly managed.

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 roads system and get rid of un-needed roads. The Eastside project area is included in this study, and the existing roads system in the area is expected to change as a result of this analysis, with fewer miles of road ultimately existing in order to attain a manageable and sustainable roads system.

Rare and Sensitive Plants

This section details the affected environment and environmental consequences for Threatened, Endangered and Sensitive Plants within the project area. The project area does not include any locations or potential habitat for Threatened or Endangered plant species.

Sensitive Native Plant Species

Flagstaff pennyroyal

Affected Environment

Flagstaff pennyroyal (*Hedeoma diffusum*) is a small perennial, mat-like herb that grows on dolomitic limestone outcrops or soils in ponderosa pine forests. It has square, wiry stems and small oval opposite leaves. The flowers are blue and occur in clusters of one to three at the nodes. 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). A third population area occurs on the Prescott National Forest. Flagstaff pennyroyal occurs in three distinctive habitats in the ponderosa pine forest, rock pavement, cliffs and limestone. Forest canopy cover ranged from zero to 86%, averaging 26.5% (Phillips, 1984). Boucher and Phillips recorded many of the currently known locations for this species.

The Limestone and Campbell Mesa areas of the project area contain numerous locations of Flagstaff pennyroyal (Table 3-35). The Peaks Wildlife Crew conducted the most recent surveys on record in 2004. Other surveys have been conducted for various projects in the Project area including road improvements, water developments and establishment of recreational facilities. Some of these locations are documented in GIS layers available in the corporate database.

Table 3-35. Locations of Flagstaff pennyroyal and treatment types.

Location	Site	Proposed Treatment
120	9	Hand thinning and prescribed burn
120	12	Hand thinning and prescribed burn
120	15	Meadow thinning
120	17	Hand thinning with prescribed burning
120	18	Deferred
120	22	Prescribed burn, no thinning
120	23	Mechanical thinning and prescribed burning
120	24	Deferred
120	26	Hand thinning with prescribed fire
309	10	Prescribed burn, no thinning
310	3	Prescribed burn, no thinning
310	5	Prescribed burn, no thinning
313	3	Prescribed burn, no thinning
313	6	Prescribed burn, no thinning
313	7	Prescribed burn, no thinning
313	8	Prescribed burn, no thinning
314	3	Prescribed burn, no thinning
314	6	Hand thinning and prescribed burn
314	11	Prescribed burn, no thinning
314	12	Prescribed burn, no thinning
315	4	Prescribed burn, no thinning
315	7	Prescribed burn, no thinning
315	11	Prescribed burn, no thinning
315	19	Prescribed burn, no thinning
316	2	Prescribed burn, no thinning
317	2	Mechanical thin with prescribed burning
318	1	Hand thinning and prescribed burn
318	2	Mechanical thin with prescribed burning
318	7	Hand thinning with prescribed burning

Environmental Consequences

Effect of No Action

There will be no direct effects to Flagstaff pennyroyal because none of the proposed management activities will occur.

With no action, dead and down fuels will continue to increase, which in turn could negatively affect the vigor of Flagstaff pennyroyal. Goodwin (1983) observed decreases in plant vigor and population density in areas of heavy litter accumulation. He suggested that complete fire exclusion could have detrimental effects on Flagstaff pennyroyal.

With no treatment, fire hazard will continue to increase therefore increasing the risk of severe wildfire in many areas of the project area. Factors that contribute to fire hazard ratings that would be reduced through management actions such as canopy cover, trees per acre and dead and down fuel loading 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. 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 and 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 and invasive weeds would also increase and contribute to the degradation of the habitat and loss of individuals and populations of Flagstaff pennyroyal.

With no treatment, there will be no additional road closures. Therefore, use of existing social roads that may exist and creation of others within Flagstaff pennyroyal populations and habitat will continue. This could adversely affect Flagstaff pennyroyal populations and potential habitat within the project area.

With no action, there will be no additional regulation of dispersed camping within the project area. This could lead to increased human impacts to Flagstaff pennyroyal. Examples of potential human impacts include campfire construction in populations such as those observed at Harding Point and Bear Sign Canyon.

Proposed Action

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 fire line construction. These activities may cause mortality of individual plants. An indirect effect includes mechanical alteration of habitat through alteration of the dolomitic limestone substrate by equipment used in various management activities. These effects will be mitigated by

These effects will be reduced by following the guidance of the Management Plan for *Hedeoma diffusum* (Boucher, 1984). The management guidelines established in the plan are designed to mitigate impacts from management activities and are reviewed before the implementation of treatments. These mitigations reduce or eliminate the direct and indirect effects of the factors

described above including potential alteration of habitat and/or deaths of individual plants, potential alteration of substrate, and the direct and indirect effects from disturbances such as slash pile burning, tree removal and road construction. The effects of slash pile burning are included below in the discussion on prescribed burning and the effects of tree removal are included in the section on thinning.

Prescribed Burning

Prescribed burning may cause direct and indirect effects. Timing of burning is important. In a burning experiment conducted by the Coconino National Forest, no adverse effects on Flagstaff pennyroyal were detected (Crisp, 1997). Burning was conducted at various intensities during pre-monsoon (spring) and post monsoon periods (fall). However, no research was conducted on the effects of burning during the summer months. Burning during the hot, dry period immediately before the onset of monsoons might kill individuals and populations of Flagstaff pennyroyal. Prescribed burns during the hot, dry period immediately before monsoons are unlikely due to high fire danger that is typically present during that time. Burning might benefit Flagstaff pennyroyal by removing heavy litter accumulation resulting from absence of fire.

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 as compared to the prescribed burning above where fuels are ignited across the landscape and there are not typically large concentrations of burning material. The direct and indirect effects of slash pile burning include deaths of individuals and potential alteration of habitat. These effects will be mitigated by following the guidance of the Management Plan for *Hedeoma diffusum* (Boucher, 1984).

Mechanical Thinning

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 might benefit Flagstaff pennyroyal by reducing tree canopy and site density in areas where the plant occurs and in potential habitat.

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. These effects will be mitigated by following the guidance of the Management Plan for *Hedeoma diffusum* (Boucher, 1984).

One of the desired future conditions of this project is to reduce the Stand Density Index in many of the treatment areas which would benefit all understory plants including Flagstaff pennyroyal in addition to reducing inter-tree competition. This goal will be accomplished removal of trees and/or prescribed burning. However, the reduction in the site density from these actions could have a negative indirect effect in areas where noxious and invasive weeds such as Dalmatian toadflax already occur in the habitat of Flagstaff pennyroyal. There are several areas within the project area where Dalmatian toadflax (*Linaria dalmatica*) has been detected in or near populations of Flagstaff pennyroyal. These areas have been identified as high priority for noxious and invasive weed treatment within the project area. Dalmatian toadflax increases after disturbance and can dominate the understory, out-competing Flagstaff pennyroyal and its native associated plant species. Increases in Dalmatian toadflax in Flagstaff pennyroyal habitat have been documented locally after prescribed fire (Phillips and Crisp, 2001).

Potential conflicts from existing populations and new introductions of noxious and invasive weeds will be mitigated by following the *Appendix E – Best Management Practices and Recommended Activities*. Incorporation of the Best Management Practices will mitigate the effects of increased disturbance from management activities, and help to control the spread and introduction of noxious and invasive weeds such as Dalmatian toadflax within the habitat of Flagstaff pennyroyal.

Cumulative Effects

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 include, but are 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 Multi-product Timber Sale, Skunk Fuels Reduction, Mountainaire HFRA fuels reduction project, recreation activities and facilities, road construction and maintenance. Effects of these projects have been addressed individually under past environmental analyses. Cumulatively, these projects and activities have not affected the overall distribution of Flagstaff pennyroyal. Many of these activities have been mitigated by following the guidance of Management Plan for *Hedeoma diffusum* (Boucher, 1984).

Activities on non-forest lands such as state and private lands have also contributed to cumulative effects on Flagstaff pennyroyal including timber harvest, fuels reduction projects, recreational uses and development. Land development on non-forest parcels has affected the amount of suitable habitat available on non-forest lands, 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 as similar actions on the Forest would be. The overall result is a possible reduction in the overall distribution and amount of suitable habitat for Flagstaff pennyroyal throughout its range.

Sunset Crater Beardtongue

Affected Environment

Sunset Crater beardtongue is a perennial herb 12 to 30 inches tall with bright pink flowers. The leaves are sharply toothed with lower leaves joining to surround the stem, forming a disk around the stem (amplexicaul). The soil in which Sunset Crater beardtongue grows is typically a layer of cinders 2 to 5 inches deep with a layer of silty soil below, important for water retention at the root level of this species (Phillips, et al., 1992). The habitat is flat or gently sloping sites in open ponderosa pine forest between 6500 to 8500 feet. Sunset Crater beardtongue is an endemic species that occurs only in the volcanic fields north and east of Flagstaff. The range of this species is limited to the Sunset Crater volcanic field near Flagstaff, including the Coconino National Forest and Sunset Crater National Monument. Although, the distribution of this species is restricted, there are no data that support decline of the species as a whole.

Only two occurrences of this species were found in Forest records and maps. These locations were recorded by Susan Smith, a local Botanist in 1992. The locations are on the top of a cinder hill in the Turkey Hills project area. The locations are approximately one mile east of Cromer School and are documented in the TES plants layer in the Project Record. Smith found

approximately 12 plants on the hill top. These plants occur in Site 301/5 which is slated for prescribed burning with no thinning under the Proposed Action.

Environmental Consequences

Effect of No Action

There will be no direct effects to Sunset Crater beardtongue because none of the proposed management activities will occur.

With no action, fire hazard will continue to increase therefore increasing the risk of severe wildfire in many areas of the project area. This would be an indirect effect to Sunset Crater beardtongue. Factors that contribute to fire hazard ratings that would be reduced through management actions such as canopy cover, trees per acre and dead and down fuel loading 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. These changes could adversely affect the habitat and populations of Sunset Crater beardtongue by damaging soil, killing existing plants and by reducing or destroying the seed bank of Sunset Crater beardtongue. Noxious and invasive weeds such as diffuse knapweed more easily invade areas of severe wildfires than unburned areas. Therefore, if a severe wildfire occurred in the habitat of Sunset Crater beardtongue within the project area, noxious and invasive weeds would also increase and contribute to the degradation of the habitat and loss of individuals and populations of Sunset Crater beardtongue.

Proposed Action

The prescribed burning treatment proposed for in Site 301/5 will not have any direct adverse effect on the populations of Sunset Crater beardtongue growing there. The observations by Goodwin (1979) suggest that burning will indirectly benefit Sunset Crater beardtongue.

An indirect effect of management actions within the potential habitat of Sunset Crater beardtongue includes an increased risk of invasion from noxious and invasive weeds. Several species of noxious and invasive weeds occur in potential habitat.

Cumulative Effects

Historically, there have been several large wildfires in the habitat of Sunset Crater beardtongue including the Burnt Fire in 1973. After the fire, Goodwin (1979) stated that Sunset Crater beardtongue was a pioneering species in the fire. However, Fule et al. (2000) found that Sunset Crater beardtongue numbers were lower on burned plots three years after treatment when compared to pre-treatment numbers. In 1992, a tornado occurred in the area near Sunset Crater, within the habitat of the Sunset Crater beardtongue. The storm damaged large numbers of trees on Forest land and within Sunset Crater National Monument. The Forest Service conducted a salvage sale and removed storm damaged trees from its land. A monitoring project conducted by the Peaks District (Crisp, 1996) found no adverse effects from the storm or the salvage sale. The cinder hills area that contains most of the habitat for Sunset Crater beardtongue is heavily used for recreation. Other activities that have occurred in the habitat include fuel wood removal, utility corridors and grazing. Sunset Crater has been collected as an ornamental on a limited basis but this practice is strongly discouraged. This limited collection has not affected the viability of

the species. Cumulatively, these projects and activities have not affected the overall distribution of Sunset Crater beardtongue.

Non-forest actions include a rapidly growing population in the Doney Park, Timberline and similar neighborhoods that are within the range of Sunset Crater beardtongue. Effects of this increasing human population include increases of human impacts to surrounding Forest lands and possibly a decrease in the amount of suitable habitat available on non-forest lands. Increased recreational use in areas such as the Cinder Hills OHV area has affected the habitat of Sunset Crater beardtongue.

Arizona leatherflower

Affected Environment

This plant was formerly included on the Region 3 Sensitive Species List, but was removed from the list in 1999. It continues to be of local interest due to its rarity on the Forest. Arizona leatherflower is a perennial herb with pinnately compound leaves with finely divided, pubescent leaflets. The leaves have petioles and join the stems at right angles. The flowers are solitary, purple and bell shaped. After blooming, the plant produces plumose achenes. Individual plants are from 8 to 12 inches tall. Habitat includes rocky hillsides with slopes from 12% to 40%, with aspects generally from 320º to 40º (Arizona Game and Fish Abstracts, 1993). This plant generally grows on limestone soil. However, a few groups have been found on basalt soils in the Fort Valley area and near Woods Canyon. Many populations of this plant occur near Lower Lake Mary, in Skunk Canyon and in Fay Canyon. Other scattered populations occur on Harold Ranch Road in east Flagstaff (private land), in Mountainaire (private land), and in Fort Valley.

High amounts of leaf litter are present in some areas around juvenile plants. The leaf litter is thought to increase humidity around seedlings and therefore benefit them (Arizona Game and Fish Abstracts, 1993). However, heavy accumulation of litter can be detrimental to seedling survival and vegetative reproduction in adults (Machinski and others, 1997). In shading studies, Machinski and others (1997) concluded that intermediate amounts (approximately 50%) of light and shade were the most beneficial conditions for Arizona leatherflower. Higher levels of light increased photosynthesis in adult plants, but resulted in lower reproductive success, and increased risk of desiccation. Low levels of light resulted in decreased photosynthesis, fewer stems per plant and lower seed production.

Distribution of this species within the project area is limited to the Fisher point/Skunk Canyon area. Populations have been documented in Site 120/17, which is scheduled for hand thinning and prescribed burning, Site 120/18 (deferral), Sites 120/19 and 22 (prescribed burning, no thinning) and in Site 317/1 which is scheduled for meadow thinning.

Environmental Consequences

Effect of No Action

There will be no direct effects to Arizona leatherflower because none of the proposed management activities will occur.

With no action fire hazard will continue to increase therefore increasing the risk of severe wildfire in many areas of the project area. Factors that contribute to fire hazard ratings that would be

reduced through management actions such as canopy cover, trees per acre and dead and down fuel loading 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. These changes could adversely affect the habitat and populations of Arizona leatherflower by damaging soil, killing existing plants and by reducing or destroying the seed bank of Arizona leatherflower. Noxious and 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 Arizona leatherflower within the project area, noxious and invasive weeds would also increase and contribute to the degradation of the habitat and loss of individuals and populations of Arizona leatherflower.

Proposed Action

Direct effects of treatments could include death or destruction of populations or individuals of this species through management activities. These effects will be minimized by not locating slash piles directly on located plants.

Indirect effects include alteration of habitat and loss of the litter layer during activities such as burning. Reduction in the amount of litter in some areas could be beneficial if some litter remained to help maintain the humidity around the plants. However, removal of all litter from the site would have adverse effects on juvenile plants. Actions such as thinning that could increase the amount of sunlight could increase photosynthesis for some populations. Changes in the amount of sunlight available for Arizona leatherflower could have either positive or negative effects depending on the amount of change produced by management actions.

Cumulative Effects

Past mitigation measures for Arizona leatherflower the establishment of 100 foot buffers around known populations within units scheduled for treatment before 1999. Recent mitigation measures in project included removal of part of the litter around existing populations to ameliorate the effects of burning (Bald Mesa project, Mogollon Rim Ranger District, 2005).

Past actions within the habitat of Arizona leatherflower include but not limited to Lake Mary small parcels fuels reduction project (2001), Skunk Canyon Prescribed Fire Fuel Reduction Project (2005), Mountainaire HFRA Project (2006), grazing, and dispersed recreation. Actions on non-Forest lands may have affected the occurrence and distribution of Arizona leatherflower in those areas. Many areas in and near Flagstaff that provided potential habitat for the plants have been altered or developed, making the habitat no longer suitable for Arizona leatherflower. At least one population on private land was destroyed during a road realignment project. Additionally, because of its unique appearance, the Arizona leatherflower may be collected and removed from the Forest and used landscaping plant. Historically, there was at least one incident of this occurring in the mid to late 1990's.

Noxious or invasive weeds

Noxious weeds or noxious or invasive weeds are receiving increasing emphasis in management decisions. Recently, the Chief of the Forest Service identified invasions by exotic species as one of the four major threats. Noxious weeds and invasive exotics can affect composition, structure and function of native ecosystems and can affect factors such as fire interval, species composition

within communities, and successional pathways. Various surveyors have detected several of noxious or invasive weed species in the Project area. Infestations range from a few scattered plants to localized but severe infestations. Treatments and best management practices for noxious or invasive weeds for the project area are listed in Appendix E of this document and were adapted for the Eastside Project from the *Final Environmental Impact Statement for Integrated Treatment of Noxious or invasive weeds on the Coconino, Kaibab and Prescott National Forest within Coconino, Gila, Mojave and Yavapai Counties, Arizona.*

Affected Environment

The noxious or invasive weed discussion below is presented in the order as ranked in the Final Environmental Impact Statement for the Integrated Treatment of Noxious or invasive weeds, Coconino, Kaibab and Prescott National Forests (FEIS). Each noxious or invasive weed species is rated by the perceived severity and risk to Forest resources.

In 2004, the Peaks Wildlife Crew conducted noxious or invasive weed surveys in portions of the Limestone, Campbell Mesa and Elden Base areas concurrently with Northern Goshawk survey transects. They detected locations for camelthorn (*Alhaghi pseudoalhagi*), Dalmatian toadflax (*Linaria dalmatica*), cheatgrass (*Bromus tectorum*) and common mullein (*Verbascum thapsus*). Additional locations for noxious or invasive weeds are documented in the SWEMP 2003 coverage currently available in the GIS files. The layer shows locations for common mullein, cheatgrass, Dalmatian toadflax, and diffuse knapweed (*Centaurea diffusa*) within the project area. Several surveyors, including past Forest Service surveys, Coconino County and state roads crews and various others, collected the information in the SWEMP layer. Many noxious or invasive weed locations in the SWEMP layer are concentrated along roadways and utility corridors. These areas tend to be dispersal corridors for weed infestations where propagules are dispersed by human activities. Additionally, these areas tend to have high levels of disturbance and are therefore more susceptible to invasion than comparable undisturbed areas.

Yellow starthistle

Yellow starthistle is an annual introduced from Europe, which grows 2 to 3 feet tall. The roots grow at least 3 feet deep, and it seeds prolifically. The roots of this plant develop faster than native perennial grasses and can out-compete them by capturing moisture and nutrients before the native plants begin to grow. Horses grazing on large quantities of this plant are susceptible to "chewing disease," a neurological disorder preventing the horse from swallowing. There is no cure for chewing disease; it is fatal.

This species receives a high rating for control because the known acreage on the Coconino, Kaibab and Prescott National Forests and within the project area is relatively limited. It is predicted that this species could be successfully eradicated from Forest lands through control efforts defined in the FEIS.

The first reports of this species within the project area were in the area around the Wildcat Treatment Plant, on City and State owned lands. Various cooperators have initiated control efforts in the past and these efforts are on-going. Two locations of one plant at each location were detected Forest lands. These were along Forest Road 545B to Robinson Pit and at the junction of Highway 89N and the Peaks Ranger Station access road. The source of these locations can be traced back to the Wildcat Treatment Plant, when it was a common practice to obtain reclaimed water from the site for use in construction work. That practice has since been discontinued but not before water was obtained and used on several roadways on the Forest that were under

construction. Many of these roads are associated with the realignment of the Sunset Crater access road junction and the rerouting of forest roads to that junction. One location for this species has been reported in the project area, in location 289 site 2 which is scheduled for hand thinning and prescribed burning.

Camelthorn

Camelthorn is a deeply rooted perennial shrub, native to Asia. It reproduces both by seeds and by below-ground rhizomes. Root systems can extend up to 30 feet below ground. Camelthorn grows well on wet or dry sites and can grow through pavement and building foundations. The aggressive nature of this species as well as its ability to reproduced both by seeds and rhizomes makes it difficult to control.

This species receives a high rating for control based on several factors including the difficulty of control. Additionally, the known acreage of this species on the Coconino, Kaibab and Prescott National Forests and within the project area is relatively limited, making the goal of contain/control achievable.

One location of this species has been reported in the Eastside project, in location 247 site 4 which is slated for mechanical thin and burn.

Musk thistle

Musk thistle is an introduced biennial which grows up to six feet tall. Its leaves are dark green with a light green midrib. Leaves extend onto the stem giving it a winged appearance. 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. There are two reported locations for this species within the Eastside project. Neither of these has been verified to assure the correct identity.

This species receives a high rating for control because the known acreage on the Coconino, Kaibab and Prescott National Forests. Within the project area, locations are relatively limited. It is predicted that this species could be successfully eradicated from Forest lands through control efforts defined in the FEIS.

There are two reported locations of this species within the project area; in location 271 site 1 and in location 282 site 12. Both of these units are slated for prescribed burning only.

Diffuse knapweed

Diffuse knapweed is an introduced biennial or short-lived perennial with erect, diffusely branched stems growing from ½ to 3 feet tall. Most plants of this species live to be 2 to 6 years old and are capable of spreading only by seed. In the fall, diffuse knapweed plants break off at ground level and tumble along the ground dispersing seeds. These plants or plant fragments can be carried to new locations by wind or dragged along by vehicles to new locations. Seeds can also be spread as the spiny bracts attach to animal fur, clothing, and vehicles and can be spread in contaminated products such as hay.

Diffuse knapweed was first detected in the Flagstaff area in the late 1970's 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 created after mature plants break at the base and are dispersed by the wind or by being dragged along by vehicles.

This species poses serious threat to restoration efforts because of its high rates of expansion and ability to out compete native vegetation.

The control goal for this species in the FEIS is contain/control. Its rating within the FEIS and the project is based on several factors. The species reproduces solely from seed. However, this species produces copious amounts of seeds, which are wind, human and animal dispersed. Additionally, there are large acreages of this plant within the project area. The predicted growth rate is 14% per year for existing populations. Knapweed may be able to dominate disturbed sites indefinitely (Sheley and Petroff, 1999).

Many infestations have been reported in the Eastside project. Many of these populations occur along the road edges of Highway 89, and Townsend-Winona Road. Infestations are particularly heavy in areas of Fernwood, Timberline and around the Flagstaff City Landfill.

Biological control agents have been released in the area of the City Landfill and are reportedly expanding from the initial release site. Additionally, Arizona Department of Transportation has attempted to control diffuse knapweed at some locations along the I-40 corridor in the Flagstaff area in the past using herbicide and burning but these treatments appear to be of limited success.

Scotch thistle

Scotch thistle is a large biennial thistle, native of Europe and eastern Asia. Characteristics of this species include broad, spiny stems with vertical ribs, large, spiny leaves with dense hairs, and violet to reddish flower heads. Scotch thistle grows in disturbed habitats and waste areas and reproduces solely from seed. Seeds are equipped with structures known as pappi, which allow the seeds to disperse on wind currents. Additionally, seeds of Scotch thistle as well as other weeds can be dispersed by many human activities, including vehicle travel.

There are several known locations for this species along Highway 89N in the Fernwood and Timberline areas, and along Route 66 in the area east of the Flagstaff Mall to Walnut Canyon. These locations are mostly confined to the right-of –way and to private lands adjacent to the highway. However, this species could become established in the project area from wind-dispersed seed and as a result of disturbance from management activities.

Dalmatian toadflax

Dalmatian toadflax is an introduced perennial plant that reproduces both by seed and vegetative root buds. The two methods of reproduction give this plant a competitive advantage under a wide range of environmental conditions. Often stands of Dalmatian toadflax will disappear for several years, only to re-establish through the seed bank or possibly vegetative root buds.

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 within the FEIS is contain/control. The predicted rate of spread for this species is 10% per year. However, the species spreads by both seeds and adventitious root sprouting.

This species is widespread throughout the ponderosa pine type on the Forest. There are numerous locations of this species throughout the Project area. Based on data from the Peaks Wildlife Crew, portions of Campbell Mesa and Elden Base are heavily infested. There are also numerous infestations in the Limestone area.

Dalmatian toadflax co-exists with Flagstaff pennyroyal in portions of Limestone and Campbell Mesa. These infestations are direct threats to the Flagstaff pennyroyal (a Region 3 Sensitive species). Dalmatian toadflax tends to increase after disturbance, especially after fire (Phillips and Crisp, 2000). Therefore, mitigation measures will be needed to prevent potential adverse effects to Flagstaff pennyroyal.

Cheatgrass

Cheatgrass is an erect winter and spring annual grass from Europe that can grow to a height of two feet. The plant is a prolific seed producer and the density of this species has more to do with available sites (bare soil) for germination than the number of seeds produced. The presence of cheatgrass has increased the fire frequency in grassland and sagebrush ecosystems (Zouhar, 2003). 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 by non-native annual grasses. Cheatgrass is also common in ponderosa pine forests throughout the western United States. Cheatgrass can provide a flammable link between open areas and forested areas, allowing fires to move from one habitat type into another. Live cheatgrass plants can be killed by fire, but seeds survive relatively severe fires and colonize recently burned areas. Additionally, offsite colonization into recently burned areas often occurs. Several techniques to control cheatgrass have been investigated, including timing of burns, herbicide treatments, grazing and competitive planting. 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).

The Peaks Wildlife Crew reported scattered infestations of cheatgrass in the Limestone and Elden Base portions of the Project area. In the past, occurrences of cheatgrass have not been documented in noxious weed surveys. Therefore, the extent of cheatgrass infestations in the Project area and across the Forest is poorly understood. Additional infestations of cheatgrass almost certainly occur throughout the Project area.

Environmental Consequences

Effect of No Action

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 treatment of right-of-ways by Arizona Department of Transportation, and release of biological control agents provided by APHIS.

With no treatment, the risk of severe wildfire will continue to increase in many areas of the project area. Factors that contribute to fire hazard ratings that would be reduced through management actions such as high canopy cover, high numbers of trees per acre and dead and down fuel loading will not be reduced. The risk of wildfire transitioning to crown fires will continue to increase in many areas of the project area. 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 noxious 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 noxious weed invasions in the project area.

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. Noxious weed populations will remain untreated and continue to expand. Mitigation measures that would help control the spread of noxious or invasive weeds will not be implemented.

Proposed Action

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 maintenance, and 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 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 and hand thinning.

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 will be mitigated by following the management actions listed in Appendix E – Best Management Practices and Recommended Activities.

Treatments that reduce the tree canopy and lower the site density will benefit all 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 intra species (between tree) 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 Activities

Prescribed burning is a disturbance that can release nutrients, reduce plant competition, increase the amount of available sunlight and increase bare soil. This benefits all 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 noxious weed populations by allowing more sunlight to reach the forest floor, increasing available nutrients, temporarily decreasing interspecies competition as well as intra species (between tree) competition, and increasing bare soil.

Pile burning will create localized severely burned areas and is a source of severe disturbance as discussed above. 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. Using previously disturbed areas including old pile sites or previously used decking areas where available instead of creating new sites within the forest will mitigate these effects. Additionally, pile sites should be monitored after burning occurs to identify and treat infestations. Management actions will be mitigated by following the management actions listed in Appendix E – Best Management Practices and Recommended Activities.

Some areas within the project area that are targeted for 'burn only' treatments have not been completely surveyed for noxious or invasive weeds. Therefore, it will be difficult to assess the complete effects of these treatments on noxious or invasive weed infestations in these areas. Additionally, there are noxious or invasive weed populations on non-Forest lands within the Project area boundary. The extent and locations of these infestations may not be completely documented. Therefore, there is some risk that infestations will expand from non-Forest land onto Forest property.

Hand Thinning Activities

Hand thinning is a less severe form of disturbance as compared to mechanical thinning. The effects are similar to prescribed fire and include reduction tree canopy, release of nutrients, reduction plant competition, increase in the amount of available sunlight and creation of bare soil. These factors benefit all understory plants including noxious or invasive weeds. However, these factors are less severe and would be of less concern than pile burning or machine piling on deck sites.

Manual Control

Manual removal of noxious or invasive weeds is proposed for several species and populations in the project area. Several techniques may be used for this control including hand pulling and removal of weeds with hand tools. District Archeologists will be consulted before using hand tools in areas where conflicts may occur. Disturbance from weed control activities should not exceed one square meter in each control area unless the Archeologist is consulted prior to the activity. The effects of manual treatments would be to reduce or eliminate the noxious weed infestations, populations and acreages in the project area.

Biological Control

Biological control agents include approved insects and pathogens that undergo a rigorous testing procedure prior to being available for release. Initial testing occurs in quarantined laboratories abroad and in the United States. The agents are tested for their effectiveness in controlling the target organism and for their host specificity. Testing includes potential effects on economic crops, rare plants, and similar species found in North America. An agent can be released only after is has been determined that it is unlikely that the agent will feed or cause injury to any native or agronomic species. Prior to the release of a new agent an environmental analysis is prepared by APHIS (Agricultural Plant Health Inspection Service). The only action the Forest Service is taking by releasing an agent is changing the location and influencing the rate of spread of the

agent. Currently, there has been at least one release of biological control insects on diffuse knapweeds in the project area.

Under the Proposed Action, there would be more releases of biological control insects on diffuse knapweed and Dalmatian toadflax. These treatments are intended to reduce the density and acreage of the targeted noxious or invasive weeds but probably will not entirely eliminate them from the targeted areas and project area in general.

Herbicide Treatment

Herbicide could be used on a limited basis to control an infestation of camelthorn in location 247 site 4. The effect of this treatment would be to eradicate or control Camelthorn from its only known location in the project area. Herbicide treatment has been addressed in the Final Environmental Impact Statement for Integrated Treatment of Noxious or invasive weeds on the Coconino, Kaibab and Prescott National Forest within Coconino, Gila, Mojave and Yavapai Counties, Arizona (2005) (FEIS). Refer to that document for a complete discussion of the effects of herbicide treatment. Direct and indirect effects of herbicide treatments are discussed comprehensively in the FEIS.

Cumulative Effects

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 Multi-product Timber Sale, Skunk Fuels Reduction, various prescribed fires and wildfires including large wildfires such as the Radio Fire (1973), Burnt Fire (1979), and Side Fire (1996), recreation activities and facilities, 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 Best Management Practices. Additional control efforts include the releases of biological control insects on diffuse knapweed in at least one location within the project area. These actions will aid in the overall reduction of noxious or invasive weeds on the Forest and immediately adjacent to the project area. Biological control insects were introduced in 2005 and 2006. If successfully established, these insects can spread within the project area and may provide local sources of biological control agents, thereby reducing the overall of this method of control

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, 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 noxious or invasive weed populations include control efforts undertaken by various agencies. These include, but are not limited to, herbicide treatments, manual control, and biological control. Arizona Department of Transportation may execute herbicide treatments on federally controlled highways in northern Arizona including the US Highway 89 corridor immediately adjacent to the project.

Past actions to treat yellow starthistle infestations in the Wildcat treatment area include removal of a large water tank from which reclaimed water was transported to many construction sites including some on Forest land, herbicide, and manual removal. While this infestation and these actions are not on Forest land, the Forest indirectly benefited from these control actions through reduction of the risk of spread of yellow starthistle from its current location into new areas including human vectored infestations as well as expansion of that population through growth and natural means of dispersal.

Economics

The Recreation and Landscape Aesthetics sections of this chapter describe the social aspects of recreation opportunity and scenery resources. This section report describes social aspects of the Flagstaff area communities and details the effects of the Proposed Action and no treatment on the Flagstaff economy. There were no significant issues identified regarding economic concerns.

Affected Environment

Community Socio-Economic Information

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 country 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 in 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*

Additional community economic status information is included in the Project Record.

Environmental Consequences

Proposed Action

Implementation of restoration activities will be a combination of Forest Service "force account" work done by Forest Service employees and contracted work done by private enterprises under the direction of the Forest Service. The following is a cast up of which portions of implementation will likely be contracted and which portions will likely be implemented under force account. This scenario could change depending on Forest Service staffing and budgets, and economic and market trends in timber removal and utilization.

Table 3-36. Projected responsible parties for implementation of the project.

Activity	Private Contractor	Forest Service Staff
Thinning and removal of trees greater than 5 inches DBH	X	
Thinning and removal of trees less than 5 inches DBH (Pre-Commercial Thinning)	X	X
Treat slash generated from thinning by lopping and/or piling	X	
Road Obliteration	X	X
Road Maintenance	X	
Pile burning		X
Broadcast burning		X
Noxious weed eradication and/or avoidance to control spread in certain areas as related to contract activities		X

Activities to be accomplished through contracts may contribute slightly to jobs in the agriculture sector of the Flagstaff economy but will not cause a significant change. Conversely, no treatment may affect local logging businesses but would not affect the Flagstaff economy, due the industry's small contribution to the diverse Flagstaff economy.

There is an increased potential for 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. 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. A reduction in outdoor recreation opportunity could affect local community income in the form of gas, hotel, grocery, outdoor equipment and other related receipts.

Local contractors that perform thinning and road maintenance and obliteration work are typically keeping busy with contracts previously available through government agencies or with contracts let in the private sector.

The Proposed Action maintains the natural landscape that supports Flagstaff's 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.

Recent large fires within the region, resulting from overly dense forests and 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 large landscape that might improve the public's perception of safety and well being in case of wildfire. 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 wildfire. No activity would eliminate fire risk completely.

Costs of Implementation

The Forest Service will implement activities with allocated project funds. Local communities do not fund costs of implementation. Implementation costs are one factor considered by the deciding official when determining a course of action.

Table 3-37 list the following agency costs of implementation are estimates based on recent, similar project costs. Table 3-37 assumes that all activities would be implemented through service contracts. In likelihood, some areas may sell as timber sale contracts, thus totals shows the estimated maximum amount of agency funds that may need to be spent to implement project activities.

Table 3-37. Project costs by treatment activity.

Activity	Cost in Dollars per Unit	Total
Thinning and Slash Piling with Road work included	$300 per acre[8]	13,780 x 300 = $4,134,000
Pile Burning in Urban Interface	$50 per acre	13,780 x 50 = $689,000 Estimate 200-500 acres per year
Broadcast burning in the Urban Interface	$200 per acre	15,256 x 200 = $3,051,200 Estimate 100-500 acres per year
Maintenance burning	$40 per acre	15,256 x 40 = $610,240 Estimate 100-500 acres per year to begin after broadcast is complete
Road Obliteration	$400 per mile	55.7 miles x 400 = $22,280

[8] These values are derived from recent bids on contracts for similar projects such as the Woody Ridge and Kachina Valley projects.

Cumulative Effects

This project, in tandem with other fuel reduction and thinning projects, offers numerous contracts to provide local employment opportunities and revenue in the logging and road construction/maintenance fields. A majority of these projects (Fort Valley, Kachina Valley, Woody Ridge, Mountainaire projects) have been developed collaboratively with Greater Flagstaff Forests Partnership and have been consecutively planned over the last few years. While planning efforts will be completed by 2007 (Jack Smith/Schultz projects) for Forest Service and GFFP projects, implementation will take longer to complete. It is estimated that contracts will be offered for all of these GFFP 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.

Chapter 4 – Project Coordination

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