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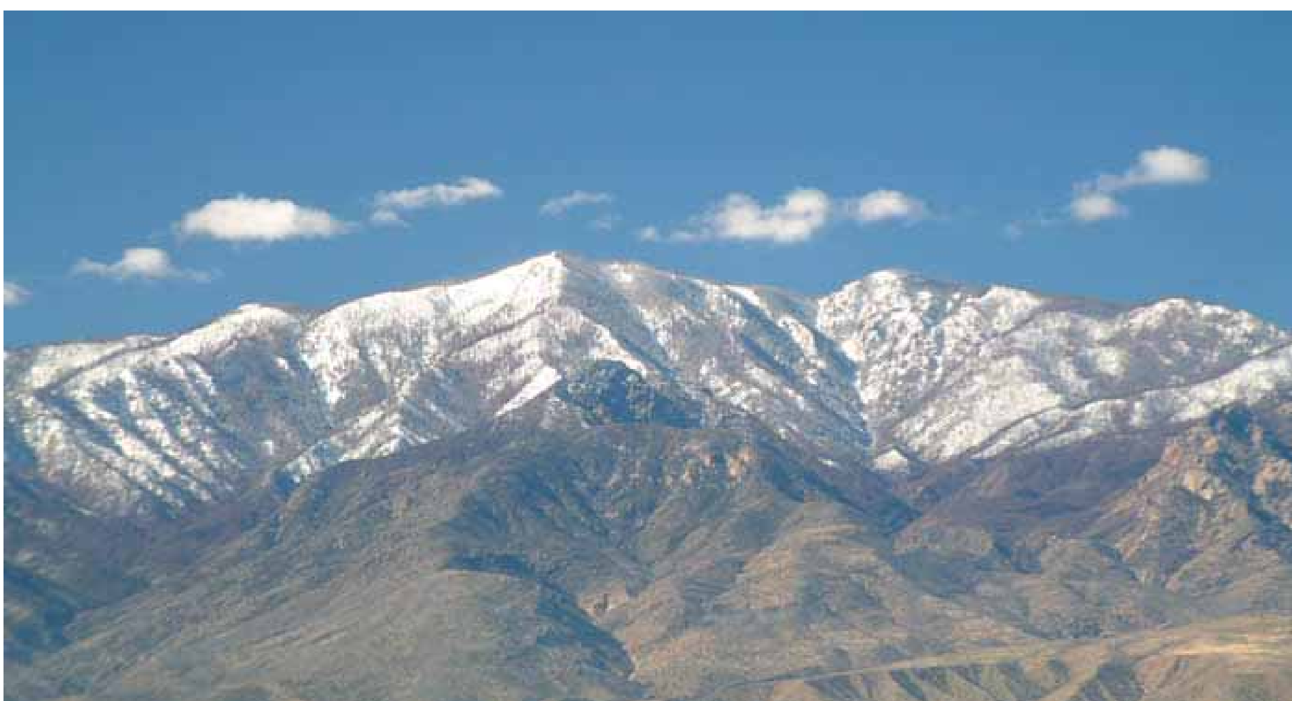
June 2009

Draft Environmental Impact Statement for the Pinaleño Ecosystem Restoration Project

Coronado National Forest, Graham County, Arizona



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Draft Environmental Impact Statement
Pinaleño Ecosystem Restoration Project

Coronado National Forest
Graham County, Arizona

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Abstract: The proposed action that is evaluated in this draft environmental impact statement (DEIS) includes on-the-ground treatments to improve forest health and improve or protect red squirrel habitat, and administrative actions to incorporate amendments to the governing "Coronado National Forest Land and Resource Management Plan" (Forest Plan), the latter of which will allow on-the-ground treatments to be implemented. Approximately 3,705 acres of forest would receive various combinations of silvicultural prescriptive treatments and/or fuel reduction actions, which include mechanical treatments and prescribed fire. To accomplish the proposed action, the Forest Plan must be amended to allow Christmas tree removal and public firewood gathering and to establish less restrictive visual quality objectives (VQOs) in the project area. Thus, the EIS will also evaluate a proposed action of amending the Forest Plan to change current standards and guidelines for the project area. Two alternatives to the proposed action were considered in detail: no action and an alternative that treats 223 fewer acres than the proposed action, restricts live tree thinning to trees less than 9 inches in diameter, and does not treat any Mexican spotted owl core areas. The Agency has identified Alternative 2 – the proposed action as the preferred alternative.

It is important that reviewers provide their comments at such times and in such a way that they are useful to the Agency's preparation of the EIS. Therefore, comments should be provided prior to the close of the comment period and should clearly articulate the reviewer's concerns and contentions. The submission of timely and specific comments can affect a reviewer's ability to participate in subsequent administrative review or judicial review. Comments received in response to this solicitation, including names and addresses of those who comment, will be part of the public record for this proposed action. Comments submitted anonymously will be accepted and considered; however, anonymous comments will not provide the respondent with standing to participate in subsequent administrative or judicial reviews.

Send Comments to: Craig Wilcox, Silviculturist (see address above) or via email to *comments-southwestern-coronado@fs.fed.us* or via fax to (928) 428-2393.

Date Comments Must Be Received: August 4, 2009

Summary

The United States Department of Agriculture, Forest Service, Coronado National Forest proposes to thin dense forests, remove some standing dead trees and down woody debris, use prescribed fire to begin restoring what was once a fire-adapted ecosystem, provide a transportation system to remove the biomass, and amend the "Coronado National Forest Land and Resource Management Plan" to allow public firewood and Christmas tree harvest and provide exceptions to visual quality objectives in the plan. The project is anticipated to be implemented over the next 10 years. The area affected by the proposal includes 5,754 acres located on the Pinaleño Mountains near Safford, Arizona, on the Safford Ranger District.

The project area is currently susceptible to wildfire and insect and disease outbreaks. These conditions threaten the declining federally endangered Mount Graham red squirrel (*Tamiasciurus hudsonicus grahamensis*) population and the health of the ecosystem. Over the past 100 years, fire suppression and other factors have diminished the natural ecological role of fire in the Pinaleño Mountains in the Safford Ranger District of the Coronado National Forest, resulting in a higher than average stand density and a heavy accumulation of dead and downed trees (fuel load). Both of these forest conditions increase the probability and consequences of severe wildland fire occurrence in the area.

In 1996 and 2004, large acreage, high intensity wildland fires expedited a reduction in the population of the Mount Graham red squirrel through habitat loss and mortality. Also, since 1996, progressive insect infestations have defoliated and killed trees in the spruce-fir and mixed-conifer forests of the Pinaleño Mountains. Tree mortality associated with these outbreaks has heightened the probability of wildland fire and contributed further to a decline in the red squirrel population through habitat loss. Today, the population of the red squirrel is at its lowest point since censuses were initiated in 1986, and the viability of the species is of paramount concern to both the Forest Service and other Federal and state wildlife management agencies.

This project is needed to restore the fire-adapted ecosystem in the Pinaleño Mountains and to protect and restore habitat for the Mount Graham red squirrel per the agency's mission and goals. The purpose of the project is to reduce fuel loading, encourage the return of the natural fire cycle, increase resiliency of mixed-conifer stands in the project area to insect and disease, and protect and restore habitat of the squirrel.

Alternatives Considered in this EIS

The DEIS considered three alternatives in detail. Five additional alternatives were eliminated from detailed study (see chapter 2).

Alternatives Considered in Detail

Alternative 1 - No Action

No action is evaluated in this DEIS as an alternative to the proposed action, as required by Council for Environmental Quality (CEQ) regulations (40 CFR Part 1502.14(d)). When analyzing the no action alternative, it is assumed that current conditions in the project area would continue in order to provide a baseline against which the impacts of the proposed action may be compared. As directed by CEQ for actions that propose projects (http://ceq.hss.doe.gov/nepa/regs/40/1-10.HTM#3), no action in this case means the proposed activity would not take place, and the resulting environmental effects from taking no action would be compared with the effects of permitting the proposed activity or an alternative activity to go forward.

If no action is taken, current management plans would continue to guide management of the project area. No fuel reduction or silvicultural treatments, as proposed by this project, would be implemented to accomplish project goals.

Alternative 2 - The Proposed Action

Alternative 2 – The proposed action would implement two primary actions:

1. Manage vegetation on approximately 3,705 acres using a combination of silvicultural or fuels reduction treatments or both.
2. Amend the "Coronado National Forest Land and Resource Management Plan" to allow regulated Christmas tree removal and public firewood gathering associated with treatment prescriptions and temporarily allow exceptions to the visual quality objectives in the project area.

A transportation system to transport removed material would be needed to accomplish project objectives. Road improvement work needed for removing and treating timber stands would include constructing temporary roads, using unclassified roads (and rehabilitating the roads after use), clearing encroaching vegetation on system roads, opening and using closed system roads (and closing them again after use), improving system roads where needed, and maintaining system roads. No road improvements or reconstruction is proposed for Swift Trail (Highway 366).

All actions include resource-specific design criteria that guide the manner in which the actions are implemented to minimize or reduce anticipated effects. These design criteria are listed in appendix A. The entire project is expected to take 10 years to complete.

Alternative 3 - The Mexican Spotted Owl Emphasis Alternative

This alternative consists of actions similar to the treatments of Alternative 2 but treats 223 fewer acres. Live tree thinning would be restricted to trees less than 9 inches in diameter, and no treatments would occur within Mexican spotted owl core areas. Implementation would be modified so that entry would not exceed 10 percent of the total number of Mexican spotted owl protected activity centers (PACs) in the Pinaleño Mountains each year. Protection zones for the Mount Graham red squirrel would be maintained within this alternative, as well as other design features that affect treatments of trees and downed woody material less than 9 inches in diameter. Design features (appendix A) and monitoring programs (appendix B) would also be maintained.

Major Conclusions Include . . .

1. Alternative 2 – The proposed action will meet the stated project purpose and need and subsequent stated goals and objectives (chapter 2, p. 44) better than the other alternatives.

2. Alternative 2 does not follow the guidelines for forest management as established by the Mexican Spotted Owl Recovery Plan but is consistent with the Forest Plan, which allows actions related to management of the Mount Graham red squirrel to supersede those of Mexican spotted owl (chapter 2, p. 44).
3. Alternative 2 – The proposed action will address Significant Issue 2 better than the other alternatives (chapter 2, p. 48).
4. Alternative 2 – The proposed action will addresses Significant Issue 3 better than the other alternatives (chapter 2, p. 48).
5. Alternative 3 – The Mexican spotted owl emphasis alternative will address Significant Issue 1 better than the other alternatives (chapter 2, p. 49).
6. Alternatives 2 and 3 will likely adversely affect the endangered Mount Graham red squirrel. Adverse effects are limited in scope, are not expected to affect viability of the species, and are outweighed by expected long-term protection and stabilization of the species habitat (chapter 3, pp. 84-96). Adverse effects to the Mount Graham red squirrel will be greater under Alternative 3 (chapter 2, p. 49) and long-term beneficial effects to the species will be less than those of Alternative 2.
7. Alternatives 2 and 3 will likely adversely affect the threatened Mexican spotted owl but are unlikely to affect viability of the species. Adverse affects to the species will be similar between both alternatives; however, Alternative 2 will result in greater long-term habitat protection for the species in the project area (chapter 2, p. 50, chapter 3 pp. 86-100).
8. Alternatives 2 and 3 will temporarily negatively affect air quality but both are within limits established by the Environmental Protection Agency (chapter 2, p. 50).
9. All alternatives will result in forest stand conditions that can be classified as Mexican spotted owl habitat in a similar proportion (chapter 2, p. 50).
10. All alternatives will result in similar old growth conditions (chapter 2, p. 50).
11. Past activities on Mount Graham have been perceived to cause harm to Western Apache people and the cultural resources they value. However, the implementation of Alternative 2 or 3 would likely benefit Pinaleño cultural heritage resources over the long term, and begin restoring the ecosystem to pre-1870 conditions as recommended by the Western Apache tribes. Implementation of the alternatives should be completed with respect and in compliance with applicable cultural heritage resource legislation (chapter 3, p. 180).

The Preferred Alternative

The proposed action, Alternative 2, is the preferred alternative.

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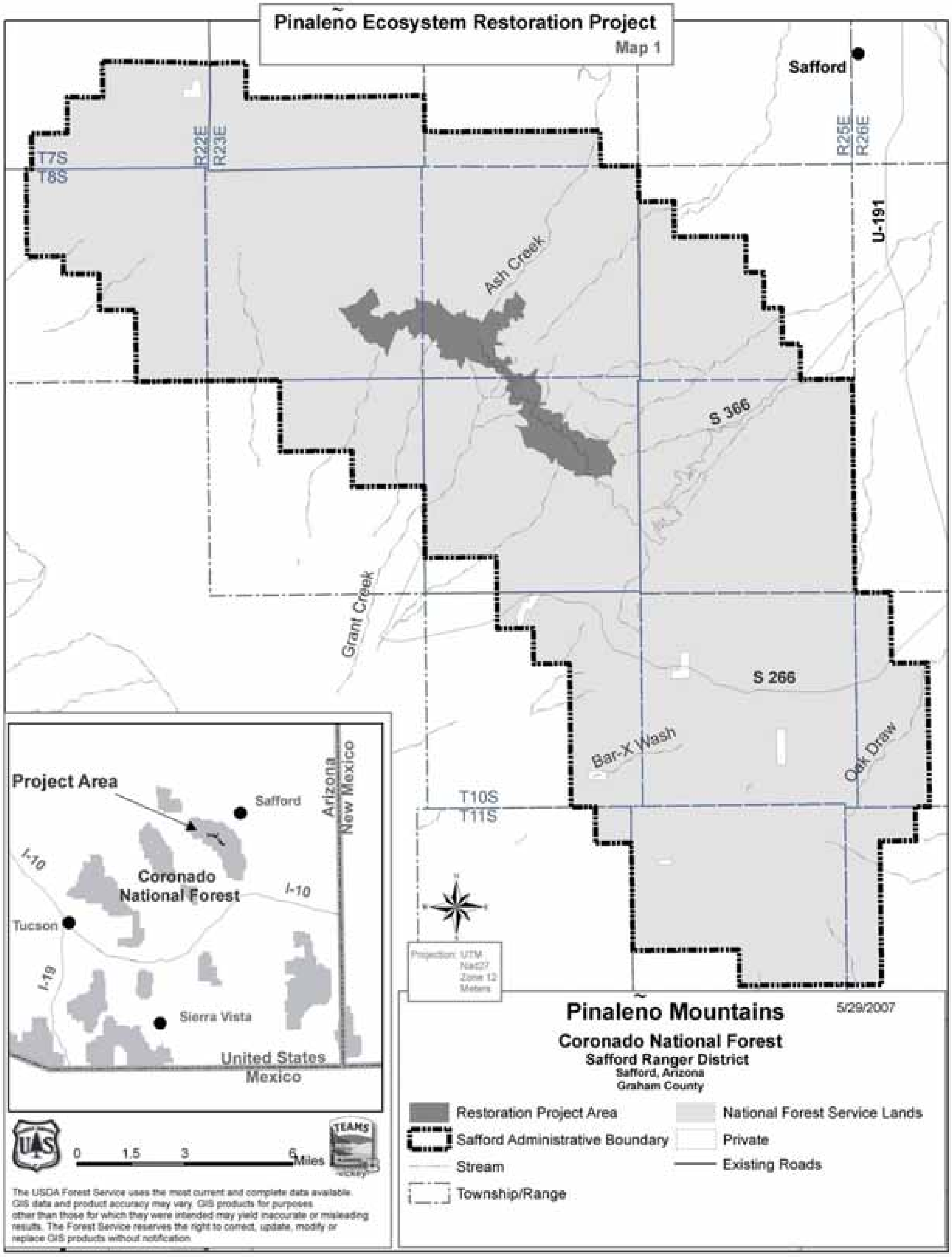


Figure 1. Location of the Pinaleño Ecosystem Restoration Project

Chapter 1. Purpose of and Need for Action

Introduction

The U.S. Department of Agriculture, Forest Service, Coronado National Forest (NF), Safford Ranger District, prepared this draft environmental impact statement (DEIS) to publicly disclose the results of an impacts analysis of a proposed fuel reduction project in Pinal County, Arizona. The EIS content and format conform to the standards established by the Council on Environmental Quality (CEQ) Regulations implementing the National Environmental Policy Act (NEPA) and Forest Service handbook (FSH) 1909.15, Environmental Policy and Procedures. The Forest Service has prepared this draft environmental impact statement in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This draft environmental impact statement discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into four chapters:

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

Additional documentation, including more detailed analyses of project area resources, may be found in the project planning record located at the Coronado National Forest, Safford Ranger District, 711 S. 14th Ave., Suite D, Safford, AZ 85546.

Background

The Safford Ranger District, Coronado National Forest is proposing the Pinaleño Ecosystem Restoration Project (PERP), located on the Pinaleño Mountains near Safford, Arizona. The

5,754-acre project area is located in Graham County, Townships 8 and 9 South, Ranges 23 and 24 East. The Pinaleño Mountains are a remote mountain range in southeastern Arizona.

They have over 7,000 feet (2,100 m) of vertical relief, more than any other range in the state. The mountains are surrounded by the Sonoran-Chihuahuan Desert. Subalpine forests cover the higher elevations. They traverse five ecological communities and contain the highest diversity of habitats of any mountain range in North America. The highest point is Mount Graham at 10,720 feet (3,267 m). The mountains cover 300 square miles.

Figure 2. Mount Graham red squirrel

The Pinaleño Mountains are a special place. One of many "sky-island[1]" ecosystems in the desert Southwest, the Pinaleño Mountains have been an important ecosystem for wildlife, Native Americans, early settlers, recreationists, and researchers. The Pinaleño Mountains contain woodland and conifer forests that feature majestic old-growth Douglas-fir trees, some of which are more than 700 years old. It is also home to numerous endemic wildlife and plant species including the endangered Mount Graham red squirrel (*Tamiasciurus hudsonicus grahamensis*; see figure 2).

Figure 3. Dead and dying trees impacted by insects in the Pinaleño Mountains

There is an increasing broad-based concern that the very attributes that make the Pinaleño Mountains a special place are at an unacceptably high risk of loss from potential catastrophic wildfires and declining forest health, and that something urgently needs to be done to reduce the risks and scale of these types of potential losses.

The Pinaleño Ecosystem Restoration Project has been developed over several years in response to events that have occurred in the Pinaleño Mountains. Active fire suppression and other factors over the past 100 years have drastically

[1] "Sky island ecosystem" is the term given to the mountain ranges that rise dramatically from a "sea" of surrounding desert. Elevations range from 3,000 to 10,720 feet above sea level, supporting vegetation communities as biologically diverse as those found between Mexico and Canada.

reduced the role of natural fire, causing the Pinaleño Mountain forests to become dense and filled with dead and down trees (figure 3). These conditions have led to a high potential for severe wildfires. In 1996 and 2004, large wildfires burned with active crown-consuming fire and directly reduced red squirrel population numbers through habitat loss and mortality (Koprowski et al. 2006). Progressive insect infestations, beginning in 1996, began defoliating and killing trees in the spruce-fir and mixed-conifer forests. The tree mortality associated with these outbreaks has resulted in increased wildfire potential and a decline in the red squirrel population through habitat loss and decreased cone crops. Population numbers of the red squirrel are at their lowest average since censuses of the population began and viability of the species is of paramount concern (figure 4). The moist mixed-conifer forest is now the primary remaining habitat for the red squirrel. These events both heightened the current concern for protecting remaining habitat, and raised the need for restoring degraded habitat.

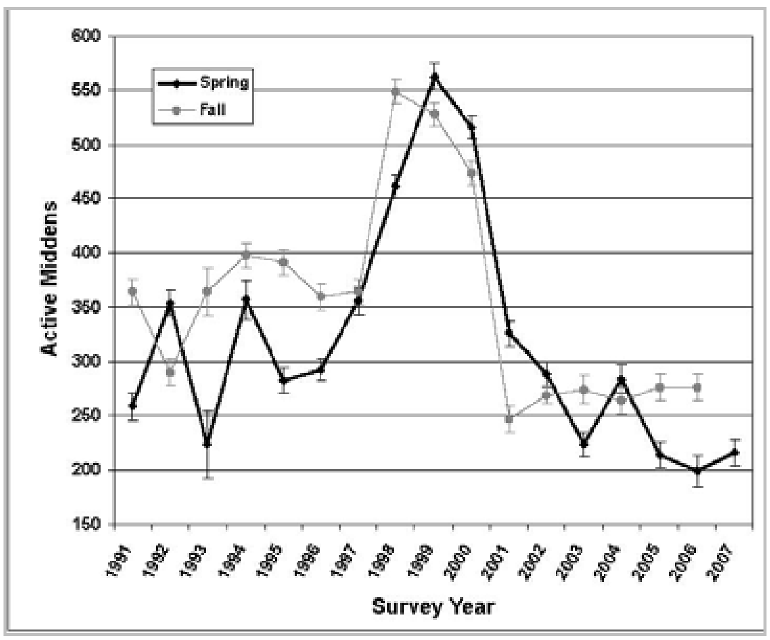


Figure 4. Mount Graham red squirrel populations from 1991-2007

In response to these conditions, the Forest Service has worked closely with the Arizona Game and Fish Department and the U.S. Fish and Wildlife Service to develop the Pinaleño Ecosystem Restoration Project. The 5,754-acre project area may seem relatively small compared to the entire mass of the Pinaleño Ecosystem Management Area (EMA). However, the project area plays a strategic role in the larger landscape and for long-term management of the entire Pinaleño Mountain range. An ultimate goal is to return fire to a more natural role throughout the Pinaleño Mountains. This will likely be accomplished using prescribed fire and wildland fire use on a large-scale basis in the future. Fuel loading and current stand conditions, particularly within the project area are such that significant use of fire as a primary management tool can't yet be contemplated. Introducing prescribed fire or managed wildfire into the project area and adjacent areas in a significant manner without mechanical treatments would lead to unacceptable impacts (stand-replacing crown fires) that would impact important endangered species habitats as well as many of the areas that are utilized and important to people.

In addition to the above considerations, fire, insects, and diseases have impacted many portions of the coniferous forests of the mountain. The 3,705 acres proposed for treatment represent the areas where investments in treatments will be practical and provide benefits not only to the individual acres being treated, but also to the strategic long-term management of the entire mountain. These 3,705 acres contain a majority of the remaining mixed-conifer forest, particularly the old-growth Douglas-fir forests that are important to both wildlife and people. These areas are extremely vulnerable and need to have an investment and priority placed on them now while a difference can be made. Thus, the goals of this project are to provide for the Pinaleño EMA as a whole, but until these critical mixed-conifer acres can be restored to a more natural state, a greater reliance on natural processes cannot be made.

Proposed Action

This project is designed to provide long-term protection to the endangered Mount Graham red squirrel (*Tamiasciurus hudsonicus grahamensis*) and its habitat by reducing the intensity of insect and disease outbreaks and the potential for severe wildfires, in accordance with the Mount Graham Red Squirrel Recovery Plan (USDI Fish and Wildlife Service 1993). Overall, the project is designed to improve long-term sustainability of the ecosystem and habitat for the species that depend upon it. Collaboration with researchers, biologists, foresters, and wildland fire management experts developed actions that meet this focus, including the incorporation of midden protection zones. This concept balances the long-term need to restore habitat for the squirrel, while ensuring that no treatments will occur in currently occupied habitat considered necessary for the short-term protection of the species.

Vegetation treatments are proposed on approximately 3,705 acres within the project area (see figure 1), and would consist of tree removal by thinning dense forests, removing standing and down dead trees, and using prescribed fire to begin restoring what was once a fire-adapted ecosystem. These treatments would be carried out over the next 10 years. A transportation system to transport removed material would be needed to accomplish project objectives. Road improvement work needed for removing and treating timber stands would include constructing temporary roads and rehabilitating roads after use, clearing encroaching vegetation on system roads, opening and using closed system roads (and closing them again after use), improving system roads where needed, and maintaining system roads.

To help accomplish the proposal, amendments to the “Coronado National Forest Land and Resource Management Plan” are proposed to allow regulated Christmas tree removal and public firewood gathering associated with treatment prescriptions and temporarily allow exceptions to the visual quality objectives in the project area (see page 163 for details).

The proposed action is described in detail in the “Alternatives” section of chapter 2. All actions include resource-specific design criteria that guide the manner in which the actions are implemented to minimize or reduce anticipated effects. These design criteria are listed in appendix A. The entire project is expected to take 10 years to complete.

Purpose of and Need for Action

The purpose of the Pinaleño Ecosystem Restoration Project is to initiate forest restoration to protect key ecosystem components and Mount Graham red squirrel habitat. By changing forest composition, structure, and density, the project is expected to reduce the potential for severe wildfires that could destroy red squirrel habitat. The project is also designed to reduce future insect and disease infestations, and to provide for the maturation and sustainability of future red squirrel habitat. Implementing the proposal would achieve the following goals:

- Initiate forest restoration efforts within the project area using guidelines provided in the Mount Graham Red Squirrel Recovery Plan and as allowed by the Forest Plan;
- Initiate the restoration of ecological processes, including the natural fire regimes (high-frequency and mixed-severity regimes) for wildlife improvement purposes;
- Improve forest health by improving the resiliency of overstory trees to insect and disease outbreaks toward wildlife improvement goals outlined in the Forest Plan;
- Within the project area, reduce the risk of stand-replacing crown fire and its threat to red squirrels and other important threatened and endangered wildlife habitat and forest ecosystems as allowed by the Forest Plan;
- Protect or promote late-successional (old-growth) forest conditions as directed in the Forest Plan; and
- Improve firefighter safety.

Specific measures and indicators of these project objectives are listed in chapter 2, “Comparison of Alternatives.”

Forest Service and Other Regulatory Direction

Coronado National Forest Land and Resource Management Plan

The “Coronado National Forest Land and Resource Management Plan” (Forest Plan) provides programmatic direction for managing resources of the Coronado National Forest. It recognizes the importance of the Pinaleño Mountains and its unique social and natural resource values. It guides the management and vision for the project area. Actions proposed under the Pinaleño Ecosystem Restoration Project area are in Forest Plan Management Area 2 (dispersed recreation, mixed-conifer), Management Area 2a (wilderness values, enhanced wildlife) and Management Area 8 (research). The Forest Plan states that management for the Mount Graham red squirrel is a primary objective. This direction is reinforced in the “Record of Decision for Amendment of Forest Plans, Arizona and New Mexico” (1996). Relevant direction from the Forest Plan and the 1996 Record of Decision that was used in the development of this project includes:

Management Area	***Plan Direction***
Management Area 2	“Monitor squirrel populations and habitat annually through inventory and analysis. Red squirrel habitat needs will supersede the needs of all other species.” (Forest Plan, p. 51) “Maintain and improve occupied habitat for: Mount Graham red squirrel… [and]…Mexican spotted owl” (Forest Plan, p. 51)

Management Area	***Plan Direction***
	"Improve old growth spruce-fir and mixed-conifer forest habitat for the Mount Graham red squirrel." (Forest Plan, p. 51) "Within suitable habitat for Mount Graham red squirrel (Pinaleño Mountains), dead and down material will not be removed for fuelwood except for on-site recreational use." (Forest Plan, p. 52) "Within suitable habitat for Mount Graham red squirrel (Pinaleño Mountains), Christmas trees will not be harvested." (Forest Plan, p. 52)
Management Area 2a (Forest Plan Amendment No. 4, January 1989, and Forest Plan Amendment No. 8, June 1996)	"…Red squirrel habitat needs will supersede the needs of other species." (Forest Plan, p. 54-2) "Improve current habitat for the endangered Mount Graham red squirrel and work toward delisting. Emphasize establishment and maintenance of old growth forests within the entire management area." (Forest Plan, p. 54-2) "Improve old growth spruce-fir and mixed-conifer habitat conditions." (Forest Plan, p. 54-3) "Within the Management Area, removal is limited to research, sanitation and salvage operations, and maintenance and improvement of wildlife habitat." (Forest Plan, p. 54-3) "Use of down woody material for firewood is restricted to on-site recreational use within areas open to public use." (Forest Plan, p. 54-3) "Utilize prescribed fire to reduce risk from wildfire and enhance wildlife values with emphasis on red squirrel habitat." (Forest Plan, p. 54-5) "Within other (non-wilderness) areas, outbreaks of insects or disease will be controlled using integrated pest management concepts when there is significant danger to the vegetation needed to sustain habitat for the Mount Graham red squirrel….." (Forest Plan, p. 54-5)
Management Area 8	"Maintain or improve occupied habitat for federally and state-listed animals." (Forest Plan, p. 75) "Delist threatened and endangered species and reoccupy historical habitat with other identified species following guidelines of approved recovery plans and memorandums of understanding." (Forest Plan, p. 75) *(Note: No activities are proposed in this management area although it is within the planning area.)*

Management Area	***Plan Direction***
Forest Plan Amendment No. 8, June 1996, Regional Mexican Spotted Owl (MSO), Northern Goshawk (NGH) and Old Growth Amendment	Mexican Spotted Owl "(These standard and guides (S and Gs) are superseded by red squirrel S and Gs when necessary only in red squirrel habitat on Mount Graham in Management Area 2 or 2A.)" (Forest Plan, pp. 15-18) "Management activities necessary to implement the Mount Graham red squirrel recovery plan, which may conflict with standards and guidelines for the Mexican spotted owl, will take precedence and will be exempted from the conflicting Mexican spotted owl standards and guidelines." (Forest Plan, pp. 15-18) Northern Goshawk "These S and Gs are superseded by red squirrel S and Gs when necessary only in red squirrel habitat on Mount Graham in Management Areas 2 or 2A. The northern goshawk standards and guidelines apply to the forest and woodland communities described below that are outside of Mexican spotted owl protected and restricted areas. Within Mexican spotted owl protected and restricted areas, the Mexican spotted owl standards and guidelines take precedence over the northern goshawk standards and guidelines." (Forest Plan, p. 19)
Record of Decision for Amendment of Forest Plans Arizona and New Mexico (1996)	"13. In all management areas except 2 and 2A, apply the following standards and guidelines in Mexican spotted owl and Northern Goshawk habitat." (Page 40, Record of Decision for Amendment of Forest Plans Arizona and New Mexico. Appendix B. Forest Plan Amendments and Forest Plan Corrections 1996) "Management activities necessary to implement the Mt. Graham red squirrel recovery plan, which may conflict with standards and guidelines for Mexican spotted owl, will take precedence and will be exempt from the conflicting Mexican spotted owl standards and guidelines." Page 90, Record of Decision for Amendment of Forest Plans Arizona and New Mexico Appendix C. Standards and Guidelines in Selected Alternative (G). 1996)

The Forest Plan is clear that the Mount Graham red squirrel recovery efforts take precedence over the Mexican spotted owl (*Strix occidentalis lucida*), northern goshawk (*Accipiter gentilis*) and old growth standards and guidelines. The primary guidance for the protection and recovery of the red squirrel is contained in the recovery plan for the species.

Guidance from the Mount Graham Red Squirrel Recovery Plan

Objective:

- "To increase and stabilize the existing Mount Graham red squirrel population by protecting existing habitat and restoring degraded habitats." (p. iii)

- "Protection that may prevent the extinction of the squirrel includes: (1) establishment of habitat management zones, … (5) forest management to reduce the probability of habitat destroying fires, and…" (p. 16)
- "Protection and restoration of habitat. This is the most important factor for continued survival of the Mount Graham red squirrel. Because habitat is limited, further habitat losses could cause extinction in the near future. Many areas of potentially suitable habitat are degraded. Restoration of degraded areas is essential." (p. 24)

Forest Vegetation Terminology

(For further information regarding these terms, please refer to appendix C)

Basal Area: a measurement of how much of a site is occupied by trees, determined by estimating the cross-sectional area of the boles of all the trees in an area at breast height (4.5 feet). Basal area is used because it is correlated with crown area, but is more easily measured.

Stand Density: a quantitative measure of how completely a stand of trees occupies a site, usually expressed in terms of number of trees, or tree basal area per acre or per hectare.

Average Tree Diameter: The average tree diameter, at breast height, of all trees in a given area.

Existing Conditions

As described in previous sections, the Pinaleño Mountains are currently susceptible to wildfire, insect and disease outbreaks, and the population of red squirrel has declined precipitously (Koprowski, Alanen and Lynch 2005).

Figure 5.Trees killed from high-intensity wildfire in the Pinaleño Mountains

Recent field observations of fuel loading and forest stand examinations indicate that the Pinaleño forest ecosystem is characterized by a large quantity of dead trees and a dense understory of small and medium sized trees. Based on an inventory of stands (table 1), the project area has a high average stand density index (SDI). SDI is an indicator of site occupancy by trees and is used as a measure of stress on trees in a given area (referred to as "stands"). When trees in a stand die from the stress of competition between individual trees for water, light, and nutrients, the stand is generally between 55 and 65 percent of maximum stand density. Individual tree health is best maintained when forest densities are below 35 percent of the maximum (Lilieholm et al. 1994). The stands in the project area currently have a forest density averaging 73 percent of the maximum potential of a mixed-conifer forest.

Late-successional trees such as Engelmann spruce (*Picea engelmannii*), white fir (*Abies concolor*), and corkbark fir (*Abies lasiocarpa var. arizonica*) are now common in the understory, while many early successional tree species such as ponderosa pine (*Pinus ponderosa*) are dying in the overstory and not regenerating within the stands. The high stand densities within the mixed-conifer communities of the Pinaleño Mountains make the forest susceptible to further insect and disease outbreaks.

Table 1. Forest stand averages of live and dead trees based on a 1996 inventory of the 214 stands within the project area

Species	Basal Area Live Trees (ft^2/ac)	Stand Density Index	Average Live Tree Diameter (in)	Basal Area Dead Trees (ft^2/ac)	Average Dead Tree Diameter
White fir	31.9	64	10.6	5.2	15.4
Corkbark fir	13.3	30	7.1	5.5	11.5
Englemann spruce	18.2	37	10.3	3.6	13.9
Ponderosa pine	14.0	25	15.9	8.3	16.8
SW white pine	39.7	76	11.5	4.7	14.7
Aspen	17.0	38	8.8	3.5	11.4
Douglas-fir	82.1	153	14.6	13.5	22.4
Hardwoods*	2.1	12	5.4	0.3	5.1
Total	218.4	435	8.6	46.3	15.1

*Primarily locust, oak, and maple species.

Further, forest stand inventories show little or no regeneration of Douglas-fir (*Pseudotsuga menziesii*), a key old-growth tree species and a primary food source of the Mount Graham red squirrel. The data also reveal that a greater proportion of larger trees are dying, which represents a serious long-term trend of degrading old-growth forest characteristics. This loss is driven by stress from high stand densities, which were historically regulated by more frequent, mixed-severity wildfires in Southwestern mixed-conifer forest ecosystems (Dieterich 1983, Graham et al. 1995).

The high stand densities and the amount of standing dead and down trees create a forest susceptible to uncharacteristic wildfire. In addition, insect activity and tree mortality have significantly increased in the Pinaleño Mountains in the past 2 decades (USDA Forest Service 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006). These insect outbreaks and the high-intensity fires that occurred have destroyed large areas of wildlife habitat, including critical habitat for the red squirrel (Koprowski, Alanen and Lynch 2005, Merrick et. al. 2007) and Mexican spotted owl. The fires increased the potential for soil erosion and flooding, diminished the scenic and recreational values of the forest, and damaged or destroyed public and private property.

Historic Condition

By examining the fire history of the area before European settlement, one can better understand why the vegetation structure and composition of the project area are significantly different today. Tree-ring studies conducted at Peter's Flat and Camp Point (Grissino-Mayer et. al. 1994) and later near Webb Peak show that widespread fires occurred frequently up until European settlement, but noticeably declined after. These studies also indicate that the forest consisted of stands of mixed-conifer species, primarily Douglas-fir, southwestern white pine (*Pinus strobiformis*), and ponderosa pine, with inclusions of lesser amounts of white fir, Engelmann spruce, and corkbark fir. The proposed project area historically experienced a frequent to mixed fire regime, with highly variable average fire return intervals, ranging from 3 to 60 years, depending largely upon each fire's location on the landscape (Swetnam, Baisan and Grissino-Mayer in press, Proceedings Mount Graham Red Squirrel Symposium). The result was a complex and highly diverse landscape with a mosaic of varying vegetation patterns. Fire created more openings and aspen groves, reduced the occurrence of fire-sensitive species, removed younger age classes of trees, and minimized the accumulation of dead trees on the forest floor. Fires tended to confine Engelmann spruce and corkbark fir to riparian areas, to moist pockets of mixed-conifer stands, and the highest elevations of the mountain.

Site-specific tree-ring data studies conducted in the Pinaleño Mountains indicate that the last widespread fires on the mountain occurred in 1879, and concluded that recent fire suppression had resulted in a current fuels buildup that is unprecedented for more than 500 years (Grissino-Mayer et al. 1994). This pattern of change is repeated in other mixed-conifer forest types in the Southwest (Dieterich 1983, White and Vankat 1993, Swetnam, Baisan and Kaib 2001, Fulé et al. 2003, Sakulich and Taylor 2007). From these studies and the 1996 data shown in table 1, it can be concluded that far-reaching changes have occurred in forest stand densities, tree age-class distributions (shifts to smaller and younger trees), and in species composition of stands (shifts from fire-tolerant to fire-intolerant species). Similar shifts have been documented in other Southwestern forests (Cooper 1960, White and Vankat 1993, Fulé et al. 2003, Moore et al. 2004).

Desired Conditions

The Mount Graham Red Squirrel Recovery Plan (appendix A, p. 34) defines desired *microsite conditions* for excellent squirrel midden habitat in the spruce-fir and mixed-conifer vegetation associations on Mount Graham. It is important to maintain these site-specific conditions and is one reason this proposal includes midden protection zones. In habitat surrounding these protection zones, the desired condition is to create a healthy and sustainable forest habitat that includes a balance between midden microsite requirements and forest conditions that reduce the risk of complete habitat loss. Therefore, the desired condition of suitable red squirrel habitat outside of midden protection zones is a forest that is resistant to insects, diseases, and uncharacteristic wildfire while maintaining or creating potential areas that meet the following microsite characteristics:

- Forest structure should consist of a nearly continuous multi-layered forest with overhead canopy closure[2] greater than 80 percent.[3]

[2] Canopy closure: the degree to which the canopy (forest layers above one's head) blocks the sunlight or obscures the sky.
[3] This is a microsite-based metric based on midden sites and not average forest conditions.

- Basal area[4] of live and dead trees of at least 65 m^2/ha (275 ft^2/ac) with groupings of 0.031 ha (0.078 ac) of large dominant trees greater than or equal to 40 cm (16 inches) diameter at breast height (d.b.h.) associated with greater than or equal to 5 to 8 logs and 1 to 2 standing snags greater than or equal to 40 cm (16 inches) d.b.h. (Mannan and Smith 1991).
- Snags[5] (standing dead trees) 10 to 15 per ha (4 to 6 snags/acre) that are greater than or equal to 40 cm (16 inches) d.b.h.
- Logs, as many as possible, need to be maintained, especially those in the latter stages of decay.

Recommended Red Squirrel Habitat Management Zones

Zone 1 areas are currently occupied, and have a high midden density. These areas are critical to the short-term survival of the squirrel. In Zone 1 areas, a maximum level of habitat protection is recommended by the recovery plan. This includes protection from catastrophic fire, and disease control.

Zone 2 contains suitable occupied habitat but with lower squirrel densities than Zone 1. Zone 2 is believed to include important dispersal corridors for the red squirrel. Management recommendations are for protection from habitat loss caused by fire and disease, and for necessary silvicultural treatments based on habitat analysis.

Zone 3 has currently suitable or potentially suitable habitat, but has more dispersed midden sites than Zones 1 or 2. The recovery plan recommends that this zone be managed to provide suitable habitat within 20 to 60 years through silvicultural techniques to improve the habitat.

Zone 4 has high, long-term (100 to 200 years) potential as red squirrel habitat. Management recommendations for this zone include intensive silvicultural treatment to obtain the sites' full habitat potential.

Suitable habitat generally contains many but not all of the optimal characteristics, and habitat recommendations may be modified based upon results from further research and monitoring. Missing in this microhabitat description is an indication of forest and landscape-level parameters and the heterogeneous landscape mosaic typical of historical mixed-conifer forests. Instead, the plan partially deals with this through habitat management zone descriptions, which are based on current and potential red squirrel habitat (see text box, right).

The Pinaleño Ecosystem Restoration Project area is primarily within Habitat Management Zones 1 through 4. The zone designations reflect whether an area is currently occupied by red squirrel, what the distribution is of current red squirrel habitat, and what the potential capacity is of the forest to develop into the desired condition.

The implementation of these management zones is designated as a priority 1 task in the Mount Graham Red Squirrel Recovery Plan under Task 121. A priority 1 task is defined by the recovery plan as an action that must be taken to prevent extinction or prevent the species from declining irreversibly in the foreseeable future.

Since the recovery plan was finalized in 1993, much of what was Zone 1 was affected by a series of insect outbreaks (which killed much of the Engelmann spruce and corkbark fir (Koprowski, Alanen and Lynch 2005)), and the Nuttall-Gibson Fire Complex in 2004 (Koprowski et al. 2006). The moist mixed-conifer forest is now the primary remaining

[4] Basal area (BA): a measure of tree density determined by estimating the cross-sectional area of all trees (usually live trees only) at 4.5 feet above the ground. Basal area is expressed as square feet per acre (or square meters per hectare).
[5] Snags: standing dead trees.

habitat for the red squirrel. These events both heightened the current concern for protecting remaining habitat, and raised the need for restoring degraded habitat.

Based on the preceding information, it is estimated that today's fuel loads and stand densities are much greater than historic forest conditions. The ecological implications of these shifts have lead to increased susceptibility to insect outbreaks and stand-replacing fires (Dieterich 1983, White and Vankat 1993, Fulé et al. 2004, Moore et al. 2004).

Therefore, there is a need to begin restoring ecological processes and treat the causes of declining ecosystem health by reducing stand densities, changing understory species composition, and reducing fuel loading. This restoration effort would trend forests toward a condition that is self-sustaining and compatible with the conditions under which they naturally evolved (Friederici 2003), employing a strategy emphasizing ecological functions and processes (Falk 2006).

According to the Mount Graham Red Squirrel Recovery Plan, the main threats to this subspecies are habitat loss and catastrophic wildfire. Over the past 20 years, approximately 50 percent of previously occupied red squirrel habitat has been rendered unsuitable due to insect outbreaks and fire (Koprowski 2005, Koprowski, Alanen, and Lynch 2005, Koprowski et al. 2006). Associated with this reduction in habitat is a corresponding decline in population size; the current population estimate is 216 squirrels (AGFD 2007, unpublished data). As such, the remaining habitat, most of which falls within the project area, is of high importance. Therefore, a long-term need exists to protect red squirrel habitat within the project area from losses due to fire, insect outbreaks, and diseases, and to restore areas of degraded habitat for this subspecies that balances short-term effects to the species.

Decision Framework

Given the purpose and need, the Coronado National Forest supervisor will review the environmental consequences and public comments on analysis, and make decisions whether to implement: (1) the proposed action, including Forest Plan amendments, (2) alternatives to the proposed action and/or amendments, or (3) the no action alternative; and approve or disapprove each of three proposed amendments to the Forest Plan.

Public Involvement

The Pinaleño Ecosystem Restoration Project began in late 2003 when an interdisciplinary team was designated to address wildfires and tree mortality on Mount Graham. From 2003 to 2007, the project was designed and revised using a number of public involvement settings that resulted in its eventual formal publication in 2007. In 2004, a letter was sent to local user and interest groups, cabin owners, and the forestwide NEPA mailing list asking for input regarding the "Mount Graham Sky Island Demonstration Project." Based on responses from this mailing, a biological working group made up of conservation groups, scientists, agency personnel from the Arizona Game and Fish Department, USDI Fish and Wildlife Service, the USDA Forest Service, and University of Arizona biologists was developed to advise the interdisciplinary team on strategies to reduce fire risk, restore forested ecosystems, and protect the endangered Mount Graham red squirrel in the Pinaleño Mountains. In May 2005, draft proposals were distributed and sent to the public. Public meetings were held to discuss and develop potential alternatives. In September 2005, tribal coordination began regarding the specific proposals being discussed. In October 2005, field trips were held to discuss potential treatments with the public and to receive input regarding those treatments. The forest received 10 comments from individuals and organizations resulting from these field trips. In January 2006, the USDA Forest Service redrafted a proposed action and distributed it for internal review. Based on internal responses and the substantive decline in the Mount Graham red squirrel population, the interdisciplinary team revised the proposal substantively to emphasize protection of currently occupied Mount Graham red squirrel habitat, while restoring declining mixed-conifer stands and improving forest stand health in potential Mount Graham red squirrel habitat.

The Forest Service developed the proposed action contained within this DEIS in early 2007. The Notice of Intent (NOI) was published in the Federal Register on August 3, 2007. The NOI asked for public comment on the proposal from August 3, 2007, to September 2, 2007. From this notice, 12 responses were received from 10 individuals or organizations. Five responses expressed advocacy for the project; three comments expressed concerns regarding wildlife species including the Mount Graham red squirrel, the Mexican spotted owl, and the northern goshawk; three comments expressed concern regarding air quality issues; two comments expressed concern regarding diameter limits and old growth; and two comments expressed concern that the size and scope of the project was not sufficient. Using the comments from the public and other agencies (see “Issues” section), the interdisciplinary team developed a list of issues and alternatives to the proposal.

This draft environmental impact statement will be available for a 45-day public review period. A final environmental impact statement and record of decision will be released following the review period. The record of decision will be subject to an administrative appeal period of 45 days.

Issues

The Forest Service separated comments into significant and nonsignificant issues. The Council on Environmental Quality (CEQ) NEPA regulations explain this delineation in Sec. 1501.7, “…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)….” A list of nonsignificant issues and reasons regarding their categorization as nonsignificant may be found in the record. Identified issues and proposed alternatives were reviewed and approved by the deciding official (Project Record Nos. 129 and 130).

Significant Issues

The Forest Service identified the following significant issues during scoping:

Significant Issue 1: The proposed project’s silvicultural prescriptions are not consistent with silvicultural guidelines of the Mexican Spotted Owl Recovery Plan.

The Coronado National Forest plan allows for the management and recovery of the Mount Graham red squirrel efforts to supersede management for the Mexican spotted owl. Following this direction, in areas of red squirrel habitat, the proposed action’s proposed vegetative treatments are not consistent with the silvicultural guidelines contained in the Mexican Spotted Owl Recovery Plan. To address this, the IDT developed an alternative that applied Spotted Owl Recovery Plan guidance to red squirrel habitat areas and developed a new action alternative. Indicators and measures used to define differences between the alternatives for this issue will include:

- Treatments and prescriptions that follow silvicultural guidelines established by the Mexican Spotted Owl Recovery Plan. This indicator will be measured by:
  - Acres of treatments that follow the guidelines.
  - Acres of treatments that do not follow the guidelines as allowed by the Forest Plan.
- Forested stands that meet habitat classification standards of the Mexican Spotted Owl Recovery Plan pre- and post-treatment. This indicator will include the following measures:
  - Projected percent of forest stands that meet classification standards of "Habitat" and "Not Habitat" as defined by the recovery plan as defined by:
    - Acres that meet stand stocking levels in terms of basal area.
    - Acres that meet stand stocking levels in terms of trees per acre greater than 18 inches d.b.h.
    - Percent of total stand density index (SDI) by size classes.

Significant Issue 2: The proposed project doesn't treat enough areas of the Pinaleño Mountains or use enough prescribed fire to fully meet the ecosystem restoration purpose and need of the project.

The IDT developed a new action alternative that increases the number of acres treated and the use of prescribed fire to treat those acres. This alternative is detailed in chapter 2, "Alternatives Eliminated from Detailed Study." Indicators and measures used to define differences between the alternatives for this issue will include:

- Amount of forest restoration treatments in the Pinaleño Mountains as measured by:
  - The percentage of acres receiving forest restoration treatments within mixed-conifer and spruce-fir stands in the Pinaleño Mountains.
  - The percentage of acres that will receive prescribed burn treatments within the mixed-conifer and spruce-fir stand in the Pinaleño Mountains.

Significant Issue 3: The proposed project may have negative effects to wildlife including the Mount Graham Red Squirrel, the Mexican spotted owl, and Northern Goshawk.

This issue was resolved through project-level design features and required further alternative development. The following indicators will be used to measure effects to wildlife species and the differences between alternatives:

Mount Graham Red Squirrel - Summary effect call for the species as measured by:

- Number of known squirrel nesting areas (middens) disturbed by the alternative.
- Acres of critical habitat negatively affected by the alternative.

- Retention of stand components necessary for red squirrel habitat:
    - percent canopy closure.
    - trees per acre (TPA).
- Predicted mortality of Mount Graham red squirrel resulting from implementation of each alternative.

Mexican Spotted Owl - Summary effect call for the species as measured by:

- Percent of available critical habitat disturbed by the alternative.
- Acres in the project area that will retain primary constituent elements of Mexican spotted owl critical habitat:
    - A range of tree species, including mixed-conifer, pine-oak, and riparian forest types, in which 30 to 45 percent of the stand density index is composed of trees with trunks 12 inches in diameter or greater.
    - Shade canopy 40 percent or greater.
    - Snags 12 inches in diameter or greater.
    - High volumes of fallen trees and other woody debris.
    - A wide range of tree species, including hardwoods.
    - Adequate levels of residual plant cover to maintain fruits, seeds, and allow for plant regeneration.

Northern Goshawk - Summary effect call for the species

Significant Issue 4: The proposed project will negatively affect air quality.

This issue was resolved through project-level design features and required further alternative development. The following indicators will be used to measure the effects to air quality and the differences between alternatives. Indicators and measures used to define differences between the alternatives for this issue will include:

- Violation of National Ambient Air Quality Standards (NAAQS).
- Predicted smoke emissions ($PM_{2.5}$ NAAQS) on sensitive receptors and how that compares to regulatory standards and requirements.

Significant Issue 5: The proposed project will decrease old growth in the analysis area.

There is a concern that removing trees greater than 9 inches d.b.h. will diminish Mount Graham red squirrel habitat and diminish old-growth characteristics. This issue was resolved through project-level design features and required further alternative development. The following indicators will be used to measure effects to old growth (this is also tracked as an objective of the project) and the differences between alternatives. Indicators and measures used to define differences between the alternatives for this issue will include:

- Comparison of stands qualifying currently as old growth with stands in 2018 and 2048 with and without treatment using the following Forest Plan criteria:

- Low-site mixed-conifer[6]: 12 trees per acre greater than 18 inches d.b.h.; greater than 80 BA; greater than 50 percent canopy cover; 2.5 snags/acre greater than 14 inches diameter and 20 feet high; 4 down logs/acre, greater than 12 inches diameter and more than 16 feet long; (pg. 24, Amendment 8).

[6] The Forest Plan provides classification for both "high" and "low" site mixed conifer stands. All stands in PERP were classified as low site mixed conifer.

Chapter 2. Alternatives, Including the Proposed Action

Introduction

This chapter describes and compares the alternatives considered for the proposed project. It includes a description and map of each alternative considered. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Information used to compare the alternatives is based upon the design of the alternative (i.e., hand-based treatments versus mechanical-based methods), the ability of each alternative to accomplish project-defined goals, and how each alternative responds to the issues developed through scoping.

Alternatives Considered in Detail

Three alternatives were considered in detail in this DEIS: (1) no action, (2) the proposed action, and (3) the Mexican spotted owl emphasis action.

Alternative 1 - No Action

No action is evaluated in this DEIS as an alternative to the proposed action, as required by Council for Environmental Quality (CEQ) regulations (40 CFR Part 1502.14(d)). When analyzing the no action alternative, it is assumed that current conditions in the project area would continue in order to provide a baseline against which the impacts of the proposed action may be compared. As directed by CEQ for actions that propose projects (http://ceq.hss.doe.gov/nepa/regs/40/1-10.HTM#3), no action in this case means the proposed activity would not take place, and the resulting environmental effects from taking no action would be compared with the effects of permitting the proposed activity or an alternative activity to go forward.

Alternative 2 - Proposed Action

The proposed action (Alternative 2) comprises vegetation treatments and proposed amendments to the Forest Plan necessary for the project to be implemented. Vegetation treatments would include implementation of both silvicultural prescriptions and fuel reduction in each of two areas designated as “forest restoration areas” and “important wildlife areas.” Removal of woody material from treatment locations includes methods common to both.” Forest Plan amendments would include those necessary to allow firewood and Christmas tree harvest in the project area and to allow visual quality objectives to be relaxed in the short term. A transportation system to transport removed material would be needed to accomplish project objectives. Road improvement work needed for removing and treating timber stands would include constructing temporary roads and rehabilitating the roads after use, clearing encroaching vegetation on system roads, opening and using closed system roads (and closing them again after use), improving system roads where needed, and maintaining system roads.

All actions include resource-specific design criteria that guide the manner in which the actions are implemented to minimize or reduce anticipated effects. These design criteria are listed in appendix A. The entire project is expected to take 10 years to complete.

Alternative 2 Vegetation Treatments

The proposed action prescribes 59 different combinations of vegetative treatments. These combinations follow two general treatment strategies referred to as "important wildlife areas" or "forest restoration." (figure 8)

As a means to protect areas with active red squirrel middens, biologists established midden protection zones using the Mount Graham Red Squirrel Recovery Plan, current research information, and maps of active red squirrel middens. The protection zones encompass all but two isolated middens, which would be buffered individually. These protection zones would not be treated under this proposal.

The important wildlife area treatment strategy is proposed in areas that contain currently unoccupied or disappeared Mount Graham red squirrel middens, Mexican spotted owl core areas, or both. This strategy is also designed to initiate forest restoration and to protect and restore degraded red squirrel habitats.

Forest restoration treatments occur outside of known Mount Graham red squirrel midden areas and Mexican spotted owl core areas. In these places surrounding important wildlife areas and midden protection zones, more aggressive treatments are allowed to restore forest conditions and to create future Mount Graham red squirrel (MGRS) habitat.

During the project planning process, general treatment prescriptions were first developed for the two treatment areas. As a result of stand-by-stand analysis of stand data, tree mortality from insects and wildfires, access for treatments, and other resource concerns, the general treatment prescriptions for some treatment units were modified (table 2). Treatments were organized into three components: silvicultural treatments, fuels treatments, and removal methods. Silvicultural treatments refer to treatment of live and dead standing trees (figure 9). Fuels treatments refer to treatment of down woody fuel (including that created by the silvicultural treatments, figure 10). Removal methods refer to treatments that include removing down woody material offsite (figure 11).

Forest Restoration Area - General Prescription

This treatment is a combination of variable density thinning, thinning from below, and group selection (for further information regarding these treatment regimes, please refer to appendix C). Within the confines of an 18-inch-maximum-cut diameter limit and a minimum 150 ft^2 per acre basal area stand-stocking level target, the thinning treatments would create forest stands that are very diverse in structure and stocking level. Figure 6 shows a forest stand (not in the project area) that is being managed under a group selection method that has a high degree of structural and stocking level diversity. A modeled visual depicting this thinning regime is shown in figure 7. The proposed treatments would create stands similar in appearance to this visual depiction. See figure 8 for locations of general prescription treatments.

Table 2. Summary of silvicultural treatments proposed by treatment area for Alternative 2; also refer to figure 9

Treatment Area		Silvicultural Treatment	Acres
Forest Restoration	General Rx	Thin live trees less than 18 inches d.b.h.; follows MSO restricted targets (150 BA and residual stocking proportioned over multiple VSS classes).	1,688
	Modified Rx 1	Reduce dead trees in snag pockets (0.25 to 1.25-acre group size) up to 18 inches d.b.h. to 6 snags/acre; general Rx in remainder.	85
	Modified Rx 2	Reduce dead trees in snag pockets (0.25 to 1.25-acre group size) up to 18 inches d.b.h. to 6 snags/acre; no live tree thinning.	112
	Modified Rx 3	Reduce dead trees in snag pockets (0.25 to 1.25-acre group size) up to 18 inches d.b.h. to 6 snags/acre; thin live trees less than 9 inches d.b.h. in remainder.	10
	Modified Rx 4	Thin trees less than 12 inches d.b.h.; follows MSO restricted targets (150 BA).	47
	Modified Rx 5	Thin trees less than 9 inches d.b.h.; follows MSO restricted targets (170 BA) (this is the same RX as the "Important Wildlife Area" General Rx below).	213
Important Wildlife Area	General Rx	Thin live trees less than 9 inches d.b.h.; follows MSO restricted targets (170 BA and residual stocking proportioned over multiple VSS classes).	752
	Modified Rx 6	Reduce dead trees in snag pockets (0.25 to 1.25-acre group size) up to 18 inches d.b.h. to 6 snags/acre; no live tree thinning.	42
	Modified Rx 7	Reduce dead trees in snag pockets (0.25 to 1.25-acre group size) up to 18 inches d.b.h. to 6 snags/acre; thin live less than 9 inches d.b.h. (this is the same as Rx 3).	67

Rx: Prescription
MSO: Mexican spotted owl
BA: basal area
VSS: Vegetation structural stage
d.b.h.: diameter at breast height

Silvicultural Treatment Terms

(please refer to appendix C)

Thinning - harvest of some trees in a forested stand to provide growing space for better quality trees, and/or to remove dead or dying trees to reduce pest problems.

Variable Density Thinning – thinning a forested stand following a regime in which remaining tree density is deliberately varied throughout the stand.

Thinning from below – A type of thinning that particularly favors the dominants or, in heavier thinning intensities, selected dominants more or less evenly distributed over the stand, by removing a varying proportion of the other trees (i.e. the removal of sub-dominants and suppressed trees). Also called "low thinning."

Group Selection – a harvest method in which patches (generally less than 1 to 2 acres) of selected trees are removed to create openings in the forest canopy and to encourage the reproduction and development of uneven-aged stands.

Figure 6. Ponderosa pine stand managed under a group selection regime showing a variety of age/size class groups and stocking

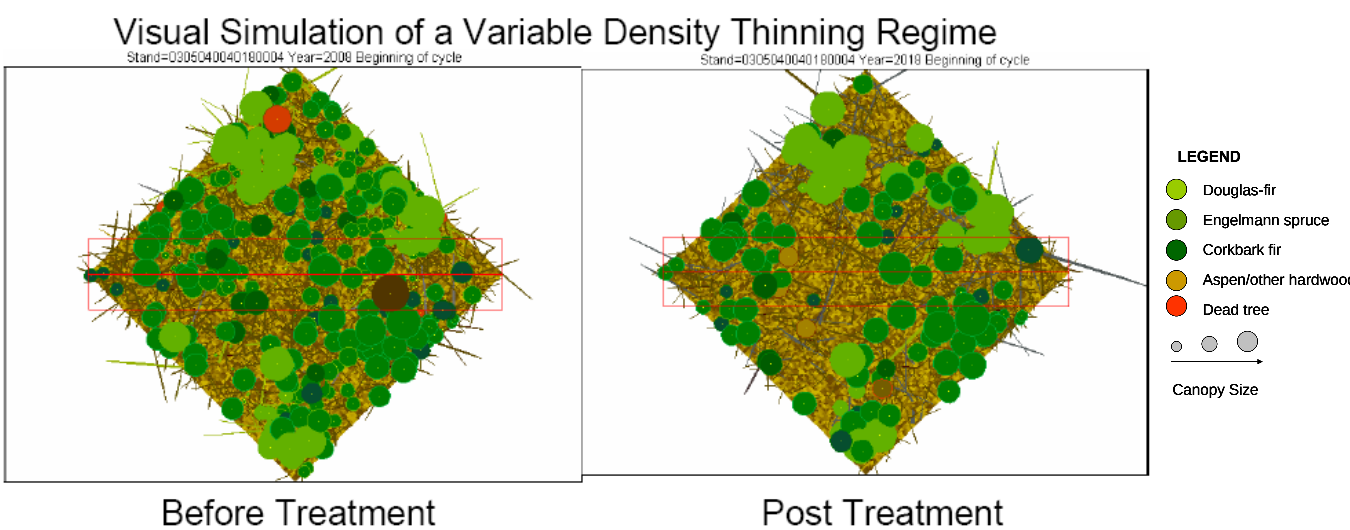


Figure 7. Overhead view of a stand located near Soldier Creek in the Pinaleño Mountains thinned using a stand average thinning regime using Forest Vegetation Simulator (appendix C).

This depiction uses prescriptions that produce results similar to a variable density thinning regime; however, under a true variable density thinning regime, the "clumpy" nature of the thinning would be more pronounced.

Specific design features for the treatment are (apply to general and modified prescriptions):

1. Using a group selection method, stands would be subdivided into five size/age classes (not counting the grass-forb/seedling stage). The size/age classes would be based upon the vegetative structural stage (VSS) size class breaks.
2. Trees up to 18 inches in diameter at breast height (d.b.h.) could be cut.
3. Average stand stocking would be reduced to about 150 ft^2 basal area per acre (34 m^2/ha).
4. The thinning would be variable density, in which some groups within the stand are thinned to a wide spacing, and some groups are thinned to a close spacing or not thinned at all. In general, the widely spaced group density would range from 25 percent to 45 percent of the maximum stand density index (SDI) for Douglas-fir. The closed canopy groups would average greater than 45 percent maximum SDI for Douglas-fir.
5. Heavily thinned groups would be located around aspen clones, ponderosa pine patches, and relics of ponderosa pine patches, or old growth Douglas-fir patches. This would enhance the growth and vigor of, or regenerate these components, as well as reduce bark beetle risk to the conifers.
6. The ratio of closed canopy to open canopy groups would be 2 to 1.

Forest Restoration Areas - Modified Treatments

Prescription 1. Reduce dead trees less than 18 inches d.b.h. in snag pockets (0.25 to 1.25-acre group size) to six snags/acre. General prescription thinning in remainder.

In these treatments, dead trees less than 18 inches d.b.h. would be removed from groups of large numbers of dead trees (snag pockets) 0.25 to 1.25 acres in size. A minimum of six of the largest and soundest snags available would be retained per acre within the groups. Species that tend to have snag longevity (such as Douglas-fir) would be favored for retention over those tree species that do not (such as aspen). Outside of the snag pockets, dead trees up to 9 inches d.b.h. would be cut. Live trees less than 18 inches d.b.h. would be thinned as described above for the "Forest Restoration Treatment Area-General Prescription" treatment. Following tree cutting, down woody material would be reduced to less than 15 tons per acre throughout the area. See "Removal Methods" (page 25 and table 5) for methodologies that will be used to accomplish this prescription. See figure 8 for locations of these modified prescriptions.

Prescription 2. Reduce dead trees less than 18 inches d.b.h. in snag pockets (0.25 to 1.25-acre group size) to six snags/acre. No live tree thinning.

In these treatments, dead trees less than 18 inches d.b.h. would be removed from groups of large numbers of dead trees (snag pockets) 0.25 to 1.25 acres in size. A minimum of six of the largest and soundest snags available would be retained per acre within the groups. Species that tend to have snag longevity (such as Douglas-fir) would be favored for retention over those tree species that do not (such as aspen). Outside of the snag pockets, all dead trees up to 9 inches d.b.h. would be cut. Following tree cutting, down woody material would be reduced to less than 15 tons per acre throughout the area. See section entitled “Removal Methods” (page 25 and table 5) for methodologies that will be used to accomplish this prescription.

Prescription 3. Reduce dead trees less than 18 inches d.b.h. in snag pockets (0.25 to 1.25-acre group size) to six snags/acre. Thin live trees less than 9 inches d.b.h.

In these treatments, dead trees less than 18 inches d.b.h. would be removed from groups of large numbers of dead trees (snag pockets) 0.25 to 1.25 acres in size. A minimum of six of the largest and soundest snags available would be retained per acre within the groups. Species that tend to have snag longevity (such as Douglas-fir) would be favored for retention over those tree species that do not (such as aspen). Outside of the snag pockets, dead trees less than 9 inches d.b.h. would be cut. Live trees less than 9 inches d.b.h. would be thinned as described above for the “Forest Restoration Treatment Area-General Prescription” treatment. Following tree cutting, down woody material would be reduced to less than 15 tons per acre throughout the area. See section entitled “Removal Methods” (page 25 and table 5) for methodologies that will be used to accomplish this prescription.

Prescription 4. Thin trees less than 12 inches d.b.h.; Mexican spotted owl restricted (150 ft^2 basal area).

In these treatments, live trees less than 12 inches d.b.h. would be thinned as described above for the “Forest Restoration Treatment Area - General Prescription” treatment.

Prescription 5. Thin trees less than 9 inches d.b.h.; follows Mexican spotted owl restricted targets (170 ft^2 basal area).

In these treatments, live trees less than 9 inches d.b.h. would be thinned as described above for the “Forest Restoration Treatment Area - General Prescription” treatment.

Important Wildlife Treatment Area - General Prescription

This treatment would be a combination of variable density thinning, thinning from below, and group selection. Within the confines of a 9-inch maximum diameter cut limit and a 170 ft^2 basal area minimum stand stocking level target, the thinning treatments would create forest stands that are diverse in structure and stocking level, but not as much so as those created by the “Forest Restoration” treatments. See section entitled “Removal Methods” (page 25 and table 5) for methodologies that will be used to accomplish this prescription. See figure 8 for locations of these important wildlife treatment area, general prescription treatments. Specific design features for the treatment would be:

1. Using a group-selection method, the stands would be subdivided into five size/age classes. The size/age classes would be based upon the vegetative structural stage size class breaks (as described on page 20).
2. Individual groups would range in size from 0.25 to 1.25 acre.
3. Trees up to 9 inches d.b.h. would be cut.
4. Average stand stocking would be reduced to about 170 ft^2 basal area.
5. The thinning would be variable density in which some groups within the matrix are thinned to a wide spacing, and some groups are thinned to a close spacing or not

thinned at all. In general, the density of the wide spacing would range from 25 to 45 percent of the maximum SDI for Douglas-fir. The closed canopy groups would average greater than 45 percent of the maximum SDI for Douglas-fir.

6. Heavily thinned groups would be placed around aspen clones, ponderosa pine patches, relics of ponderosa pine patches, and old-growth Douglas-fir patches. This would enhance the growth and vigor of, or regenerate these components, as well as reduce bark beetle risk to the conifers.
7. The ratio of closed canopy to open canopy groups would be 2 to 1.

Important Wildlife Treatment Area - Modified Treatments

Prescription 6. Reduce dead trees less than 18 inches d.b.h. in snag pockets (0.25 to 1.25-acre group size) to six snags/acre. No live tree thinning.

In these treatments, dead trees less than 18 inches d.b.h. would be removed from groups of large numbers of dead trees (snag pockets) 0.25 to 1.25 acres in size. A minimum of six of the largest and soundest snags available would be retained per acre within the groups. Species that tend to have snag longevity (such as Douglas-fir) would be favored for retention over those tree species that do not (such as aspen). Outside of the snag pockets, all dead trees up to 9 inches d.b.h. would be cut. Following tree cutting, down woody material would be reduced to less than 15 tons per acre throughout the area. See "Removal Methods" section (page 25) for methodologies that will be used to accomplish this prescription. See figure 8 for locations of these important wildlife treatment area, modified prescription treatments.

Prescription 7. Reduce dead trees in snag pockets (0.25 to 1.25-acre group size) up to 18 inches d.b.h. to six snags/acre. Thin live trees less than 9 inches d.b.h.

In these treatments, dead trees less than 18 inches d.b.h. would be removed from groups of large numbers of dead trees (snag pockets) of 0.25 to 1.25 acres in size. A minimum of six of the largest and soundest snags available would be retained per acre within the groups. Species that tend to have long snag longevity (such as Douglas-fir) would be favored for retention over those tree species that do not (such as aspen). Outside of the snag pockets, dead trees up to 9 inches d.b.h. would be cut. Live trees less than 9 inches d.b.h. would be thinned as described above for the "Important Wildlife Treatment Area-General Prescription" treatment. Following tree cutting, down woody material would be reduced to less than 15 tons per acre throughout the area. See section entitled "Removal Methods" (page 25) for methodologies that will be used to accomplish this prescription.

Alternative 2 Fuel Reduction Treatments

In addition to the proposed silvicultural treatments, complementary fuels reduction treatments are proposed to meet project needs 1 and 2. In some units, the fuel treatments would occur concurrently with the proposed silvicultural treatments, and in other treatment units, the fuel treatments are the only proposed treatments. Table 3 and figure 10 display proposed fuels treatment activity combinations; individual treatment activities are summarized in table 4. Acreages for areas where a combination of "masticate" and "hand cut, pile, and burn" treatments are proposed include only the acreage total for "masticate" in table 4. Acreage is displayed in this manner because hand cutting, piling, and burning would take place on only a very small portion of the area. Definitions used in this section are found below the following tables.

Hand Cut, Pile, and Burn

Debris created by pruning, or tree thinning would be piled by hand and burned during conditions when risk of fire spread is low, and when smoke will be adequately dispersed. Where this treatment does not follow a silvicultural treatment involving thinning of live trees, then small standing dead trees less than 9 inches d.b.h., existing downed material, and pruned tree limbs (occasionally) would be treated. Hand piles would be placed away from downed logs greater than 16 inches d.b.h., be up to 6 feet high and 8 feet in diameter, and in order to prevent tree scorch, would be placed as far from the canopy drip line of trees as possible. In addition to treatment units for which this activity is prescribed, it would also be applied within all treatment units along the Swift Trail (State Road 366, FS Road 803), Riggs Lake Road (FS Road 287), and Bible Camp Road (FS Road 508). Along these roads, fuels would be cut, piled, and burned for a distance of up to 150 feet from the road edge. These treatments would not occur within red squirrel midden protection areas or in Mexican spotted owl core areas.

Table 3. Proposed fuels treatment activity combinations and acres

Fuels Treatment Activity Combinations	Acres
Lop and scatter	124
Lop and scatter; hand cut, pile, and burn	608
Lop and scatter; hand cut, pile, and burn; followup underburn	1,004
Lop and scatter; underburn	1,356
Masticate	332
Masticate; hand cut, pile, and burn steep slopes; followup underburn	129
Underburn	153

Table 4. Proposed acres of individual fuels treatment activities

Fuels Treatment Activity	Acres
Lop and scatter	3,092
Hand cut, pile, and burn	1,741
Masticate	461
Underburn	2,642

Lop and Scatter

Down trees and tree limbs would be cut by hand and the material dispersed to reduce fuel concentrations. Where this treatment does not follow a silvicultural treatment, only small standing dead trees less than 9 inches d.b.h. and existing down material would be treated.

Masticate

Standing and down trees as prescribed under the silvicultural treatments would be chopped, shredded, or chunked up by machine, and left onsite.

Underburn

Fuels would be reduced by prescribed burning with a low-intensity and low-severity burn.

Pruning

Although not displayed in the tables above, trees would be pruned adjacent to the Swift Trail (State Road 366, FS Road 803), Riggs Lake Road (FS Road 287), and Bible Camp Road (FS Road 508). Trees would be pruned to a height of 10 feet above the ground, or up to one-third of the tree height, whichever is less. Pruning distance from the road would be up to 150 feet from the road edge. This treatment would be applied only in the proposed treatment units along these roads and not in Mexican spotted owl cores.

Alternative 2 Removal Methods

Trees would be removed from some treatment units and taken to collection points (landings) by a variety of methods and combinations of those methods (table 5 and figure 11). The removal method proposed for a treatment unit depends upon a number of factors, including topography, availability of road access, cost, and resource protection needs. Once material is removed from treatment units and taken to landings, it would be processed into sawlogs, firewood, or chips, and trucked from the project area or made available to the public. Some material may be piled and burned at the landing site. Descriptions of each removal method follow table 5.

Table 5. Proposed removal methods (definitions follow)

Removal Methods	Acres
Whole-tree yard; hand cut; remove by ground-based equipment and cable	14
Whole-tree yard; hand cut; remove by ground-based equipment with cable	2
Whole-tree yard; hand cut; remove by skyline	944
Whole-tree yard; hand cut; remove by skyline and ground-based equipment with cable	96
Whole-tree yard; machine or hand cut; remove by ground-based equipment	1,178
Whole-tree yard; machine or hand cut; remove by ground-based equipment with cable	123
Whole-tree yard; machine or hand cut; remove by skyline	66
Whole-tree yard; machine or hand cut; remove by skyline and ground-based equipment	53
Whole-tree yard; machine or hand cut; remove by skyline and ground-based equipment with cable	36

Whole-tree Yard

Thinned trees would be transported from stump to the collection point or processing site (landing) with tops and limbs attached. Trees may be carried or dragged on the ground.

Hand Cut

Trees would be cut using hand-carried machines (e.g., chain saws) to the desired stocking and would either be removed from the site, pile and burned, or scattered in the site.

Remove by Ground-based Equipment with Cable

Thinned trees would be pulled from the site and taken to landings by a ground-based machine (skidder or tractor) equipped with a grapple or cable (chokers and winch). Ground contact by dragged material would occur.

Remove by Ground-based Equipment and Cable

Thinned trees would be pulled from the site to landings by a combination of a ground-based machine equipped with a grapple or cable (chokers and winch) for short distances and a small cable yarder or jammer (operating from existing roads or trails) for skidding. No lateral skidding or material suspension would be required.

Remove by Skyline

Thinned trees would be transported from the site to landings by a skyline cable system. The stump end of trees being removed would be suspended, but in most cases the trees would not be fully suspended and ground contact would occur.

Remove by Ground-based Equipment

Thinned trees would be transported from the site to landings with a ground-based machine such as a skidder or forwarder.

Machine Cut

Thinned trees would be cut by a ground-based machine such as a track-mounted feller-buncher and removed from the site.

Alternative 2 Implementation Schedule

The action would be implemented over 10 years following an implementation schedule that focuses treatments in areas that will protect select occupied red squirrel habitat and then treats areas of restoration away from currently occupied habitat. This strategy will allow pre- and post-implementation monitoring (appendix B) in units around occupied habitat before additional units are implemented. This strategy will enable resource managers to adapt implementation based upon information derived from project monitoring. Initial treatments are also designed to reduce fire threats from the southern exposures of the mountain, which are considered the most urgent fire threats to occupied red squirrel habitat.

The analysis area was divided into 10 general implementation units. In general, implementation of actions within these units will progress in the order displayed in figure 12.

Alternative 2 Proposed Amendments to the Land and Resource Management Plan for the Coronado National Forest

Please refer to the section “Actions Common to All Action Alternatives” on page 36 of this chapter.

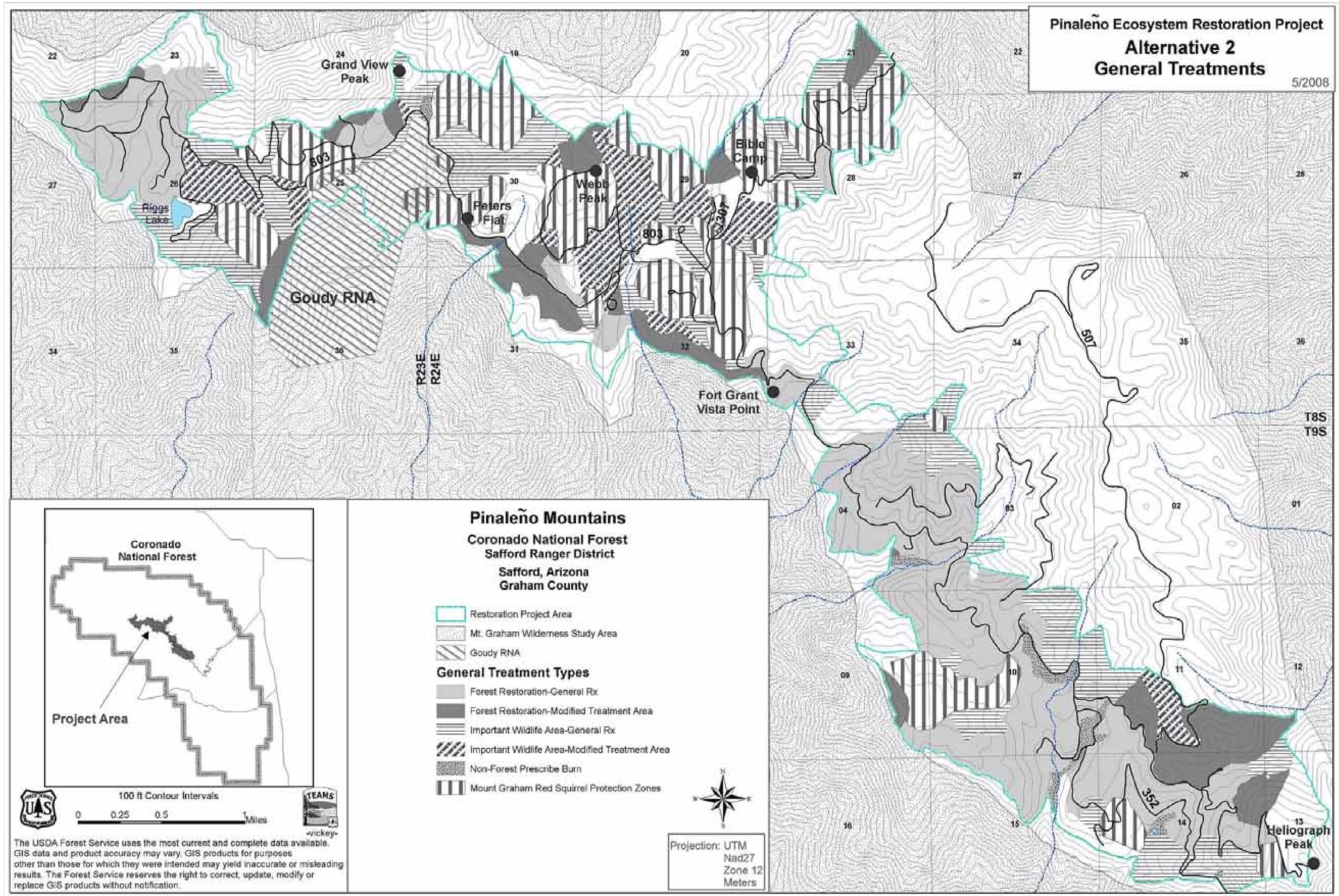


Figure 8. General treatments in Alternative 2 of the Pinaleño Ecosystem Restoration Project

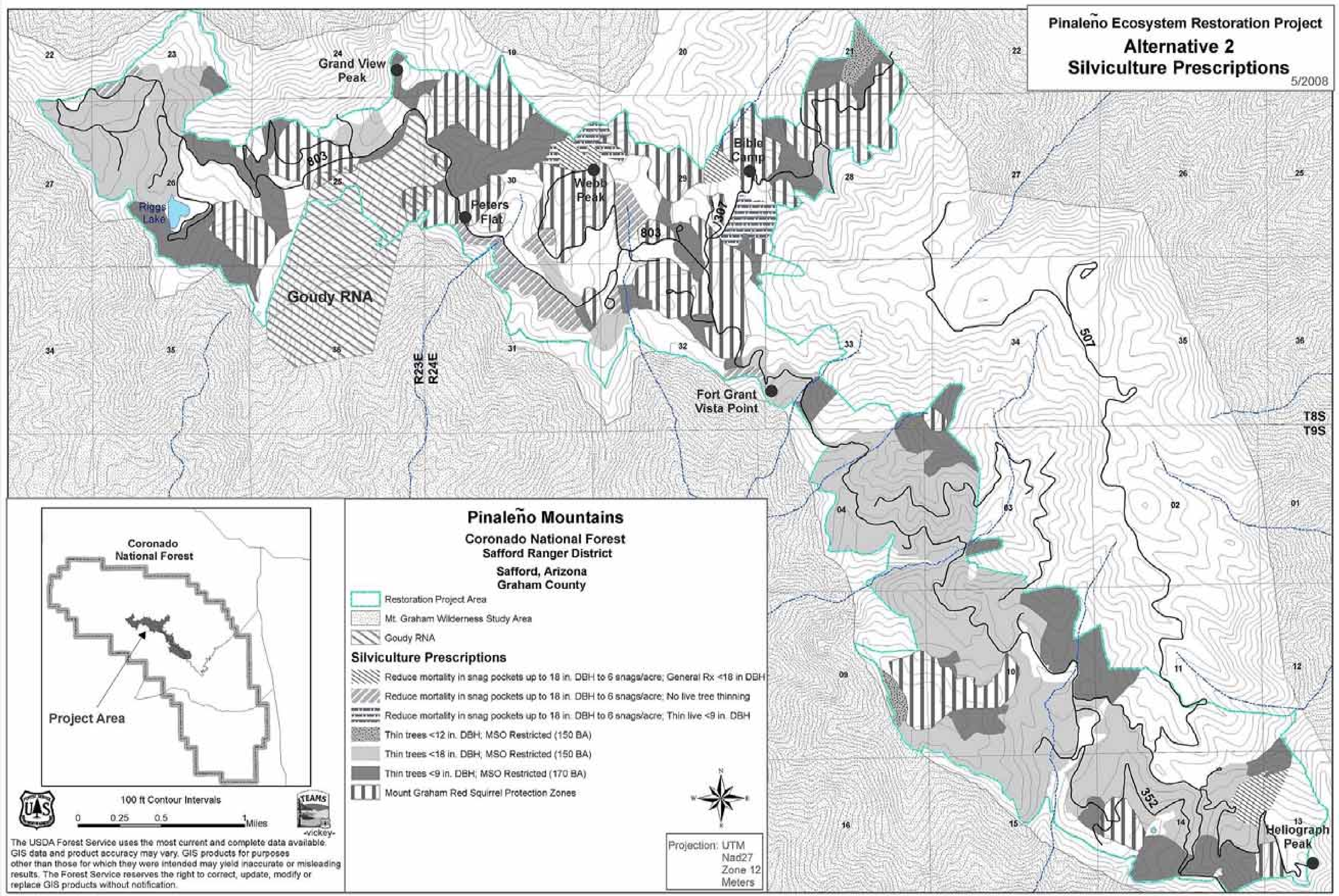


Figure 9. Silvicultural prescriptions for Alternative 2 of the Pinaleño Ecosystem Restoration Project

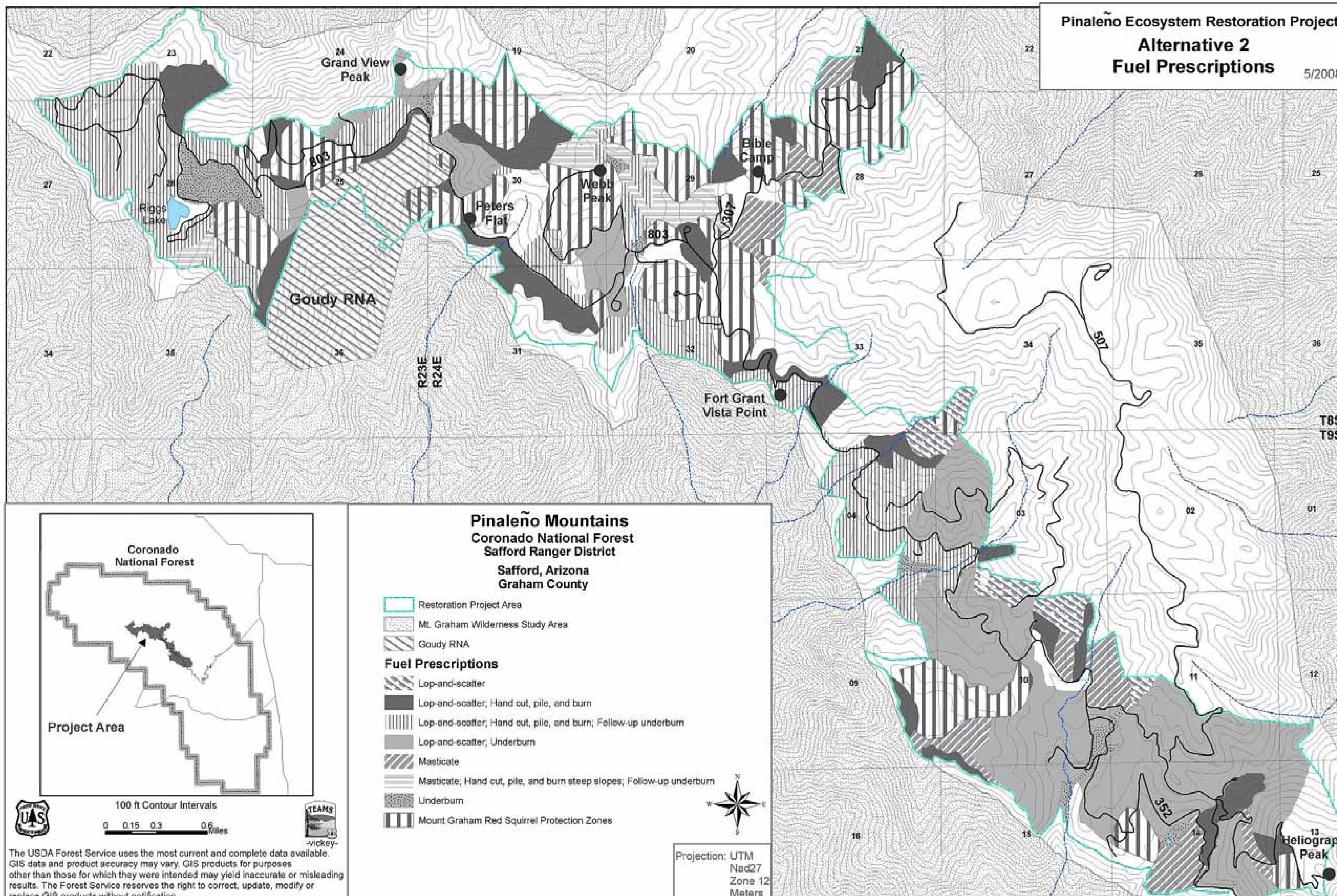


Figure 10. Fuel reduction treatments proposed in Alternative 2

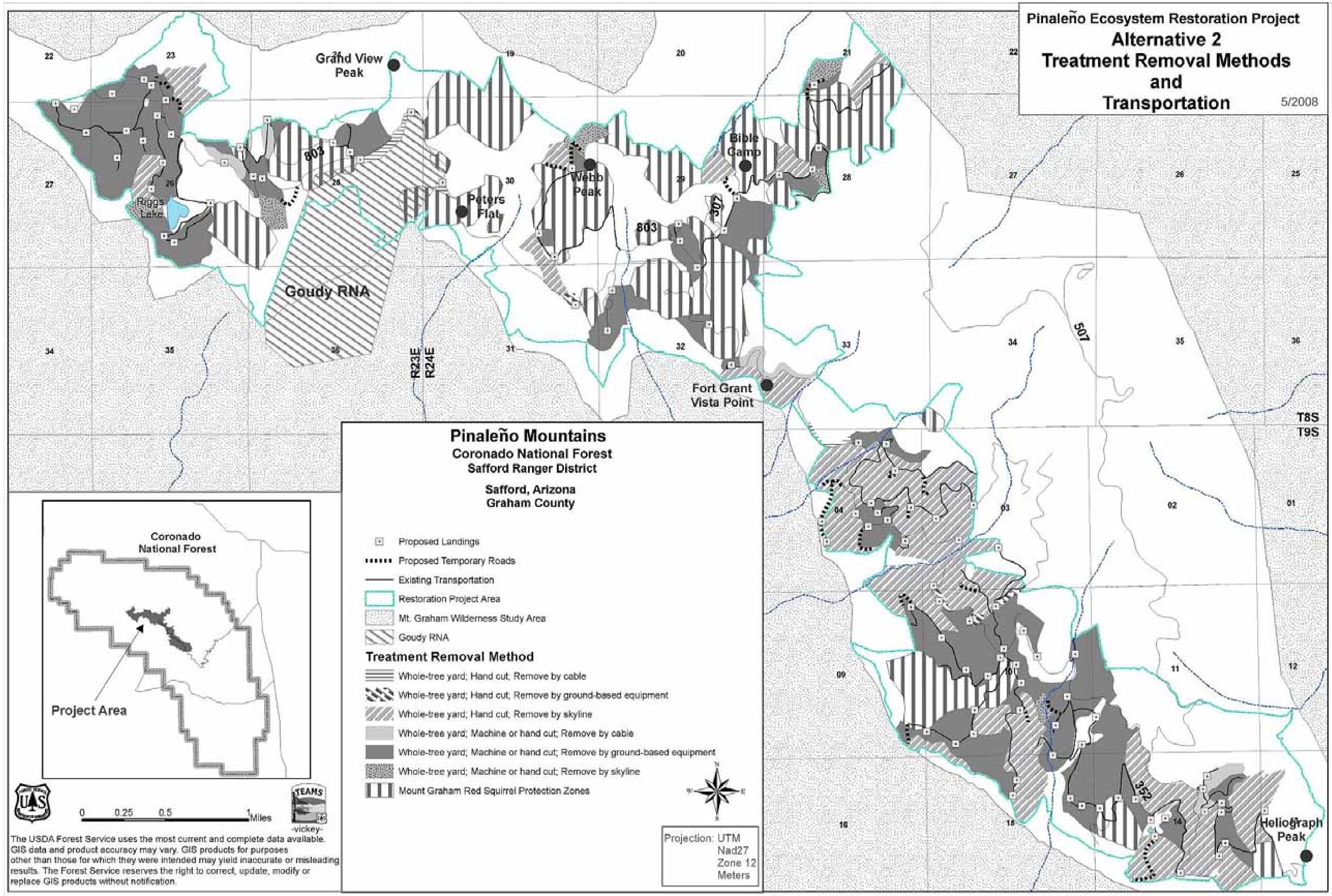


Figure 11. Removal and transportation system proposed in Alternative 2

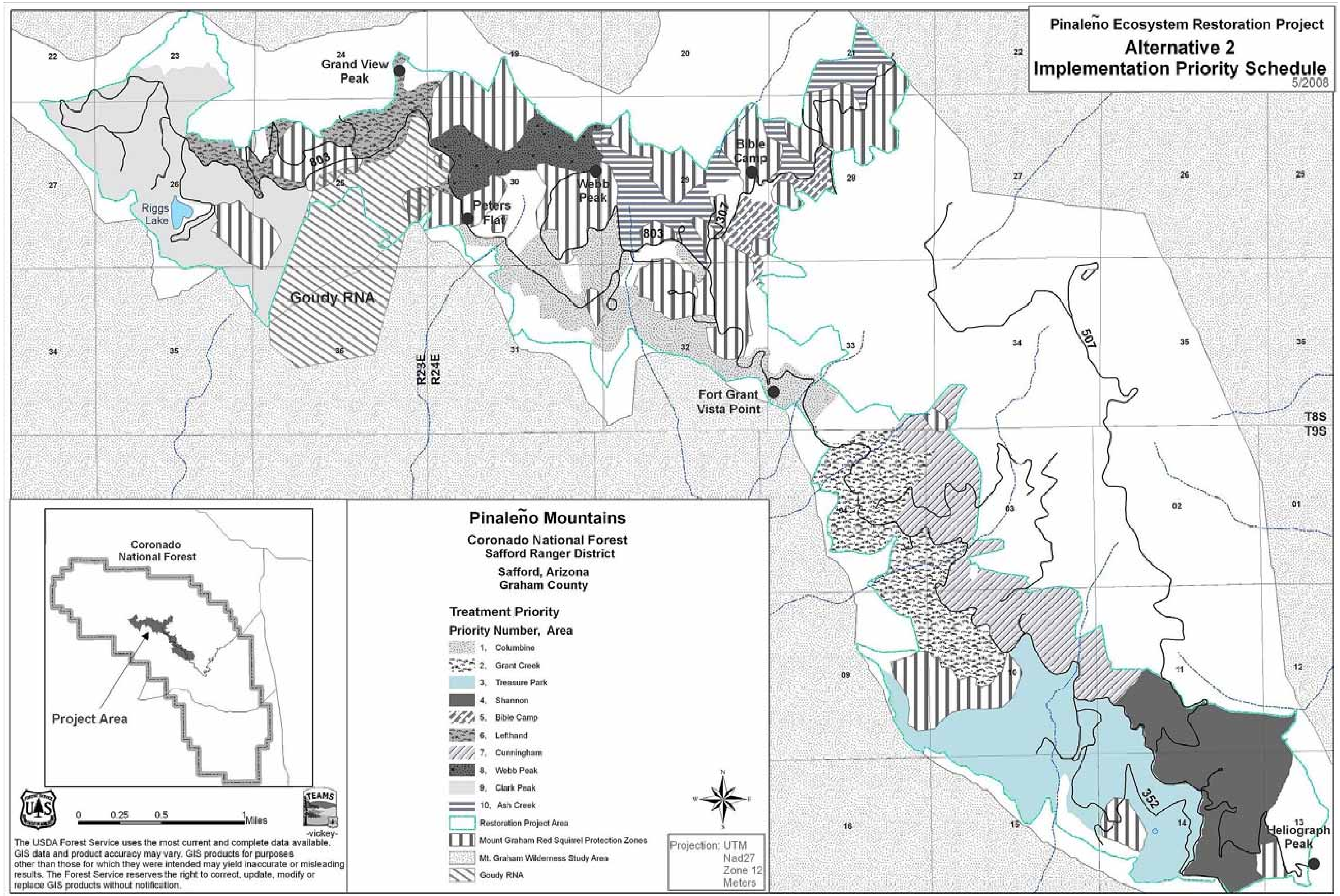


Figure 12. Implementation units and their priority for scheduling for Alternative 2

Alternative 3 - the Mexican Spotted Owl Emphasis Alternative

This alternative consists of actions similar to the Important Wildlife Area treatments of Alternative 2 but treats 223 fewer acres, live tree thinning will be restricted to trees less than 9 inches in diameter, and no treatments will occur within Mexican spotted owl core areas. Implementation will be modified so that entry will not exceed 10 percent of the total number of Mexican spotted owl protected activity centers (PACs) in the Pinaleño Mountains each year. Protection zones for the Mount Graham red squirrel will be maintained within this alternative, as well as other design features that affect treatments of trees and downed woody material less than 9 inches in diameter. Monitoring programs in appendix B and design features in appendix A would also be maintained.

Table 6. Summary of silvicultural treatments proposed by treatment area for Alternative 3; also see figure 14

Treatment Area		Silvicultural Treatment	Acres
Important Wildlife Area	General Rx	Thin trees less than 9 inches d.b.h.; follows MSO restricted targets (170 ba and residual stocking proportioned over multiple VSS classes).	2,482
	Modified Rx 8	Reduce dead trees in snag pockets (0.25 to 1.25-acre group size) up to 12 inches d.b.h. to 6 snags/acre; no live tree thinning.	144
	Modified Rx 7	Reduce dead trees in snag pockets (0.25 to 1.25-acre group size) up to 12 inches d.b.h. to 6 snags/acre; thin live less than 9 inches d.b.h.	167

Rx: Prescription
ba: basal area
d.b.h.: diameter at breast height
MSO: Mexican spotted owl
VSS: Vegetation structural stage

Alternative 3 Vegetation Treatments

Important Wildlife Treatment Area - General Prescription

This treatment would be a combination of variable density thinning, thinning from below, and group selection. Within the confines of a 9-inch maximum diameter cut limit and a 170 ft^2 basal area minimum stand stocking level target, the thinning treatments would create forest stands that are diverse in structure and stocking level, but not as much so as those created by the "Forest Restoration" treatments in Alternative 2. See section entitled "Removal Methods" (page 25 and table 9) for methodologies that will be used to accomplish this prescription.

Specific design features for the treatment would be:

1. Using a group-selection method, the stands would be subdivided into five size/age classes. The size/age classes would be based upon the vegetative structural stage size class breaks (as described on page 20).
2. Individual groups would range in size from 0.25 to 1.25 acres.
3. Trees up to 9 inches d.b.h. would be cut.
4. Average stand stocking would be reduced to about 170 ft^2 basal area.
5. The thinning would be variable density in which some groups within the matrix are thinned to a wide spacing, and some groups are thinned to a close spacing or not thinned at all. In general, the density of the wide spacing would range from 25 to 45

percent of the maximum SDI for Douglas-fir. The closed canopy groups would average greater than 45 percent of the maximum SDI for Douglas-fir.

6. Heavily thinned groups would be placed around aspen clones, ponderosa pine patches, relics of ponderosa pine patches, and old-growth Douglas-fir patches. This would enhance the growth and vigor of, or regenerate these components, as well as reduce bark beetle risk to the conifers.
7. The ratio of closed canopy to open canopy groups would be 2 to 1.

Important Wildlife Treatment Area - Modified Treatments

Prescription 6. Reduce dead trees in snag pockets (0.25 to 1.25-acre group size) up to 18 inches d.b.h. to six snags/acre. No live tree thinning.

In these treatments, dead trees less than 18 inches d.b.h. would be removed from groups of large numbers of dead trees (snag pockets) of 0.25 to 1.25 acres in size. A minimum of six of the largest and soundest snags available would be retained per acre within the groups. Species that tend to have snag longevity (such as Douglas-fir) would be favored for retention over those tree species that do not (such as aspen). Outside of the snag pockets, all dead trees up to 9 inches d.b.h. would be cut. Following tree cutting, down woody material would be reduced to less than 15 tons per acre throughout the area. See "Removal Methods" section (page 25 and table 9) for methodologies that will be used to accomplish this prescription.

Prescription 7. Reduce dead trees in snag pockets (0.25- to 1.25-acre group size) up to 18 inches d.b.h. to six snags/acre. Thin live trees less than 9 inches d.b.h.

In these treatments, dead trees less than 18 inches d.b.h. would be removed from groups of large numbers of dead trees (snag pockets) of 0.25 to 1.25 acres in size. A minimum of six of the largest and soundest snags available would be retained per acre within the groups. Species that tend to have snag longevity (such as Douglas-fir) would be favored for retention over those tree species that do not (such as aspen). Outside of the snag pockets, dead trees up to 9 inches d.b.h. would be cut. Live trees less than 9 inches d.b.h. would be thinned as described above for the "Important Wildlife Treatment Area-General Prescription" treatment. Following tree cutting, down woody material would be reduced to less than 15 tons per acre throughout the area. See section entitled "Removal Methods" (page 25 and table 9) for methodologies that will be used to accomplish this prescription.

Alternative 3 Fuel Reduction Treatments

As described above, in addition to the proposed silvicultural treatments, complementary fuels reduction treatments are proposed. Table 7 and figure 15 display proposed fuels treatment activity combinations.

Table 7. Proposed fuels treatment activity combinations and acres for Alternative 3

Fuels Treatment Activity Combinations	Acres
Lop and scatter	105
Lop and scatter; hand cut, pile, and burn	566
Lop and scatter; hand cut, pile, and burn; followup underburn	966
Lop and scatter; underburn	1,312
Masticate	257
Masticate; hand cut, pile, and burn steep slopes; followup underburn	128
Underburn	97

Table 8. Proposed acres of individual fuels treatment activities for Alternative 3

Fuels Treatment Activity	Acres
Lop and scatter	2,949
Hand cut, pile, and burn	1,532
Masticate	385
Underburn	2,503

Alternative 3 Removal Methods

Trees would be removed from some treatment units as described above in Alternative 2. Table 9 displays acres by removal method. Figure 16 shows locations of different types of the proposed removal and transportation systems.

Table 9. Proposed removal methods (definitions follow) for Alternative 3

Removal Methods	Acres
Whole-tree yard; hand cut; remove by cable	8
Whole-tree yard; hand cut; remove by ground-based equipment	16
Whole-tree yard; hand cut; remove by skyline	798
Whole-tree yard; machine or hand cut; remove by cable	46
Whole-tree yard; machine or hand cut; remove by ground-based equipment	901
Whole-tree yard; machine or hand cut; remove by skyline	47

Alternative 3 Implementation Schedule

The action would be implemented over 10 years following an implementation schedule that treats within spotted owl PACS following spotted owl guidelines balancing the need to treat in areas that will protect select occupied red squirrel habitat while treating areas of restoration away from currently occupied habitat. This mixed strategy may allow pre- and post-implementation monitoring (appendix B) in units around occupied habitat before additional units are implemented. This strategy may enable resource managers to adapt implementation based upon information derived from project monitoring.

The analysis area was divided into 10 general implementation units. In general, implementation of actions within these units will progress in the order displayed in figure 17.

Actions Common to All Action Alternatives

Proposed Amendments to the Land and Resource Management Plan for the Coronado National Forest

Opportunities exist to efficiently implement this project through stewardship contracting, volunteers, public firewood collection, Christmas tree permits, local forest staff, timber sales, and service contracts. The Coronado Forest Plan limits activities that would allow the use of stewardship contracting, public firewood gathering, and Christmas tree utilization. Therefore, this proposal would amend the Coronado Forest Plan in the following sections to allow these activities:

Forest Plan, pp. 52-55 – Management Area 2 and 2a, Timber Sales Preparation and Administration

Current Plan:	Proposed Change:
"3. Within suitable habitat for the Mount Graham red squirrel (Pinaleño Mountains), dead and down material will not be removed for fuelwood except for on-site recreational use."	"3. Within suitable habitat for the Mount Graham red squirrel (Pinaleño Mountains), dead and down material will not be removed for firewood except for onsite recreational use *and except for within the boundaries of the Pinaleño Ecosystem Restoration Project area in the Pinaleño Mountains during the active life of this project.*"
"4. Within suitable habitat for the Mount Graham red squirrel (Pinaleño Mountains), Christmas trees will not be harvested."	"4. Within suitable habitat for the Mount Graham red squirrel (Pinaleño Mountains), Christmas trees will not be harvested *except where designated within the boundaries of the Pinaleño Ecosystem Restoration Project area in the Pinaleño Mountains during the active life of this project."*

Although the proposed project would better meet visual quality objectives for the long term, treatments may not meet visual quality standards and guidelines of the Forest Plan in the short term. Specifically, treatments in the foreground along sensitivity level 1 and 2 travelways and near developed recreation areas are not likely to meet the visual quality objective of "Retention." Vegetation removal (and associated slash, stumps, stacked logs, and skid roads) and blackened vegetation and tree trunks from fuel reduction treatments will be visible to casual visitors. Therefore, this proposal would amend the Forest Plan in the following sections on "Management Emphasis and Intensity" to allow these activities:

- Management Area 2 (Forest Plan, p. 50)
- Management Area 2a (Forest Plan, p. 54)
- Management Areas 3a and 3b (Forest Plan, p. 59)

Current Plan:	Proposed Change:
“Visual quality objectives will be met”	“Visual quality objectives will be met, except in areas within the Pinaleño Ecosystem Restoration Project area in the Pinaleño Mountains designated as “Foreground Retention.” In the project area, during the active life of the project, a broad interpretation of this visual quality objective will be used. During the active life of the Pinaleño Ecosystem Restoration Project, visible evidence of thinning and underburning resulting from implementation of the prescriptions will be allowed within the following constraints: (a) A visual mosaic of forest conditions, large trees, and small patches of more open (“parklike”) stands may be created. (b) Slash, stumps, logs, and skid trails in foreground areas along system roads and trails will generally be cleaned up within 1 year. (c) Effects from prescribed fire (blackened, scorched vegetation and tree trunks) may be visible for up to 3 years following treatments.”

Transportation System Needed for Alternatives 2 and 3

A transportation system to transport removed material would be needed to accomplish objectives in Alternatives 2 and 3 (see table 10). Existing open and closed system roads would be used for hauling sawlogs, small round wood, and chips. Existing closed roads would be improved and maintained for fuel removal operations. After operations are complete on the closed roads, natural drainage features would be restored, and the roadbeds would be seeded and closed. Unclassified road segments would be improved for hauling, and then permanently rehabilitated after project completion. Roads that are now used as trails would be restored to haul use conditions until no longer needed, then retained for trail use after operations. Temporary roads would be constructed for removal operations and would be rehabilitated (permanently closed to motorized travel) and re-vegetated after use. Temporary roads would be constructed for removal operations and would be obliterated and restored after use by scarifying or subsoiling to reduce soil compaction, and planting to reestablish vegetation cover. Woody debris would be placed on the roadbed clearing to discourage off-road vehicle use and to restore soil organic material after operations are complete.

Table 10. Miles of proposed road work for Alternatives 2 and 3

	Alternative 1	Alternative 2	Alternative 3
Haul road improvements and maintenance	0	22.2	21.8
Swift Trail road maintenance	0	6.3	6.3
Temporary road construction	0	4.5	3.5

Collaborative Study Units Common to Alternatives 2 and 3

Northern Arizona University Ecosystem Restoration Institute (ERI) will be collaborating with the Coronado National Forest on two small forest restoration demonstration plots to further our understanding and application of restoration concepts and ideas. One called the Hospital Flats Unit is about 8 acres and is within Treatment Unit 40. The other is called the Heliograph Unit and is equivalent to Treatment Unit 14. The Hospital Flats demonstration plots will be a mechanical treatment using the same general design features as the Forest Restoration Treatments - Alternative 2, except that diameter limits are determined by tree age for each tree species and understory trees are retained based on a pre-settlement tree replacement schedule.

The ERI foresters established a diameter-age relationship for each of the conifer tree species in the plot, determining the average diameter of the presettlement trees. Presettlement age was determined to be 130 years as measured at d.b.h. Treatment of the aspen and other non-conifer trees were not included under the prescription. The presettlement trees were marked as leave trees. All other evidence (logs and stumps) of presettlement trees were also flagged. Replacement trees of the same species were selected for missing trees at a ratio of 1.5 new trees for each missing tree. Later a field crew from ERI stem mapped the plot so that tree spacing relationships can be studied. The plot will be treated when the adjacent proposed stands are treated, probably in year 2 of implementation. Fuels and removal treatments will not differ from Alternative 2. The Heliograph plot will be treated with prescribed fire only under a prescription jointly developed by ERI and the Coronado. Ten inventory pretreatment plots have been established within the unit. These will be inventoried again following treatment.

Interpretive materials will be developed, and monitoring of trees and wildlife response will follow. Knowledge gained from this prescription will aid in the understanding of mixed-conifer ecology and restoration, leading to future treatment designs.

Design Criteria Common to All Alternatives

The Forest Service also developed design criteria to be used as part of all of the action alternatives. Design criteria are displayed in appendix A.

Monitoring Requirements Common to All Alternatives

During and following project activities, monitoring would occur to evaluate resource conditions of the ecological unit where activities occur. A detailed monitoring plan is attached in appendix B.

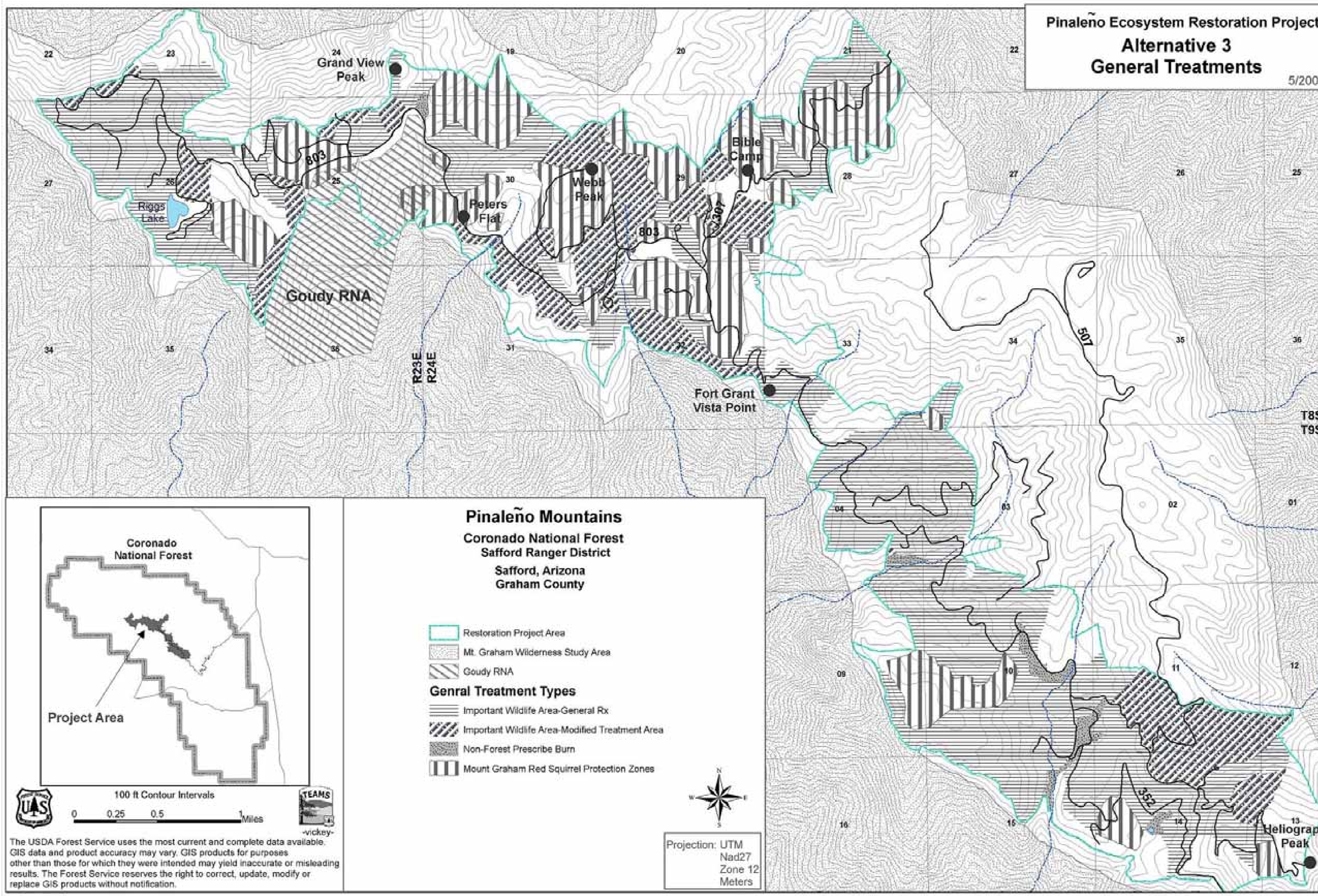


Figure 13. General treatments in Alternative 3 of the Pinaleño Ecosystem Restoration Project

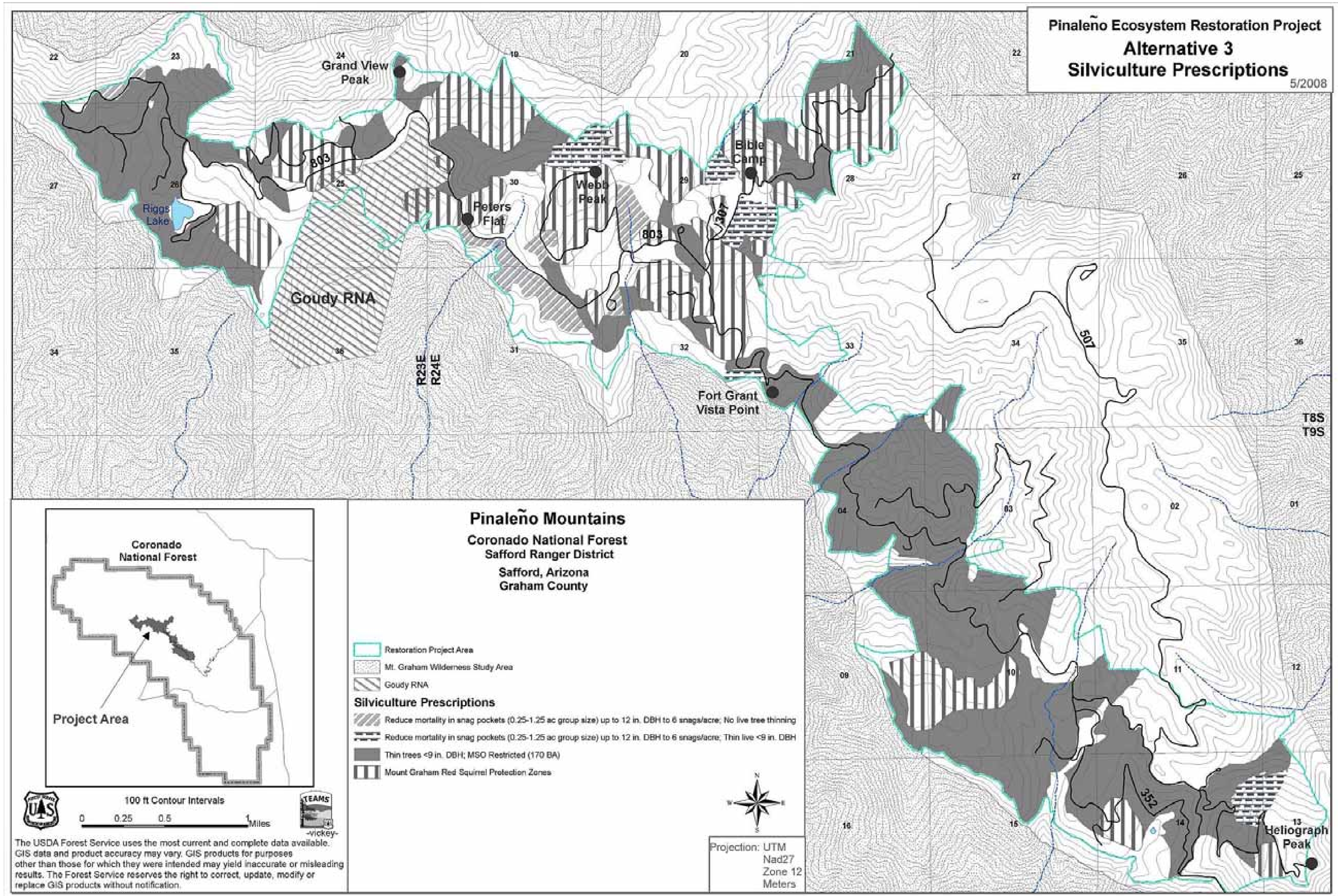


Figure 14. Silvicultural prescriptions for Alternative 3 of the Pinaleño Ecosystem Restoration Project

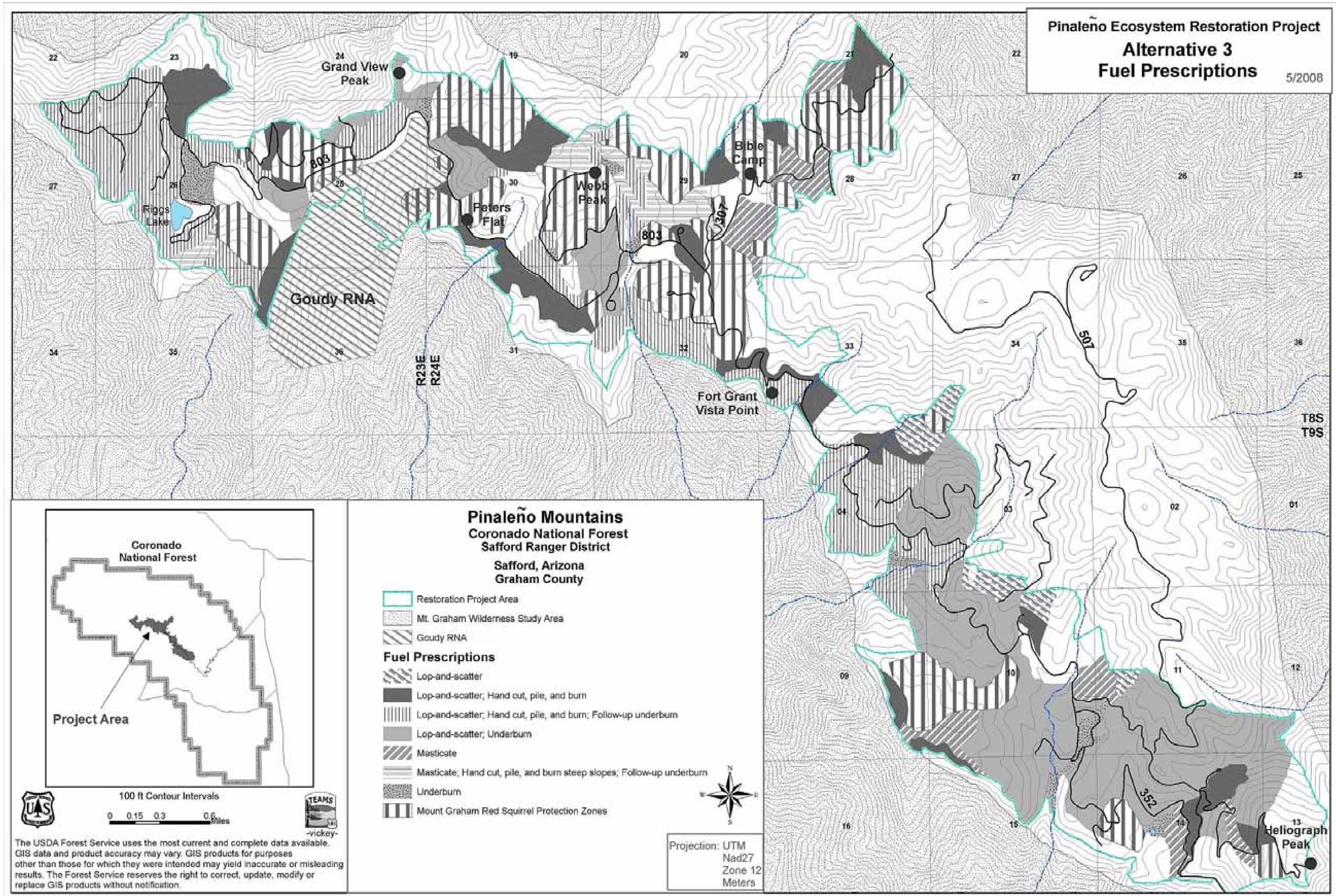


Figure 15. Fuel reduction treatments proposed in Alternative 3

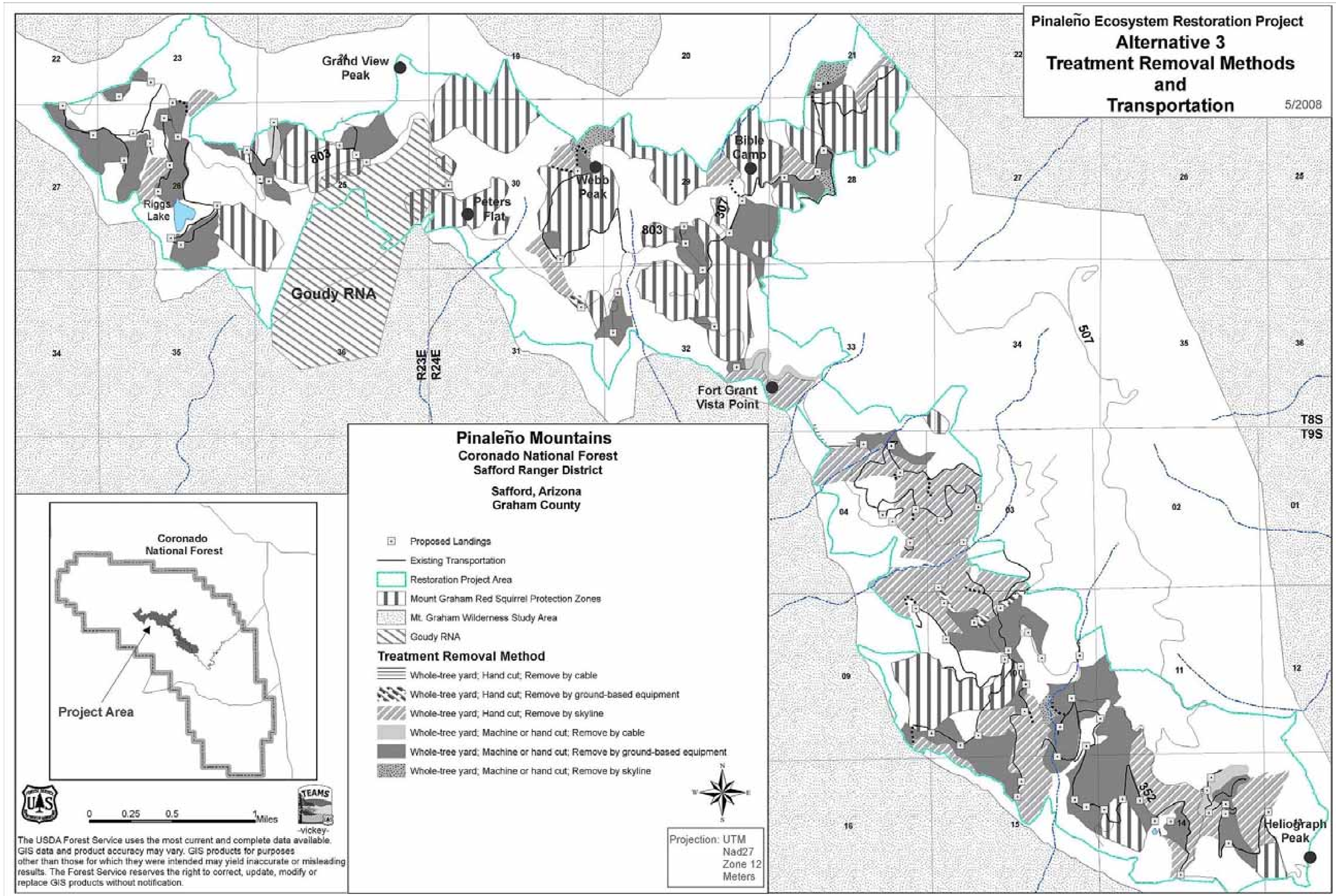


Figure 16. Removal and transportation system proposed in Alternative 3

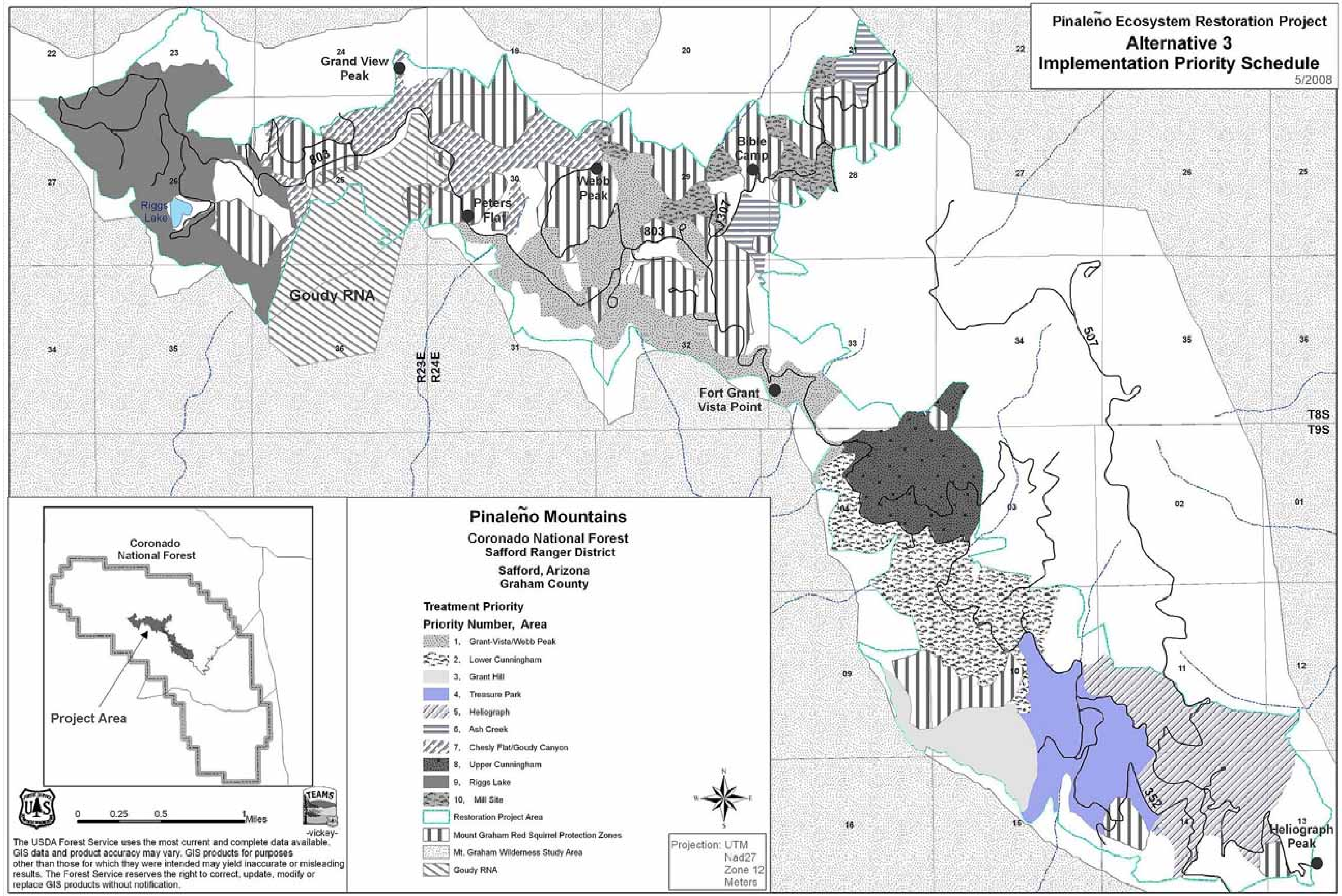


Figure 17. Implementation units and their priority for scheduling for Alternative 3

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the proposed action provided suggestions for alternative methods for achieving the purpose and need. Some of these alternatives may have been outside the scope of the project's stated purpose and need, duplicative of the alternatives considered in detail, or determined to be components that would cause unnecessary environmental harm. Therefore, an alternative was considered, but dismissed from detailed consideration for reasons summarized below.

1. **Enhanced Prescribed Burning:** This alternative was developed in response to Significant Issue 2. This alternative would increase the number of acres to be treated and increase the use of prescribed fire to better meet the purpose and need of the project. The interdisciplinary team (IDT) developed a scenario and maps of potential treatment units that would use prescribed burning as the primary tool to achieve the project's forest restoration goals. In addition, to the extent possible, the IDT added additional acres and extended project boundaries to accommodate prescribed burning. For example, in some cases, it was necessary to move boundaries to natural barriers such as ridgetops to facilitate prescribed burn units. After development and initial analysis in 2007, it was decided not to consider this alternative in detail because:
    a. The uncertainty of effects of extensive prescribed burning on the habitat of the endangered Mount Graham red squirrel could not be resolved and the potential for unacceptable short-term effects to the species was considered too high. Given that, the alternative would not meet a critical part of the project purpose and need.
    b. The extensive and repeated prescribed burning that would be required under this alternative was deemed unattainable given present budgets and expertise on the forest and, therefore, full implementation of the alternative was considered unachievable.

2. **Pinaleño Ecosystem Restoration Proposal (2005):** This alternative was released for public comment in May 2005. This proposal was very similar to the current proposed action; however, it did not include midden protection zones, variable density thinning, specific removal methods, or as many treatments in areas designed to buffer currently occupied Mount Graham red squirrel habitat. This alternative was dropped from detailed consideration because it no longer met the project's defined purpose and need and because of its potential negative impact on the Mount Graham red squirrel.

3. **PEM Enhanced Treatments:** This alternative responds to Significant Issue 3. This proposal was developed in 2004 to take forest restoration action within the Pinaleño Ecosystem Management (PEM; USDA Forest Service 2001) Demonstration Project area (1,100 acres). In addition, it proposed fuels management projects on 5,000 to 11,000 acres "mountainwide." This alternative would have a 9-inch diameter limit except around summer homes and campgrounds where a 12-inch diameter limit was to be used. The emphasis would be on fuels reduction resulting in a linear green fuel

break. This proposal was essentially dropped when it was decided that summer homes and campgrounds would be treated under a separate decision, and that the alternative would no longer meet the revised purpose and need of the Pinaleño Ecosystem Restoration Project.

4. **Restoration with Fuel Break:** A proposal to take forest restoration action within a 5,500-acre area in the mixed-conifer zone was considered. The green fuel break was still emphasized. This proposal was dropped on June 4, 2004, when it was determined that a fuel break (something fire would not cross or spot across) was not feasible due to the topography.

5. **Defensible Corridor:** The proposal to take two actions: (1) fuels reduction action, and (2) forest restoration action within the 5,500-acre area identified was considered. The fuels reduction action was to be done to develop a “defensible corridor.” There would be a 9-inch diameter cap on trees cut within the defensible corridor. The forest restoration area, approximately half of the entire project area, was proposed to have trees up to 24 inches removed to promote restoration of the mixed-conifer forest. This proposal was dropped March 9, 2005, when the alternative was considered to conflict with management direction in areas occupied by Mount Graham red squirrels and Mexican spotted owls.

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in these tables is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 11. Comparison of action alternatives by activity and outputs

Activity	Alternative 1	Alternative 2	Alternative 3
Silvicultural treatments (tree thinning) acres	0	3,016	2,793
Forest restoration prescriptions (acres)	0	2,155	0
Important wildlife area prescriptions (acres)	0	861	2,793
Fuel reduction treatments	0	3,705	3,431
Lop and scatter	0	3,092*	2,949*
Hand cut, pile, and burn	0	1,741*	1,532*
Masticate	0	461*	385*
Underburn	0	2,642*	2,503*
Hand cut < 6″ d.b.h. trees, acres	0	1,740*	1,660
Prune acres	0	475*	475
Tree removal activities			
Hand fell > 6″ d.b.h. acres (removal)	0	1,038	822
Ground-based skid acres	0	1,256	917
Cable skid acres	0	77	54
Skyline yard acres	0	1,076	845
Tractor swing skid acres	0	228	172
Swing haul slash tons	0	1,514	790
Transportation needs			
Haul road improvements and maintenance miles	0	22.22	21.81

Table 11. Comparison of action alternatives by activity and outputs

Activity	Alternative 1	Alternative 2	Alternative 3
Temporary road construction miles	0	4.5	3.5
Swift Trail road maintenance miles	0	6.25	6.25
Removal volumes			
Sawlogs CCF	0	10,451	0
ES house logs CCF	0	502	0
Small round wood CCF	0	10,249	10,432
Chips tons	0	14,333	5,881
Estimated treatment costs ($)	500,000**	8,336,615	5,550,288
Estimated revenues ($)	0	231,070	165,564

* These acres represent an acre of each treatment. Many of these treatments occur on the same actual acre. For example, a single acre may have pruning, lop and scatter and underburn treatments all prescribed. For this reason, the total number of treatment acres may appear to exceed the total number of acres to receive fuels treatments.

** These represent planning costs of this project that will have been expended if the “No Action” alternative is chosen.

Table 12. Comparison of alternatives by project objectives

Project Objective	Alternative 1	Alternative 2	Alternative 3
Initiate forest restoration efforts within the project area using guidelines provided in the Mount Graham Red Squirrel Recovery Plan Objective: (1) display changes in risk of losing stand components due to restoration efforts, (2) display changes in how stands in the area would meet or not meet red squirrel habitat requirements in the future. Measurements: (1) display current, no action 2015, action alternatives 2015 modeled bark beetle risk, (2) display current, no action 2015, action alternatives 2015 modeled fire mortality, (3) display how well current, no action (30-50 years or so in future), action alternatives (30-50 years or so in future) would be meeting red squirrel habitat requirements.	Douglas-fir beetle risk would continue to be high in a large portion of the area and would become more uniformly high as risk increases in stands currently less than high. Diseases such as dwarf mistletoe would continue to increase (p. 65).	Insect and disease related risk would be reduced throughout the project area because the proposed treatments will increase growth and vigor of residual trees. Stand densities would be reduced and individual diameter growth of residual trees would increase. Alt. 2 produces the largest and most long-standing effects of any alternative in reducing the risk of insect and disease in the project area (p. 72).	Insect and disease related risk would be reduced throughout the project area because the proposed treatments will increase growth and vigor of residual trees but not to the extent of Alternative 2. Stand densities would be reduced and individual diameter growth of residual trees would increase (p. 72).
	A large portion of the area would continue to be susceptible to severe wildfires (Hall 2008) with high levels of potential tree mortality (p. 67). Average basal area mortality due to wildfire is predicted between 56 to 60 percent over the next 30 years (p. 65).	Overall fire risk would be reduced to stands within the project area and fire modeling shows some protection to occupied red squirrel areas receiving no treatments by thinned stands adjacent to these areas. Overall predicted basal area mortality is predicted to be 23 to 44 percent over the next 30 yrs (p. 73).	Overall fire risk would be reduced to stands within the project area and fire modeling shows some protection to occupied red squirrel areas receiving no treatments by thinned stands adjacent to these areas. Overall predicted basal area mortality is predicted to be 22 to 43 percent over the next 30 yrs (p. 27).
	Existing MGRS habitat will persist into the future and continue to face threats of degradation due to wildfire and insect and disease outbreaks (pp 100-107).	Existing MGRS habitat will persist into the future but threats of degradation due to wildfire and insect and disease outbreaks is reduced. Areas around currently occupied habitat that is lacking in stand characteristics preferred by the MGRS will benefit by increased forest health, growth, and vigor and by moving stands closer to old-growth characteristics preferred by the MGRS. This increased growth and vigor is expected to result in larger cone crops and presents the potential to provide more habitat to the species over the longer term (pp. 101-107).	Effects to existing and potential MGRS habitat are similar to those of Alternative 2 but over fewer acres and with a lessened scope (pp. 101-107).

Table 12. Comparison of alternatives by project objectives

Project Objective	Alternative 1	Alternative 2	Alternative 3
Initiate the restoration of ecological processes, including the natural fire regimes (high-frequency and mixed-severity regimes). Effects on fuel loading: A range of 5 to 20 tons per acre provides acceptable risks of fire hazard and fire severity while providing desirable quantities for soil productivity, soil protection, and wildlife needs (Brown et al. 2003).	The average fuel loading is currently about 34 tons per acre and is expected to increase another 6 tons per acre in 10 years (2018) and 12 tons per acre in 30 years (2048) (p. 79).	Under Alternative 2, an average reduction of about 24 tons per acre (60 percent) as compared to Alternative 1 is expected (by 2018). This will result in average fuel loading of 10 tons, which is within the desired range. An average increase of about 6 tons per acre may occur again in about 30 years if no maintenance takes place (p. 81).	The effects are the same as Alternative 2. An average reduction of about 24 tons per acre (60 percent) as compared to Alternative 1 is expected (by 2018). This will result in average fuel loading of 10 tons, which is within the desired range. An average increase of about 6 tons per acre may occur again in about 30 years if no maintenance takes place (p. 81).
Effects on Condition Class: These are generalized risk rankings ranging from Fire Condition Class 1 through 3. This will only be a qualitative assessment discussion on how condition class may be trending. Fire regime and condition classes are defined below.	The project area will continue to trend toward Condition Class 3 (p. 79).	The project area will trend toward Condition Class 1 (p. 83).	The project area will trend toward Condition Class 1 (p. 83).
Improve forest health by improving the resiliency of overstory trees to insect and disease outbreaks. Objective: (1) reduce forest stand stocking to increase growth and vigor and so reduce bark beetle outbreak risk and enhance tree resistance to disease and slow disease spread, and (2) modify species composition to reduce risk to defoliator outbreaks and to promote species more resilient to fire.	Douglas-fir beetle risk would continue to be high in a large portion of the area and would become more uniformly high as risk increases in stands currently less than high. Diseases such as dwarf mistletoe would continue to increase (p. 62).	Insect and disease related risk would be reduced throughout the project area because the proposed treatments will increase growth and vigor of residual trees. Stand densities would be reduced and individual diameter growth of residual trees would increase. Alt. 2 produces the largest and most long-standing effects of any alternative in reducing the risk of insect and disease in the project area (p. 72).	Insect and disease related risk would be reduced throughout the project area because the proposed treatments will increase growth and vigor of residual trees but not to the extent of Alternative 2. Stand densities would be reduced and individual diameter growth of residual trees would increase (p. 72).
Measurements: (1) changes in species compositions at the project area and individual stand levels; (2) changes in stocking levels at the project area and individual stand levels; (3) changes in modeled bark beetle risk, current condition vs. treatments; and (4) if possible, given stand exam data damages content,	Stands would continue to move toward dominance by late-seral, shade-tolerant species such as white fir as the older shade-intolerant early to mid-seral trees die with little replacement (p. 62). Douglas-fir—more tolerant of shade—does not decline as a proportion of the stocking as rapidly as pines do, but it is	Shade-tolerant species will be reduced as modeling shows that corkbark fir, Engelmann spruce, and white fir decrease due to thinning species preferences for removing those species, with a relative increase in hardwoods, ponderosa pine, southwest white pine, and Douglas-fir (p. 67).	Shade-tolerant species will be reduced as modeling shows that corkbark fir, Engelmann spruce, and white fir decrease due to thinning species preferences for removing those species, with a relative increase in hardwoods, ponderosa pine, southwest white pine, and Douglas-fir but not to

Table 12. Comparison of alternatives by project objectives

Project Objective	Alternative 1	Alternative 2	Alternative 3
demonstrate quantitatively stand level reductions in dwarf mistletoe rating, or discuss qualitatively.	declining. The most tolerant of shade species such as corkbark fir and white fir, increase.		the extent of Alternative 2 (p. 67).
	Stand density indexes (SDI) and trees per acre (TPA) will continue to increase while the average stand diameter will continue to decrease. Approximately, 48 percent of the project area has a SDI of greater than 55 percent meaning that more than half of the project area is at high risk to insect caused tree mortality at the stand level (pp. 62-65).	SDI and TPA will decrease resulting in an increase in the overall average stand diameter. Alternative 2 would greatly reduce the proportion of the area in the zone of imminent mortality in 2018 and 2048 resulting in about 32 percent of the area and in the zone of imminent mortality in the model year 2018 when all treatments have been completed. Due to tree growth, by the year 2048 most of the forested area would again be in the zone of imminent mortality in both action alternatives, however, there would be 12 percent less under Alternative 2 than Alternative 3 (p. 68).	SDI and TPA will decrease resulting in an increase in the overall average stand diameter. Alternative 3 would greatly reduce the proportion of the area in the zone of imminent mortality in 2018 and 2048 resulting in about 43 percent of the area and in the zone of imminent mortality in the model year 2018 when all treatments have been completed. Due to tree growth, by the year 2048 most of the forested area would again be in the zone of imminent mortality in both action alternatives (p. 68).
Within the project area, reduce the risk of stand-replacing crown fire and its threat to the red squirrel and other important threatened and endangered wildlife habitat and forest ecosystems. Objective: Reduce potential fire types in the project area. Measure: Fire type expressed as surface, passive torching or crown fire as a percentage of the project areas. Low severity surface fire is desired.	Surface Fire: 15% Passive Crown Fire: 72% Active Crown Fire: 13% (p. 79)	Surface Fire: 43% Passive Crown Fire: 53% Active Crown Fire: 4% (p. 81)	Surface Fire: 35% Passive Crown Fire: 61% Active Crown Fire: 4% (p. 81)

Table 12. Comparison of alternatives by project objectives

<table>
<tr><th>Project Objective</th><th>Alternative 1</th><th>Alternative 2</th><th>Alternative 3</th></tr>
<tr>
<td>Protect or promote late-successional (old-growth) forest conditions

Objective: Reduce stocking in stand understories and mid-stories to maintain old-growth trees and accelerate the growth of smaller trees toward the desired old-growth type.
Measurements: (1) Display percentage of stands qualifying as old growth in 2008, 2018 and 2048; and (2) Resiliency of resulting stands to insect and disease infestations.</td>
<td>2008 – 83%
2018 – 88%
2048 – 93%
(p. 71)

High stocking resulting in decreased resiliency to insect and disease (see project objective 3 above).</td>
<td>2008 – 83%
2018 – 86%
2048 – 92%
(p. 71)

Reduced stocking resulting in increased resiliency to insect and disease (see project objective 3 above).</td>
<td>2008 – 83%
2018 – 85%
2048 – 91%
(p. 71)

Reduced stocking resulting in increased resiliency to insect and disease (see project objective 3 above).</td>
</tr>
<tr>
<td>Improve firefighter safety.

Effects on potential fire behavior: (1) Fire line intensity expressed as flame length in feet associated with fire hazard. Flame lengths generally less than 4 feet are desired allowing for safe direct attack by hand crews. Flame lengths greater than 4 feet generally require equipment to be employed such as dozers and aircraft; beyond 8 feet torching, crowning and spotting can occur.</td>
<td><table>
<tr><th>Flame Length</th><th>Fire line Intensity Hazard Rating</th><th>Percent of Project Area</th></tr>
<tr><td><4 feet</td><td>Low</td><td>10%</td></tr>
<tr><td>4.1-8 feet</td><td>Low to Moderate</td><td>6%</td></tr>
<tr><td>8.1-11 feet</td><td>Moderate</td><td>5%</td></tr>
<tr><td>> 11 feet</td><td>High</td><td>79%</td></tr>
</table>(p. 79)</td>
<td><table>
<tr><th>Flame Length</th><th>Fire line Intensity Hazard Rating</th><th>Percent of Project Area</th></tr>
<tr><td><4 feet</td><td>Low</td><td>43%</td></tr>
<tr><td>4.1-8 feet</td><td>Low to Moderate</td><td>19%</td></tr>
<tr><td>8.1-11 feet</td><td>Moderate</td><td>5%</td></tr>
<tr><td>> 11 feet</td><td>High</td><td>33%</td></tr>
</table>(p. 79)</td>
<td><table>
<tr><th>Flame Length</th><th>Fire line Intensity Hazard Rating</th><th>Percent of Project Area</th></tr>
<tr><td><4 feet</td><td>Low</td><td>38%</td></tr>
<tr><td>4.1-8 feet</td><td>Low to Moderate</td><td>8%</td></tr>
<tr><td>8.1-11 feet</td><td>Moderate</td><td>1%</td></tr>
<tr><td>> 11 feet</td><td>High</td><td>53%</td></tr>
</table>(p. 79)</td>
</tr>
</table>

Table 13. Comparison of alternatives by significant issue

<table>
<tr><th>Significant Issue</th><th>Indicator/Measure</th><th colspan="2">Alternative 1</th><th colspan="2">Alternative 2</th><th colspan="2">Alternative 3</th></tr>
<tr><td rowspan="7">Significant Issue 1
Mexican Spotted Owl Recovery Plan Guideline Consistency</td><td colspan="7">Treatments and prescriptions that follow silvicultural guidelines established by the Mexican Spotted Owl Recovery Plan as measured by:</td></tr>
<tr><td>Acres of treatments that follow the guidelines.</td><td colspan="2">N/A</td><td colspan="2">861</td><td colspan="2">2,793</td></tr>
<tr><td>Acres of treatments that do not follow the guidelines as allowed by the Forest Plan.</td><td colspan="2">N/A</td><td colspan="2">2,155</td><td colspan="2">0</td></tr>
<tr><td rowspan="4">Forested stands that meet habitat classification standards of the Mexican Spotted Owl Recovery Plan measured by:
Projected percent of forest stands, post treatment, that meet classification standards of “MSO Habitat” which include: (1) acres that meet stand stocking levels in terms of trees per acre greater than 18 inches d.b.h.; (2) acres that meet stand stocking levels in terms of basal area (at least 150 ft^2; and (3) percent of total stand density index (SDI) by size classes (at least 10 percent of current SDI in 12-18″ d.b.h.,18-24″ d.b.h., and >24″ d.b.h. classes).</td><td>Model Year</td><td>Percent of Stands that are MSO Habitat</td><td>Model Year</td><td>Percent of Stands that are MSO Habitat</td><td>Model Year</td><td>Percent of Stands that are MSO Habitat</td></tr>
<tr><td>2008</td><td>36%</td><td>2008</td><td>37%</td><td>2008</td><td>37%</td></tr>
<tr><td>2018</td><td>40%</td><td>2018</td><td>40%</td><td>2018</td><td>42%</td></tr>
<tr><td>2048</td><td>57%</td><td>2048</td><td>56%</td><td>2048</td><td>62%</td></tr>
<tr><td>Significant Issue 2
Amount of Ecosystem Restoration Treatments</td><td>Amount of Forest Restoration Treatments in the Pinaleño Mountains:
The percentage of acres receiving forest restoration treatments within mixed-conifer in the Pinaleño Mountains.
The percentage of acres that will receive prescribed burn treatments within the mixed-conifer and spruce-fir stand in the Pinaleño Mountains.</td><td colspan="2">0%
0%</td><td colspan="2">11%
13%</td><td colspan="2">10%
12%</td></tr>
<tr><td rowspan="2">Significant Issue 3
Mount Graham Red Squirrel</td><td>Summary effect call for species</td><td colspan="2">No effect on the Mount Graham red squirrel</td><td colspan="2">“May effect likely to adversely effect” the Mount Graham red squirrel</td><td colspan="2">“May effect likely to adversely effect” the Mount Graham red squirrel</td></tr>
<tr><td>Will squirrel nesting areas (middens) be disturbed by the alternative?</td><td colspan="2">No</td><td colspan="2">Potentially yes, but occupied sites have been removed from treatment and each treatment unit will be surveyed prior to implementation, therefore, the potential is limited.</td><td colspan="2">Potentially yes, but occupied sites have been removed from treatment and each treatment unit will be surveyed prior to implementation, therefore, the potential is limited.</td></tr>
</table>

Table 13. Comparison of alternatives by significant issue

Significant Issue	Indicator/Measure	Alternative 1	Alternative 2	Alternative 3
	Will acres of critical habitat be negatively affected by the alternative?	No	There is the possibility that short-term negative effects may occur. However, the majority of habitat components will be maintained, and additional components will be created.	There is the possibility that short-term negative effects may occur. However, the majority of habitat components will be maintained, and additional components will be created.
	Are retention of stand components necessary for red squirrel habitat including percent canopy closure and trees per acre (TPA) being met?	In some areas	Yes	Yes, but not to the degree of Alternative 2. This alternative would create a more open understory and potentially increase aerial predators.
	Is there predicted mortality of MGRS resulting from implementation of the alternative?	Yes, due to continued habitat threats due to wildfire, insects, and disease.	Yes, potential mortality may occur due to increased traffic and aerial predators.	Yes, potential mortality may occur due to increased traffic and aerial predators. Due to the open understory, aerial predation is expected to be higher than Alternative 2.
	Will the alternative reduce long-term survival risks due to the threat of uncharacteristic wildfire, insects, and disease to habitat?	No	Yes	Yes, but to a lesser extent than Alternative 2.
Significant Issue 3 Mexican Spotted Owl	Summary effect call for the species	No effect on the Mexican spotted owl	"May effect likely to adversely effect" the Mexican spotted owl	"May effect likely to adversely effect" the Mexican spotted owl
	Percent of available critical habitat disturbed by the alternative.	0%	2.2%	2.1%
	Percent of project area that will retain primary constituent elements of Mexican spotted owl critical habitat in 2018.	40%	40%	42%
	Are shade canopies 40 percent or greater and snags 12 inches in diameter or greater maintained?	Yes to a greater extent than Alternatives 2 and 3.	Yes	Yes to a greater extent than Alternative 2.
	Is there a range of tree species, including mixed-conifer, pine-oak, and riparian forest types, 30 to 45 percent of which are trees with trunks 12 inches in diameter or greater?	Yes	Yes	Yes
	Are there high volumes of fallen trees and other woody debris?	Yes to a greater extent than Alternative 2 or 3.	Yes	Yes
	Is there a wide range of tree species, including	Yes	Yes	Yes

Table 13. Comparison of alternatives by significant issue

Significant Issue	Indicator/Measure				Alternative 1	Alternative 2	Alternative 3
	hardwoods?						
	Are there adequate levels of residual plant cover to maintain fruits, seeds, and allow for plant regeneration present?				Yes	Yes	Yes
Significant Issue 3 Northern Goshawk	Summary effect call for the species				Actions are not likely to impact the species.	Actions are not likely to impact the species.	Actions are not likely to impact the species.
Significant Issue 4 Air Quality	Comparison of predicted smoke emissions ($PM_{2.5}$) on sensitive receptors to regulatory standards and requirements.	Sensitive Receptors	Direction to location of potential receptor	Approximate distance (miles) from project area to potential receptor	24-hour $PM_{2.5}$ ($\mu g/m^3$) Concentration of $PM_{2.5}$ at the area of interest	24-hour $PM_{2.5}$ ($\mu g/m^3$) Concentration of $PM_{2.5}$ at the area of interest	24-hour $PM_{2.5}$ ($\mu g/m^3$) Concentration of $PM_{2.5}$ at the area of interest
		Safford Community	NE	9 miles	0	<1	<1
Significant Issue 4 Air Quality (continued)	The National and Arizona 24-hour ambient air quality standards for $PM_{2.5}$ is 35 $\mu g/m^3$	Pima Community	N	12 miles	0	<1	<1
		Thatcher Community	N	10 miles	0	<1	<1
		Galiuro Wilderness (Class 1 Wilderness)	W	20 miles	0	<1	<1
		Santa Teresa (Other Wilderness)	NW	16 miles	0	<1	<1
		U.S. Highway 70	NE	9 miles	0	<1	<1
		U.S. Highway 91	E	6 miles	0	<1	<1
		Interstate Highway 10	S	30 miles	0	<1	<1
		Recreation areas, camp-grounds and picnic areas	Adjacent and within	0.1 – 5 miles	0	25	25

Table 13. Comparison of alternatives by significant issue

Significant Issue	Indicator/Measure				Alternative 1	Alternative 2	Alternative 3
		Astrophy-sical Site	Adjacent and within	0.2 mile	0	25	25
		Arizona Bible Camp	Adjacent and within	0.1 mile	0	25	25
		Columbine Admin. Site	Adjacent and within	0.1 mile	0	25	25
Significant Issue 5 Old Growth	Comparison of stands qualifying currently as old growth with stands in 2018 and 2048 with and without treatment. This indicator is measured by percent of the project area that can be classified as old growth.				2008 – 83% 2018 – 88% 2048 – 93% (p. 71)	2008 – 83% 2018 – 86% 2048 – 92% (p. 71)	2008 – 83% 2018 – 85% 2048 – 91% (p. 71)

Chapter 3. Affected Environment and Environmental Consequences

This chapter summarizes the physical, biological, social, and economic environments of the project area and the effects of implementing each alternative on that environment. It also presents the scientific and analytical basis for the comparison of alternatives presented in the alternatives chapter.

Analysis presented in this chapter considers past, present, and reasonably foreseeable actions that may contribute toward cumulative effects or the efficacy of the proposed action alternatives. Table 14 lists the actions that have occurred within or adjacent to the project area. It is presented here so that it is not repeated throughout chapter 3 for each resource specific analysis. These activities were considered in the design of the action alternatives and considered in the cumulative effects analysis presented in the following sections.

For each resource-based analysis, this list was used as a starting point for actions that could be considered under cumulative effects. Depending upon the geographic and temporal scope of the direct and indirect effects determined for each resource area, specialists may have considered actions beyond this list.

Table 14. Past, present, and foreseeable activities

Project Name	Activity	Year	Approximate Acres within Analysis Area
Past Activities			
Nuttall and Clark Peak Wildfire Events	Wildfire, wildland fire suppression activities	1996 and 2004	36,000+
Present Activities			
Pinaleño Ecosystem Management (PEM) Project. Hazard reduction treatment focused primarily along the Swift Trail.	Hand thinning, hand pile and burning, chipping.	2003 and ongoing	1,100
Hazard Tree Removal - Columbine Cabins SU, Arizona Bible Camp.	Hand thinning, hand pile and burning, chipping.	2005	30
Hazard Tree Removal – Arizona Department of Transportation (DOT) Hwy. 366 right-of-way, FS Road 803, Rigg Flat CG, Columbine Corrals, Soldier Creek CG, Columbine Cabin Recreation Residences, Cunningham CG, Hospital Flats CG, and Shannon CG.	Hand thinning, hand pile and burning, chipping.	2006	30
Renewal recreation residence special use permits in Turkey Flat (outside of action area) and Columbine.	Renewal of summer home permits.	2008	5
Foreseeable Activities			
Wildland-urban interface (WUI) hazard reduction project around the Columbine Cabins SU, Arizona Bible Camp, Heliograph SU and Ladybug Saddle.	Hand thinning, hand pile and burning, chipping.	2008	30
Renewal of Astrophysical Site Permit	Use of astrophysical site and associated roads and facilities.	2010	10

Forest Vegetation

Introduction

This analysis describes the desired and existing condition of the forest vegetation within the project area, compares the potential effects of each alternative on the forest stands proposed for treatment, and compares how each alternative achieves project objectives.

Overview of Issues

A significant issue raised during the public comment period expressed concern that the proposed project's silvicultural prescriptions are not consistent with the Mexican Spotted Owl Recovery Plan. To address this issue, the analysis objective in this section will be to display how well treatments would retain current spotted owl habitat and how well treatments would reduce the risk of losing spotted owl habitat to wildfires.

Affected Environment

Past Activities and Events

The existing condition of forested stands in the project area has been influenced by past fires, tree thinning, bark beetle epidemics, and fire suppression activities (USDA Forest Service 2004a, 2007a). In the early part of the 20th century (starting in the 1920s), timber was harvested from the project area. We are assuming from field observations and knowledge of the nature of the older timber harvesting operations in the western United States that the harvesting was an extensive—but not intensive—selection harvest in which scattered individual large and valuable trees were removed. In recent years, a number of stands in the project were thinned under the 2001 Pinaleño Ecosystem Management (PEM) Project. Wildfire activity decreased in the area around the 1880s due largely to human-related factors such as livestock grazing and fire suppression. Recent wildfires that have impacted the analysis area are the Nuttall Fire of 2004 and the Clark Peak Fire of 1996. Beginning in 1996, bark beetles and defoliators began defoliating and killing trees in the spruce-fir and mixed-conifer forests and have resulted in increased tree mortality in the project area in the past 2 decades (Lynch 2006, USDA Forest Service, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006). All of these management activities and events have been included in characterizing the existing condition.

Forest Types

A number of forest types are included within stands proposed for treatment and not proposed for treatment (table 15). Note that the acre values below proposed for treatment and not proposed for treatment are from the Alternative 1 (no action) GIS layer and do not match exactly the area computed from the action alternative GIS layers due to stand splitting during the development of the action alternatives. The forest types in table 15 were classified by the Forest Vegetation Simulator (FVS) based upon stand exam data and FVS modeling of wildfire and bark beetle impacts. The forest type is based upon the predominant species present in the stand (Arner et al. 2001) and does not reflect the mixed species composition of most stands. Most, if not all, stands proposed for treatment in the project area have diverse species compositions and can be considered mixed conifer. Most of the deciduous oak and other hardwood forest types, and a portion of the aspen forest type, are in stands severely impacted by past wildfires.

Table 15. FVS classified forest types for stands proposed for treatment

Forest Type	Acres Not Proposed for Treatment	Acres Proposed for Treatment
Douglas-fir	856	2,092
Ponderosa pine	47	152
White fir	146	494
Engelmann spruce	80	48
Engelmann spruce-subalpine fir	153	96
Subalpine fir	212	99
Southwest white pine	293	497
Aspen	52	50
Deciduous oak	7	6
Other hardwoods	0	32
Non-stocked forest	132	71
Non-forest vegetated	42	74
Lake	20	0
	2,040	3,711

Acres proposed for treatment in the action alternatives. These acres will not be treated under Alternative 1 but are delineated here such that effects to these acres can be compared appropriately.

Stocking Levels

We will be discussing tree stocking levels in terms of trees per acre (TPA), basal area per acre (BA), stand density index (SDI), and percent canopy cover (PCC). Each measure displays a somewhat different aspect of tree stocking and is used to give a clear picture of the existing condition, and changes taking place with or without management action. We display and discuss stocking levels for stands that are not proposed for treatment and stands that are proposed for treatment in Alternative 2. We separated these two groups of stands so that we can better identify and discuss changes due to the proposed treatments in the action alternatives. This concept is carried throughout this analysis and other analysis presented in this chapter.

Existing Condition

The forest stands in the project area can be characterized as being: (1) heavily stocked with a large number of small diameter trees; (2) contain a substantial stocking of mature and old trees with most of the area qualifying as old growth; (3) at a high risk to Douglas-fir beetle; (4) dominated by or moving toward dominance by fire intolerant, shade tolerant, climax species; (5) susceptible to high-intensity fires and fire mortality; and (6) generally low to moderate dwarf mistletoe levels with some areas that are highly infected.

Stocking

Trees per Acre (TPA)

Figures 18 and 19 show the existing (2008) diameter distribution for stands proposed for treatment (figure 18) and not proposed for treatment (figure 19). The figures show a forest with increasing numbers of small trees with decreasing d.b.h., a very large number of trees less than 3 inches d.b.h. (2-inch d.b.h. class). Total TPA averages 867 and 885 TPA with 499 and 570 TPA in the 2-inch size class. In these two figures, the very large number of trees in the smallest size class makes it difficult to display the diameter distribution and species composition of larger trees.

In figures 20 and 21, we show the same groups of stands in the year 2008 with the 2-inch size class removed so that the tree species composition and diameter distribution of larger trees can better be displayed. These two figures show a distribution that is almost flat for trees larger than the 24-inch size class, but which is relatively steeply increasing with decreasing d.b.h. for trees smaller than the 24-inch size class. The figures also show a substantial stocking in the larger and older trees with about 27 TPA present greater than or equal to 18 inches d.b.h.

Figures 20 and 21 also show that the most intolerant of shade trees—ponderosa pine and southwestern white pine—decrease in proportion of the stocking with decreasing d.b.h. Douglas-fir—more tolerant of shade—does not decline as a proportion of the stocking as rapidly as pines do. In the distribution, the larger size classes are dominated by ponderosa pine, southwestern white pine, and Douglas-fir with few large white fir. The most tolerant of shade species such as corkbark fir and white fir increase in proportion of the stocking in the smaller size classes. As historic data has shown, this area was in general, frequently burned by low- to mixed-severity wildfires. We can interpret this species distribution as characteristic of stands that were generally maintained as dominated by seral species by disturbance, but which are now naturally progressing toward dominance by the climax species, which for most of the project area is white fir. It must be understood, however, that these distributions are averages of a number of stands and within the project area, the climax species varies and sites can be found where white fir, Douglas-fir and corkbark fir can be considered climax.

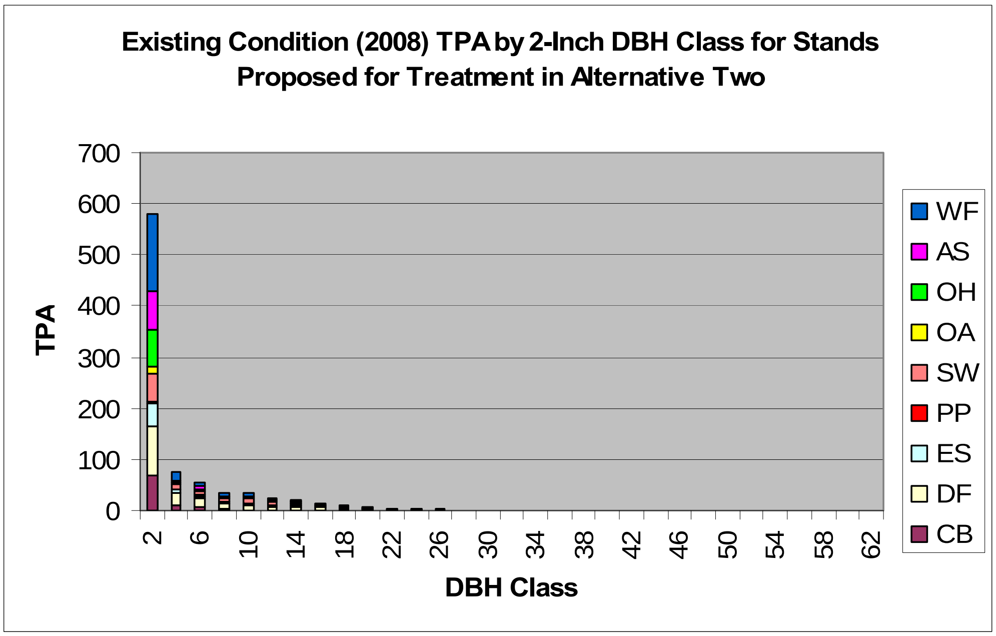
Stand Density Index

Stands that are above 55 percent of the maximum SDI can be considered to be in a “zone of imminent mortality” in which trees will be dying due to competition for site resources. Below this zone is the zone of “full site occupancy.” In 2008, about 48 percent of the forested stand area in the project area is in the zone of imminent mortality and most of the area is in these two zones (table 16). In 2008, about 43 percent of the forested area meets Mexican spotted owl standards and guides (Forest Plan 1996) threshold values criteria requiring at least 10 percent of the existing stand density index be present in each of three tree size classes: greater than or equal to 12 and less than 18 inches d.b.h., greater than or equal to 18 and less than 24 inches d.b.h., and greater than or equal to 24 inches d.b.h.

Table 16. Stand area (acres) within SDI zones. Stands above 55 percent are in the "zone of imminent mortality"

	Year	Less than 25%	≥ 25 and < 35%	≥ 35 and < 55%	55% and Greater	Total
Not Treated	2008	220	83	847	828	1,979
To Be Treated	2008	217	274	1,252	1,893	3,636

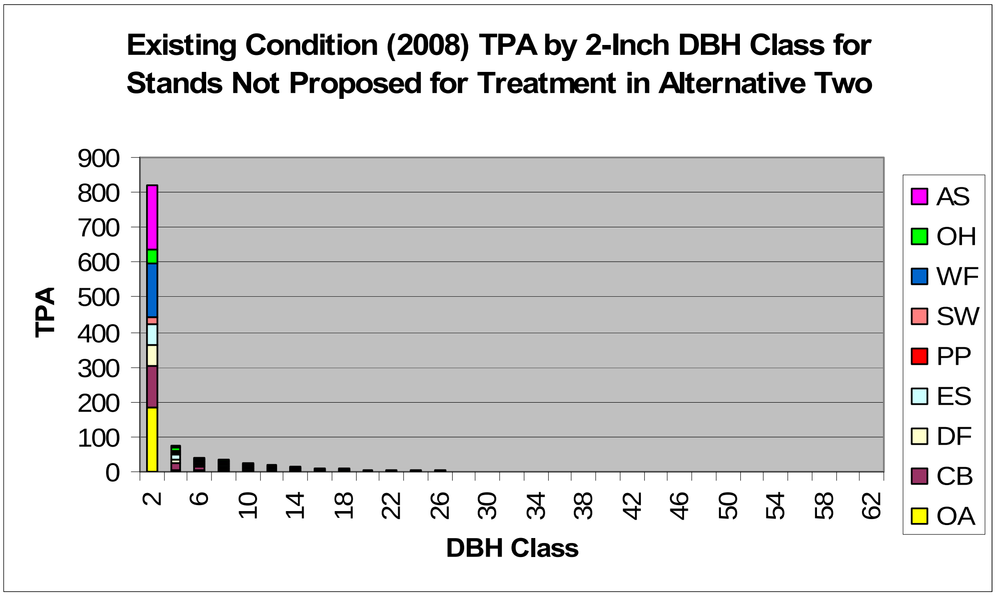
* Acres proposed for treatment in the action alternatives. These acres will not be treated under Alternative 1 but are delineated here so that effects to these acres can be compared appropriately.



WF – white fir (*Abies concolor*), AS – quaking aspen (*Populus tremuloides*), OH – other hardwoods, OA – oak (*Quercus* spp.), SW – southwest white pine *(Pinus strobiformis*), PP – ponderosa pine (*Pinus ponderosa*), ES – Engelmann spruce (*Picea Engelmanneii*), DF – Douglas-fir (*Pseudotsuga menziesii*), CB – corkbark fir *(Abies lasiocarpa* var. *arizonica*)

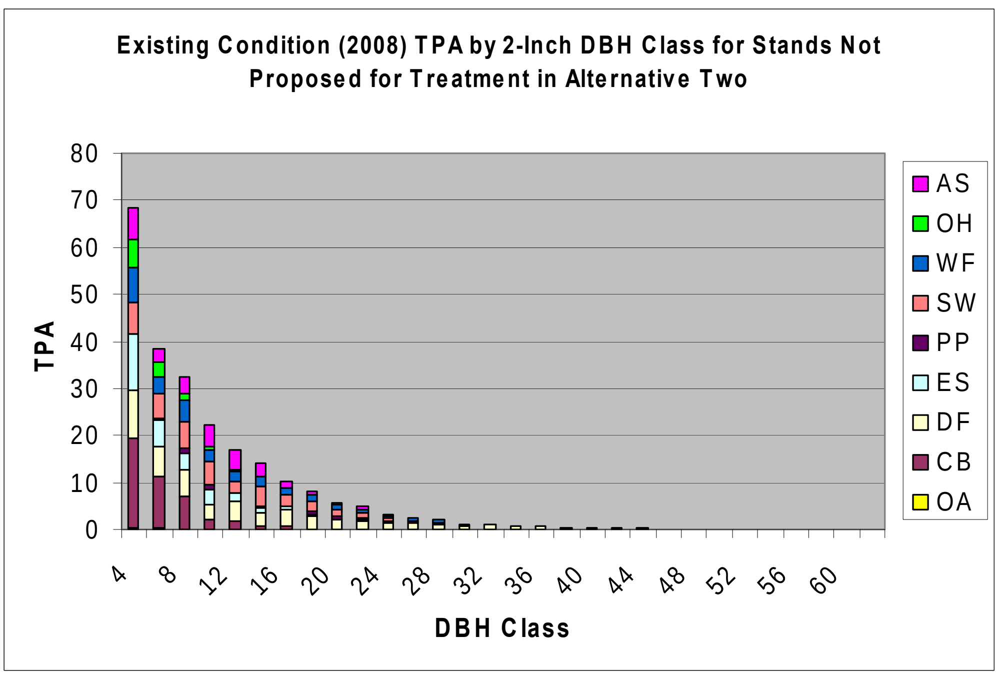
Figure 18. Existing condition diameter distribution for stands proposed for treatment[7] in Alternative 2

[7] This refers to stands proposed for treatment in the action alternatives. These stands will not be treated under Alternative 1 but are delineated here so that effects to these stands can be compared appropriately.



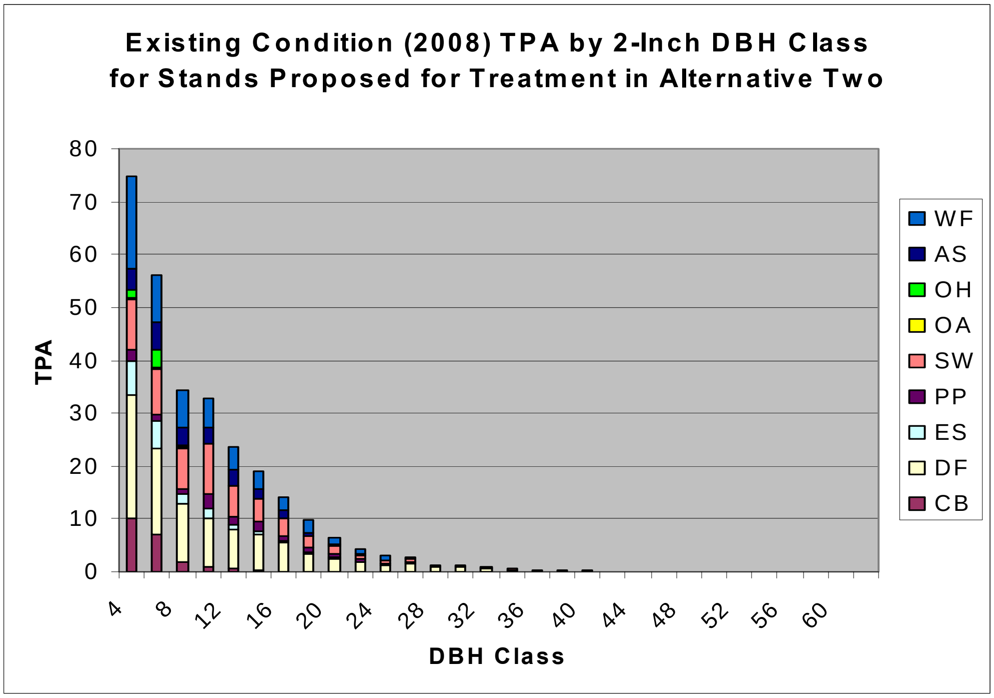
AS – quaking aspen, OH – other hardwoods, WF – white fir, SW – southwest white pine, PP – ponderosa pine, ES – Engelmann spruce, DF – Douglas-fir, CB – corkbark fir, OA – oak

Figure 19. Existing condition diameter distribution for stands not proposed for treatment in Alternative 2



AS – quaking aspen, OH – other hardwoods, WF – white fir, SW – southwest white pine, PP – ponderosa pine, ES – Engelmann spruce, DF – Douglas-fir, CB – corkbark fir, OA – oak

Figure 20. Existing condition diameter distribution in 2008 without 2-inch d.b.h. class for stands not proposed for treatment in Alternative 2. This chart more clearly shows the differences among diameter classes larger than 2 inches.



WF – white fir, AS – quaking aspen, OH – other hardwoods, OA – oak, SW – southwest white pine, PP – ponderosa pine, ES – Engelmann spruce, DF – Douglas-fir, CB – corkbark fir

Figure 21. Existing condition diameter distribution in 2008 without 2-inch d.b.h. class for stands proposed for treatment* in Alternative 2. This chart more clearly shows the differences among diameter classes larger than 2 inches.

* This refers to stands proposed for treatment in the action alternatives. These stands will not be treated under Alternative 1 but are delineated here so that effects to these stands can be compared appropriately.

Basal Area

The existing forests are denser than their historic norm. In terms of basal area, most of the forested area in the project area has basal areas greater than or equal to 150 ft^2 (4,553 acres or 81 percent) and 170 ft^2 (4,003 acres or 71 percent).

Average Tree Diameter

The project area contains a high number of mid-story trees indicating a lack of disturbance. In 2008, the average tree diameter (QMD) is 9 inches. For information regarding this topic, please see appendix C.

Diameter Growth

In 2008, the potential average diameter growth for the time period from 2008 to 2018 is 0.68 for the group of stands that would not be treated and 0.59 for the "to be treated" group of stands.

Bark Beetle Hazard

Since the primary bark beetle currently of concern in the project area and its potential effect on Mount Graham red squirrel habitat is the Douglas-fir beetle (*Dendroctonus pseudotsugae*), in this analysis we concentrate upon characterizing and analyzing treatment effects upon Douglas-fir beetle hazard. Hazard is a measure of a stand's ability to support a population of Douglas-fir beetles. Table 17 displays Douglas-fir beetle hazard (risk) with no management action for the group of stands proposed for treatment (to be treated) and the group of stands not proposed for treatment (not treated) in Alternative 2. Slightly over one-half of the stand area in the project area is rated as high and very high hazard. For information regarding bark beetle hazard, please see appendix C.

Table 17. Douglas-fir beetle hazard rating acres for existing condition

Risk Rating	Not Treated (Acres)	To be Treated* (Acres)
Extremely Low	69	35
Very Low	373	496
Low	273	852
Moderate	172	494
High	1,019	1,443
Very High	73	316
Total	1,979	3,636

* Acres proposed for treatment in the action alternatives. These acres will not be treated under Alternative 1 but are delineated here so that effects to these acres can be compared appropriately.

Potential Fire Mortality

If a fire were to occur in area stands under 90th percentile weather conditions in 2008, about 60 percent of the basal area stocking in the group of stands that are not proposed for treatment, and about 67 percent of the basal area stocking in the group of stands that are proposed for treatment would be killed.

Dwarf Mistletoe

Ninety-two of the stands in the project area had dwarf mistletoe recorded on southwestern white pine, ponderosa pine, Douglas-fir, or Englemann spruce. The average FVS computed dwarf mistletoe rating (DMR) for all stands in the project area is 0.377 with a minimum of 0.002 and a maximum of 2.661. This stand-level rating includes all trees in the stands. The low value indicates that dwarf mistletoe is present, but at generally low levels and partially reflects the high densities of host tree species such as white fir. There are several stands, however, that have relatively high ratings (above 3). The average dwarf mistletoe rating of just the trees for which a dwarf mistletoe infection was recorded is an average of 2.7 with a range of 1.2 to 6.0.

Old Growth

In this analysis, we classified stands as old growth based upon the number of live trees greater than 18 inches d.b.h., total stand BA, and total percent canopy cover. In the existing condition (2008), we classified about 83 percent of the forested area as old growth.

Desired Condition

The desired condition for the project area comes from the Coronado Forest Plan, as amended, and is outlined in chapter 1 of this document. The focus of this project is to protect habitat for the Mount Graham red squirrel and key ecosystem components by changing the composition, structure, and density of forest vegetation. Changing these characteristics is also expected to reduce the potential for severe wildfires that could destroy red squirrel habitat. Management direction for forest vegetation is provided in the Forest Plan in the management area descriptions for MAs 2, 2A, and 8. Details are provided in the silviculture report (Amell 2008). All of the project area is considered unsuitable for timber management; however, the Forest Plan allows for vegetation management where necessary that consists of sanitation salvage operations, maintenance and improvement of wildlife habitat, and control of insect and disease outbreaks. In MA 2A, the Forest Plan specifies “outbreaks of insects or disease will be controlled using integrated pest management concepts when there is a significant danger to the vegetation needed to sustain habitat for the Mount Graham red squirrel and astronomical research activities” (Forest Plan, p. 54-5). In this project, the desired condition for vegetation is to create conditions that protect and reduce risks to red squirrel habitat.

Environmental Consequences

Methodology

The Forest Vegetation Simulator (FVS) program was used to model the effects of treatments on tree growth and stocking, and to provide stand attributes for fire intensity and type modeling using the Flammap program. FVS modeling is further described in appendix C.

The Alternative 2 and 3 sections describe the condition of forested stands in the analysis area in the years 2018 and 2048 as if treatments are implemented. We chose the year 2018 because we modeled all treatments, including all prescribed burning, to be completed in the year 2015. We modeled a 10-year cycle from 2008 to 2017, and since activities modeled in the FVS-FFE extension are “pushed” to the end of the cycle, their effects show up at the beginning of the next cycle, that is in 2018. We selected the year 2048 as sufficiently far into the future to assess the longevity of effects.

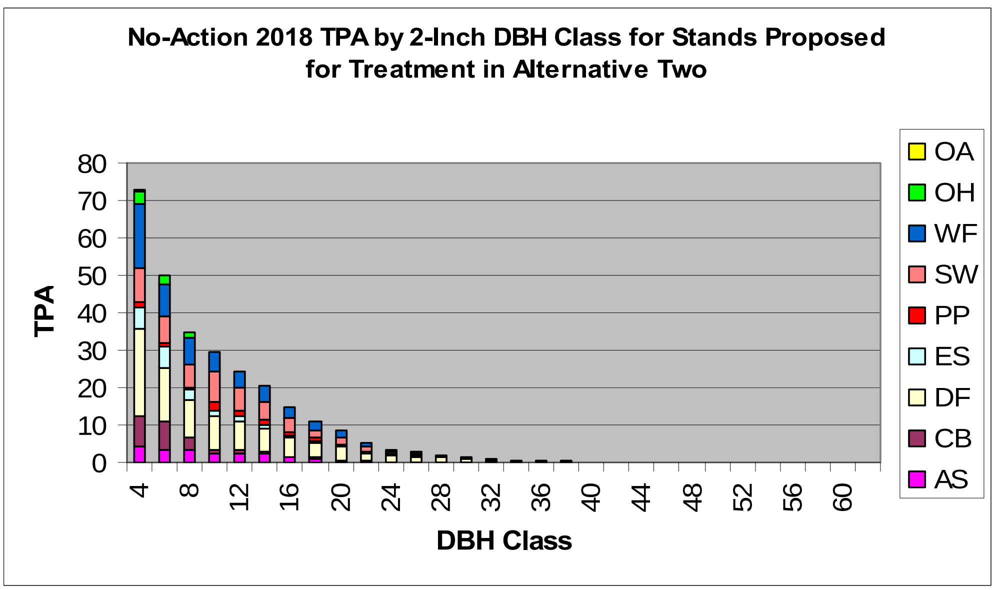
Alternative 1 - No Action

Direct and Indirect Effects

In Alternative 1, no treatments are proposed. Stand conditions would be as described above for the existing condition, and the future condition with no action in 2018 and 2048 as described below. Stand stocking would continue to be high and assuming no additional wildfire and insect related mortality would continue to increase. Stands would continue to move toward dominance by late-seral, shade-tolerant species such as white fir as the older shade-intolerant early- to mid-seral trees die with little replacement. Douglas-fir beetle risk would continue to be high in a large portion of the area and would become more uniformly high as risk increases in stands currently less than high. Diseases such as dwarf mistletoe would continue to increase. A large portion of the area would continue to be susceptible to severe wildfires (Hall 2008) with high levels of potential tree mortality.

Stocking Levels

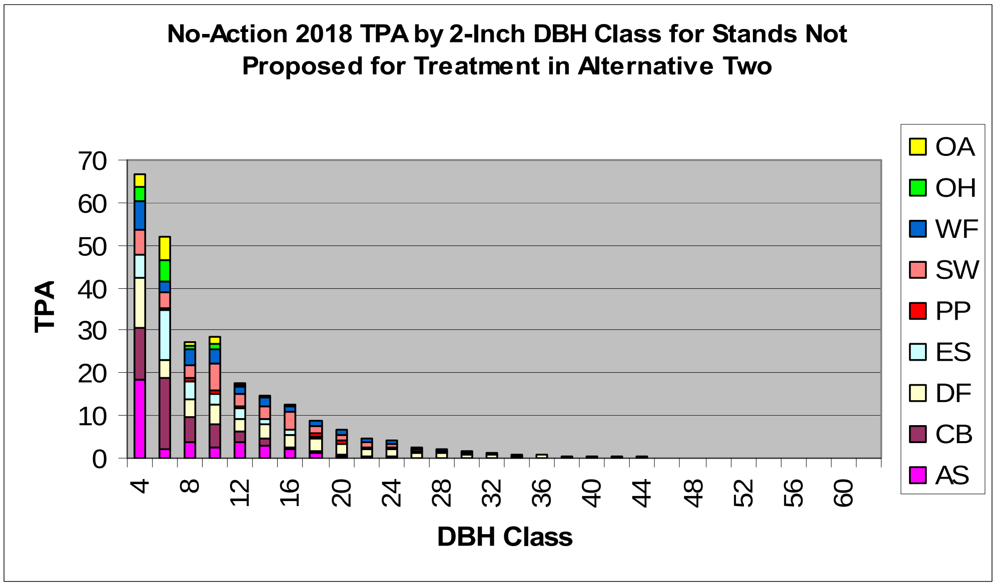
Trees per Acre - The following diameter distributions do not include the smallest diameter class, because as shown in the existing condition, the very large number of trees in that diameter class makes it difficult to display TPA and species compositions for larger trees. The small trees shown in the existing condition are still there in the following discussion but not displayed. Figure 22 displays the TPA by 2-inch d.b.h. class for stands that are proposed for treatment in Alternative 2 for the year 2018 and figure 23 displays the distribution for stands that are proposed for treatment in Alternative 2 for the year 2018. The relatively steep increase in TPA in the smaller d.b.h. size classes and decrease in proportion of the stocking of the shade-intolerant trees with decreasing d.b.h. discussed in the “Existing Condition” persists. Douglas-fir—more tolerant of shade—does not decline as a proportion of the stocking as rapidly as pines do, but it is declining. The most tolerant of shade species such as corkbark fir and white fir increase.



OA – oak, OH – other hardwoods, WF – white fir, SW – southwest white pine, PP – ponderosa pine, ES – Engelmann spruce, DF – Douglas-fir, CB – corkbark fir, AS – quaking aspen

Figure 22. No action 2018 diameter distribution without 2-inch d.b.h. class for stands proposed for treatment* in Alternative 2

* This refers to stands proposed for treatment in the action alternatives. These stands will not be treated under Alternative 1 but are delineated here so that effects to these stands can be compared appropriately.



OA – oak, OH – other hardwoods, WF – white fir, SW – southwest white pine, PP – ponderosa pine, ES – Engelmann spruce, DF – Douglas-fir, CB – corkbark fir, AS – quaking aspen

Figure 23. No action 2018 diameter distribution without 2-inch d.b.h. class for stands not proposed for treatment in Alternative 2

Stand Density Index

Table 18 shows the forested area within SDI zones for the existing condition (2008) and in the year 2018 and 2048 if no management action is taken. These values assume that no other disturbances take place. Stands that are above 55 percent of the maximum SDI can be considered to be in a "zone of imminent mortality" in which trees will be dying due to competition for site resources. Below this zone is the zone of "full site occupancy." In 2008, about 48 percent of the forested stand area in the project area is in the zone of imminent mortality and most of the area is in these two zones. The proportion of area within the zone of imminent mortality increases over time as stand stocking increases until most of the forested area is within that zone. For information regarding this topic, please see appendix C.

Table 18. Stand area (acres) within SDI zones

	Year	< 25%	≥ 25 and < 35%	≥ 35 and < 55%	≥ 55%	Total
Not Treated	2008	220	83	847	828	1,979
Not Treated	2018	198	48	639	1,095	1,979
Not Treated	2048	171	12	211	1,585	1,979
To Be Treated*	2008	217	274	1,252	1,893	3,636
To Be Treated*	2018	185	177	1,058	2,217	3,636
To Be Treated*	2048	124	57	657	2,797	3,636

* Acres proposed for treatment in the action alternatives. These acres will not be treated under Alternative 1 but are delineated here so that effects to these acres can be compared appropriately.

In 2008, about 43 percent of the forested area meets Mexican spotted owl standards and guides (Forest Plan 1988, as amended and "Record of Decision for Amendment of Forest Plans, Arizona and New Mexico, Appendix C Standards and Guidelines in Selected Alternative (G)," May 1996, Southwestern Region) threshold values criteria for restricted areas requiring at least 10 percent of the existing stand density index be present in each of three tree size classes: greater than or equal to 12 and less than 18 inches d.b.h., greater than or equal to 18 and less than 24 inches d.b.h., and greater than or equal to 24 inches d.b.h. Due to tree growth and assuming no mortality other than modeled competition related mortality, the proportion of forested area meeting these criteria would increase to 44 percent in 2018 and 58 percent in 2048.

Basal Area

Table 19 shows that most of the forested area in the project area has basal areas greater than or equal to 150 ft^2 (81 percent) and 170 ft^2 (71 percent) in the existing condition (2008). Assuming no stand disturbances that would reduce stocking, with no action, the proportion of the forested area exceeding these stocking levels would continue to increase.

Table 19. Alternative 1 area and percent of forested area greater than or equal to 150 and 170 ft^2 BA for 2008, 2018, and 2048.

Year	BA ≥ 150 Ft^2 Acres (Percent)	BA ≥ 170 Ft^2 Acres (Percent)
2008	4,553 (81)	4,003 (71)
2018	4,970 (88)	4,587 (81)
2048	5,198 (92)	5,146 (91)

Average Tree Diameter

Table 20 displays the average FVS computed quadratic mean diameter (QMD) with no management action for the years 2008, 2018, and 2048 for stands proposed for treatment and not proposed for treatment in Alternative 2. Quadratic mean diameter is the average diameter of the trees in the stand expressed as the diameter of the tree of the mean basal area (appendix C). With no action and assuming no stand disturbances, the average diameter would continue to increase.

Table 20. Alternative 1 QMD for 2008, 2018, and 2048

	Year	QMD
Not Treated	2008	10
Not Treated	2018	10
Not Treated	2048	13
Treated*	2008	9
Treated*	2018	10
Treated*	2048	12

* Acres proposed for treatment in the action alternatives. These acres will not be treated under Alternative 1 but are delineated here so that effects to these acres can be compared appropriately.

Diameter Growth

Table 21 displays the average diameter growth and basal area growth with no management action for all trees in stands proposed for treatment and not proposed for treatment in Alternative 2. The growth displayed is average d.b.h. growth for the 4-year FVS modeled time period from 2004 to 2008 (2008) and the 10-year FVS modeled time periods from 2008 to 2018 (2018) and from 2018 to 2048 (2048). Basal area growth displayed is the increase in basal area during the 30-year time period from 2018 to 2048. With no action and no disturbances, average tree growth would decline.

Table 21. Alternative 1, average d.b.h. and BA growth for 2008, 2018, and 2048

	Year	Average d.b.h. Growth (Inches)	Basal Area Growth (Sq Ft)
Not Treated	2008	0.19	
Not Treated	2018	0.68	
Not Treated	2048	0.61	39
To Be Treated*	2008	0.19	
To Be Treated*	2018	0.59	
To Be Treated*	2048	0.55	33

* Acres proposed for treatment in the action alternatives. These acres will not be treated under Alternative 1 but are delineated here so that effects to these acres can be compared appropriately.

Table 22. Alternative 1 potential percent basal area fire mortality in 2008, 2018, and 2048

	Year	Average Potential Percent BA Mortality
Not Treated	2008	60
Not Treated	2018	60
Not Treated	2048	49
To Be Treated*	2008	67
To Be Treated*	2018	67
To Be Treated*	2048	56

* Acres proposed for treatment in the action alternatives. These acres will not be treated under Alternative 1 but are delineated here so that effects to these acres can be compared appropriately.

Bark Beetle Hazard

With no action, bark beetle hazard would increase as stand stocking levels and the proportion of basal area in large Douglas-fir increases. The proportion of forested area considered a high hazard would increase. For information regarding bark beetle hazard ratings, please see appendix C.

Potential Fire Mortality

Table 22 displays the average potential fire mortality in terms of basal area per acre if no management action were to occur for stands proposed for treatment (to be treated) and not proposed for treatment (not treated) in Alternative 2. The mortality prediction is from the FVS-FFE Potential Fire Report for 90th percentile weather conditions (Hall 2008) and represents expected mortality if a wildfire were to burn the stands under those conditions. With no action, over one-half of the stand basal area would be expected to die, but the proportion decreases over time due to increased tree sizes and resistance to fire. For information regarding FVS, please see appendix C.

Dwarf Mistletoe

With no management action, dwarf mistletoe would continue to increase in the proportion of trees infected and the severity of the infections.

Old Growth

In this analysis, we classified stands as old growth based upon the number of live trees greater than 18 inches d.b.h., total stand BA, and total percent canopy cover. Table 23 displays the proportion of the forested area in the analysis area we classified as old growth in 2008, 2018, and 2048 with no action being taken and assuming no stand disturbances. Over time, the amount of area classified as old growth would increase due to tree growth and stocking increases.

Table 23. Acres and percent of analysis area classified as old growth for 2008, 2018, and 2048 in Alternative 1

Year	Acres	Percent of Project Area
2008	4,667	83
2018	4,945	88
2048	5,235	93

Cumulative Effects

The direct and indirect effects identified above generally may impact the mixed-conifer and spruce-fir vegetation types of the Pinaleño Mountains. Therefore, given the geographic extent of these effects cumulative impacts this analysis will consider the additive impacts of activities that could or have impacted these forest types within the Pinaleño Mountains.

In addition, the potential direct and indirect effects of implementing the proposed project are predicted to persist in varying intensities over the next 30 years. Therefore, for cumulative effects, this analysis considers effects within the above geographical boundary that will persist or occur during that same time period.

Events and management activities that have occurred in the project area include the Clark Peak Fire, Nuttall Fire, bark beetle and defoliator activity, and PEM thinning. These events and activities postdate the stand exam data. To develop and characterize the existing condition, we modeled the effects of these events and activities on area stands, as well as tree growth since stand exam data collection, using the FVS program (appendix C). Past activities and events, including the PEM thinning, therefore, have already been discussed above and considered in a discussion of cumulative effects and so will not be discussed in detail here. We will note again though, that as discussed above, the Clark Peak Fire and Nuttall Fire severely burned portions of the project area, bark beetle mortality extensively killed spruce and fir trees in portions of the project area, and the PEM thinning thinned stand understories in about 1,100 acres of the project area. Note that this discussion differs from the fire and fuels report (Hall 2008) in that Hall (2008) lists the PEM project as “ongoing” whereas in this project, we modeled it as being completed in the year 2007.

Alternatives 2 and 3

Direct and Indirect Effects

The following section describes the condition of forested stands in the analysis area in the years 2018 and 2048 if Alternative 2 or 3 treatments are implemented. We chose the year 2018 because we modeled all treatments, including all prescribed burning, to be completed in the year 2015. We modeled a 10-year cycle from 2008 to 2017, and since activities modeled in the FVS-FFE extension are “pushed” to the end of the cycle, their effects show up at the beginning of the next cycle, that is in 2018. We selected the year 2048 as sufficiently far into the future to assess the longevity of effects.

Stocking Levels

Trees per Acre, **Alternative 2** – Figure 24 shows stand diameter distributions for year 2018 and figure 25 shows distributions for 2048. Some stands would have trees thinned up to 9 inches d.b.h., some would have trees thinned up to 18 inches d.b.h. and some would be treated by prescribed burn only. The distribution shows that the diameter distribution less than 18 inches d.b.h. has been flattened by the treatments, but considering that this distribution represents an average over all treated stands, individual stand distributions would show more and less of the flattening. Modeling of the diameter distributions shows that the number of trees per acre in the smaller diameter classes would be greatly reduced, the number of trees per acre in the 12- to 18-inch d.b.h. class would be reduced, and since no trees are being removed larger than 18 inches d.b.h., there would no real change above the 18-inch size class. Total TPA shown in figure 24 is 169, and in figure 25 is 139.

Modeling also showed that the proportion of stocking in corkbark fir, Engelmann spruce, and white fir have decreased due to thinning species preferences for removing those species, greater predicted mortality of those species to prescribed burning activities, and the greater numbers of those species in the smaller d.b.h. classes (figure 21), with a relative increase in hardwoods, ponderosa pine, southwest white pine, and Douglas-fir because they are preferred to retain. In the distribution displayed in figure 24, TPA for white fir is 31 percent, corkbark fir is 33 percent, ponderosa pine is 53 percent, white pine is 44 percent and Douglas-fir is 48 percent of that showing in figure 21.

Trees per Acre, **Alternative 3 -** Figures 26 and 27 show diameter distributions for Alternative 3. When compared with no action above, the diameter distributions show that TPA in the smaller diameter classes would be greatly reduced. Since no trees are being removed larger than 9 inches d.b.h., there would be no change above the 10-inch size class because of the thinning treatments. In figure 26, total TPA shown is 182, and in figure 27 total TPA shown is 149. Although not as easy to determine from the figures, we may also note that the proportion of stocking in corkbark fir, Engelmann spruce, and white fir have decreased due also to thinning species preferences for removing those species, greater predicted mortality of those species to prescribed burning activities, and the greater numbers of those species in the smaller d.b.h. classes (figure 21), with a relative increase in hardwoods, ponderosa pine, southwest white pine, and Douglas-fir. In the distribution displayed in figure 26, TPA for white fir is 42 percent, corkbark fir is 29 percent, ponderosa pine is 77 percent, white pine is 50 percent, and Douglas-fir is 59 percent of that showing in figure 21.

Table 24 displays the TPA greater than 18 inches d.b.h. for Alternative 1 in the years 2008, 2018, and 2048 and for the action alternatives in the year 2018 and 2048. The stands not proposed for treatment are shown for Alternative 1 only because values for the other two alternatives for this group are similar.

Table 24. TPA greater than 18 inches d.b.h. for all three alternatives

Alternative	Year	TPA ≥18 in. d.b.h.
1 (Not treated)	2008	26
1 (Not treated)	2018	31
1 (Not treated)	2048	42
1 (Treated)	2008	27
1 (Treated)	2018	31
1 (Treated)	2048	44
2 (Treated)	2018	28
2 (Treated)	2048	41
3 (Treated)	2018	28
3 (Treated)	2048	42

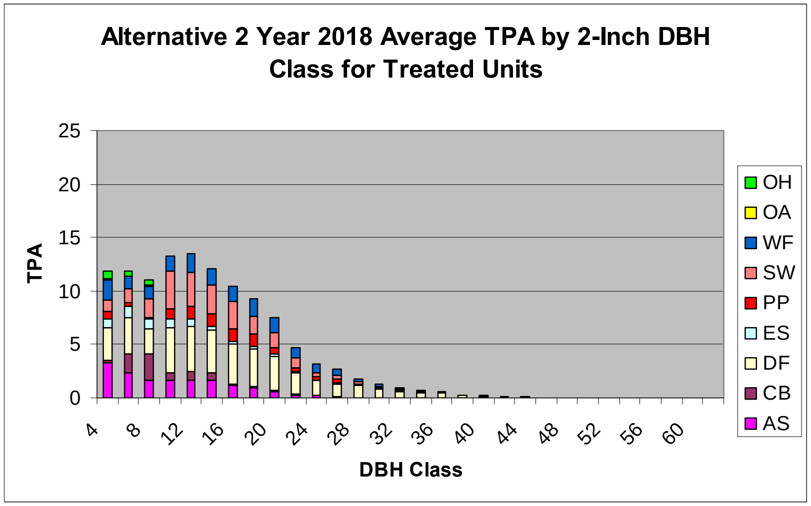


Figure 24. Diameter distribution for stands proposed for treatment in Alternative 2, year 2018

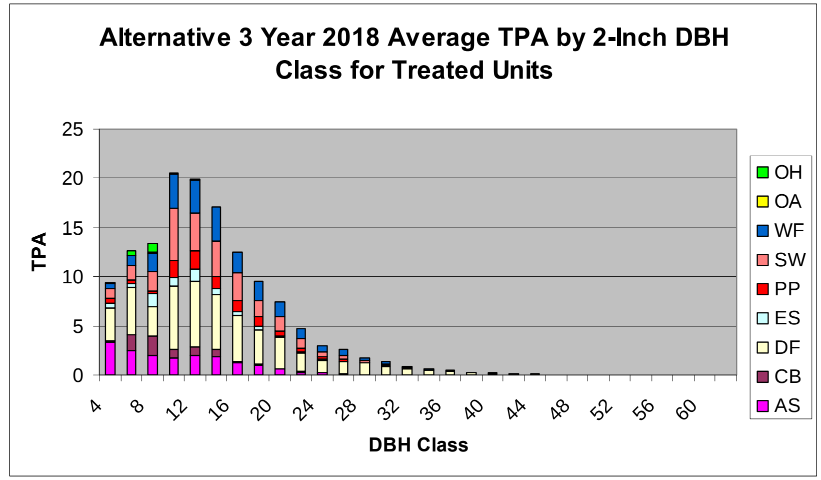


Figure 26. Diameter distribution for stands proposed for treatment in Alternative 3, year 2018

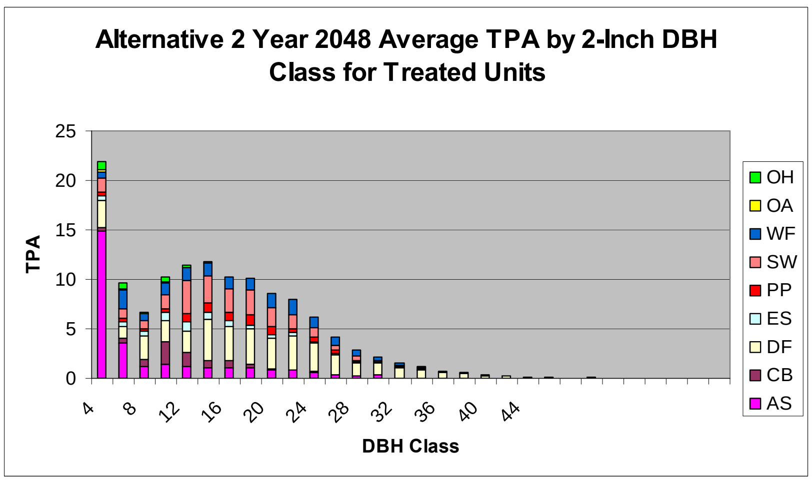


Figure 25. Diameter distribution for stands proposed for treatment in Alternative 2, year 2048

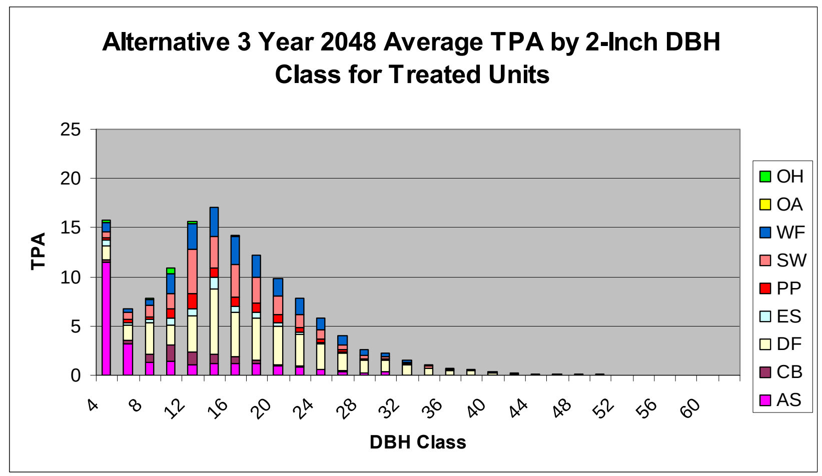


Figure 27. Diameter distribution for stands proposed for treatment in Alternative 3, year 2048

TPA = trees per acre; DBH = diameter at breast height; OH – other hardwoods, OA – oak, WF – white fir, SW – southwest white pine, PP – ponderosa pine, ES – Engelmann spruce, DF – Douglas-fir, CB – corkbark fir, AS – quaking aspen

Stand Density Index - Alternatives 2 and 3

Table 25 displays acres by SDI zone for the years 2008, 2018, and 2048 for each of the alternatives. Stands that are above 55 percent of the maximum SDI can be considered to be in a “zone of imminent mortality” in which trees will be dying due to competition for site resources. The existing condition (Alternative 1 in 2008) shows about 48 percent of the forested stand area in the project area is above 55 percent of the maximum SDI for Douglas-fir. With no action, stocking levels would continue to increase and in 2018 and 2048, most of the project area would be in this zone. The two action alternatives would greatly reduce the proportion of the area in the zone of imminent mortality in 2018 and 2048 with Alternative 2 resulting in about 32 percent of the area and Alternative 3 resulting in about 43 percent of the area in the zone of imminent mortality in the model year 2018 when all treatments have been completed. Due to tree growth, by the year 2048 most of the forested area would again be in the zone of imminent mortality in both action alternatives, however, there would be 12 percent less under Alternative 2 than Alternative 3.

In terms of the proportion of forested area meeting Mexican spotted owl habitat threshold values for SDI, both action alternatives would increase the amount of forested area meeting these values over Alternative 1. This increase is mostly due to an artifact of the Forest Plan habitat-modeling scheme. That is, the threshold values are based upon the proportion of existing SDI in three tree size classes: greater than or equal to 12 and less than 18 inches d.b.h., greater than or equal to 18 and less than 24 inches d.b.h., and greater than or equal to 24 inches d.b.h. Some of the treatments would thin trees in the 12- to 18-inch d.b.h. class, but the larger size classes would not be affected and all thinning would be “from below” and would mostly reduce tree stocking less than 12 inches d.b.h. Therefore, in the habitat modeling scheme, it would be expected that the treatments, by reducing existing stand SDI and reducing little—if at all—existing SDI in the three largest size classes of the model, would increase the proportion of the stands meeting the threshold values. We also note that since thinning treatments would thin down to 150 or 170 ft^2 BA, and that no trees over 18 inches d.b.h. would be cut, the amount of area meeting all restricted area threshold values would also be expected to increase.

Table 25. Comparison of alternatives showing percent of area within each SDI percentage range

Alternative	Year	< 25% Max SDI (Percent Area)	≥ 25 and < 35% Max SDI (Percent Area)	≥ 35 and < 55% Max SDI (Percent Area)	≥ 55% Max SDI (Percent Area)
1	2008	8	6	37	49
1	2018	7	4	30	59
1	2048	5	1	16	78
2	2018	8	12	49	31
2	2048	6	4	40	50
3	2018	9	9	39	43
3	2048	6	3	28	63

Basal Area – Alternatives 2 and 3

Table 26 displays the average stand BA and percent of the forested area in the project area with greater than or equal to 150 ft^2 and 170 ft^2 BA. Treatments would reduce average basal area in 2018 in both action alternatives and the proportion of forested area with BA greater than or equal to 150 ft^2 and 170 ft^2. The modeled thinning would not reduce BA below 150 ft^2 or 170 ft^2 depending upon the treatment so the reduced area below 150 and 170 is due to the modeled prescribed burning following the thinning. In the modeling exercise, the modeled thinning prescriptions reduced BA to the target and the prescribed burning reduced BA to just below the target.

Table 26. Average stand basal area and percent of forested area 150 and 170 BA and greater

Alternative	Year	Average Stand BA for Treated Stands	Percent of Forested Area 150 Ft^2 BA and Greater	Percent of Forested Area 170 Ft^2 BA and Greater
1	2008	193	81	71
1	2018	211	88	81
1	2048	250	92	91
2	2018	155	66	55
2	2048	200	86	82
3	2018	171	77	71
3	2048	215	89	86

Average Tree Diameter

Table 27 displays the modeled QMD for all three alternatives for all treated stands in the years 2008, 2018, and 2048. Due to slightly heavier thinning in many Alternative 2 treatments (150 ft^2 basal area minimum versus Alternative 3 170 ft^2 basal area minimum), average tree diameter in treated stands would be slightly higher in Alternative 2. Because all thinning treatments are largely thinning from below in which large trees are favored for retaining over small trees, the average diameter of both action alternatives is higher than Alternative 1. Non-treated stands for the action alternatives are not included in this table, but the values would essentially be the same as shown for Alternative 1.

Table 27. Alternative QMD comparison

Model Year	Alternative 1 (Inches)	Alternative 2 Pre-thin/Post-thin (Inches)	Alternative 3 Pre-thin/Post-thin (Inches)
2008	9	9/13	9/13
2018	10	15	14
2048	12	18	17

Diameter Growth

Both action alternatives would increase tree growth rates in the treated stands. Table 28 displays the average diameter growth and basal area growth for stands proposed for treatment (to be treated) and not proposed for treatment (not treated) in each alternative. The growth displayed is average d.b.h. growth for the 4-year FVS modeled time period from 2004 to 2008 (2008) and the 10-year FVS modeled time periods from 2008 to 2018 (2018) and from 2018 to 2048 (2048). Basal area growth displayed is the increase in basal area during the 30-year time period from 2018 to 2048.

Due to the treatments, average diameter growth would increase in both action alternatives by about 28 percent over Alternative 1. In terms of basal area growth, both action alternatives would increase growth about 27 percent (Alternative 2) and 25 percent (Alternative 3) in the time period from 2018 to 2048. The two actions alternatives are approximately equal in terms of how they increase growth, but it should be noted that Alternative 2 proposes to treat about 218 acres more than Alternative 3. We must also note that although the basal area growth rate increases do not seem great, in the action alternatives the basal area growth involves fewer and larger trees than in Alternative 1. Both action alternatives would grow large trees faster than the no action alternative.

Table 28. Comparison of alternatives for average d.b.h. and BA growth

	Year	Alternative 1	Alternative 2		Alternative 3	
		Basal Area Growth (Sq Ft)	Average d.b.h. Growth (Inches)	Basal Area Growth (Sq Ft)	Average d.b.h. Growth (Inches)	Basal Area Growth (Sq Ft)
To Be Treated	2008		0.07		0.07	
To Be Treated	2018		0.82		0.82	
To Be Treated	2048	33	0.76	45	0.76	44
Not Treated	2008		0.07		0.18	
Not Treated	2018		0.68		0.67	
Not Treated	2048	39	0.61	42	0.60	41

Bark Beetle Hazard

Bark beetle activity and hazard for a number of bark beetles, including Douglas-fir beetle, is related to poor tree growth and stand density. Much of the area can be considered at a risk to Douglas-fir beetle (table 17) with slightly over one-half of the stand area in the project area rated as high and very high hazard. Prevention measures to reduce bark beetle hazard include reducing stocking to maintain or increase tree growth and vigor. In this analysis, we compare the effects of alternatives on bark beetle hazard by comparing the extent to which the action alternatives would (1) reduce stocking in the highest SDI class, the zone of imminent mortality, and (2) increase d.b.h. growth. Both action alternatives will reduce the proportion of the forested area in the project area relative to no action immediately following treatments in the model year 2018 and in the model year 2048. Alternative 2 would reduce stocking to a greater degree for a larger area than Alternative 3. Thinning effects for Alternative 2 would last farther into the future than Alternative 3. For information regarding bark beetle hazard, please see appendix C.

Potential Fire Mortality

Table 29 displays the average potential fire mortality in terms of basal area per acre for stands proposed for treatment in Alternatives 2 and 3. Potential fire mortality for stands not proposed for treatment is displayed for Alternative 1 in table 22 and does not change in the action alternatives. The mortality prediction is from the FVS-FFE Potential Fire Report for 90th percentile weather conditions (Hall 2008) and represents expected mortality if a wildfire were to burn the stands under those conditions. Both action alternatives would reduce basal area mortality substantially relative to Alternative 1 for all three FVS-FFE model years shown. Note that in model year 2008, the effects of tree thinning alone is shown, and in model year 2018 the effects of the thinning treatments and the prescribed burning treatments are shown. From 2018 to 2048, we see a reduction in all categories probably due to 30 years of modeled growth resulting in greater average tree size and fire tolerance. The two action alternatives are very close in their potential fire mortality with Alternative 2 slightly higher in 2008, perhaps due to greater modeled fuel loads. For information regarding FVS, please see appendix C.

Table 29. Alternatives 2 and 3 FVS-FFE potential BA mortality in 2008, 2018, and 2048 for proposed treatment stands

Year	Alternative 2 Average Potential BA Mortality	Alternative 3 Average Potential BA Mortality
2008	44	42
2018	26	27
2048	23	23

Dwarf Mistletoe

All thinning treatments would favor retaining trees that are not infected with dwarf mistletoe or lightly infected over trees that are heavily infected. The stand dwarf mistletoe ratings would be reduced by all thinning treatments. In addition, fires have been shown to reduce dwarf mistletoe and it is expected that the proposed prescribed burning would also reduce mistletoe levels to some degree, although the effects of just that activity have not been analyzed in this project. In Alternative 2, stands for which thinning up to an 18-inch d.b.h. is proposed, the thinning would reduce the dwarf mistletoe rating by 33 percent. For stands proposed for thinning to 9 inches d.b.h., the thinning would reduce the dwarf mistletoe rating by 38 percent. For stands proposed for thinning to 9 inches d.b.h. in Alternative 3, the thinning would reduce the dwarf mistletoe rating by 59 percent.

Old Growth

Our classification of stands as old growth indicates that most of the forested area could currently be considered old growth (table 30). Assuming no other disturbances from insects and wildfires, over time the proportion would increase. Neither action alternatives would reduce the proportion of the area we classified as old growth. The increase in stands classified as old growth in 2018 and 2048 may be slightly less in the action alternatives because of thinning and underburning effects in stands that are slightly under the old-growth classification criteria in 2008, but the differences in all three alternatives as modeled are so small that we cannot say that the apparent differences are simply due to slight differences in the modeling exercise.

Table 30. Modeled old growth comparison for all alternatives

Alternative	Year	Percent of Project Area
1 (Existing Condition)	2008	83
1	2018	88
1	2048	93
2	2018	86
2	2048	92
3	2018	85
3	2048	91

Cumulative Effects

The direct and indirect effects, identified for Alternatives 2 and 3, generally impact the mixed-conifer and spruce-fir vegetation types of the Pinaleño Mountains over the next 30 years. Therefore, the geographic and temporal extent considered for cumulative effects is the same as that defined for Alternative 1.

As discussed above, past activities or occurrences including the Nuttall Fire, Clark Peak Fire, PEM thinning and the recent insect-related mortality have been taken into account in characterizing the existing condition. This cumulative effects discussion involves changes to the existing condition due to the activities proposed and discussed above for Alternative 2. The activities would reduce stocking and modify species composition to some degree, but the acreage involved is so slight relative to the size of the project analysis area and the Alternative 2 proposed treatments, that the cumulative effects are essentially the same as described above for the direct and indirect effects.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Both action alternatives are consistent with MA 2 direction for uneven-aged management. Proposed treatments would manage for five age classes based upon VSS classes rather than four age classes suggested in the Forest Plan to meet wildlife objectives. Proposed treatments would also maintain open meadows as required. Insects and diseases would be managed using an integrated pest management approach to recognize and prevent favorable insect outbreak conditions and to reduce disease impacts. Thinning slash would be disposed of in a timely manner to prevent the buildup of damaging insects. Chemical hormones (MCH) may be used to reduce bark beetle mortality if needed.

Action alternatives are also consistent with MA-2A direction to limit removal of vegetation to sanitation and salvage operations and maintenance and improvement of wildlife habitat. Insect and disease outbreaks would be controlled using integrated pest management concepts. No activities are proposed for the Goudy RNA (MA-8).

Fire and Fuels

Introduction

This analysis describes the desired and existing condition of the fire and fuels resource within the project area, and evaluates the effects of the proposed action and no action alternatives. Modeling methodology, assumptions, fire history and fire risk maps are contained in appendix D. Other relevant data is located in the project record.

Affected Environment

Regulatory Direction

Management direction for fire and fuels management in the project area can be found in the "National Fire Plan and 10-year Comprehensive Strategy" (USDA and USDI 2006), the "Coronado National Forest Land and Resource Management Plan" (Forest Plan; USDA Forest Service 1986, amended 1995), and the "Mount Graham Red Squirrel Recovery Plan" (USDI Fish and Wildlife Service 1993) as described in chapter 1.

Fire History and Occurrence

Wildfire suppression since the early 1900s has greatly reduced fire frequency, and in many areas, entirely eliminated fire from these forests. On Mount Graham, wildfires (both human-caused and natural) still occur, requiring active suppression due to the present potential for catastrophic fires (Mount Graham Red Squirrel Recovery Plan, USDI Fish and Wildlife Service 1993, page 16).

During the presettlement period, wildfires were commonplace in the Pinaleño Mountains for at least 8,000 years and should, therefore, be considered a "natural" component of this forest community. The mixed-confer fire regime of the past 4 or 5 centuries suggests this community was relatively stable and highly resilient to changes induced by fires. The presettlement Pinaleño mixed-conifer stand densities were probably low and more spatially heterogeneous than today's stands, possibly with an important understory component of grasses. High fuel loadings have contributed to, and forest structure now favors the occurrence of high-intensity, stand-replacing fires in contrast to the low-intensity, stand-maintenance fires that occurred prior to Euro-American settlement. This hazard is further increased by the high flammability of Englemann spruce and corkbark fir trees (Grissino-Mayer et al. 1994).

Recorded lightning and human-caused fires within the Pinaleño Mountains from 1982 to 2006 show that about 338 lightning and 120 human-caused ignitions occurred in the Safford Ranger District primarily between April and August. Recent large fire events occurring in the project area were the Nuttall-Gibson Complex in 2004, which burned 29,400 acres, and the Clark Peak Fire in 1996, which burned 6,716 acres. Approximately 424 acres of the Clark Peak Fire occurred within the project area and about 170 acres of the Nuttall-Gibson Complex occurred within the project area with varying degrees of severity. Field observations show that most of the upper elevations, western and southern slopes that were not burned during these events are still susceptible to high-intensity, severe stand-replacing fire that could threaten important resources.

Existing Condition

Vegetation

Stand examinations indicate that the Pinaleño forest ecosystem is characterized by a large quantity of dead trees and a dense understory of small and medium sized trees (Amell 2008).

Observations show that in the unburned portions of the upper coniferous zones and western slopes (ponderosa pine and mixed-conifer community), there are high densities of small diameter trees, standing dead trees, and down wood throughout the Pinaleño Mountains. Decades of fire exclusion have significantly altered forest stand density and species composition, particularly in dry western forests dominated by ponderosa pine and Douglas-fir that historically supported fire regimes with short, mean fire return intervals and mostly low-severity fires (Cooper 1960, Covington and Moore 1994). These changes in forest structure and surface fuels increase risks for extreme fire behavior and large, stand-replacing wildfires in areas that formerly supported low- and mixed-severity fire regimes (Covington and Moore 1994, Graham et al. 2004).

Much of today's understory trees consist of Engelmann spruce, corkbark fir and white fir, which now comprise a significantly higher percentage of the mixed-conifer forest communities than what likely would been the case in the presettlement forest. From these observations, it is estimated that today's fuel loads and tree densities are much greater than pre-1879 forest conditions, leaving the forest increasingly vulnerable to disease, insect infestation, and widespread crown fire. High fuel loading and dense stands of young trees create a continuous fuel arrangement that can contribute to severe crown fire as evidenced by the Clark Peak Fire of 1996 and the Nuttall-Gibson Fire in 2004.

Fuel Loading

Based on FVS/FFE modeling, the average surface fuel loading, including duff and litter, of the potential treatment areas is approximately 57 tons per acre. Some units range up to 100 plus tons per acre. These tonnages are considered moderately heavy and could contribute to increased fire line intensity, torching, crowning, and spotting. Such conditions would lead to large fire growth and suppression difficulty (Brown et al. 2003).

Fire Regime and Condition Class

A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning (Agee 1993). Coarse-scale definitions for natural (historical) fire regimes have been developed by Hardy et al. (2001) and Schmidt et al. (2002) and interpreted for fire and fuels management by Hann and Bunnell (2001). The five natural (historical) fire regimes are classified based on average number of years between fires (fire frequency) combined with the severity (amount of replacement) of the fire on the dominant overstory vegetation (see text box right).

Fire Regimes

I – 0 to 35-year frequency and low (surface fires most common) to mixed severity (less than 75 percent of the dominant overstory vegetation replaced).

II – 0 to 35-year frequency and high (stand-replacement) severity (greater than 75 percent of the dominant overstory vegetation replaced).

III – 35 to 100+-year frequency and mixed-severity (less than 75 percent of the dominant overstory vegetation replaced).

IV – 35 to 100+-year frequency and high (stand replacement) severity (greater than 75 percent of the dominant overstory vegetation replaced).

V – 200+-year frequency and high (stand-replacement) severity.

Condition Classes

Condition Class 1: Fire regimes are within an historical range and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within their historical range.

Condition Class 2: Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased), resulting in moderate changes to one or more of the following: fire size, intensity, severity, and landscape patterns. Vegetation attributes have been moderately altered from their historic range.

Condition Class 3: Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. This leads to dramatic changes to one or more of the following: fire size, intensity, severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range.

Three fire condition classes categorize and describe vegetation composition and structure conditions that currently exist inside the fire regime groups (see text box left). Based on the coarse-scale national data (Schmidt et al. 2002), they serve as generalized wildfire risk rankings. Condition classes are a way of categorizing how much key ecosystem components such as species composition, structural stage, and stocking level have changed in an area due to changing fire regimes.

A condition class layer was obtained through LANDFIRE. This course-level assessment shows that the project analysis area is dominated by Condition Class 3. A discussion on LANDFIRE can be viewed in appendix D. Swetnam et al. (2003) conducted a study on tree-ring perspectives on fire regimes and forest dynamics in mixed-conifer and spruce-fir forests on Mount Graham. The following is quoted from their study:

> "A generalized picture of fire regime variations along elevational gradients on Mount Graham was one of infrequent surface and crown fires in the lower elevations (i.e., about 7,000 to 8,500 feet), frequent surface fires (5 to 35 year intervals) at middle to high elevations (i.e., about 8,500 to 9,500 feet), and very infrequent crown fires at the highest elevations (i.e., 150 to 300+ year intervals). It is important to note that these were very general characterizations of fire frequencies and severities, and there was considerable spatial and temporal variability. For example, although fires were frequent in the mixed-conifer zone and generally of low severity, it was also likely that high severity fire occurred in some variable sized patches within this type. Also, very infrequent, large and high severity crown fires were the norm within the spruce-fir zone, but it was possible that occasional surface or ground fires crept into portions of the spruce-fir forest from adjacent mixed-conifer, and small-patch size (individual trees or groups of trees) high severity events also probably occurred in this zone.
>
> One of the more interesting implications of the high frequency surface fire regime of the mixed-conifer forests on Mount Graham was the possibility that this fire regime promoted some degree of long-term stability to the higher elevation spruce-fir forests. Frequent surface fires in the mixed conifer would have maintained relatively open stands with low woody fuel accumulations, grassy understories, and elevated tree canopy layers. Fires igniting in the mixed-conifer, or at lower elevations, would have spread through the mixed-conifer zone at relatively low intensities/severities, so that when fires reached the high elevation spruce-fir zone they were unlikely to spread into the canopy and develop into crown fires. A typical observation of surface fire spread from mixed conifer to spruce-fir (under low to moderate wind conditions) is that fire spread slows down dramatically in the relatively tightly packed needles of the closed-

> canopy, spruce-fir. In the shady, cool and moist conditions of spruce-fir, there is generally little herbaceous cover, and surface fires typically become smoldering ground fires that do not spread great distances.
>
> In contrast, a century of greatly reduced fire frequencies since 1893 has undoubtedly led to increased woody fuel accumulations and forest densities in the mid-elevation mixed-conifer forests. As a result, fires igniting in this zone, or down slope of this zone, have a high probability of becoming crown fires before they reach the spruce-fir zone. This kind of transmission of crown fire from the low and mid elevations to the high elevations, in fact, was the circumstance for the 6,000+ acre Clark Peak Fire of 1996. This late April fire would have been a much larger event if it had not occurred so early in the season, when fuel moistures were still relatively high in the spruce-fir zone.
>
> Ultimately, the preservation of extensive spruce-fir ecosystems (including red squirrels) on Mount Graham will depend upon restoring forest structures and surface fire regimes in the mid-elevation mixed conifer forests. If these structures and fire regimes are not restored at a minimal level, we think that extensive crown fires will continue to occur on Mount Graham until most of the spruce-fir forest is reduced to isolated small patches, and much younger successional stands with widespread aspen. The mixed-conifer forests are also likely to be increasingly converted to aspen and shrub fields. ”

Based on general discussion from Swetnam et al. (2003) and condition class layers developed through LANDFIRE data, it is assumed that most of the vegetation attributes within the project analysis area have been significantly altered from their historical range and currently are in Condition Class 3.

Potential Fire Behavior

Fire line intensity is widely used as a means to relate visible fire characteristics and interpret general suppression strategies. There are several ways of expressing fire line intensity. A visual indicator of fire line intensity is flame length (Rothermel 1983, DeBano et al. 1998). Table 31 compares fire line intensity, flame length, and fire suppression difficulty interpretations.

Fire modeling was conducted to evaluate the existing potential of fire line intensity, crown fire, and relative hazard rating for the proposed project area under high fire danger (90th percentile) weather conditions. Results of these modeled outcomes are summarized in tables 32 and 33 and visually displayed in appendix D.

Based on this assessment, approximately 90 percent of the proposed treatment area could generate flame lengths over 4 feet. Most notable is that about 79 percent of the project area could generate high intensity fire (greater than 11-foot flame lengths). About 85 percent of the area is susceptible to passive or active crown. This is in line with generalizations made by Swetnam and others (2003) concerning crown fire risk of the project area. This means indirect suppression strategies would need to be employed for most of the area as described in table 31. Conditions like these can lead to high acreage burned and significant adverse effects on resources (Scott and Reinhardt 2001).

Table 31. Fire line intensity interpretations

Fire Line Intensity	Flame Length	BTU/ft/sec	Interpretations
Low	< 4 feet	Less than 100	Direct attack at head and flanks with hand crews, hand lines should stop spread of fire.
Low to Moderate	4-8 feet	100-500	Employment of engines, dozers, and aircraft needed for direct attack, too intense for persons with hand tools.
Moderate	8-11 feet	500-1,000	Control problems, torching, crowning, spotting; control efforts at the head are likely ineffective. This would require indirect attack methods.
High	> 11 feet	Greater than 1,000	Control problems, torching, crowning, spotting; control efforts at the head are ineffective. This would require indirect attack methods.

Table based on Rothermel (1983)

Table 32. Existing condition fire line intensity

Flame Length	Fire Line Intensity Hazard Rating	Acres	Precent
<4 feet	Low	600	10%
4.1-8 feet	Low to Moderate	343	6%
8.1-11 feet	Moderate	280	5%
> 11 feet	High	4,528	79%
Total		5,751	100%

Table 33. Existing condition potential fire type

Fire Type	Acres	Percent
Surface Fire	875	15%
Passive Crown Fire	4,141	72%
Active Crown Fire	735	13%
Total	5,751	100%

Loss of habitat and mortality of larger mature trees is likely if high-intensity crown fire is established. Given the current condition, fuel treatment is needed to meet the purpose and need and to protect critical habitat.

Environmental Consequences

Measurement Indicators Used for Analysis - Fire managers are concerned about the potential wildland fire hazard because of high fuel loads, and dense ladder and crown fuel conditions in the project area. Measurement indicators used to help address the purpose and need relevant to fire behavior and firefighter safety include:

- **Effects on fuel loading**: A range of 5 to 20 tons per acre provides acceptable risks of fire hazard and fire severity while providing desirable quantities for soil productivity, soil protection, and wildlife needs (Brown et al. 2003).
- **Effects on potential fire behavior**: (1) Fire line intensity expressed as flame length in feet associated with fire hazard. Flame lengths generally less than 4 feet are

desired allowing for safe direct attack by hand crews. Flame lengths greater than 4 feet generally require equipment to be employed such as dozers and aircraft; beyond 8 feet torching, crowning and spotting can occur; (2) Fire type expressed as surface, passive torching or crown fire. Low severity surface fire is desired.

- **Effects on Condition Class**: These are generalized risk rankings ranging from Fire Condition Classes 1 through 3. This will only be a qualitative assessment discussion on how condition class may be trending (see figure 28).

Alternative 1 - No Action

Direct and Indirect Effects

Effects on Fuel Loading

Under this alternative, no treatments are planned; therefore, surface, ladder and crown fuels would persist as discussed under the existing condition and accumulate further over time. With no modification of fuel loading and forest structure, fire behavior under normal, summer conditions would persist as described under the existing condition, threatening resources within the project area.

Table 34 shows the average fuel loading of the proposed treatment areas by diameter size class (not including duff and litter) projected within the project area. Under Alternative 1, the average fuel loading is currently about 34 tons per acre and is expected to increase another 6 tons per acre in 10 years (2018) and 12 tons per acre in 30 years (2048). This exceeds the desired condition.

Table 34. Fuel loading of alternatives by diameter size class

Treatment Areas	0-3″ Diameter Tons per Acre			3-6″ Diameter Tons per Acre			6-12″ Diameter Tons per Acre			12+″ Diameter Tons per Acre			Total Tons per Acre		
	Alternative			Alternative			Alternative			Alternative			Alternative		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Year 2008 (Existing)	7	10	10	5	6	6	12	9	8	10	5	4	34	30	28
Year 2018 (10 years)	10	5	5	5	2	2	14	5	5	11	4	4	40	16	16
Year 2048 (30 years)	11	6	6	7	3	3	15	6	7	13	7	7	46	22	23

Effect on Potential Fire Behavior

Fire behavior was modeled based on fuel loading, stand composition, and structure to evaluate potential fire line intensity, crown fire and relative hazard rating for the project analysis area. The FlamMap model was used to evaluate fire behavior over the entire project analysis area under 90th percentile high fire danger conditions. Results of these modeled outcomes are shown in tables 35 and 36, and visually displayed in appendix D.

Under Alternative 1, only 10 percent of the area would exhibit flame lengths less than 4 feet. Most notable is that about 79 percent of the project area could generate high-intensity fire (greater than 11-foot flame lengths). About 72 percent of the area is susceptible to passive crown fire and 13 percent of the area subject to active crown fire. For most of the area, direct suppression tactics would not be as effective, fire line production capability would be reduced, and indirect suppression strategies would need to be employed as described in table 31. Fires that escape initial attack, usually those burning under severe conditions could produce large severe stand-replacing crown fires as occurred in 1996 and 2004 with the Clark Peak and Nuttall Fires. The potential for crown fire in the project analysis area is substantiated by Swetnam et al. (2003). This would result in greater risk to firefighter safety.

Table 35. Potential flame length (fire line intensity) of the alternatives

Flame Length	Fire Line Intensity Hazard Rating	Alternative 1		Alternative 2		Alternative 3	
		Acres	Percent	Acres	Percent	Acres	Percent
< 4 feet	Low	600	10%	2,491	43%	2,181	38%
4.1-8 feet	Low to Moderate	343	6%	1,074	19%	477	8%
8.1-11 feet	Moderate	280	5%	271	5%	59	1%
> 11 feet	High	4,528	79%	1,915	33%	3,034	53%
Total		5,751	100%	5,751	100%	5,751	100%

Table 36. Potential fire type of the alternatives

Fire Type	Alternative 1		Alternative 2		Alternative 3	
	Acres	Percent	Acres	Percent	Acres	Percent
Surface Fire	875	15%	2,499	43%	2,021	35%
Passive Crown Fire	4,141	72%	3,018	53%	3,488	61%
Active Crown Fire	735	13%	234	4%	242	4%
Total	5,751	100%	5,751	100%	5,751	100%

In the absence of any kind of human-caused or natural disturbance, indirect effects would occur from the natural progression of forest growth and change. The project analysis area could expect an increase in surface fuel loading that increases flame length, an increase in ladder fuels that affects torching of trees, and an increase in crown density that makes crown fire probable.

Effect on Condition Class

As discussed under the existing condition, it is believed that vegetation attributes have been significantly altered from their historical range and that most of the area will likely continue trending toward Condition Class 3 under this alternative.

Cumulative Effects

The cumulative effects area was determined to be all of Mount Graham extending out to the forest boundary. This is because of the island nature of the area and because collective activities within this area can modify fire behavior. Fires and fuel reduction activities were considered from the past 50 years and are projected over the next 50 years. Fire regimes, condition class (figure 28), fire history, and ignitions were considered throughout the Pinaleño Mountains. Full discussion and other maps of these conditions are found in appendix D and the fire and fuels specialist report (Hall 2008).

There is evidence of old timber stand thinning activity that selectively removed portions of the large tree overstory; however, the effects pertaining to fuel loading and fire behavior have long since diminished. Past, present, and reasonably foreseeable activities recognized as having potential cumulative effects that could further modify fuels and fire behavior within the analysis area are listed at the beginning of chapter 3.

Cumulative Effects on Fuel Loading, Fire Behavior, and Condition Class

Alternative 1 would not contribute to the reduction of fuel loading or potential fire behavior within the cumulative effects area. The collective past, present and foreseeable activities considered reduce surface, ladder and crown fuels that contribute to reduction in fire line intensity and crown fire hazard. Activities that have had more influential effects are the Nuttall and Clark Peak Fires and the PEM project. In stands where mortality occurred from the Nuttall and Clark Peak Fires and the spruce beetle and the western balsam bark beetle, dead trees are beginning to fall, contributing to the fuel loading. This is compounded by developing new growth in these areas consisting of shrubs and other vegetation. Because of growth and decay, the potential for increased fire line intensity is redeveloping in these fire areas.

Collectively the past, present and foreseeable activities are likely to have some bearing on trending condition class downward to Condition Class 1 (especially the Nuttall and Clark Peak Fires because of their shear size). However, vegetation attributes (species composition and structure) are not considered fully intact or functioning within their historical range because of the severe impacts these fire events had on the landscape.

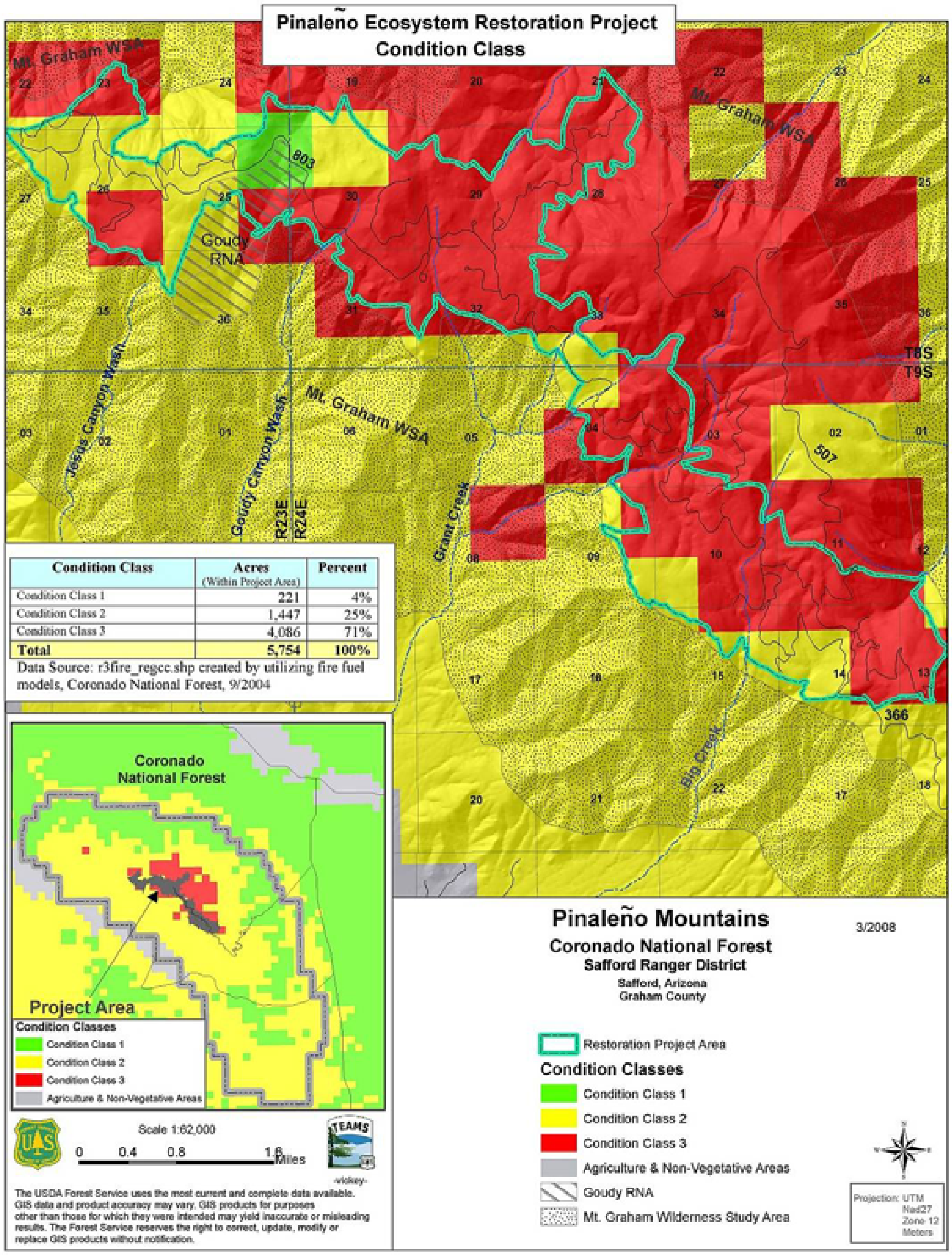
Summary – Alternative 1

Under this alternative, the surface fuel loading is expected to increase (in about 10 to 30 years), resulting in increased flame length (fire line intensity). Ladder fuels that consist of dense small diameter trees and low hanging limbs would not be reduced, therefore, making passive crown fire more probable. Tree density (canopy fuels) would not be reduced making crown fire more likely. No progress would be made toward the restoration of ecological processes that include the reintroduction of low-intensity prescribed fire. Stands would remain at risk to severe stand-replacing crown fire threatening the red squirrel and other important wildlife habitat and forest ecosystems. The ability of firefighters to safely and effectively suppress wildland fire would become more difficult as fire behavior characteristics intensify. The selection of this alternative would not contribute to the purpose and need, the desired condition, Forest Plan direction, or respond to the National Fire Plan goals of reducing hazardous fuels to modify current fire behavior.

Alternatives 2 and 3

Direct and Indirect Effects

Under Alternatives 2 and 3, surface, ladder, and crown fuels would be treated to reduce fuel loading and associated fire behavior of the proposed treatment areas. Although treatments are not being proposed on every acre, the continuity of fuels across the project area would be broken up within the project analysis area.



Condition Class	Acres (Within Project Area)	Percent
Condition Class 1	221	4%
Condition Class 2	1,447	25%
Condition Class 3	4,086	71%
Total	**5,754**	**100%**

Data Source: r3fire_regcc.shp created by utilizing fire fuel models, Coronado National Forest, 9/2004

Figure 28. Existing condition classes in the Pinaleño Mountains and the proposed project area

Effect on Fuel Loading

Fuel loading was modeled for the proposed treatment units and is summarized in table 34. Treatments are expected to be completed by 2018. Under Alternatives 2 and 3, an average reduction of about 24 tons per acre (60 percent) as compared to Alternative 1 is expected (by 2018). This reduction in fuel loading is within the desired range. An average increase of about 6 tons per acre may occur again in about 30 years if no maintenance takes place, however, that amount is still considered acceptable.

Effect on Potential Fire Behavior

Modeled potential fire behavior data across the project area for Alternative 2 are summarized in tables 35 and 36 and can be viewed in appendix D. Under Alternative 2, about 43 percent of the area would exhibit flame lengths less than 4 feet. Under Alternative 3, about 38 percent of the area would exhibit flame lengths less than 4 feet. With either alternative, this is an improvement (33 percent for Alternative 2 and 28 percent for Alternative 3) in moving the area toward a surface fire condition as compared with Alternative 1. The more notable change is a 46 percent reduction in high surface fire flame lengths (greater than 11 feet) with Alternative 2 as compared to Alternative 1. Alternative 3 would result in a 26 percent reduction in high surface fire flame lengths (see table 35).

Modeling suggests there would be a 9 percent reduction in crown fire potential with either alternative. Alternative 2 is predicted to create about a 19 percent reduction in passive fire potential as compared with Alternative 1; whereas Alternative 3 is predicted to result in a 11 percent reduction. About 53 percent of the area could still exhibit passive crown fire and 4 percent could generate active crown fire. Under this alternative, greater firefighter safety and fire line construction capability can be expected. This is because fire behavior is reduced in the treated areas, resulting in smaller and less severe fires, thereby reducing the risk to important ecological resources and wildlife habitat.

Because this project would occur in stages over about a 10-year period, activity slash fuels may remain for a while. Potential fire risk could increase temporarily until all treatments have been completed. Fulé and others (2001) concluded that restoration treatment is not complete when the thinning is finished and that slash fuels increase the fire hazard as long as they remain on the ground, so prompt treatment with prescribed fire or mechanical means is important.

Effect on Condition Class

Historic fire regimes were an important consideration in fuel treatment placement and method for both action alternatives. Proposed treatments in Alternatives 2 and 3 would help restore fuel conditions that facilitate low-intensity prescribed fire. Treatments would help restore the area to its historic regime at intervals discussed in Swetnam and others (2003) and trend the area toward Condition Class 1. Omi and Martinson (2003) suggest that fuel treatments are most effective when they complement ecosystem restoration objectives, such as the removal of small trees from ecosystems that historically experienced frequent fire.

Cumulative Effects

Effect on Fuel Loading, Fire Behavior, and Condition Class

The effects of past, present and foreseeable activities are the same as described under Alternative 1. The effects of Alternative 2 or 3 combined with past, present and foreseeable activities are expected to further reduce surface, ladder and crown fuels within the cumulative effects area. This would alter fire line intensity, crown fire and severity of wildfires and contribute to the success of fire personnel to effectively suppress wildfires. Alternative 2 would result in slightly better beneficial effects than Alternative 3.

The cumulative effects on condition class are the same as described in Alternative 1. The selection of Alternative 2 or 3 combined with other past, present and foreseeable activities stated above would make the area more suited for future low-intensity prescribed fire applications, therefore, progress would be made toward initiating the restoration of ecological processes that contribute toward Condition Class 1. The importance of fire as a regulator of tree establishment highlights the need to use prescribed fires at appropriate intervals as part of the forest restoration and fuel reduction processes.

Summary – Alternatives 2 and 3

With either alternative, surface fuel loading would be reduced resulting in decreased flame length (fire line intensity) in the treated stands. Alternative 2 is predicted to result in a greater reduction in flame lengths greater than 11 feet than Alternative 3 (46 percent vs. 26 percent). Both alternatives would result in a reduction in passive and active crown fire as compared with Alternative 1. Progress would be made toward the restoration of ecological processes that include the reintroduction of low-intensity prescribed fire. There would be a reduced risk of severe stand-replacing crown fire that threatens the red squirrel and other important wildlife habitat and forest ecosystems. The ability of firefighters to safely and effectively suppress wildland fire would be improved. The selection of this alternative would contribute to the purpose and need, the desired condition, Forest Plan direction, and respond to the National Fire Plan goals of reducing hazardous fuels to modify fire behavior.

Both alternatives involve prescribed burning, which always carries some degree of risk of a fire escape resulting from unforeseen factors such as adverse changes in weather. However, all prescribed burning requires that a burn plan be developed to minimize the risk of fire escape. There could be temporary road, campground and hiking trail closures as a result of implementation of proposed activities.

Comparisons of fuel loading and potential fire behavior are summarized in figures 29, 30 and 31. An exact comparison of acres cannot be made because there are some differences in units being proposed under the action alternatives. Based on these comparisons and the discussions above, Alternative 2 would produce slightly more desirable conditions than Alternative 3.

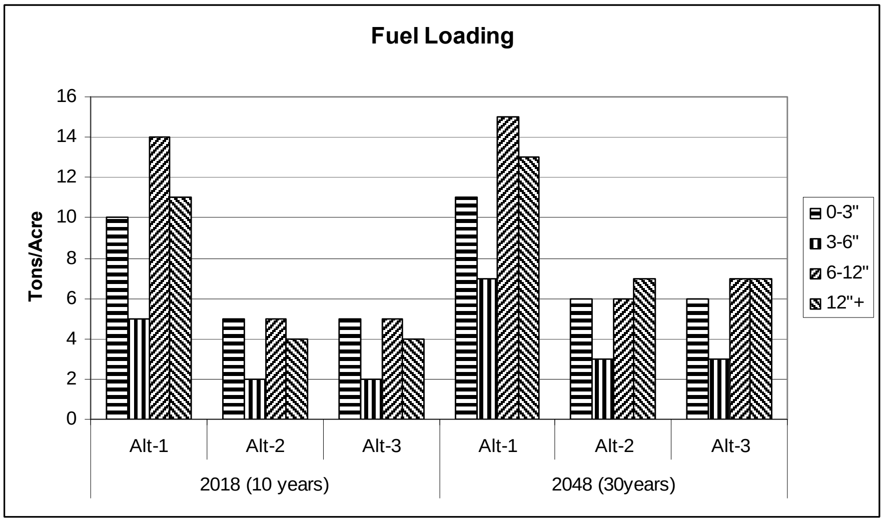


Figure 29. Fuel loading comparison of the alternatives

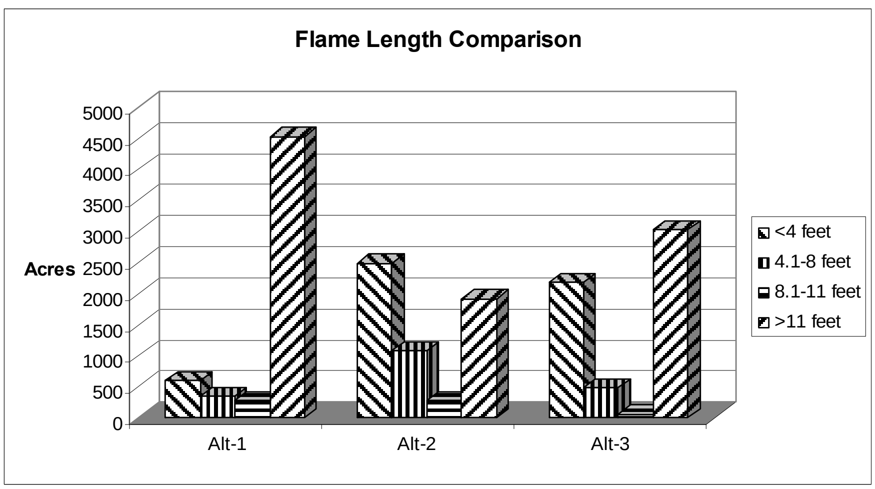


Figure 30. Flame length comparison of the alternatives

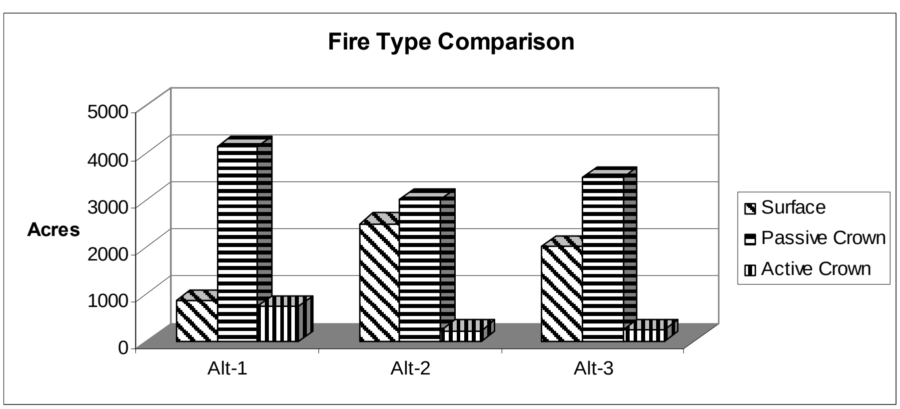


Figure 31. Fire type comparison by alternative

Wildlife

Introduction

This analysis describes the desired and existing condition of wildlife populations and habitat resources within the project area, and evaluates the effects of the proposed action and no action alternatives. While impacts to all wildlife resources are evaluated, the analysis focuses on the following species having “special status”:

1. **Federally Listed Species:** Those that are listed under the authority of the Endangered Species Act by the U.S. Fish and Wildlife Service (USFWS) as threatened and endangered (TES), those proposed for listing as such, and areas that are designated by the USFWS as critical habitat in the proposed area of effect. FSM 2670.31 directs each forest to evaluate its programs and site-specific actions to determine their potential effect on federally listed species.
2. **Regional Forester Sensitive Species (RFSS):** Those that are listed by the Regional Forester as “sensitive” in Region 3 (USDA Forest Service 1999) because there is concern for population viability across their range, and all occurrences contribute significantly to conservation of the species. FSM 2670.32 directs that a biological evaluation be prepared to determine potential effects on species designated as “sensitive” by the Regional Forester. United States Department of Agriculture Regulation 9500-4 directs the Forest Service to avoid actions that may cause a sensitive species to become threatened or endangered (FSM 2670.12).
3. **Management Indicator Species (MIS):** Conceptually, MIS comprise a select few species that are representative of many other species. As such, they provide a basis for overall forest management based, in part, on the effects on these species and their habitats. National Forest Management Act (NFMA) implementing regulations and Forest Service Manual (FSM) 2600 guidelines require that forest plans identify certain vertebrate and/or invertebrate species as MIS, and that these species be monitored “in order to assess the effects of management activities on their populations and the populations of other species with similar habitat needs which they may represent (FSM 2620.5).”

Particular emphasis in this analysis is placed on the threatened and endangered species, such as the Mount Graham red squirrel, Mexican spotted owl, bald eagle, and Apache trout. Discussion of the impacts on RFSS and MIS are included here, but can be found in greater detail in the Pinaleño Ecosystem Restoration Project wildlife report (Casey 2008). A review of compliance with the Migratory Bird Treaty Act is found in appendix E. Additional relevant data is located in the project record.

Overview of Issues

Two key issues raised during the public comment period are analyzed in this section. First, there was concern that implementation of the proposed action may negatively affect the Mount Graham red squirrel, the Mexican spotted owl, and northern goshawk (Issue 3). In addition, there was a concern that proposed actions were not consistent with the Spotted Owl Recovery Plan (Issue 2). To address these issues, the analysis will discuss the indicators as detailed in chapter 1.

Affected Environment

Federally Listed Threatened and Endangered Species

The project will involve treatment of approximately 3,405 acres of mixed conifer in the upper elevations of the Pinaleño Mountains. The mixed conifer areas mainly consist of Douglas-fir (*Pseudotsuga menziesii*), southwestern white pine, ponderosa pine, corkbark fir, white fir, quaking aspen, and Engelmann spruce. Table 37 summarizes the occurrence and designation of federally listed threatened and endangered species in the vicinity of the project area. Impacts to the jaguar and Mexican gray wolf are not included in this analysis because they are not known to occur within the analysis area.

Table 37. Federally listed threatened and endangered species and their critical habitat within the project area

Species (ESA Designation)	Presence or Absence
Mount Graham red squirrel (Endangered)	Occurs within the analysis area; suitable habitat available.
Mexican spotted owl (Threatened)	Occurs within the analysis area; suitable habitat available.
Bald eagle (Threatened)	Occurs within the analysis area; suitable habitat available.
Apache trout (Threatened)	Occurs within the analysis area; suitable habitat available.
Gila trout (Threatened)	May occur within the analysis area during implementation of this project; suitable habitat available.
Jaguar (Endangered)	Does not occur within the analysis area.
Mexican gray wolf (Endangered)	Does not occur within the analysis area.

*Mount Graham Red Squirrel (*Tamiasciurus hudsonicus grahamensis*)*

The endangered Mount Graham red squirrel is one of 25 subspecies of red squirrels in North America. Its habitat is conifer forest, especially old-growth spruce-fir, Douglas-fir and mixed conifer, and its only population is found in the upper elevations of the Pinaleño Mountains. The Mount Graham subspecies has been isolated from other subspecies of red squirrels since the end of the Pleistocene glacial periods approximately 10,000 years before present. Recent studies have shown that the Mount Graham red squirrel differs genetically from other red squirrel subspecies found in the nearby White Mountains and elsewhere in North America (Sullivan and Yates 1994).

The Mount Graham red squirrel was thought to have been extinct in the 1950s, but small numbers of squirrels were “rediscovered” in the 1970s. The squirrel was added to the Federal endangered species list in 1987 by the U.S. Fish and Wildlife Service (USFWS), after the estimated population in 1986 was observed to be less than 400. Loss of Mount Graham red squirrel habitat because of past logging, drought, insect infestations, and catastrophic fires has exacerbated the decline in population.

Issues that affect both habitat and population of the Mount Graham red squirrel include predation; tree infestation by native and exotic insects (Koprowski et al. 2005); direct mortality; the loss of habitat and middens as a consequence of catastrophic wildland fire (Koprowski et al. 2006); human disturbance; road and trail traffic; use of recreation sites (USDI Fish and Wildlife Service 1993); loss or reduction of food sources because of drought; and potential competition with an introduced squirrel (Abert's squirrel, *Sciurus aberti*) for food and territory (Edelman et al. 2005).

The Arizona Game and Fish Department (AZGFD) and Forest Service have conducted biannual population estimates of Mount Graham red squirrel since 1986. Most recently, the spring 2004 Mount Graham red squirrel census estimated a range of 284 (±13) Mount Graham red squirrel occupying the Pinaleño Mountains before the Nuttall Complex wildland fire. The fall 2004 census, conducted approximately 2 months after the Nuttall Fire, reported a population estimate of 264 (±12), showing a small decline, probably direct mortalities from the fire. A more notable decline was shown in the results of the spring 2005 census, which indicated a population size of 214 (±12). This decline is believed to have resulted from latent indirect effects of the Nuttall Fire, such as loss of cover, loss of food caches when middens were burned, and mortality of orphaned young (Personal communication, J. Koprowski, University of Arizona, with Mount Graham Red Squirrel Recovery Team, May 8, 2006). A rebound was shown by the fall 2005 census, which estimated 276 squirrels (±12). However, the spring 2006 census estimated a population of 199 squirrels (±15), almost a 10 percent decline from the previous spring count. The fall 2006 estimate rebounded to a population of 276 squirrels (±12). In spring of 2007, the population was estimated to be 216 (±12) squirrels, and was followed by another increase in the fall of 2007, when the population was estimated to be 299 (±11) squirrels. The chronology of Mount Graham red squirrel estimates of population is depicted in figure 32.

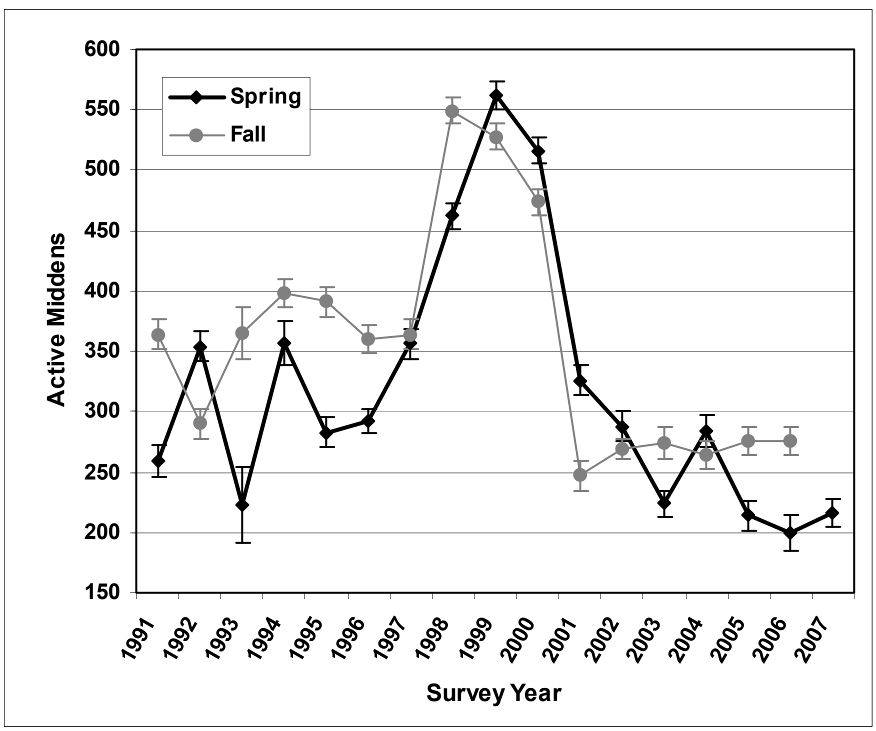


Figure 32. Population estimates for the Mount Graham red squirrel since the inception of a biannual interagency survey in 1986 (AGFD, unpublished data)

Mount Graham red squirrels create middens, areas that consist of piles of cone scales in which squirrels cache additional cones as an over-wintering food source. Placement of middens tends to be in areas with high-canopy closure near food sources (e.g., Douglas-fir, corkbark fir, and Engelmann spruce trees). Such placement allows specific moisture levels to be maintained within the midden, thereby creating prime storage conditions for cones and other food items, such as mushrooms, acorns, and bones. The squirrel also prefers to establish middens in areas that have large snags or downed logs that provide cover and travel routes (USDI Fish and Wildlife Service 1993).

All known squirrel midden locations, both historical and present, were considered in this impacts analysis to ensure that the effects reported are conservative (i.e., in favor of protection of the species). An Arizona Game and Fish Department database of all midden locations found since 1996 served as the basis for the effects analysis, and all active middens (currently in use by Mount Graham red squirrel), inactive middens (not currently in use by Mount Graham red squirrel), and disappeared middens (middens that have been deemed inactive for three consecutive surveys and show no characteristics of recent use – i.e., no presence of cone scales or other food items of Mount Graham red squirrel) were used for analysis.

The Mount Graham red squirrel inhabits a narrow selection of habitats, which include high elevation areas with corkbark fir and Engelmann spruce trees, and the transition zone comprised of Douglas-fir, corkbark fir, Engelmann spruce, southwestern white pine, and ponderosa pine. Current information on red squirrel habitat on Mount Graham reports that approximately 11,700 acres of coniferous forest are occupied (USDI Fish and Wildlife Service 1993 and 1999). Recent studies by the Arizona Game and Fish Department indicate that approximately 16,680 acres of “potentially suitable” habitat exists above 7,750 feet elevation (Hatten 2000). Of occupied habitat, approximately 2,700 acres are considered excellent or good quality (USDI Fish and Wildlife Service 1999). Hatten (2000) estimated as much as 27,181 acres might be suitable as red squirrel habitat, but only a portion of this is occupied.

Approximately 1,900 acres of critical habitat were designated for the Mount Graham red squirrel in 1990 (U.S. Fish and Wildlife Service 1990; figure 33).

The areas determined to be critical habitat were based upon the fact that, at the time of listing of the species, these areas “contain[ed] major concentrations of the Mount Graham red squirrel, and the habitat necessary to its survival, including cover, food sources, nest sites, and midden sites (USDI Fish and Wildlife Service 1990).” As such, the areas represent the highest elevations (i.e., those above 10,000 feet) in the Pinaleño Mountains, as well as slightly lower elevations on north-facing slopes, which provide the cooler, moister surroundings necessary for successful midden sites. All of the spruce-fir vegetation association is included within the boundaries of critical habitat, along with a small portion of the mixed conifer.

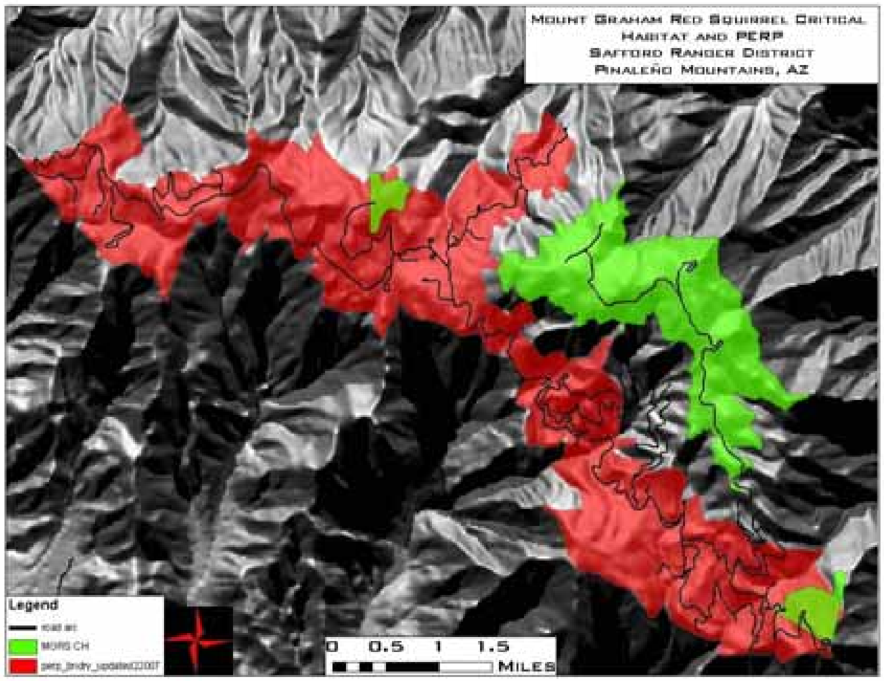


Figure 33. Mount Graham red squirrel critical habitat, as designated in 1990, in relation to the Pinaleño Ecosystem Restoration Project area (USFWS 1990)

*Mexican Spotted Owl (*Strix occidentalis lucida*)*

The Mexican spotted owl occurs throughout Arizona and New Mexico, parts of Colorado and Utah, and south into Mexico. It is one of three subspecies of spotted owls; the other two are the northern (*S. o. caurina*) and the California spotted owl (*S. o. occidentalis*). The Mexican subspecies is geographically isolated from the other two.

Mexican spotted owls roost during day and hunt at dusk and at night. They breed primarily in dense old-growth, mixed-conifer forests, ponderosa pine-Gambel oak forests, and riparian forests located on steep slopes, especially in deep, shady ravines (Fletcher and Hollis 1994). Breeding sites have high canopy closure, high basal area, many snags, and many downed logs. Owls usually nest in cavities about 80 feet up coniferous trees; however, they also use scrapes on cliff sites or abandoned platform nests. Pairs may not breed yearly. Males feed females and young until young are 2-weeks old. Young fledge in 5 to 7 weeks (AZGFD 2005).

Breeding season begins in late February or March, with juveniles fledging between mid-May and mid-June (USDI Fish and Wildlife Service 1995). Formal nighttime callback surveys are performed four times per year between May 1 and July 31 in each of 13 protected activity centers (PACs; i.e., 600-acre areas in which owl nesting and foraging activities are focused) in the Pinaleños. If owl presence is confirmed within a PAC, daytime surveys are performed to locate owl roosting and nesting sites. Owl

Protected Activity Centers (PACs) - 600-acre areas in which owl nesting and foraging activities are focused.

Core Areas - 100 acres of the highest quality owl habitat surrounding the nest site.

nest sites are protected within "core areas," which are composed of 100 acres of the highest quality owl habitat surrounding the nest site.

Multistoried forest with many potential patches is desirable habitat for Mexican spotted owl foraging. Woodrats are the most frequently taken prey and provide most biomass. Birds, lagomorphs (rabbits), and insects are also frequently taken. In Arizona, range size for single owls averages 1,600 acres and combined home ranges occupied by pairs, 2,000 acres (AZGFD 2005).

Critical habitat for Mexican spotted owls was designated in August 2004 by the U.S. Fish and Wildlife Service (see figure 34). The primary constituents of critical habitat for this subspecies include sections of spruce-fir forest, mature mixed-conifer forest, pine-oak associations, riparian forests, and canyon habitats. All of these habitats, to varying extents, include uneven-aged stands, snags and downed logs, canopy closure at or above 40 percent, and trees greater than or equal to 12 inches diameter at breast height (d.b.h.), which are the favored characteristics of owl nesting habitat. Owl recovery also depends upon managers maintaining a diverse mosaic of habitats, including meadows and other open areas, for the owls to have foraging grounds and a diverse prey base as well (USDI Fish and Wildlife Service 2004).

This project will directly affect 3,405 acres of land in the Pinaleño Mountains. Of these, approximately 951 acres fall outside of PACs (leaving 2,454 acres that will fall within PACs and be treated). These remaining acres comprise approximately 2.2 percent of the available critical habitat (110,216 acres – USDI Fish and Wildlife Service 2004, converted to ArcGIS, with acreage calculated) within this particular mountain range (figure 35).

For the areas of the project that fall within protected activity centers, core areas have also been designated based on recent protocol survey results (see figure 35). Seven owl cores fall completely within or partially within the project area. No work would be conducted within owl cores during the breeding season. Live tree thinning within core areas would be limited to trees 9 inches in diameter and smaller, in order to provide some reduction of fuel loading, without removing roosting and nesting trees.

The "Coronado National Forest Land and Resource Management Plan" (Amendment No. 8, 1996) incorporates standards and guidelines written specifically to protect the needs of Mexican spotted owls. These guidelines do several things:

1. Assign the forest a responsibility to designate PACs and define the means by which that must be done;
2. Define the levels of protection that are warranted in various areas of habitat:
    a. Protected Areas – these are areas within designated PACs, areas of mixed-conifer and pine-oak forests with slopes greater than 40 percent, and reserved lands including the Mount Graham Wilderness Study Area, Goudy Research Natural Area, and all wild and scenic rivers;
    b. Restricted Areas – these are areas of mixed-conifer, pine-oak, and riparian forests outside of protected areas;
3. And provide suggested restrictions for projects and their design features for each area.

Within protected areas, suggested restrictions include retaining key forest species, large logs and snags, and harvesting only conifers less than 9 inches in diameter. Only 10 percent of PACs with known nest sites should be treated to reduce fire risks, followed by additional 10 percent increments, should treatments prove effective. Core areas of 100 acres would be designated around nest sites (or encompass the highest quality nest/roost habitat); no treatments would occur within the cores. Light prescribed burning is encouraged, but would avoid core areas. Pre- and post-treatment monitoring would be conducted in association with all treatments.

Within restricted areas, guidance includes managing for a distribution of owl nest/roost habitat characteristics across the landscape to allow for a diversity of stand conditions and prey species. Minimum threshold values for these characteristics (10 percent at 170 BA, and an additional 15 percent at 150 BA) are recommended for the Basin-Range West recovery unit. Again, retaining key forest species, large logs, and snags is encouraged. Other direction includes managing for natural variation in disturbance patterns and stand conditions, maintaining all species of native trees, allowing natural canopy gap processes to occur, and emphasizing uneven-aged management of forests. Prescribed burning is also encouraged in these areas, to reduce fuel accumulation.

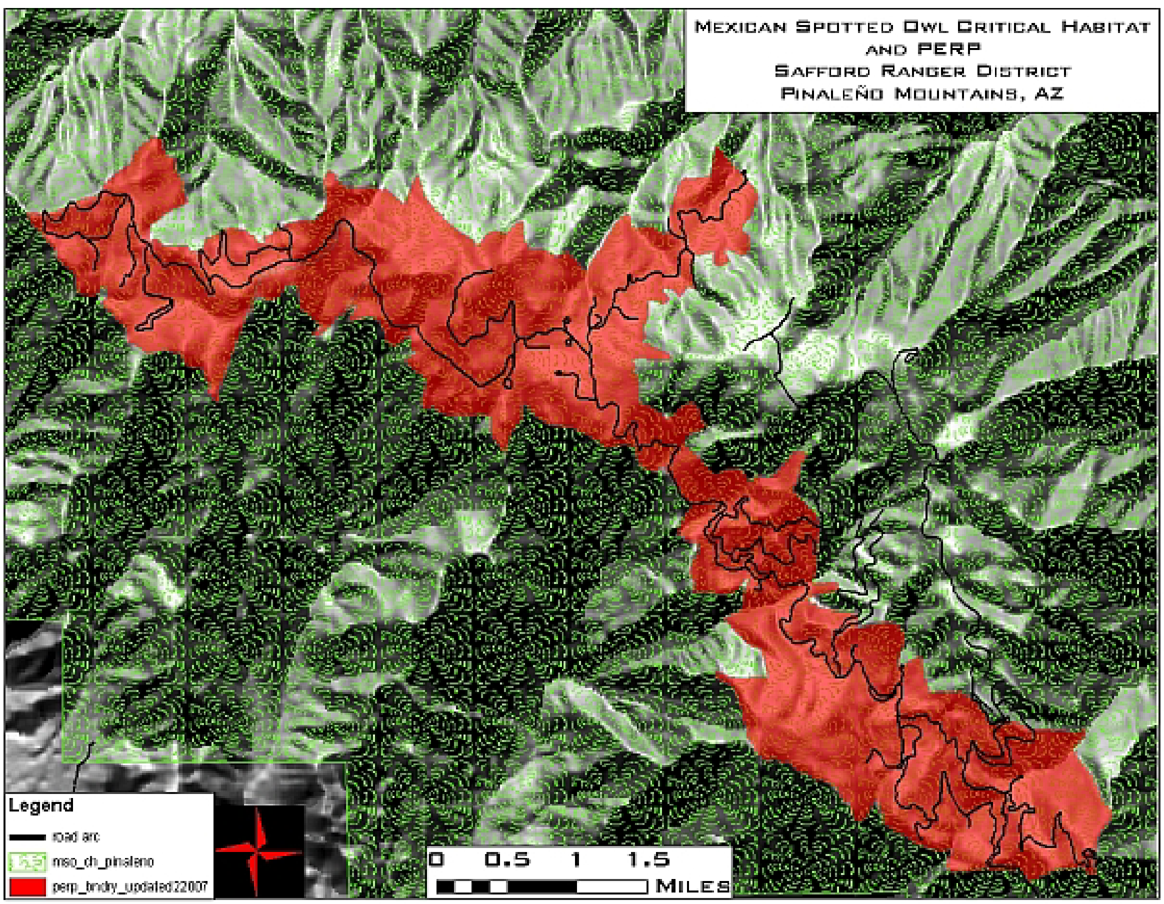


Figure 34. Mexican spotted owl critical habitat in relation to the Pinaleño Ecosystem Restoration Project

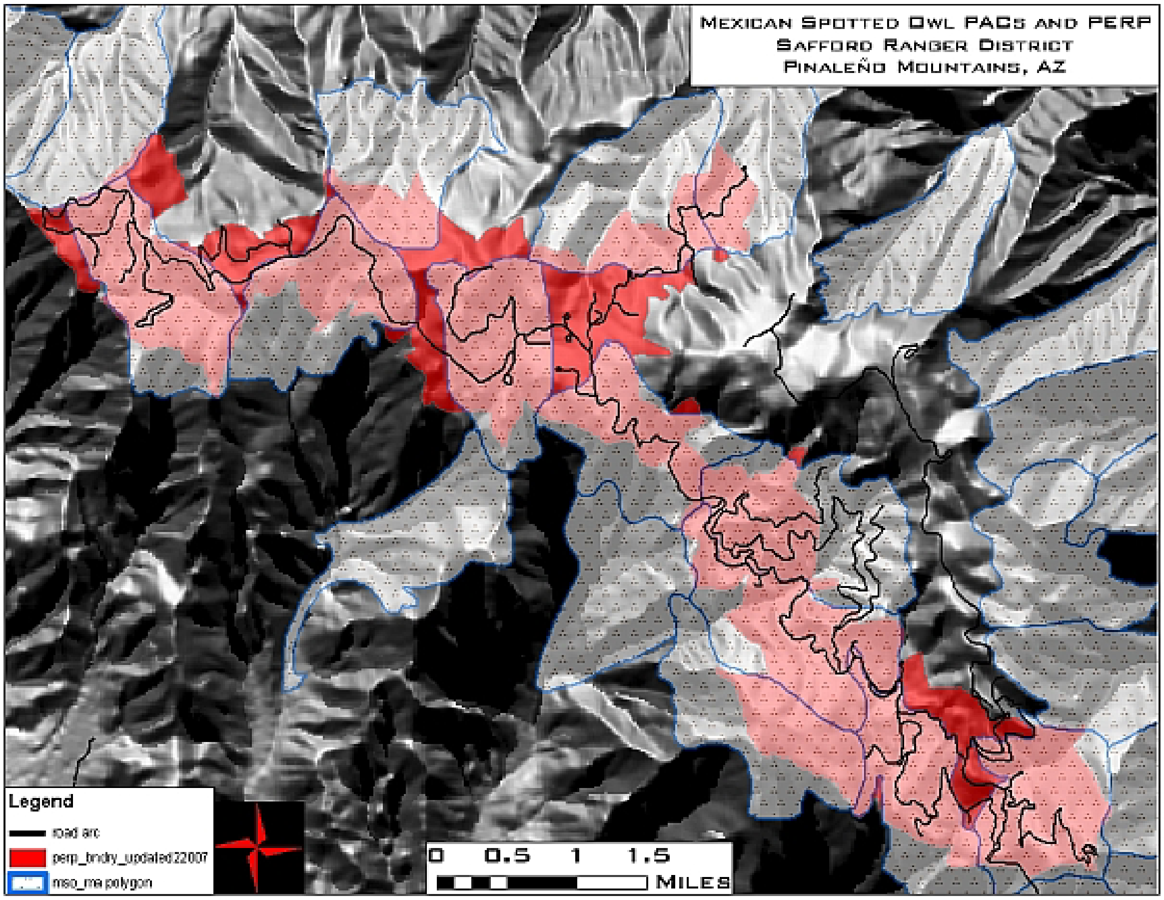


Figure 35. Mexican spotted owl protected activity centers (PACs) in relation to the Pinaleño Ecosystem Restoration Project

*Bald eagle (*Haliaeetus leucocephalus*)*

Bald eagles typically occupy habitats near open water sources, including estuaries, lakes, rivers, and coastal areas. They are an occasional visitor to the Pinaleños wintering in areas such as Riggs Lake, adjacent to the project area. They are also known to perch in areas outside or adjacent to the project area boundary. They have four types of perches: (1) guard/sentry perch—these perches are located in tall trees, cliff tops and ridgetops, and cliff faces where the nest can be watched; (2) foraging perch—these perches are normally adjacent to or overhanging the river or lake, and are low to moderate in height; (3) shade perch (warm arid areas)—these are areas that provide adequate shade during warm periods of the year; and (4) roost perch—these perches are mainly used for resting at night, are usually sheltered from the elements (e.g. wind), and are near to or possessing a good view of the nest (AZGFD 2002).

*Apache Trout (*Oncorhyncus apache*)*

Within the Pinaleño Mountains, Apache trout are found in Grant, Ash, Marijilda, and Frye Creeks. They prefer cool, clear, high elevation streams and rivers. They tend to be restricted to elevations of approximately 1,763 meters (5,780 feet) and higher. Woody streamside vegetation is dominated by fir and pine species, quaking aspen, willow (*Salix* spp.), and Arizona alder (*Alnus oblongifolia*) (Harper 1978).

The trout in these creeks were evaluated for genetic purity in 1998; the fish in Ash, Marijilda, and Frye Creeks were found to be up to 88 percent hybridized with nonnative rainbow trout (Porath and Nielsen 2003). The trout in these three creeks, therefore, do not qualify for a recovery action. Recent direction from the USFWS indicates that actions involving these hybrids do not require Section 7 consultation and, as such, effects to fish in these three drainages will not be discussed further.

Apache trout inhabiting Grant Creek are considered pure, and the effects analysis that follows is directed only toward the population in this creek.

*Gila trout (*Oncorhyncus gilae*)*

These fish do not currently exist within or downstream of the project area; however, renovation of streams on the north-facing slopes is currently in the planning phase. Renovation in the Ash, Frye, and Marijilda Creeks will consist of removing existing hybridized Apache trout and replacing them with Gila trout, which likely inhabited these creeks and other tributaries of the Gila River in the past.

The main threats to the recovery of Gila trout are related to changes in habitat quality and suitability, as well as the effects of catastrophic wildfires. The former changes in habitat are considered side effects of poor management related to grazing and logging practices, while the latter is considered a combined effect of poor grazing management and wildfire suppression (USDI Fish and Wildlife Service 2003). Recent and ongoing field surveys by the Arizona Game and Fish Department indicate that these creeks, in which introductions of Gila trout are planned, are in good condition to provide suitable habitat, spawning habitat, sufficient perennial water, and food sources for Gila trout (personal communication, S. Jason Kline, Arizona Game and Fish Department, with Anne L. Casey, Safford District Biologist, April 14, 2008).

According to data in the soils and hydrology specialist report (Lefevre 2008), both Ash Creek and Marijilda Creek were surveyed prior to the Nuttall Complex Wildfire of 2004. Marijilda was considered to be in “fair” condition, with 55 percent tree canopy available. However, during the Nuttall Complex, this drainage in particular received heavy fire activity, and post-fire surveys indicated that bank protection (or streamside vegetation) was reduced from 100 percent in 2003 to approximately 2 percent in 2006. Ash Creek, on the other hand, was surveyed as being in good condition, with 45 percent tree canopy available. Streamside vegetation was measured at 98 percent in 2003, and due to only small areas of this watershed being burned, this measurement has likely changed little due to fire effects.

Regional Forester’s Sensitive Species (RFSS)

Populations of all Forest Service sensitive wildlife, fish, and plants must be maintained at viable levels in habitats distributed throughout their geographic range on National Forest System lands (FSM 2670.22). The population viability of RFSS becomes a concern when downward trends in population numbers or habitat capability are predicted. When the Forest Service undertakes or approves an activity on National Forest System lands, the agency seeks to avoid or minimize impacts to RFSS. Table 38 lists the RFSS on the Safford Ranger

District of the Coronado and their presence or absence from the project area. Analysis regarding the northern goshawk is presented in detail because it was identified in Significant Issue 3.

Table 38. Regional Forester's Sensitive Species on the Safford Ranger District

Species Name	Presence or Absence
Mammals	
White-bellied long-tailed vole	Occurs within the analysis area; suitable habitat available.
Pinaleño pocket gopher	Not within the analysis area.
Mexican long-tongued bat	Occurs within the analysis area; suitable habitat available.
Western yellow bat	Not within the analysis area.
Western red bat	Not within the analysis area.
Allen's lappet-browed bat	Occurs within the analysis area; suitable habitat available.
Pale Townsend's big-eared bat	Occurs within the analysis area; suitable habitat available.
Pocketed free-tailed bat	Not within the analysis area.
Greater western mastiff bat	Not within the analysis area.
Plains harvest mouse	Not within the analysis area.
Northern pygmy mouse	Not within the analysis area.
White-nosed coati	Occurs within the analysis area; suitable habitat available.
Hooded skunk	Occurs within the analysis area; suitable habitat available.
Birds	
Apache northern goshawk	Foraging habitat available.
Peregrine falcon	Foraging habitat available.
Common black-hawk	Not within the analysis area.
Flammulated owl	Occurs within the analysis area; suitable habitat available.
Gould's wild turkey	Occurs within the analysis area; suitable habitat available.
Northern gray hawk	Not within the analysis area.
Western yellow-billed cuckoo	Not within the analysis area.
Abert's towhee	Not within the analysis area.
Amphibians	
Lowland leopard frog	Not within the analysis area.
Invertebrates	
Pinaleño monkey grasshopper	Not within the analysis area.
A tiger beetle (*Amblycheila Baroni*)	Not within the analysis area.
Aryxna giant skipper	Not within the analysis area.
Obsolete viceroy	Not within the analysis area.
Chiricahua white butterfly	Occurs within analysis area; suitable habitat available.
A tiger beetle (*Cicindela Purpurea Cimerrona*)	Occurs within the analysis area; suitable habitat available.
Arizona metalmark	Not within the analysis area.
False ameletus mayfly	Not within the analysis area.
Mountain silverspot butterfly	Occurs within the analysis area; suitable habitat available
Pima orange tip	Not within the analysis area.
Poling's giant skipper	Not within the analysis area.
Sabino Canyon damselfly	Not within the analysis area.
Ursine giant skipper	Not within the analysis area.
Clark Peak Talussnail	Not within the analysis area.

Table 38. Regional Forester's Sensitive Species on the Safford Ranger District

Species Name	Presence or Absence
Mimic Talussnail	Occurs within the analysis area; suitable habitat available.
Pinaleño Talussnail	Not within the analysis area.
Wet Canyon Talussnail	Not within the analysis area.
Pinaleño Mountainsnail	Not within the analysis area.
Plants	
Chiricahua dock	Not within the analysis area.
Coppermine milk vetch	Occurs within the analysis area; suitable habitat available.
Mock pennyroyal	Occurs within the analysis area; suitable habitat available.
Arizona alum root	Occurs within the analysis area; suitable habitat available.
Bigelow thoroughwort	Not within the analysis area.
Arizona giant sedge	Not within the analysis area.
Broad leaf ground cherry	Not within the analysis area.
Chihuahuan sedge	Not within the analysis area.
Chihuahuan stickseed	Occurs within the analysis area; suitable habitat available.
Mexican broomspurge	Not within the analysis area.
Superb beardtongue	Not within the analysis area.
Pinaleño Jacob's Ladder	Not within the analysis area.
Rusby hawkweed	Not within the analysis area.
White-flowered cinquefoil	Occurs within the analysis area; suitable habitat available.
Trans-Pecos indian paintbrush	Not within the analysis area.
Aravaipa sage	Not within the analysis area.
Arizona manihot	Not within the analysis area.
Arizona monkshood	Not within the analysis area.
Bartram stonecrop	Not within the analysis area.
Box Canyon muhly	Not within the analysis area.
Catalina beardtongue	Not within the analysis area.
Chiricahua mountain brookweed	Not within the analysis area.
Chiricahua rock cress	Occurs within the analysis area; suitable habitat available.
Counter-clock fishhook cactus	Not within the analysis area.
Goodding's onion	Occurs within the analysis area; suitable habitat available.
Lemmon's morning glory	Not within the analysis area.
Lemmon's stevia	Not within the analysis area.
Needle-spined pineapple	Not within the analysis area.
Nodding blue-eyed grass	Not within the analysis area.
Pima indian mallow	Not within the analysis area.
Shade violet	Occurs within the analysis area; suitable habitat available.
Sparseleaf hermannia	Not within the analysis area.
Sycamore Canyon muhly	Not within the analysis area.
Trelease agave	Not within the analysis area.
Tumamoc globeberry	Not within the analysis area.
Wiggins milkweed vine	Not within the analysis area.

Apache Northern Goshawk (Accipiter gentilis apache)

This species is found throughout Arizona, generally in high-elevation, old-growth ponderosa pine and mixed-conifer forests, as well as plateaus. It tends to breed at elevations above 6,000 feet, choosing Arizona pine and ponderosa pine for nest placement; from one to eight nests are built in March and early April. Short-distance foraging flights are taken from the nest to prey upon tree squirrels, rock squirrels, cottontail rabbits, band-tailed pigeons, mourning doves, Stellar's jays, northern flickers, and Montezuma quail (AGFD 2003). Goshawk populations appear to have declined over the past 50 years. Goshawks are found throughout the Pinaleños with six nesting pairs occurring in or around the project area boundary.

Management Indicator Species (MIS)

Management indicator species and their habitat are monitored to observe trends in resources, evaluate management actions, and provide a timely warning of problems or undesirable conditions affecting the resource. MIS were selected during the development of each forest plan according to their being threatened or endangered, requiring special habitat needs, or in high public demand. The analysis of impacts to MIS as part of the NEPA process contributes to the identification of trends, which may necessitate development of mitigation or new alternatives when a proposed action is under consideration. Table 39 lists the MIS species for the forest that were analyzed in detail. These species occur within the analysis area and have suitable habitat there. Those species that do not occur in the analysis area and do not have suitable habitat there, were not analyzed in detail and are listed below the table.

Table 39. Summary of management indicator species and their forest plan indicator group that occur within the analysis area and have suitable habitat there. These species were analyzed in detail.

Species	Forest Plan Indicator Group
Cavity Nesters	
Sulphur-bellied Flycatcher	Cavity nesters, riparian, diversity, special interest, TES
Primary and Secondary Cavity Nesters	Cavity nesters
Riparian Species	
Sulphur-bellied Flycatcher	Cavity nesters, riparian, diversity, special interest, TES
Black bear	Riparian, diversity, game
Species Needing Diversity	
White-tailed deer	Diversity, herbaceous cover, game
Sulphur-bellied Flycatcher	Cavity nesters, riparian, diversity, special interest, TES
Black bear	Riparian, diversity, game
Species Needing Herbaceous Cover	
White-tailed deer	Diversity, herbaceous cover, game
Mearn's quail	Herbaceous cover, game, special interest
Game Species	
White-tailed Deer	Diversity, herbaceous cover, game
Mearn's quail	Herbaceous cover, game, special interest
Black Bear	Riparian, diversity, game
Special Interest Species	
Mearn's quail	Herbaceous cover, game, special interest
Sulphur-bellied Flycatcher	Cavity nesters, riparian, diversity, special interest, TES

Table 39. Summary of management indicator species and their forest plan indicator group that occur within the analysis area and have suitable habitat there. These species were analyzed in detail.

Species	Forest Plan Indicator Group
Threatened and Endangered Species	
Peregrine falcon	TES (delisted)
Sulphur-bellied Flycatcher	Cavity nesters, riparian, diversity, special interest, TES
Apache trout	TES
Twin-spotted rattlesnake	TES
Mount Graham red squirrel	TES
Gould's turkey	TES (reintroduced)

Species not analyzed in detail – The following management indicator species are not present in the project area and do not have suitable habitat there; therefore, they were not analyzed in detail.

- Coppery-tailed (Elegant) trogon
- Gray hawk
- Blue-throated hummingbird
- Rose-throated becard
- Thick-billed kingbird
- Northern beardless tyrannulet
- Bell's vireo
- Merriam's turkey
- Buff-breasted flycatcher
- Pronghorn antelope
- Desert massassauga
- Baird's sparrow
- Northern beardless tyrannulet
- Desert bighorn sheep
- Five-striped sparrow
- Mexican stoneroller
- Gila topminnow
- Gila chub
- Sonora chub
- Arizona ridge-nosed rattlesnake
- Huachuca (Sonora) tiger salamander
- Tarahumara frog
- Western barking frog
- Spikedace
- Arizona treefrog

Environmental Consequences

Criteria that are generally used to evaluate adverse impacts on wildlife and ecosystem sustainability include: the potential for a reduction in species populations and diversity; depletion or fragmentation of plant and animal habitat; loss of threatened, endangered or other special status species; and impairment of ecological integrity, resilience or health, such as disruption of food chains, decline in species population, and alterations in predator-prey relationships.

Alternative 1 - No Action

Direct and Indirect Effects

Effect on Mount Graham Red Squirrel, Mexican Spotted Owl, Bald Eagle, Apache Trout, and Gila Trout

This alternative would involve no disturbance, no alteration to critical habitat, and no changes in stand structure or fire and fuels conditions. While the outcome of this alternative would be a continuance of the threats facing these species, there would be no effects due to management actions. This alternative would have “**no effect**” on these species.

Direct, Indirect, and Cumulative Effects

Effect on Regional Forester’s Sensitive Species

Table 40 provides a summary of the effects determination for the Regional Forester’s Sensitive Species considered in this analysis for Alternative 1. There would be no impact to any species with suitable or foraging habitat available.

Table 40. Summary of effects on Regional Forester’s Sensitive Species

Species Name	Habitat Determination	Effect Determination
Mammals		
White-bellied long-tailed vole	Suitable habitat available	No Impact
Mexican long-tongued bat	Suitable habitat available	No Impact
Allen’s lappet-browed bat	Suitable habitat available	No Impact
Pale Townsend’s big-eared bat	Suitable habitat available	No Impact
White-nosed coati	Suitable habitat available	No Impact
Hooded skunk	Suitable habitat available	No Impact
Birds		
Peregrine falcon	Foraging habitat available	No Impact
Flammulated owl	Suitable habitat available	No Impact
Gould’s wild turkey	Suitable habitat available	No Impact
Chiricahua white butterfly	Suitable habitat available	No Impact
A tiger beetle (*Cicindela purpurea cimerrona*)	Suitable habitat available	No Impact
Mimic talussnail	Suitable habitat available	No Impact
Plants		
Coppermine milk vetch	Suitable habitat available	No Impact
Mock pennyroyal	Suitable habitat available	No Impact
Arizona alum root	Suitable habitat available	No Impact
Chihuahuan stickseed	Suitable habitat available	No Impact
White-flowered cinquefoil	Suitable habitat available	No Impact
Chiricahua rock cress	Suitable habitat available	No Impact
Goodding’s onion	Suitable habitat available	No Impact
Shade violet	Suitable habitat available	No Impact

Effects on the Apache Northern Goshawk

With no action, habitat for this species may be lost due to large-scale, catastrophic wildfires, or areas of the forest subjected to insect infestations and drought. Current conditions do not appear to be having a negative impact on goshawks, but as stands continue to mature and become more dense, risk of destruction by wildfire and other influences increases. Meadows and smaller forest openings may be lost through succession, and this loss may make the project area less suitable for foraging activities. The no action alternative would not likely result in a trend toward Federal listing or loss of viability of the species.

Two additional thinning projects (e.g., PEM and SUP) are currently in the planning or implementation stages within this mountain range. The PEM project focuses solely in the understory of the forest, removing trees up to 9 inches in diameter at breast height (d.b.h.). Due to the small size of trees being removed under PEM, it is unlikely that tree removals will greatly affect goshawks. The SUP project will be focused in areas that fall within 300 feet of cabin or electronic sites, and focus mainly in the understory of the forest as well. Some larger trees will also be removed in the Turkey Flat recreation residence area, which may create further small patches of foraging habitat for goshawk prey species.

MIS Species

Alternative 1 is not expected to contribute significantly to changes in the forestwide population of or habitat availability for any MIS that occurs in the analysis area. For a detailed discussion of the effects on MIS, see the Pinaleño Ecosystem Restoration Project wildlife report.

Alternative 2

Direct and Indirect Effects on Mount Graham Red Squirrel

All active and inactive middens have been included in Mount Graham red squirrel protection zones (areas that will not be treated; figure 36), therefore, direct effects to the species from thinning and burning treatments should be minimized. Protection zones were designed in conjunction with representatives of the Arizona Game and Fish Department, U.S. Fish and Wildlife Service, and U.S. Forest Service, with input from University of Arizona squirrel researchers. These protection zones were defined based on all known midden sites. No thinning, prescribed burning, or other treatments will occur within the protection zones, in order to minimize disturbance to Mount Graham red squirrels. These zones were created to allow treatment between zones, in order to provide fire protection to areas of high squirrel density, while protecting individual squirrels from adverse effects from treatment.

The main direct effect expected from this alternative is disturbance. Use of equipment including skidders, masticators, chain saws, and trucks to remove wood byproducts will cause high levels of noise throughout the project area. The Mount Graham red squirrel protection zones should provide some distance between squirrels and surrounding implementation areas, but noise will not be lessened to any great extent within each implementation block. Implementing within specific blocks (figure 37) during each year of the project should allow some reprieve to areas of the mountain in which work is not being conducted. Blocks also allow preplanning so that while some areas with squirrels are treated early in the project, these will be followed by treatments in areas without squirrels to allow time for monitoring (outlined in appendix B) to take place. Yearly reviews by interagency and private biologists will occur to allow ongoing assessments of the effects of the project, and to determine if additional alterations to treatments should be incorporated.

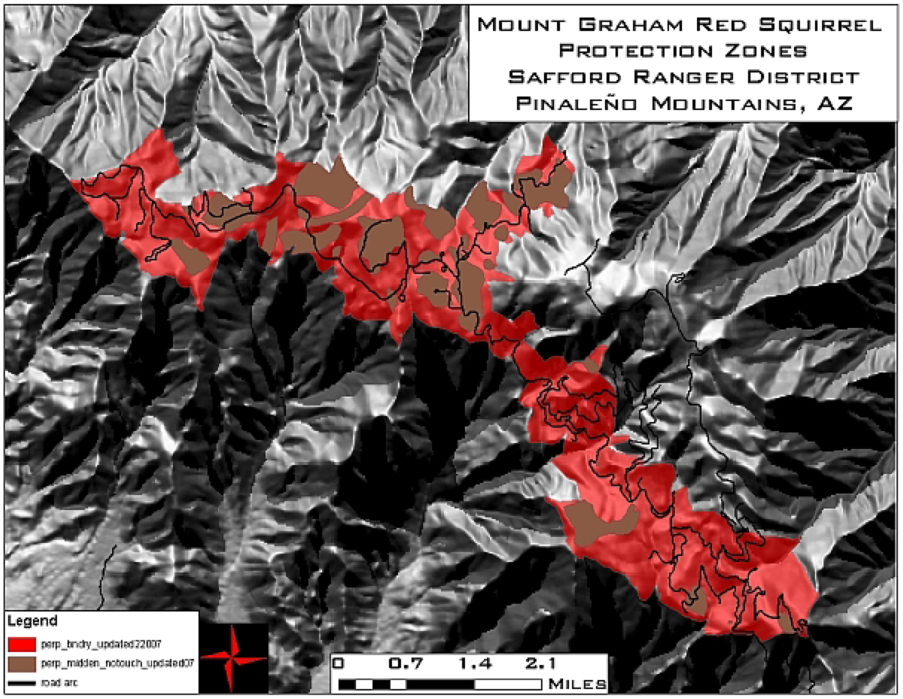


Figure 36. Mount Graham red squirrel protection zones within the Pinaleño Ecosystem Restoration Project area

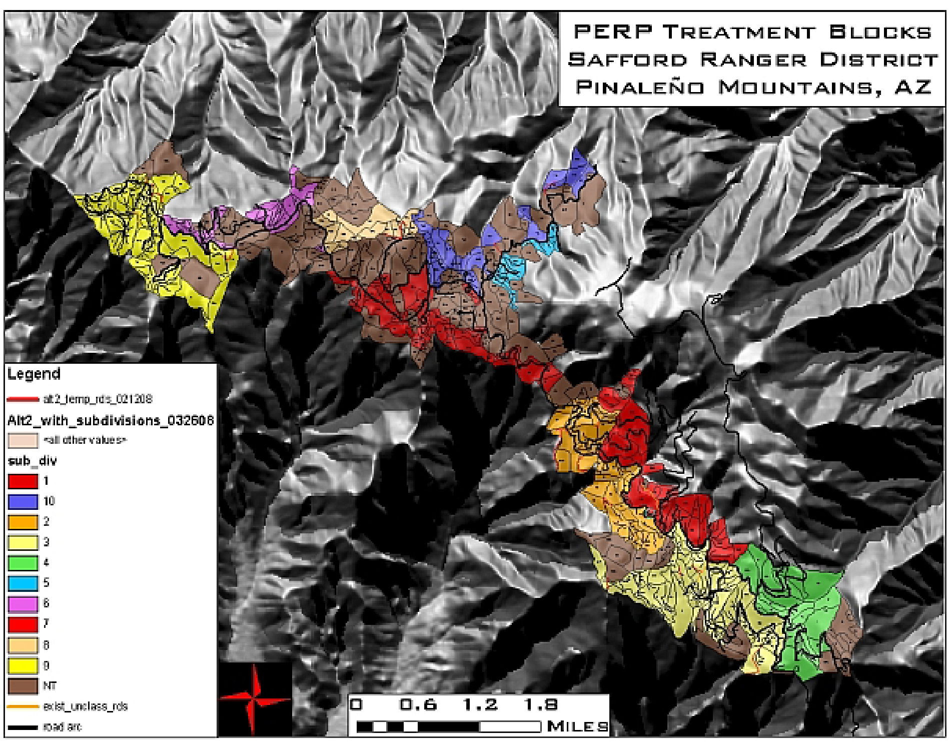


Figure 37. Treatment blocks designed for the Pinaleño Ecosystem Restoration Project

While the use of protection zones and implementation blocks will reduce direct effects, there remains potential for harm to individuals. Pre-implementation surveys within each block will be completed to assure that no new middens will be directly disturbed by thinning and burning activities. If new middens are found within treatment areas, they will be provided with buffers of untreated area, according to the design features listed in appendix A. All protection zones and any new middens that are found will be black-lined prior to prescribed burning. Prescribed burns will be designed to remove fuel loading on the ground; they will be managed and implemented to occur during weather conditions and seasons that encourage low-severity burn conditions. These low-severity burns should minimize the potential for embers to cause midden damage, scorching of mature trees, and harm to squirrels themselves.

Because not all nesting locations for this subspecies are known, there is potential for individual nests to be removed due to tree felling. Nests containing young could be abandoned in areas where work is occurring. Pre-implementation surveys in each block will reveal some of these locations, where damage and disturbance could then be minimized. There is some potential for individuals to be harmed by falling trees or debris during the implementation phase. Because of the noise associated with treatments, it is likely that squirrels will move temporarily to avoid noise and human activities, thereby removing themselves from areas in which falling trees and debris could harm them.

The main source of concern for potential squirrel mortality due to this project is the increase in traffic that would be associated with this alternative. Current use of Swift Trail is limited to administrative access for Forest Service personnel, Mount Graham International Observatory personnel, and Arizona Department of Transportation personnel during the winter months (November 15 through April 15 yearly), in accordance with the Arizona-Idaho Conservation Act of 1988. During the summer months, this mountain range provides a popular place for recreating to avoid lower elevation heat. However, despite this popularity, traffic remains low; average daily traffic counts from years 2003, 2004, and 2005 show 60, 90, and 100 vehicles per day, respectively. As a result, squirrel mortality due to roadkill events is low, with one report of mortality in 2008, another in 2007, and two in 2004 (U.S. Fish and Wildlife Service, personal comment 2008). Traffic impacts may exist throughout the area for the duration of implementation; use of a series of treatment blocks, which average approximately 300 acres each, should limit the direct effects in each particular area to approximately 2 years of noise and disturbance.

According to the transportation and operations specialist report (Yurczyk 2008; appendix E), 843,068 total haul miles would be traveled to remove wood byproducts from the project area. This translates to approximately 52,700 round trips of hauling vehicles up and down the Swift Trail area over the life of the project, or an average of 5,270 round trips per year. The result, based on 2 to 6 months of work per year, allowing for weather and equipment availability, is that traffic related to implementation of the project would add approximately 44 to 132 additional vehicles per day to the existing traffic. This is an increase of 52 to 157 percent over current traffic levels (an average of 84 vehicles per day). Due to this increase, the potential for squirrels to be killed due to roadkill events could be expected to increase proportionally.

Indirect effects of this alternative on squirrels are, in large part, expected to be beneficial, as they pertain to the sustainability of its habitat as well as the amelioration of one of the main threats to the subspecies' persistence—wildfire. As discussed in the introduction to this analysis, Alternative 2 will reduce the stand density index (SDI) in many portions of the project area (see table 41).

As shown in table 41, the no action alternative allows for a continual increase in the amount of acreage that falls within the "zone of imminent mortality" (areas with 55 percent or greater maximum SDI). Under Alternatives 2 and 3, the SDI decreases with treatment, and then rises naturally over time without treatment. This return rate is somewhat slower under Alternative 2 treatments, partially due to the prescription involving removal of larger trees (up to 18 inches in diameter). In Alternative 3, only smaller trees are removed (less than 9 inches in diameter), and these trees would more quickly replace themselves than larger trees. If wildfire is allowed to play a natural role in the ecosystem after treatments are completed, the return to higher acreages in both Alternatives 2 and 3 may be slower. Over the long term, Alternative 2 is expected to reduce the acreage in the zone of imminent mortality more efficiently than either of the other two alternatives. This provides for a forest that is more sustainable, because the competition among trees for water and nutrients would be reduced. Growth rates of trees would increase under both Alternatives 2 and 3, thus decreasing the amount of time treated areas take to reach sizes preferred by red squirrels.

Table 41. Percent of total area in each stand density index (SDI) category for Alternatives 2 and 3, versus untreated stands

	Year	<25 Percent Max SDI		≥25 and <35 Percent		≥35 and <55 Percent Max SDI		≥55 Percent Max SDI		Total
		Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	
Alt. 1	2008	217	6	274	8	1,252	34	1,893	52	3,636
Alt. 1	2018	185	5	177	5	1,058	29	2,217	61	3,636
Alt. 1	2048	124	3	57	2	657	18	2,797	77	3,636
Alt. 2	2018	266	7	646	18	2,103	58	620	17	3,636
Alt. 2	2048	142	4	199	5	2,042	56	1,253	34	3,636
Alt. 3	2018	295	9	439	13	1,535	45	1,113	33	3,382
Alt. 3	2048	144	4	148	4	1,309	39	1,782	53	3,382

Alternative 2 treatments provide better fire benefits than the no action alternative and Alternative 3 (see figure 38). These benefits are achieved by treating fuels and reducing the likelihood of active and passive crown fires and favoring conditions that will support surface fires to which this forest was adapted prior to fire suppression. In areas and conditions where fire must be suppressed, Alternative 2 would reduce the occurrence of fire with flame lengths that exceed those that can be fought with direct attack. This reduces the need for the use of aerial retardant applications, which bring noise disturbance and potential toxins into squirrel habitat.

There is some potential for an increase in aerial predators, as many of the resident and migratory raptor species are well adapted to flight below the forest canopy, making squirrels easy prey. These include northern goshawks, peregrine falcons, sharp-shinned hawks and, occasionally, spotted and great-horned owls. Some of the smaller owls in the area may also prey on juvenile squirrels, specifically, the northern saw-whet owl. Tree removals associated with Alternative 2 may cause an increase in the abundance of raptors, which could lead to increased squirrel mortality.

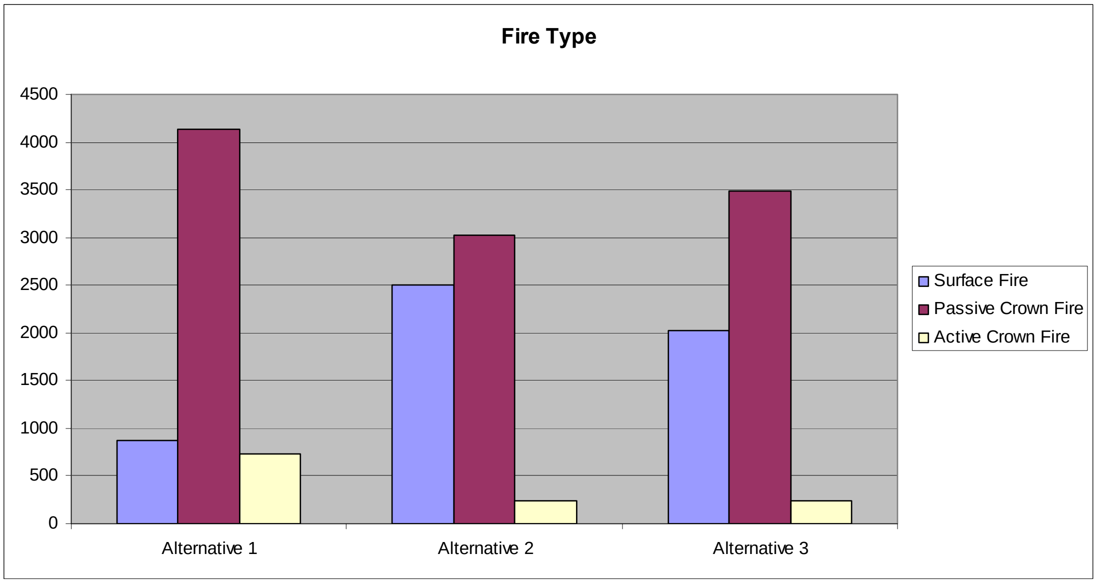


Figure 38. Comparison of alternatives in terms of expected fire types

Due to the potential for noise and human disturbance with Alternative 2, as well as potential for mortality resulting from vehicles and increased predator numbers, the biologist has made a determination of "**may affect/likely to adversely affect**" for the Mount Graham red squirrel.

Effects to Critical Habitat

In the designation of critical habitat for the Mount Graham red squirrel, the only major constituent element identified was the presence of dense stands of mature spruce-fir forest (U.S. Fish and Wildlife Service 1990). However, at the time of designation, this vegetation association provided habitat for the highest density squirrel concentration in the Pinaleño Mountains. In the mid-1990s, insect infestations rapidly killed the majority of trees within this area, as waves of different insects, including spruce beetles (*Dendroctonus rufipennis*), western balsam bark beetles (*Dryocoetes confuses*), a moth (*Nepytia janetae*), and others, swept the area (Koprowski et al. 2005). Squirrel concentrations steadily shifted down in elevation to previously occupied areas of mixed-conifer forest, where squirrel activity remains highest (AGFD, unpublished information).

Defining squirrel habitat quantitatively remains difficult; general characteristics include the presence of coniferous trees with a closed canopy and high quantities of snags and downed logs. Mannan and Smith (1991) suggested several variables for use in defining habitats preferred for midden placement within the transition zone (vegetation association that contains many of the components of both mixed-conifer and spruce-fir): (1) canopy cover 85 percent and greater was evident at all middens surveyed during their study; (2) one snag larger than 16 inches in diameter; (3) 8 downed logs larger than 16 inches in circumference and 33 feet long; (4) 4.1 trees greater than 16 inches in diameter; (5) 12 trees from 8 to 16 inches in diameter; (6) 33 trees less than 8 inches in diameter; and (7) basal area of live and dead trees greater than 74 m^2/ha (322 sq ft/ac). Smith and Mannan's recommendations were based on the mean values of 0.3 ha (0.73 ac) midden sites. The recorded ranges in many parameters were quite wide (see table 42).

Table 42. Physical and vegetation measurements at midden sites in transition zone (mixed-conifer) as reported by Smith and Mannan (1994)

Variable	Mean	Range
Percent slope	21.2	4.0 – 47.0
Nearest opening (m)	16.8	1.0 – 65.0
Percent CC (Canopy Closure (CC) w/spherical densiometer)	90.0	51.0 – 100.0
Percent CC Ave. @ 5 meters	86.9	58.5 – 97.8
Percent CC @ 10 meters	85.0	59.8 – 98.8
Visibility (percent of target blocked @ 10 meters)	34.8	0.0 – 85.5
Log volume (m^3/ha)	331.3	0.0 – 1,295.5
Basal area (m^2/ha)	73.9	30.1 – 165.8
Trees/ha, < 5 m	2,044.9	254.8 – 5,732.5
Trees/ha, 5-10 m	2014.6	424.6 – 5,180.5
Small trees/ha (< 20 cm, d.b.h.)	1,084.2	127.4 – 3,917.2
Medium trees/ha (20 - 40 cm)	389.4	63.7 – 923.6
Large trees/ha (> 40 cm)	134.9	0.0 – 414.0
Large snags (> 40 cm)	33.8	0.0 – 191.1
Foliage volume (m^3/ha)	33,065.0	9,359.0 – 80,396.0

As listed in appendix A, design features have been created to minimize negative effects on squirrels and their critical habitat. These features require that at least six of the largest snags and logs be retained in each acre of treatment; pre-treatment sweeps would be completed within each block to assure any new middens receive protection; no treatments would occur within 92 feet of middens found in areas slated for important wildlife area prescriptions (Koprowski 2005); and no treatment within 200 feet of a midden found in the forest restoration area treatments. These features should help to minimize negative modifications of squirrel habitat.

Percent canopy cover as calculated from forest stand exams and then by calculations through FVS (Forest Vegetation Simulator, a model) seems to provide a more conservative estimate of canopy cover (vertical canopy cover) than methods used by Smith and Mannan (1994) who used a concave spherical densiometer which measures angular canopy cover (table 43). This is partially due to differences in methods, a lack of spatially specific information in the program, and partially a result of averaging canopy cover across stands for the purposes of project analysis (Christopher and Goodburn 2008). As can be seen from the current condition data, shown in the table below, canopy cover is not at the desired level even before treatments begin (table 44).

Table 43. Percent canopy cover (PCC) for years 2008, 2018, and 2048 for Alternative 1

	Year	PCC >9 d.b.h.	PCC ≥9, <18 d.b.h.	PCC ≥18 d.b.h.	Total PCC
Not Treated	2008	26	23	18	54
Not Treated	2018	27	25	21	57
Not Treated	2048	24	24	30	60

Table 44. Trees per acre (TPA) by custom size classes

	Year	≥ 0 and < 6 (No. of Trees)	≥ 6 and < 9 (No. of Trees)	≥ 9 and < 12 (No. of Trees)	≥ 12 and < 18 (No. of Trees)	≥ 18 and < 24 (No. of Trees)	≥ 24 (No. of Trees)	Grand Total
Not Treated	2008	743	47	31	37	16	11	885
Not Treated	2018	662	46	36	39	18	13	814
Not Treated	2048	427	43	29	42	24	18	583
Treated	2008	686	59	46	49	17	10	867
Treated	2018	596	61	44	52	20	11	784
Treated	2048	364	45	34	51	27	17	539

Basal area as calculated in the silviculture specialist report for this project indicates that these measures, too, fall somewhat short of the above recommendations, in current conditions, as well as after treatments. The number of logs per acre will be reduced, as the wildlife design features only allow for retention of six logs per acre. However, additional design features allow for felling large snags (after six have been retained in standing condition) for use as part of the log component. In addition, where logs and snags are in short supply, two slash piles per acre may be left unburned, to serve as cover and potential midden sites.

Because the majority of habitat components would be maintained during implementation of Alternative 2, and additional components created when opportunities arise, the biologist has made a determination of "**may affect/not likely to adversely affect**" regarding critical habitat for the Mount Graham red squirrel.

Relationship of the Proposed Action to Recent Habitat Analysis

The USDA Forest Service, Arizona Game and Fish Department, and the USDI Fish and Wildlife Service met June 13, 2008, to discuss the relevance of recent habitat analyses to the Pinaleño Ecosystem Restoration Project planning and analysis process. In particular, the group focused on a remote sensing/GIS study published in 2007 that required some specific attention (Wood et al. 2007).

The team reviewed the Wood et al. study (also to be found as appendix B of his master's thesis) to determine relevance to the project proposal. It was determined that Wood's study confirms the location of potential, but unoccupied habitat in most of the project area. This is similar to conclusions in a study by James Hatten in 2000. These studies support the current placement and prescriptions in the proposed project, because the focus of the project is to restore habitat especially for this species.

Working to improve potential habitat is the purpose of the project; currently, stands in the project area are lacking characteristics that attract Mount Graham red squirrels. As discussed above, several remote sensing projects (Hatten 2000; Wood et al. 2007) have been conducted in and around the project area. While the stands within the project area may show evidence of meeting the physical characteristics of squirrel habitat (i.e., high canopy cover, large numbers of logs and snags, etc.), the areas suggested as "potential habitat" in both studies have failed to support squirrel occupation. Many portions of the project area have never been known to support squirrel occupation, despite meeting the supposed physical characteristics of squirrel habitat. There are many possibilities for these areas not to be occupied, including that they meet the quantitative measures of squirrel habitat while not actually contributing to the needs of the squirrels. For example, many of the stands have large numbers of logs and snags and high measured canopy cover, but in actuality, trees in some of these overstocked areas do not produce cones (the main squirrel food source) as a result of insects, mistletoe infestations, and disease. There is potential for this project to improve forest health and to result in a structure that is more resilient to natural processes and, hopefully, more inhabitable by squirrels.

In addition to the prescribed treatments, Alternative 2 proposes sweep surveys in all treatment areas prior to implementation to ascertain whether new middens have been created. This could potentially provide the Forest Service, wildlife management agencies, and researchers new information about the distribution of Mount Graham red squirrels. Pre- and post-treatment monitoring would also allow for some assessment of the effects of treatments on Mount Graham red squirrels.

Another result of David Wood's research is a model that assesses the threats of insect infestations and wildfires on the red squirrel population. This research (appendix C of Wood's thesis) clearly states that these two threats could cause the population to drop below various thresholds for the squirrels, and both remain major threats to the population under current forest conditions. In essence, this study supports the threat reduction logic that is incorporated into this project.

In conclusion, the interagency team felt that current prescriptions for the Pinaleño Ecosystem Restoration Project were confirmed by the Wood et al. and Hatten studies, and that these habitat analyses and the threat analysis support the direction in which the Forest Service is moving with the project.

Cumulative Effects on Mount Graham Red Squirrel

The direct and indirect effects, identified above, generally may impact 26 percent of the Mount Graham red squirrel known suitable habitat and 11 percent of its designated critical habitat. Therefore, given the geographic extent of these effects and limited population of the Mount Graham red squirrel, for cumulative impacts this analysis will consider the additive impacts of activities that could or have impacted the known occupied and previously occupied habitat of the Mount Graham red squirrel (see figure 39).

In addition, the potential direct and indirect effects of implementing the Pinaleño Ecosystem Restoration Project are projected to persist in varying intensities over the next 30 years. Therefore, for cumulative effects, this analysis will consider effects within the above geographical boundary that will persist or occur during that same time period.

Building of the Mount Graham Astrophysical Complex in its current form was implemented using "Reasonable and Prudent Alternative 3," which included the assignment of take for six squirrels per year. Likely mortality was attributed to increased traffic, and two middens were likely to be abandoned as a result of disturbance due to site construction and operation (1988 -approximately 10 acres - AESO/SE #2-21-86-F-75). The permits for the Columbine and Turkey Flat summer homes are in the renewal process after consultation with the U.S. Fish and Wildlife Service (2008 - AESO/SE #22410-2007-F-0163); the Forest Service was assigned take for two Mount Graham red squirrels (one for potential harassment/disturbance from human presence and recreation activities nearby; one for potential mortality due to a likelihood of being hit by a vehicle).

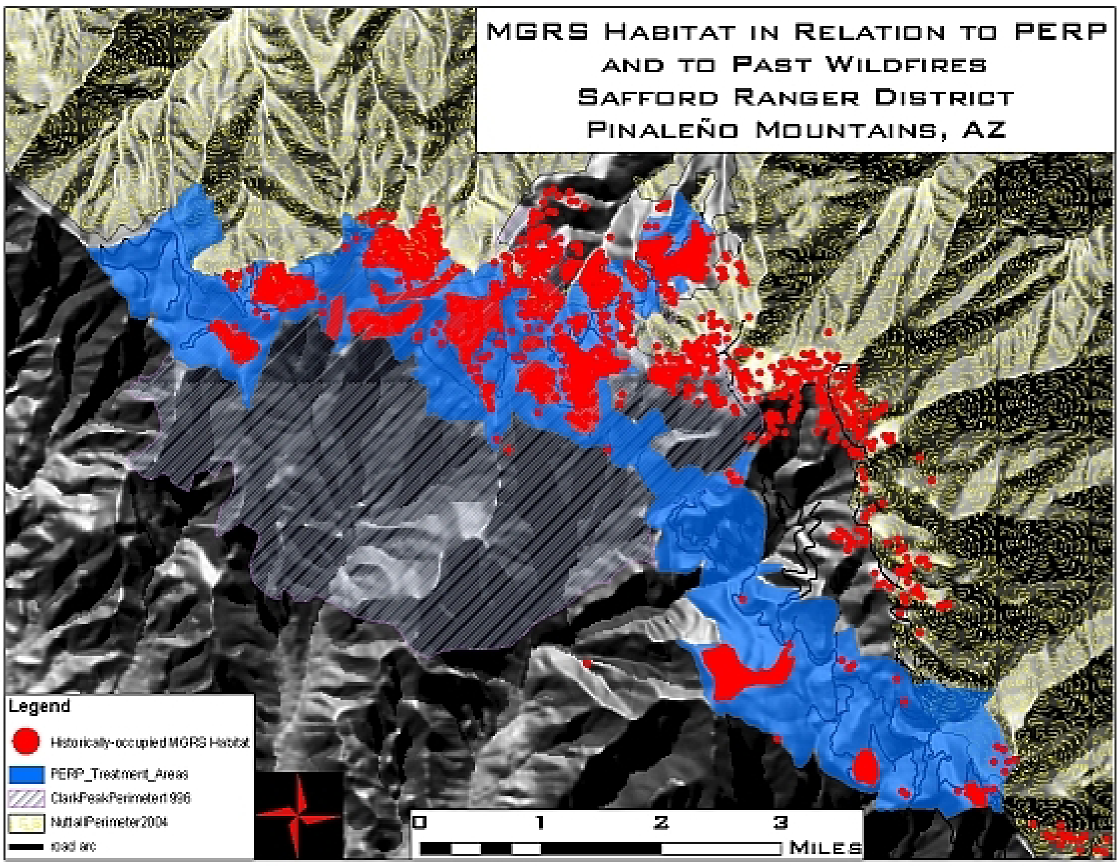


Figure 39. Mount Graham red squirrel habitat in relation to two large wildfires (Clark Peak, 1996 and Nuttall Complex Wildfire, 2004) that occurred in the past 25 years

The 2001 Pinaleño Ecosystem Management Project was assigned a limit of take for three squirrels due to harm from potential burning or damaging a midden or harassment due to smoke and work-related noise (2000 – 1,000 acres - AESO/SE #2-21-98-F-282). Both PEM and the special uses area hazardous fuel treatments, which received concurrence without any assignment of incidental take (2007 – 250 acres – AESO/SE #02-21-05-I-0818), were designed and coordinated with other resource protection agencies, including the U.S. Fish and Wildlife Service and Arizona Game and Fish Department, to reduce fuel loading, increase forest health, and encourage return of the natural fire cycle. Treatments completed under PEM provided firefighters safer areas to combat wildfire during the Nuttall Complex in 2004, and provided a relatively unburned area for squirrels to move into after leaving heavily burned areas. Consultation for the suppression activities that occurred during the Nuttall Complex Wildfire (2004 - 29,000 acres - AESO/SE #02-21-04-M-0299) resulted in take of one squirrel due to fire suppression activities undertaken by the Forest Service.

Wildland fire has also resulted in direct mortality of red squirrels as well as damaged or destroyed habitat in forested areas. Research conducted during and shortly after the Nuttall Complex Wildfire of 2004 (Koprowski et al. 2006) indicates that high-intensity fires may directly cause mortality of squirrels (7 of the 55 radio-collared squirrels in the study were known to be killed by this particular fire). Census data collected in the spring of 2005 (AZGFD, unpublished data) indicated that changes in habitat and loss of middens due to burning may also reduce the population of red squirrels by destroying food items cached to last through the winter months (see figure 32). Proposed treatments will actually decrease the likelihood of wildfires being as destructive as the Nuttall Complex Wildfire and, as such, should offset this threat somewhat in the future.

Scorching of surviving trees and overstocked stands may leave forests increasingly susceptible to insect infestation. In the area of potential effect, the natural frequency and intensity of wildland fire has changed in the past several decades from frequent, low-intensity fires in the understory to catastrophic, high-intensity crown fires that consume thousands of acres of vegetation. Insect populations have devastated the spruce-fir forests at the highest elevations of the mountain, resulting in the presence of few live, large, old spruce and fir trees. Over half of the critical habitat designated for the squirrel was devastated by insect infestation in the mid- to late-1990s (Koprowski et al. 2005).

Vehicle and foot traffic from recreational use, wood gathering, hunting, and fire patrols often interrupt foraging and other behaviors, and may cause direct mortality or injury of protected species. Other actions that have contributed to cumulative impacts on squirrels include roads, recreation, and administrative developments, all of which have fragmented habitat or promoted and increased pressure on populations near recreational uses. No research exists on the effects of recreation activities on red squirrels, so effects from these activities are difficult to determine and, at this point in time, impossible to quantify.

The past actions discussed above have all had impacts on Mount Graham red squirrels. Because increased traffic and noise due to implementation activities will also be a side effect of proposed treatments, the aforementioned effects to red squirrels will likely be additive to those of the observatory, summer home permit renewals, recreation and other uses, and fire suppression activities. There is also potential for active and inactive middens to be damaged by prescribed burning activities. These effects will be additive to those caused by previous and future wildfires.

While these past actions caused both direct and indirect impacts to squirrels, the current proposed action has incorporated many design features (see appendix A) to minimize direct effects and reduce some of the very threats that cause additional impacts in the future. According to the silviculture specialist report (Amell 2008) and the fire and fuels specialist report (Hall 2008), initial treatments will reduce the density of the forest, canopy cover, fire behavior, and fuel loading for approximately 30 years following treatment. Without further treatments, forest conditions and fire risk will begin returning to current levels. Such long-term benefits from a relatively short implementation period are unprecedented in this mountain range. While the potential for impacts during the implementation phase exist as a result of traffic, noise, and other disturbance, having a 30-year or more reduction in the main threats to this subspecies outweighs the temporary potential for short-term (i.e., during the implementation phase) negative effects to the squirrels.

By design, it is unlikely that effects from the Pinaleño Ecosystem Restoration Project will begin to approach the devastation caused by past high-intensity wildfires (1996 and 2004) and particularly insect infestations (in the mid-1990s). These two natural processes, occurring at unnatural intensities, have affected over 40,000 acres total within this mountain range, effectively removing the spruce-fir portion of the forest from productivity, and damaging large portions of the mixed-conifer forest. Because the spruce-fir forest was considered the highest quality habitat for these squirrels, the loss of that forest component was immediately reflected in population estimates for the subspecies (see figure 32).

The goals of proposed treatments include beneficial effects to the Mount Graham red squirrel and other listed species, such as a reduction in fuel loading and canopy closure to reduce one of the main threats to this species (e.g., high-intensity wildfire). Tree health should also improve as a result of treatments, where tree density is lowered so that trees are not competing with each other for water and nutrients. This may increase forest resistance to insect infestations and improve the cone crops available as food sources for the squirrels.

The Mount Graham Red Squirrel Recovery Plan identifies that it is vital for the long-term survival of this species that forest health is improved, because the isolation of the habitat in this mountain range makes immigration and emigration to and from other pockets of high quality habitat impossible (USDI Fish and Wildlife Service 1993). In addition, past wildfires have removed large parcels of land from productivity as squirrel habitat (USDI Fish and Wildlife Service 1993), and overcrowding of trees has reduced the productivity of existing habitat, by reducing cone crops and stressing trees to the point that they become prime hosts for insects, which cause widespread forest destruction (Koprowski et al. 2005). As identified by the recovery plan, if this subspecies is to persist in the Pinaleño Mountains, steps must be taken to protect existing occupied habitat, improve unoccupied areas with the goal being eventual occupation, and reduce the fire potential of the surrounding lower areas to prevent catastrophic wildfires from spreading into occupied areas (USDI Fish and Wildlife Service 1993). This project provides the first step into a mountain-wide management plan that could potentially do all of these things. While some of the effects will be additive with those of past and ongoing actions, this project will provide benefits to this subspecies for approximately 30 years. The positive long-term outcomes of the project are aligned with the recovery plan's actions to ensure survival of this species; it is the collective opinion of biologists from the Forest Service, Arizona Game and Fish Department, and U.S. Fish and Wildlife Service that the positive effects of the proposal outweigh anticipated short-term negative effects. The cumulative impacts discussed above, while serious, will not negate the potential for improvements to habitat and the security of the Mount Graham red squirrel population.

Direct and Indirect Effects on Mexican Spotted Owl

Thirteen owl PACs and seven owl core areas occur partially within the project area. Design features dictate that no work would occur within owl cores during the breeding season.

Because work would occur during daylight hours, disturbance of foraging owls is unlikely. Because not all nesting locations for this subspecies are known, there is potential for individual nests to be removed due to tree felling. For unknown nest sites, or sites where owls may have moved nest sites due to effects of earlier fires or weather events that remove trees, young could be abandoned in areas where work is occurring. Protocol surveys in each block would continue to be conducted prior to implementation, and could reveal some of these locations to help minimize damage and disturbance. There is some potential for individuals to be harmed by falling trees or debris during the implementation phase. Because of the noise associated with treatments, it is likely that owls would move temporarily to avoid noise and human activities, thereby removing themselves from areas in which falling trees and debris could harm them.

The main source of concern for potential owl mortality relates to the increase in traffic that would be associated with this alternative. Current use and changes in traffic are the same as reported under the Mount Graham red squirrel analysis above. Because existing traffic is generally light, owl mortality due to roadkill events is low, with one report of mortality within the past 5 years.

Implementing activities within specific blocks (figure 36) during each year of the project should allow some reprieve to areas of the mountain in which work is not being conducted. Blocks also allow preplanning so that while some areas within PACs are treated early in the project, these would be followed by treatments in areas without owls to allow time for monitoring (outlined in appendix B) to take place. Yearly reviews by interagency and private biologists would occur to allow ongoing assessments of the effects of the project, and to determine if additional alterations to treatments should be incorporated.

Indirect effects of this alternative on owls are, in large part, expected to be beneficial, as they pertain to the sustainability of its habitat as well as the amelioration of one of the main threats to the species' persistence—wildfire. As discussed in the introduction to this analysis and again in the Mount Graham red squirrel analysis, Alternative 2 would reduce the stand density index (SDI) in many portions of the project area (table 41). As shown in table 45, the no action alternative allows for a continual increase in the amount of acreage that falls within the "zone of imminent mortality." Under Alternatives 2 and 3, the SDI decreases with treatment, and then rises naturally over time without treatment. This return rate is somewhat slower under Alternative 2 treatments, partially due to the prescription involving removal of larger trees (up to 18 inches in diameter). In Alternative 3, only smaller trees are removed (less than 9 inches in diameter), and these trees would more quickly replace themselves than larger trees. If wildfire is allowed to play a natural role in the ecosystem, the return to higher acreages in both Alternatives 2 and 3 may be slower. Over the long term, Alternative 2 is expected to reduce the acreage in the zone of imminent mortality more efficiently than either of the other two alternatives. This provides for a forest that is more sustainable, because the competition among trees for water and nutrients would be reduced. Growth rates of trees would increase under both Alternatives 2 and 3, thus decreasing the amount of time treated areas take to reach conditions preferred by spotted owls.

Alternative 2 treatments provide better fire benefits than the no action alternative and Alternative 3 (see figure 38). These benefits are achieved by treating fuels and reducing the likelihood of active and passive crown fires and favoring conditions that will support surface fires to which this forest was adapted before fire suppression. In areas and conditions where fire must be suppressed, Alternative 2 would reduce the occurrence of fire with flame lengths that exceed those that can be fought with direct attack. This reduces the need for the use of aerial retardant applications, which bring noise disturbance and potential toxins into owl habitat.

There is some potential for an increase in aerial predators, as many of the resident and migratory raptor species are well adapted to flight below the forest canopy and specifically in hunting other birds. These include northern goshawks, peregrine falcons, and great-horned owls. Tree removals associated with Alternative 2 may cause an increase in the abundance of raptors, which could lead to increased owl mortality. Due to the potential for noise and human disturbance with Alternative 2, as well as potential for mortality resulting from vehicles and increased predator numbers, the biologist has made a determination of "**may affect/likely to adversely affect**" for the Mexican spotted owl.

Effects to Critical Habitat

Primary constituent elements of Mexican spotted owl critical habitat related to forest structure and maintenance of adequate prey species include the following:

1. A range of tree species, including mixed-conifer, pine-oak, and riparian forest types, 30 to 45 percent of which are trees with trunks 12 inches in diameter and larger.
2. Shade canopy 40 percent or greater.
3. Snags 12 inches in diameter or greater.
4. High volumes of fallen trees and other woody debris.
5. A wide range of tree species, including hardwoods.
6. Adequate levels of residual plant cover to maintain fruits, seeds, and allow for plant regeneration. (U.S. Fish and Wildlife Service 2004).

Wildlife design criteria (appendix A) address many of the primary constituent elements defined for critical habitat for this subspecies. Design features that relate to critical habitat for owls include: (1) retaining a wide range of tree species, with no removal of hardwoods at all; (2) maintaining regeneration for all tree species currently occupying the project area; (3) retaining six of the largest snags per acre and six of the largest logs per acres; (4) in areas where six large logs are not available, but high numbers of snags are available, consider dropping up to six snags per acre after prescribed burning is complete; and (5) where snags and logs are both scarce, then stack logs or leave at least two slash piles per acre unburned to provide cover for small mammal prey.

In the first primary constituent element, there is also some direction for the size of trees to be retained in a stand. The following table summarizes the stand composition expected after implementation of Alternative 2, in terms of trees per acre (table 45). This table shows that in the years following treatment, trees 12 inches in diameter and larger compose an average of 36 to 54 percent of the total number of trees in the stand (silviculture specialist report, Amell 2008).

Table 45. Average trees per acres (TPA) by diameter classes for Alternative 2 - the years 2018 and 2048

Year	0″ to <6″ d.b.h.	≥6″ to <9″ d.b.h.	≥9″ to <12″ d.b.h.	≥12″ to <18″ d.b.h.	≥18″ to <24″ d.b.h.	≥24″ d.b.h.	Grand Total
2018	68	18	21	32	18	10	168
2048	39	9	16	33	24	17	138

Predicted canopy cover following treatment is shown in table 46. Note that in all years, the average percent canopy cover exceeds the guidance in the primary constituent elements above.

Some snags above 12 inches in diameter may be removed as hazards to workers or for being in excess of the design feature, which indicates a limit of six of the largest snags per acre. In addition, some felled logs (also in excess of six per acre) may be removed in order to improve the achievement of fuel reduction to reach fire behavior goals.

Table 46. Percent canopy cover (PCC) provided by various sizes of trees for the years 2008, 2018, and 2048 for Alternative 2

Year	Percent CC >9	Percent CC ≥9 to <18	Percent CC ≥18	Total Precent CC
2008	26	26	17	55
2018	11	20	20	43
2048	9	19	29	48

Under this alternative, the standards and guidelines from the Coronado Forest Plan are incorporated and the proposed forest plan amendments will become standards and guides. A small number of PACs will be treated within each treatment block to allow for assessment of project effects. Key forest species (such as hardwoods), many logs, and many snags will be retained. All areas that meet threshold criteria prior to treatment will retain those characteristics after treatment. There will be no loss of Mexican spotted owl habitat that meets threshold criteria.

However, in order to design treatments that most effectively encourage forest health, reduce fire hazard, and restore Mount Graham red squirrel habitat, we have chosen to modify the Forest Plan to allow some variation from the guidelines under this alternative. Alternative 2 calls for removals of trees over 9 inches d.b.h. within protected areas, and treatments will be conducted within designated core areas. There will also be some building of temporary roads within spotted owl habitat in order to facilitate the removal of fuels from the forest.

While numbers of snags and logs may be removed, all primary constituent elements will be evident in the remaining habitat, and fire hazard will be reduced to assure the sustainability of this habitat. For the reasons stated above, the biologist has made a determination of "**may affect/is not likely to adversely affect**" for critical habitat of the Mexican spotted owl under Alternative 2.

Consistency with Forest Management Guidelines of the Mexican Spotted Owl Recovery Plan

For comparison purposes, this analysis looks at all alternatives proposed in the Pinaleño Ecosystem Restoration Project and estimates whether forested stands before and after treatment can be classified as Mexican spotted owl habitat as defined by the recovery plan. For a stand to be classified as habitat, it had to meet the following criteria: (1) at least 10 percent of the current SDI had to be classified as greater than or equal to 12" d.b.h., (2) the BA had to be at least 150 ft^2 per acre, and (3) at least 20 trees per acre were classified as at least 18" d.b.h. Stands that did not meet all of these criteria were not classified as habitat. Table 47 displays the total acreage and percent of forested stand area classified as habitat and not habitat from available stand data within the project boundary and FVS modeling of wildfire and proposed treatment effects. In comparing the alternatives below, we must caution that there are 26 acres “missing” from Alternative 3’s acreage that we have not yet located. However, this small acreage would make very little change in the percentage values, and for ease of interpretation, we consider the 2008 values for Alternative 1 as “Baseline Conditions” for all alternatives.

Table 47 shows very little difference between Alternatives 1 and 2. This does not mean the treatments are not affecting habitat of individual stands. It probably means that thinning effects that are moving stands out of “habitat” to “not habitat” and vice versa sum to about the same acreage.

Table 47. Proportion of analysis area forested stands classified as Mexican spotted owl habitat

Model Year	Alternative 1		Alternative 2		Alternative 3	
	Habitat (Percent)	Not Habitat (Percent)	Habitat (Percent)	Not Habitat (Percent)	Habitat (Percent)	Not Habitat (Percent)
2008	36	64	37	63	37	63
2018	40	60	40	60	42	58
2048	57	43	56	44	62	38

Table 48 shows the acres if area classified as “habitat” and “not habitat” for Alternative 1 further subdivided into stands proposed for treatment (To Be Treated) and not proposed for treatment (Not To Be Treated) in Alternative 2. This is done so one can better compare the effects of treatments on Mexican spotted owl habitat because the area or the stands involved in each group are then very close to being the same between the three alternatives. There are, however, small acreage differences between the alternatives due to treatment delineation differences between the spatial layers.

Table 48. Acres of Mexican spotted owl habitat and not habitat for "to be treated" and "not to be treated' stands in Alternative 1

Year	Not to be Treated		To be Treated	
	Not Habitat	Habitat	Not Habitat	Habitat
2008	1,210	769	2,363	1,271
2018	1,172	842	2,181	1,454
2048	951	1,028	1,484	2,150

Table 49 shows the percent of increase or decrease in stand areas for the area classified as "habitat" and "not habitat" in table 48. The negative numbers mean that the amount of acreage in that classification decreased. For example, the "-3" value for "Not to be Treated/Not Habitat" means that from 2008 to 2018 the acreage decreased by 3 percent of the 2008 value.

Table 49. Percent of increase or decrease in stand areas for habitat and not habitat in Alternative 1

Year	Not to be Treated		To be Treated	
	Not Habitat	Habitat	Not Habitat	Habitat
2018	-3	5	-8	14
2048	-19	27	-32	48

Table 50 shows the acres of area classified as "habitat" and "not habitat" for Alternative 2 further subdivided into stands proposed for treatment (To be Treated) and not proposed for treatment (Not to be Treated). Table 51 shows the percent of increase or decrease in stand areas for the area classified as "habitat" and "not habitat" in table 47.

Table 50. Acres of Mexican spotted owl habitat and not habitat for "to be treated" and "not to be treated' stands in Alternative 2

Year	Not to be Treated		To be Treated	
	Not Habitat	Habitat	Not Habitat	Habitat
2008	1,210	769	2,365	1,271
2018	1,136	842	2,227	1,408
2048	955	1,023	1,556	2,080

Table 51. Percent of increase or decrease in stand areas for habitat and not habitat in Alternative 2

	Not to be Treated		To be Treated	
	Not Habitat	Habitat	Not Habitat	Habitat
2018	-6	10	-6	11
2048	-16	21	-30	48

Table 52 shows the acres of area classified as “habitat” and “not habitat” for Alternative 3 further subdivided into stands proposed for treatment (To be Treated) and not proposed for treatment (Not to be Treated). Table 53 shows the percent of increase or decrease in stand areas for the area classified as “habitat” and “not habitat” in table 47.

Table 52. Acres of Mexican spotted owl habitat and not habitat for “to be treated” and “not to be treated” stands in Alternative 3

Year	Not to be Treated		To be Treated	
	Not Habitat	Habitat	Not Habitat	Habitat
2008	1,288	916	2,251	1,133
2018	1,259	945	2,003	1,381
2048	1,019	1,185	1,085	2,299

Table 53. Percent of increase or decrease in stand areas for habitat and not habitat in Alternative 3

Year	Not to be Treated		To be Treated	
	Not Habitat	Habitat	Not Habitat	Habitat
2018	-2	3	-11	22
2048	-19	25	-46	67

We note in the tables that: (1) the treatments in both Alternatives 2 and 3 appear to lead to a greater increase in the amount of forest meeting the Mexican spotted owl habitat classification than Alternative 1 does; and (2) Alternative 3 leads to a greater increase than Alternative 2.

Table 54 shows the percent of increase or decrease in stand areas for the area classified as “habitat” and “not-habitat” in table 47.

Table 54. Percent of increase or decrease in stand areas for habitat and not habitat in Alternative 3

Year	Not to be Treated		To be Treated	
	Not Habitat	Habitat	Not Habitat	Habitat
2018	-2	3	-11	22
2048	-19	25	-46	67

We note in the tables that: (1) the treatments in both Alternatives 2 and 3 appear to lead to a greater increase in the amount of forest meeting the Mexican spotted owl habitat classification than Alternative 1 does; and (2) Alternative 3 leads to a greater increase than Alternative 2.

Table 55 displays for Alternative 3 acreages of stands that do not meet the habitat classification and the main reason that they do not meet the classification. We can note in this table results are very similar to those described above for Alternative 2.

Table 55. Forested acreage in Alternative 3 not meeting Mexican spotted owl habitat classification requirements and reason for not meeting the requirements

Year	All	Basal Area and Percent SDI	Basal Area Only	Percent SDI	Trees per Acre > 18 Inches	Trees per Acre > 18 Inches and Basal Area	Trees per Acre > 18 Inches and Percent SDI
2008	649	53	152	1,468	49	204	1,000
2018	579	188	462	1,218		413	504
2048	282	70	109	1,780	16	63	191

Several items of interest in Table 55: (1) acreage in the "Percent SDI" column decreases from 2008 to 2018 which is expected at least partly due to understory stocking reductions increasing the proportion of the SDI in larger size classes; (2) acreage in the "Percent SDI" column increases from 2018 to 2048 which could be due to greatly increased stocking in understory hardwoods, or to trees growing larger and into the next size class resulting in the smaller size class dropping below 10 percent; (3) acreage in all fields involving basal area increases from 2008 to 2018, probably due to tree thinning activities; (4) acreage in the "Trees per Acre > 18 Inches" field increases from 2008 to 2018 in only 3 acres, which could be due to modeled background and prescribed burning mortality; (5) acreage in the "Trees per Acre > 18 Inches" field disappears from 2008 to 2018 which we can speculate that it may have moved to one of the other categories; and (6) acreage in the fields involving trees per acre greater than 18 inches decreased greatly due probably to increased tree growth.

Table 56 displays Alternative 1 acreages of stands that do not meet the habitat classification and the main reason that they do not meet the classification. In this table, the "Basal Area Only" field includes stands that are subdivided into the "Basal Area and Percent SDI" and "Basal Area Only" fields of table 55. We can observe in the table that the acreage not meeting the percentage per size class criteria increases rather than decreases in the action alternatives. This could be due to the stocking increasing in the smaller diameter classes causing the percent stocking in one or more of the three largest d.b.h. classes to fall below 10 percent of the SDI. Acreage in all other fields decreases as expected.

Table 56. Forested acreage in Alternative 1 not meeting Mexican spotted owl habitat classification requirements and reason for not meeting the requirements

Year	All	Basal Area Only	Percent SDI	Trees per Acre > 18 Inches	Trees per Acre > 18 Inches and Basal Area	Trees per Acre > 18 Inches and Percent SDI
2008	684	212	1,463	49	164	1,000
2018	404	92	2,036		146	674
2048	254	132	1,771		29	248

Cumulative Effects on Mexican Spotted Owl

The direct and indirect effects, identified above, generally may impact 15 percent of the Mexican spotted owl known occupied habitat and 2.7 percent of its designated critical habitat within this mountain range. Therefore, given the geographic extent of these effects, for cumulative impacts this analysis will consider the additive impacts of activities that could or have impacted the known occupied and previously occupied habitat of the Mexican spotted owl.

In addition, the potential direct and indirect effects of implementing the Pinaleño Ecosystem Restoration Project are predicted to persist in varying intensities diminishing over the next 30 years. Therefore, for cumulative effects, this analysis will consider effects within the above geographical boundary that will persist or occur during that same time period.

The only activities that have resulted in incidental take statements for the Mexican spotted owl within the area of effect in the past 20 years have been suppression activities implemented during two large-scale wildfires: the Clark Peak Fire of 1996, and the Nuttall Complex Wildfire of 2004. The suppression activities undertaken during the Clark Peak Fire resulted in take of eight spotted owls (1999 – 7,405 acres - AESO/SE #2-21-96-F-286). Suppression activities that occurred during the Nuttall Complex Wildfire (2004 - 29,000 acres - AESO/SE #02-21-04-M-0299) resulted in take of "four adult [spotted owls] and associated young" due to fire suppression activities undertaken by the Forest Service (see figure 40).

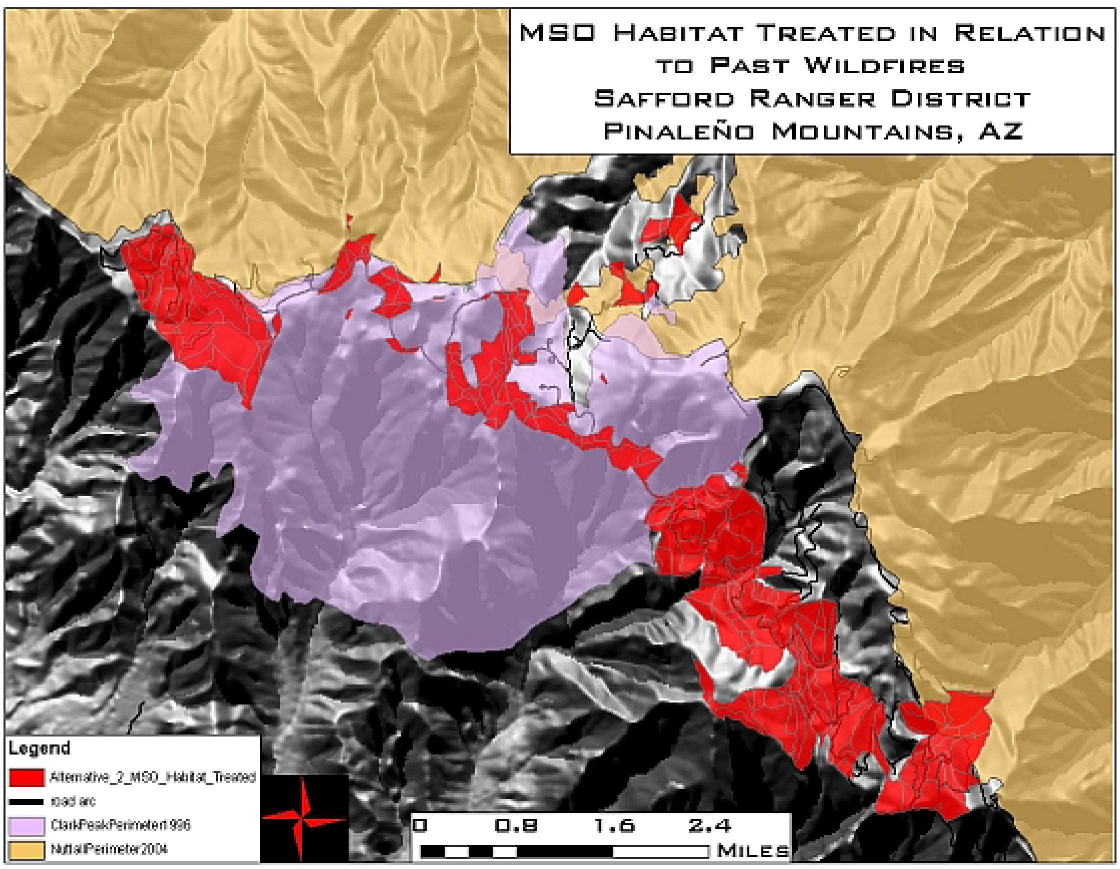


Figure 40. Mexican spotted owl habitat treated in relation to two large wildfires (Clark Peak, 1996 and Nuttall Complex Wildfire, 2004) that occurred in the past 20 years

Additional projects, as described below, have occurred within the area of effect. While any or all of these projects may create some noise disturbance, consultation has resulted in findings of “no effect” or “not likely to adversely affect spotted owls.” The permits for the Columbine and Turkey Flat summer homes are in the renewal process after consultation with the U.S. Fish and Wildlife Service (2008; AESO/SE #22410-2007-F-0163). The 2001 Pinaleño Ecosystem Management Project (2001; 1,000 acres - AESO/SE #2-21-98-F-282) and the special uses area hazardous fuel treatments (2007; 250 acres – AESO/SE #02-21-05-I-0818), were designed and coordinated with other resource protection agencies, including the U.S. Fish and Wildlife Service and Arizona Game and Fish Department, to reduce fuel loading, increase forest health, and encourage return of the natural fire cycle.

Wildland fire has likely resulted in direct mortality of spotted owls as well as damaged or destroyed habitat in forested areas. Proposed treatments will actually decrease the likelihood of wildfires being as destructive as the Nuttall Complex Wildfire and, as such, should offset this threat somewhat in the future.

Scorching of surviving trees and overstocked stands may leave forests increasingly susceptible to insect infestation. In the area of potential effect, the natural frequency and intensity of wildland fire has changed in the past several decades from frequent, low-intensity fires in the understory to catastrophic, high-intensity crown fires that consume thousands of acres of vegetation. Insect populations have devastated the spruce-fir forests and many areas of the mixed-conifer forest, resulting in the presence of few live, large, old trees that provide prime roosting and nesting areas.

Vehicle and foot traffic from recreational use, wood gathering, hunting, and fire patrols often interrupts foraging and other behaviors, and may cause direct mortality or injury of protected species. Other actions that may have contributed to cumulative impacts on owls include roads, recreation, and administrative developments, all of which have fragmented habitat or promoted and increased pressure on populations near recreational uses. Recent research (Swarthout and Steidl 2001 and 2003) suggests that disturbance by hikers, other recreationists, and workers approaching roosting sites may cause harmful effects to Mexican spotted owls. These encounters may result in changes in calling behavior, prey handling, and flushing behaviors, leading to reduced foraging and potentially lowered reproduction. However, with the information available, these effects to owls are impossible to quantify. The majority of proposed actions will occur outside of core areas where owls are likely to perform roosting and nesting activities.

The past actions discussed above have all had impacts on Mexican spotted owls. Because increased traffic, noise, and human presence due to implementation activities will also be a side effect of proposed treatments, the aforementioned effects to spotted owls will likely be additive to those of wildfires, fire suppression activities, recreation, and other uses. There is also potential for torching of limited numbers of trees that could serve as roosts and/or nesting sites during prescribed burning activities. These effects will be additive to those caused by previous and future wildfires.

While these past actions caused both direct and indirect impacts to spotted owls, the current proposed action has incorporated many design features (see appendix A) to minimize direct effects and reduce some of the very threats that cause additional impacts in the future. For example, the silviculture specialist report (Amell 2008) and the fire and fuels specialist report (Hall 2008b) state initial treatments will reduce the density of the forest, canopy cover, fire behavior, and fuel loading for approximately 30 years following treatment; without further treatments, forest conditions and fire risk will begin returning to current levels. Such long-term benefits from a relatively short implementation period are unprecedented in this mountain range. While the potential for impacts during the implementation phase exists as a result of traffic, noise, and other disturbance, having a 30-year or more reduction in the main threats to this subspecies outweighs the temporary potential for short-term (i.e., during the implementation phase) negative effects to the owls.

By design, it is unlikely that effects from the project will begin to approach the devastation caused by past high-intensity wildfires (1996 and 2004) and insect infestations (in the mid-1990s). These two natural processes, occurring at unnatural intensities, have affected over 40,000 acres of the mixed-conifer forest that provide high quality habitat for this subspecies within this mountain range. These impacts have generally resulted in the long-term loss of habitat while the impacts of the proposed treatments will primarily be of short-term temporal disturbance and not loss of long-term habitat.

The goals of the proposed treatments include beneficial effects to the Mexican spotted owl and other listed species, such as a reduction in fuel loading and canopy closure to reduce one of the main threats to this subspecies (e.g., high-intensity wildfire). Tree health should also improve as a result of treatments, where tree density is lowered so that trees are not competing with each other for water and nutrients. Increasing tree health, cone crops, and the mosaic qualities of the mixed-conifer forest should also improve the diversity and abundance of prey available for spotted owls. These goals are directly in line with reducing the threats listed in the Mexican Spotted Owl Recovery Plan (USDI Fish and Wildlife Service 1995).

Past wildfires have removed large parcels of land from productivity as owl habitat, precipitated the need for fire suppression activities, which may also cause harm to owls. Overcrowding of trees has reduced the productivity of existing habitat, by reducing cone crops that may support small mammal populations and by stressing trees to the point that they become prime hosts for insects, which cause widespread forest destruction. Steps must be taken to protect existing occupied habitat, improve unoccupied areas to serve as additional nesting or foraging habitat, and reduce the fire potential of the surrounding lower areas to prevent catastrophic wildfires from spreading into occupied areas. This proposed project provides the first step into a mountain-wide management plan that could potentially do all of these things. While some of the effects will be additive with those of past and ongoing actions, this project will provide benefits to this subspecies for approximately 30 years. The positive effects of this project outweigh short-term negative effects, and the cumulative impacts discussed above, while serious, will not negate the potential for improvements to habitat and the security of Mexican spotted owls in this area.

Direct, Indirect, and Cumulative Effects on Bald Eagle

No bald eagle nesting has been documented within the Pinaleño Mountains. Adult birds occasionally overwinter in the valleys surrounding these mountains, and occasionally individuals will be seen foraging around and west of Riggs Flat Lake, which falls within the project area. Due to road conditions and weather considerations, this lake is generally inaccessible during the winter; it is unlikely that human activities will cause disturbance to foraging birds. No mortality would result from treatments.

Habitat elements, including a variety of trees in which to perch, will be maintained in areas that undergo treatment under Alternative 2. Because thinning will only remove trees up to 18 inches in diameter, high availability of large trees will remain in place, particularly in the areas near Riggs Flat Lake. Habitat preferences will be maintained.

Due to the inaccessibility of Riggs Flat Lake during the winter months, the fact that bald eagles leave the area early in the year, and the retention of many trees suitable for bald eagle perching, Alternative 2 will have **no effect on** bald eagles.

Direct, Indirect and Cumulative Effects on Apache Trout

The main threats to the recovery of Apache trout are related to changes in habitat quality, mainly due to changes in streamside vegetation and unregulated harvest (USDI Fish and Wildlife Service 2007). According to the soils and hydrology specialist report (Lefevre 2008), the Grant Creek watershed (including Grant Creek, Post Creek, and Soldier Creek) was surveyed in 2003 and judged to be in good condition, with 50 percent canopy cover and 97 percent bank protection (i.e., 97 percent of the bank was protected by vegetation). There has been little or no fire activity in this watershed since the survey occurred. This watershed contains some soils impaired by historical use from logging roads. Approximately 24 acres of the entire watershed can be attributed to roaded area, of which 2.9 acres exist in riparian areas. The proposed action would require the creation of some temporary roads that would cause an increase of 0.9 percent of the watershed above current use. (*Note: These acres are summaries for the entire area, which would include roads that are likely far enough from fish habitat that their effects would not directly affect fish in Grant Creek. However, in an effort to be conservative on behalf of the species, these numbers are being used as a high estimate for the wildlife portion of the analysis.)

The proposed action alternative would develop no significant increase in contributing area for runoff or surface erosion in the scope of catchments. Adequate streamside protection zones (currently set at a minimum of 150 feet) and best management practices should effectively prevent rilling and channelized flow, and prevent fine sediment from entering channels above what would occur under the no action alternative. There would likely be some runoff generated by this alternative that would not have occurred if the project were not implemented. However, due to the small increase in the presence of temporary roads and the goal of prescribed burns that minimize the potential for high-severity fire and ensuing runoff events, Alternative 2 **may affect, but is unlikely to adversely affect** the Apache trout.

Direct, Indirect, and Cumulative Effects on Gila Trout

According to the soils and hydrology specialist report (Lefevre 2008), the overall effect of roads is expected to be similar to the existing conditions within the project area. Placement of temporary roads and skid roads during implementation of this alternative would increase the existing watershed impacts by approximately 5 acres in the Ash Creek watershed (or 0.7 percent over current use) and approximately 13 acres (0.9 percent increase from current use) in the Grant Creek watershed. The proposed action would develop no significant increase in contributing area for runoff or surface erosion in the scope of catchments. Adequate streamside protection zones (currently set at a minimum of 150 feet) and best management practices should effectively prevent rilling and channelized flow, and prevent fine sediment from entering channels above what would occur under the no action alternative. Thus, treatment under this alternative provides more erosion protection than the other two alternatives, thereby maintaining water quality for Gila trout.

In addition, use of a group selection thinning prescription should allow for more significant changes in the behavior of wildfires, reducing the likelihood of large-scale, catastrophic wildfires. Use of prescribed burning as a phase of the treatments may cause small ash flows into areas that will eventually be stocked with Gila trout; however, this alternative allows for reintroduction of a natural process into the ecosystem, while allowing managers to plan to make use of natural influences, such as time of year, humidity levels, fuel moisture levels, and wind conditions. By using controlled burning methods, areas can be treated, fuels reduced, and conditions controlled so that large erosion events do not occur as a byproduct.

Due to the small increase in the presence of temporary roads and the goal of prescribed burns that minimize the potential for high-severity fire and ensuing runoff events, **Alternative 2 may affect, but is unlikely to adversely affect Gila trout.**

Direct, Indirect, and Cumulative Effects to Regional Forester's Sensitive Species (RFSS)

Analysis of impacts of Alternative 2 on RFSS is discussed in detail in the Pinaleño Ecosystem Restoration Project wildlife report located in the project file. As the proposed action is not likely to result in a trend toward Federal listing or loss of viability for any of these species, the summary of those findings is excerpted for this analysis. Table 57 lists the RFSS present in the project area and indicates whether the proposed action is predicted to impact them.

Table 57. Regional Forester sensitive species, habitat and effects determinations

Species Name	Habitat Determination	Actions Likely to Impact Species?
		Alternative 3
Mammals		
White-bellied long-tailed Vole	Suitable habitat available.	Implementation of any of the alternatives may impact individuals of this species, but is not likely to result in a Federal trend toward listing of the species or loss of its viability on the forest.
Mexican long-tongued bat	Suitable habitat available.	Implementation of any of the alternatives may impact individuals of this species, but is not likely to result in a Federal trend toward listing of the species or loss of its viability on the forest.
Allens lappet-browed bat	Suitable habitat available.	Implementation of any of the alternatives may impact individuals of this species, but is not likely to result in a Federal trend toward listing of the species or loss of its viability on the forest.
Pale Townsend's big-eared bat	Suitable habitat available.	Implementation of any of the alternatives may impact individuals of this species, but is not likely to result in a Federal trend toward listing of the species or loss of its viability on the forest.
White-nosed coati	Suitable habitat available.	Implementation of any of the alternatives may impact individuals of this species, but is not likely to result in a Federal trend toward listing of the species or loss of its viability on the forest.
Hooded skunk	Suitable habitat available.	Implementation of any of the alternatives may impact individuals of this species, but is not likely to result in a Federal trend toward listing of the species or loss of its viability on the forest.

Table 57. Regional Forester sensitive species, habitat and effects determinations

Species Name	Habitat Determination	Actions Likely to Impact Species? Alternative 3
Birds		
Apache northern goshawk	Foraging habitat available.	Implementation of any of the alternatives may impact individuals of this species, but is not likely to result in a Federal trend toward listing of the species or loss of its viability on the forest.
Peregrine falcon	Foraging habitat available.	No
Flammulated owl	Suitable habitat available.	No
Gould's wild turkey	Suitable habitat available.	No
Invertebrates		
Chiricahua white butterfly	Suitable habitat available.	No
A tiger beetle (*Cicindela purpurea cimerrona*)	Suitable habitat available.	No
Mimic talussnail	Suitable habitat available.	No
Plants		
Coppermine milk vetch	Suitable habitat available.	No
Mock pennyroyal	Suitable habitat available.	No
Arizona alum root	Suitable habitat available.	No
Chihuahuan stickseed	Suitable habitat available.	No
White-flowered cinquefoil	Suitable habitat available.	No
Chiricahua rock cress	Suitable habitat available.	Implementation of any of the alternatives may impact individuals of this species, but is not likely to result in a Federal trend toward listing of the species or loss of its viability on the forest.
Goodding's onion	Suitable habitat available.	Implementation of any of the alternatives may impact individuals of this species, but is not likely to result in a Federal trend toward listing of the species or loss of its viability on the forest.
Shade violet	Suitable habitat available.	Implementation of any of the alternatives may impact individuals of this species, but is not likely to result in a Federal trend toward listing of the species or loss of its viability on the forest.

Direct, Indirect, and Cumulative Effects on Apache Northern Goshawk

If the proposed action is implemented, this species would most likely remain stable, although populations in general are expected to slightly decline because of other factors, including fire suppression, loss of prey habitat, insect and tree disease outbreaks, and loss of nesting habitat due to grazing (AGFD 2003).

Alternative 2 provides prescriptions that may improve habitat conditions for this raptor, but still remain more conservative than those provided in goshawk management guidelines supported by Youtz et al. (2008). The project should result in an increase of the mosaic qualities of the habitat within the project area and, potentially, a positive effect on the abundance and diversity of its primary prey species. Some disturbance of birds is likely to occur as a result of human presence and noise; however, historical monitoring of nesting birds in this mountain range have indicated that nests have not been abandoned despite large-scale wildfires (i.e., Clark Peak Fire of 1996 and Nuttall Complex of 2004) or mid-scale thinning projects. This alternative is not likely to result in a trend toward Federal listing or loss of viability of the species.

Two additional thinning projects (e.g., PEM and SUP) are currently in the planning or implementation stages within this mountain range. The PEM project focuses solely in the understory of the forest, removing trees up to 9 inches in diameter at breast height (d.b.h.). Due to the small size of trees being removed under PEM, it is unlikely that tree removals will greatly affect goshawks. The SUP project will be focused in areas that fall within 300 feet of cabin or electronic sites, and focus mainly in the understory of the forest as well. Some larger trees will also be removed in the Turkey Flat recreation residence area, which may create further small patches of foraging habitat for goshawk prey species.

Direct, Indirect, and Cumulative Effects MIS Species

Alternative 2 is not expected to contribute significantly to changes in the forestwide population of or habitat availability for any MIS that occurs in the analysis area. For a detailed discussion of the effects on MIS, see the Pinaleño Ecosystem Restoration Project wildlife report.

Alternative 3

Direct and Indirect Effects on Mount Graham Red Squirrel

Similar weaknesses and strengths characterize Alternative 3 as those found in Alternative 2. However, because thinning occurs mainly in the understory, both positive and negative effects are somewhat reduced.

In this alternative, there remains potential for individual nests to be removed due to tree felling, for nests to be abandoned, and for harm to individuals due to falling trees and/or debris. Increased traffic will also occur, but to a lesser extent than in Alternative 2. According to the transportation and operations specialist report (Yurczyk 2008), 110,480 total haul miles would be traveled to remove wood byproducts from the project area. This translates to approximately 6,905 round trips of hauling vehicles up and down the Swift Trail area over the life of the project, an average of 690 round trips per year. Based on a 2- to 6-month working period each year, this is an estimated increase of 7 to 21 percent over current traffic levels (an average of 84 vehicles per day). Due to this increase, there is an increased potential for squirrels to be killed due to roadkill events.

Alternative 3 does a poorer job at reducing fire behavior across the landscape, and it takes fewer stands out of the “zone of imminent mortality” than Alternative 2. It also retains the potential for increased raptor populations, though this may be somewhat decreased in this alternative.

However, the major difference between these two alternatives is that of forest structure. Table 58 displays trees per acre within each tree size class and shows just how focused Alternative 3 is on the understory component of the forest. Because of this, more of the smaller trees have to be removed from the forest in order to attain desired SDIs, something that was obtained in Alternative 2 by a balanced removal of trees of different size classes. As a result, the product of Alternative 2 would be a series, and in some cases, large blocks of large trees with a regeneration component interspersed with openings; Alternative 3 would result in a fairly closed canopy, but a very open understory, leaving squirrels with no cover when they are on the ground foraging for dropped conifer cones. In this alternative, not only are predator numbers likely to increase, but predator success is likely to increase as well.

Due to the potential for noise and human disturbance in Alternative 3, as well as potential for mortality resulting from vehicles and from increased abundance of raptors, the biologist has made a determination of "**may effect/likely to adversely affect**" for the Mount Graham red squirrel.

Effects to Critical Habitat

Design features would remain the same for this alternative and, as such, they are likely to limit the effects to many of the components of squirrel habitat. The same elements fall short of recommended measures, with basal areas lower than recommended and reduced numbers of logs. Project design again allows the potential to seize opportunities to provide additional habitat components in areas where snags and additional logs or woody materials are necessary.

Because the majority of habitat components are maintained during implementation of this project, and additional components created when opportunities arise, Alternative 3 **may affect but is not likely to adversely affect** critical habitat for the Mount Graham red squirrel.

Cumulative Effects on Mount Graham Red Squirrel

Cumulative effects would be similar to those detailed in Alternative 2.

Direct and Indirect Effects on Mexican Spotted Owl

Similar weaknesses and strengths characterize Alternative 3 as those found in Alternative 2. However, because thinning occurs mainly in the understory, both positive and negative effects are somewhat reduced.

In this alternative, there remains potential for individual nests to be removed due to tree felling, for nests to be abandoned, and for harm to individuals due to falling trees and/or debris. Increased traffic will also occur, but to a lesser extent than in Alternative 2, as discussed in the Mount Graham red squirrel analysis. Due to this traffic increase, there is an increased potential for owls to be killed due to roadkill events.

Alternative 3 does a poorer job at reducing fire behavior across the landscape, and it takes fewer stands out of the "zone of imminent mortality" than Alternative 2. It also retains the potential for increased raptor populations, though this may be somewhat decreased in this alternative.

However, the major difference between these two alternatives is that of forest structure. Table 58 displays trees per acre within each tree size class and shows just how focused Alternative 3 is on the understory component of the forest. Because of this, more of the smaller trees have to be removed from the forest in order to attain desired SDIs, something that was obtained in Alternative 2 by a balanced removal of trees of different size classes. As with the analysis for the Mount Graham red squirrel, the product of Alternative 2 would be a series and, in some cases, large blocks of large trees with a regeneration component, interspersed with openings; Alternative 3 would result in a fairly closed canopy, but a very open understory, leaving owls with no cover when they are on the ground foraging for prey. In this alternative, not only are predator numbers likely to increase, but predator success is likely to increase as well.

Due to the potential for noise and human disturbance in Alternative 3, as well as potential for mortality resulting from vehicles and from increased abundance of raptors, the biologist has made a determination of "**may effect/likely to adversely affect**" for the Mexican spotted owl.

All design features from appendix A of the Pinaleño Ecosystem Restoration Project wildlife report would apply for Alternative 3; as such, the logic applied above is applicable for this analysis as well. Differences exist in some features of stand structure, including trees per acre (table 58) in each size class, and percent canopy cover (table 59).

Table 58. Average trees per acre (TPA) for custom d.b.h. classes for Alternative 3 – year 2018 and 2048

Year	≥0″ to <6″ d.b.h.	≥6″ <9″ d.b.h.	≥9″ <12″ d.b.h.	≥12″ to <18″ d.b.h.	≥18″ to <24″ d.b.h.	≥24″ d.b.h.	Grand Total
2018	60	20	32	43	23	18	182
2048	31	11	19	45	26	16	149

Table 59. Percent canopy cover for Alternative 3 in 2008, 2018, and 2048

Year	Percent CC >9″	Percent CC ≥9V to <18″	Percent CC ≥18″	Total Percent CC
2008	26	26	17	54
2018	9	24	19	44
2048	7	23	29	49

These tables show that Alternative 3 results in trees larger than 12 inches diameter composing an average of 46 to 58 percent of the total number of trees in the remaining stands (Silviculture specialist report, Amell 2008). The percent canopy cover retained under this alternative exceeds the 40 percent recommendation of the primary constituent elements.

Because no trees larger than 9 inches in diameter would be removed under this alternative, Alternative 3 would have **no effect** on the primary constituent elements of critical habitat for Mexican spotted owls.

Direct, Indirect, and Cumulative Effects on Bald Eagle

No bald eagle nesting has been documented within the Pinaleño Mountains. Adult birds occasionally overwinter in the valleys surrounding these mountains, and occasionally individuals will be seen foraging around and west of Riggs Flat Lake, which falls within the project area. Due to road conditions and weather considerations, this lake is generally inaccessible during the winter; it is unlikely that human activities will cause disturbance to foraging birds. No mortality will result from treatments.

Due to the inaccessibility of Riggs Flat Lake during the winter months, the fact that bald eagles leave the area early in the year, and the retention of many trees suitable for bald eagle perching, Alternative 3 would have **no effect** on bald eagles.

Direct, Indirect, and Cumulative Effects on Apache Trout and Gila Trout

While treatments differ between Alternative 2 and Alternative 3, actual ground disturbance varies little. While the total disturbed area under Alternative 2 (including current uses) is expected to be 5.6 percent, under Alternative 3 it is expected to be 5.1 percent (soils and hydrology specialist report, Lefevre 2008). It is unlikely that this small difference would cause significant variation in the amount of erosion generated by the project.

There would likely be some runoff generated by this alternative that would not have occurred if the project were not implemented. However, due to the small increase in the presence of temporary roads and the goal of prescribed burns that minimize the potential for high-severity fire and ensuing runoff events, Alternative 3 **may affect, but is unlikely to adversely affect** the Apache trout and Gila trout.

Direct, Indirect, and Cumulative Effects to Regional Forester's Sensitive Species

Impacts to these species are similar to those disclosed in Alternative 2.

Direct, Indirect, and Cumulative Effects on MIS Species

Alternative 3 is not expected to contribute significantly to changes in the forestwide population of or habitat availability for any MIS that occurs in the analysis area. For a detailed discussion of the effects on MIS, see the Pinaleño Ecosystem Restoration Project wildlife report.

Air Quality

Introduction

This analysis describes the desired and existing condition of the air quality resource within the project area and evaluates the potential effects of the proposed action and no action alternatives.

Overview of Issues

There is a concern that the proposed project will negatively affect air quality. The measurement indicator for this issue will be the predicted smoke emissions on sensitive receptors and how they compare to regulatory standards and requirements.

Affected Environment

Arizona is divided into 11 airsheds by the Arizona State Air Quality Bureau (appendix A of the air quality report, Hall 2008). The project area lies entirely within Upper Gila River Airshed (7). Smoke produced within the analysis area would most likely be carried in a north, northeast direction by the predominantly south and southwest wind flow pattern that influences the project area.

The Upper Gila River Airshed is influenced predominantly by smoke and dust originating from the desert. Smoke emissions result from wildfires and prescribed fires by private and other government entities. Wildland fires burning south from Mexico contribute to air quality degradation. Dust, originating from tilled farmland during dry windy weather, can add to local haze and reduce air quality.

Under the current State and Federal rules, wildland fires are considered natural events so the smoke they produce is not considered a violation of air quality standards or visibility protection goals. Conversely, prescribed fires are considered active management so the smoke produced is considered as an impact on air quality and visibility standards.

Particulate Matter and Public Health

Sources of emissions that contribute to the particles in the atmosphere that cause visibility impairment fall into two broad classes: natural sources of emissions and human-caused (or anthropogenic) sources of emissions.

Natural sources of emissions include a wide variety of pollutants that are emitted to the atmosphere. Wildfire emissions include primarily fine particulates (organic carbon, elemental carbon, and fine soils), course soils, oxides of nitrogen, and volatile organic compounds. Volcanic activity produces fine and course soils and, in many instances, sulfur dioxide. High winds can create emissions from natural undisturbed lands that contain primarily coarse and some fine soils.

Human-caused sources of emissions also contribute to visibility impairment. Point sources (such as utility boilers, smelters, industrial boilers, and refineries) produce the majority of the sulfur dioxide in the region, and about 25 percent of the oxides of nitrogen (RHSIP 2003). Mobile sources (such as cars, trucks, off-road equipment, trains, and planes) produce the majority of the oxides of nitrogen in the Grand Canyon Visibility Transport Commission (GCVTC) region and half of the human-caused volatile organic carbon emissions. In addition to direct emissions from mobile sources, road dust can be an important source of course and fine soil emissions. Finally, area sources (which make up all the other source types not discussed above) generate a broad range of emissions of all pollutants of interest for visibility and can be important especially in large population centers.

Wildfires emit the same pollutants as prescribed fires. In general, emissions from wildfires are greater per acre burned and often occur at times when climatic conditions such as wind direction may carry smoke directly into sensitive areas.

Occasional brief exposure of the public to low concentrations of drift smoke is more of a temporary, short-term nuisance than a health concern. However, high smoke concentrations of long duration (greater than 24 hours) can be a serious health matter, particularly near health care facilities or homes of people with respiratory illnesses. Chronic exposure to relatively low smoke concentrations can contribute to respiratory problems and cancer. The risk of developing cancer from exposure to prescribed fire has been estimated to be less than 1 in 1 million (USDA Forest Service 1989).

Smoke exposure among wildland firefighters has been associated with adverse health effects ranging from acute irritation and shortness of breath to headaches, dizziness and nausea lasting up to several hours; however, these are uncommon events (Reinhardt and Ottmar 2000).

Existing Condition

Smoke-sensitive Areas

A general list of sensitive receptors that could be impacted by smoke in or near the project area is shown in table 60. A general overview of the potential impact area can also be viewed in appendix B of the air quality report, Hall 2008.

Table 60. Summary of sensitive receptors adjacent to or near the project area

Sensitive Receptors	Direction to Location of Potential Receptor	Approximate Distance (miles) from Project Area to Potential Receptor
Safford Community	NE	9 miles
Pima Community	N	12 miles
Thatcher Community	N	10 miles
Galiuro Wilderness (Class 1 Wilderness)	W	20 miles
Santa Teresa (Other Wilderness)	NW	16 miles
U.S. Highway 70	NE	9 miles
U.S. Highway 91	E	6 miles
Interstate Highway 10	S	30 miles
Recreation Areas, Campgrounds and Picnic Areas	Adjacent and within	0.1 – 5 miles
Astrophysical Site	Adjacent and within	0.2
Arizona Bible Camp	Adjacent and within	0.1
Columbine Administrative Site	Adjacent and within	0.1

Desired Condition

Federal, State and Local Regulations and Standards

The framework for controlling air pollutants in the United States is mandated by the 1970 Clean Air Act, as amended in 1977 and 1990 (42 U.S.C. §7401 et seq.). The act was designed to “protect and enhance” the quality of the Nation’s air resources. The act encourages reasonable Federal, State and local government actions for pollution prevention.

State implementation plans (SIPs) are developed by each state to implement the provisions of the act. The SIPs describe the State's actions to achieve and maintain the National Ambient Air Quality Standards (NAAQS).

Many State and local air quality regulations stem from provisions of the Clean Air Act. These include:

- National and State Ambient Air Quality Standards
- General Conformity Rule (1990 Clean Air Act Amendments) (Section 176 (c) of the Clean Air Act (part 51, subpart W, and part 93, subpart B)
- Regional Haze Rule (1990 Clean Air Act Amendments), 40 CFR Part 51
- The Interim Air Quality Policy on Wildland and Prescribed Fires (U.S. EPA 1998)
- Arizona Department of Air Quality (ADEQ) regulations
- "Coronado National Forest Land and Resource Management Plan" standards and guidelines for air quality

Detailed information on these regulations and standards are contained in the air quality report located in the project file (Hall 2008).

Monitoring

The Arizona Department of Environmental Quality (ADEQ), local agencies, and Federal land managers at Arizona's 12 Class I areas are cooperatively operating a visibility monitoring network to track impairment of visual air quality. The intent of this visibility monitoring operational plan is to characterize long-term trends in all Arizona Class I areas as completely as possible using ambient visibility measurements, within constraints of an area's size, terrain, or logistics, for each of the 12 federally protected Class I areas in Arizona.

The EPA's air quality index (AQI) rates air quality in the vicinity of the project area as "good" most of the time. Table 61 displays sampled AQI values for Graham County except for 1998. The AQI is a system for measuring and rating pollution levels for five of the six "criteria" pollutants regulated under the Clean Air Act.

Table 61. Air quality index (AQI) for Graham County

Graham County Air Data Monitor-AQI Report				
Year	**Days Monitored**	**Good Days**	**Moderate Days**	**Unhealthy Days**
1997	45	43	2	0
1999	31	25	6	0
2000	42	39	3	0
2001	59	58	1	0
2002	58	57	1	0
2003	60	57	3	0
2004	61	60	1	0
2005	53	53	0	0
2006	57	57	0	0
2007	60	59	1	0

Found on the Web at http://www.epa.gov/air/data/index.html

Environmental Consequences

Methodology

The Smoke Impact Spreadsheet (SIS) model was used to calculate particulate matter (PM) emissions and concentrations downwind of a prescribed fire proposed in both action alternatives by assessing a typical prescribed burn (see air quality report, Hall 2008). SIS conservatively predicts (that is, estimates higher than actual) downwind PM concentrations for comparison with appropriate Federal or State air quality standards. Particulate matter air pollution refers to microscopic airborne particles made up of dust, dirt, soot, smoke, sulfates, nitrates, and liquid droplets. PM can vary in size, but according to the EPA, particles less than 2.5 micrometers in diameter ($PM_{2.5}$) are believed to pose the greatest risks to human health.

Due to the small size of $PM_{2.5}$, it can travel longer distances and has a longer life than coarse particulate matter. Health problems can be caused by $PM_{2.5}$ especially for people suffering from cardiopulmonary illnesses. Federal Ambient Air Quality Standards are set at levels intended to protect the public health. Particulate concentrations that exceed health standards may occur for several miles downwind of prescribed burning activities.

The effects area for air quality has varying scales. When looking at the smoke sensitive and Class 1 areas, a maximum perimeter distance of 50 miles was considered. The timespan for effects analysis of air quality is 1 to 2 days because unlike most industrial and urban sources, prescribed fire smoke is usually transitory in nature, lasting only 1 or 2 days at a single location.

Alternative 1 - No Action

Direct and Indirect Effects

This alternative has no planned silvicultural or fuels reduction treatments, therefore, it would have no immediate direct adverse effects on air quality. This alternative does not include prescribed burning and, therefore, would have negligible potential for affecting air quality other than that which may occur under a wildfire situation. Impacts from dust, vehicle emissions, and other sources would not change from current conditions.

Indirectly, large wildfires could occur with the natural accumulation of fuels. Emissions from wildfire may also occur over a period of a few days to several weeks as opposed to intermittent days over several years for a prescribed fire project.

Cumulative Effects

It is assumed past activities would have had some effect on the air quality of the area; however, those effects are gone and cannot be viewed cumulatively. If a wildfire occurred, there is potential for the NAAQS to be exceeded depending on the size and duration of the wildfire. If a large wildfire were to occur, the Forest Service and ADEQ would probably restrict all regulated burning. However, effects of smoke from a large wildfire could become cumulative with present and foreseeable activities or combined with unregulated pollutants in the area, such as dust from roads.

Alternatives 2 and 3

Alternatives 2 and 3 propose mechanical and thinning, mastication, hand pile and burning, and prescribed understory burning over a 10-year period. Under these alternatives, two categories of activities may contribute to air quality impacts if implemented. Both categories of activities would result in temporary, transient impacts to local, and possibly regional, air quality. The first involves dust from ground disturbances that may be associated with thinning, mastication, and removal activities. The second activity is from prescribed underburning and pile burning.

Direct and Indirect Effects

Alternatives 2 and 3 would have a direct, short-term impact on air quality in the project area. Management activities proposed under these alternatives would likely cause direct short-term impacts from dust. Specifically these activities involve chipping, chewing, and grinding of live and dead vegetation, loading and processing activities at landing sites, and truck transportation of material. These activities are not anticipated to result in significant impacts to regional air quality because of the transitory nature of fugitive dust and because mitigation measures such as road watering would be applied.

Management activities proposed under these alternatives would also generate short-term impacts from smoke resulting from prescribed understory burning and hand pile burning. The largest unit planned for burning under these alternatives is approximately 200 acres in size. Modeling considered the impacts of a burn this size occurring over a 24-hour period. Results of modeling are shown in table 62. Modeled $PM_{2.5}$ concentrations are projected to be below the Federal Ambient 24-hour standard, therefore, the standards for public health established by the EPA for NAAQS ($PM_{2.5}$) would not be violated under these alternatives.

Receptors located within the project analysis area such as campground areas, the Arizona Bible Camp and the astrophysical site may experience higher concentrations of $PM_{2.5}$ during the course of burning as indicated above and, depending on air movement, may be impacted by inversions in the evenings.

The closest Class 1 airshed (Galiuro Wilderness) lies to the west. Modeling shows there would be no significant impacts to this or any other Class 1 airshed resulting from this project.

Table 62. Concentrations of $PM_{2.5}$ in areas of concern

Sensitive Receptors	Direction to Location of Potential Receptor	Approximate Distance (miles) from Project Area to Potential Receptor	24-hour $PM_{2.5}$ ($\mu g/m^3$) Concentration of $PM_{2.5}$ at the Area of Interest
Safford Community	NE	9 miles	<1
Pima Community	N	12 miles	<1
Thatcher Community	N	10 miles	<1
Galiuro Wilderness (Class 1 Wilderness)	W	20 miles	<1
Santa Teresa (Other Wilderness)	NW	16 miles	<1
U.S. Highway 70	NE	9 miles	<1

Table 62. Concentrations of $PM_{2.5}$ in areas of concern

Sensitive Receptors	Direction to Location of Potential Receptor	Approximate Distance (miles) from Project Area to Potential Receptor	24-hour $PM_{2.5}$ ($\mu g/m^3$) Concentration of $PM_{2.5}$ at the Area of Interest
U.S. Highway 91	E	6 miles	<1
Interstate Highway 10	S	30 miles	<1
Recreation Areas, Campgrounds and Picnic Areas	Adjacent and within	0.1 – 5 miles	25
Astrophysical Site	Adjacent and within	0.2	25
Arizona Bible Camp	Adjacent and within	0.1	25
Columbine Administrative Site	Adjacent and within	0.1	25

The National and Arizona 24-hour ambient air quality standards for $PM_{2.5}$ is 35 $\mu g/m^3$

The action alternatives would produce some smoky days in the local area. Some smoke would be expected to settle into the lower draws and drainages during the evening hours following a burn. The dominate winds are generally from the south and southwest, therefore, there is some possibility of transitory smoke in the direction of the communities of Safford, Pima and Thatcher. Because of distance and the difference in elevation, it is more likely that smoke from these activities on Mount Graham will be transported over the top and away from these communities. Impacts in the form of nuisance smoke, smell or haze may be experienced in these communities under the worst-case scenario.

Prescribed burning would be conducted when weather conditions are predicted to produce good-to-excellent smoke dispersal. Pertinent smoke impact mitigation measures would be applied, as outlined in this document. The effect on air quality is expected to be short term because once the smoke has dispersed, the emissions are diluted and transported from local airsheds. Careful application of mitigation measures as noted in the document should ensure compliance with the NAAQS. Permits are issued by the ADEQ only if conditions are favorable for burning.

Although difficult to measure, an indirect beneficial effect from proposed treatments is a reduction in the emissions that would be released from wildfires in the area (Ottmar 2001 p. 159). If a high-intensity crown fire were to occur, the amount of live fuel that could burn would tend to release high amounts of particulate matter. By removing the small diameter surface fuels with controlled low intensity prescribed fire, the potential of a high intensity catastrophic fire developing within the stands would be reduced significantly.

Cumulative Effects

Proposed management activities under Alternatives 2 and 3 combined with past, present, and foreseeable activities would contribute to the emissions that effect air quality. These alternatives and their impacts on air quality are difficult to address in terms of cumulative effects. Large fires have occurred near the project area over the past century as described above; however, those effects on air quality are gone and cannot be viewed cumulatively. If a wildfire occurred, there is a potential for the NAAQS to be exceeded depending on the size and duration of wildfire.

It is acknowledged that multiple prescribed burn activities, occurring at the same time, could cumulatively increase particulate levels. Generally, the effects of one burn activity are completed before another burn activity begins. Impacts to air quality would generally be confined to no more than a few hours or at most a few days. The cumulative effect of prescribed fire on air quality is rather short lived, because once the burn is over and the smoke has dissipated, the effect is over.

The effects of the proposed action from smoke are not likely to have cumulative effects with other activities in the airshed given the oversight by the ADEQ that allows for good smoke dispersion. Daily regulation of the amount of burning is managed to reduce impacts and negative effects of smoke. The number of days to accomplish prescribed burning in this project would compete with other burning in the airshed on any given day. The Forest Service would be responsible for establishing burn priorities and the ADEQ would be responsible for managing all the burning on a given day. If air quality is exceeding thresholds when proposed activities are scheduled to occur, implementing either one of these alternatives may result in some delays in burning as a result of this increased demand for "air space."

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Because of extensive air quality monitoring and regulation, all alternatives would comply with Federal, State and local regulations and standards, and would not be likely to cause any significant air quality impacts.

Soils

Introduction

This analysis describes the desired and existing condition of the soil resource within the project area and evaluates the potential direct, indirect, and cumulative effects of the proposed action and no action alternatives.

Overview of Issues

No significant issues pertaining to soils were defined during scoping (chapter 1, p. 13).

Affected Environment

Geology

The Gila River-Stockton Wash portions of this project and the highest elevation areas of the Post Creek, Grant Creek, and Big Creek drainages, found in the Willcox Playa watershed, are composed of granite. The remainder of the project, including all the Gila River – Cottonwood Wash portion and Babcock and Goudy as well as the lower elevations of the Post Creek, Grant Creek, and Big Creek drainages of the Willcox Playa watershed is underlain by gneiss.

Existing Condition

Soil Types and Condition

The project area is comprised of three general ecosystem survey (GES) units, which are summarized below in table 63 and all of them are within the Low Sun Cold (LSC) climatic gradient (USDA Forest Service 1991). Characteristics of each of these soils are summarized in table 64. Soil types and their geographic positions are summarized in figure 41.

Table 63. General ecosystem survey unit acres

GES Unit 451		GES Unit 466		GES Unit 476		Total	
Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
1,200	21	2,905	50	1, 646	29	5, 751	100

Table 64. General ecosystem survey unit descriptions

GES UNIT	Average Gradient Percent	Surface Texture/ Modifier	Soil Depth	Parent Material	Erosion Hazard
451	25	Very Gravelly/Sandy Loam	Deep	Granites	Moderate
466	4 to 25	Very Gravelly/Sandy Loam	Deep	Granites	Slight
476	60 to 100	Extremely Cobbly/Sandy Loam	Deep	Granites	Moderate

The most recent soil condition field monitoring data was collected in 2001, using the protocols from the Forest Service Handbook 2509.18-99-1 R3 Supplement titled "Soil Management Handbook" (USDA Forest Service 1999a). Soil conditions are approximate as it was not possible to visit all of the project area. Conditions were determined by evaluations field inspections, Digital Elevation Models (DEMs), aerial photo interpretation, personal observations, GES data, slope characteristics and topographic maps. Approximately 19 percent of all the acres in the project area are on over 40 percent slope (table 65).

Table 65. Acres and percent of different slope gradients

0-20 Percent		20-40 Percent		40+ Percent		Total
Acres	Percent	Acres	Percent	Acres	Percent	Acres
1,898	33	2,761	48	1,092	19	5,751

Soil condition monitoring evaluated existing soil quality, based on interpreting factors that affect soil stability, soil hydrology and nutrient cycling, all of which are interrelated (USDA Forest Service 1999a). These functions are defined as follows:

- **Soil Hydrologic Function**. The ability of the soil to absorb, store, and transmit water, both vertically and horizontally. This function is assessed by evaluating or observing changes in surface structure, surface pore space, consistence, bulk density, and infiltration or penetration resistance. Increases in bulk density or decreases in porosity results in reduced water infiltration, permeability, and plant available moisture.

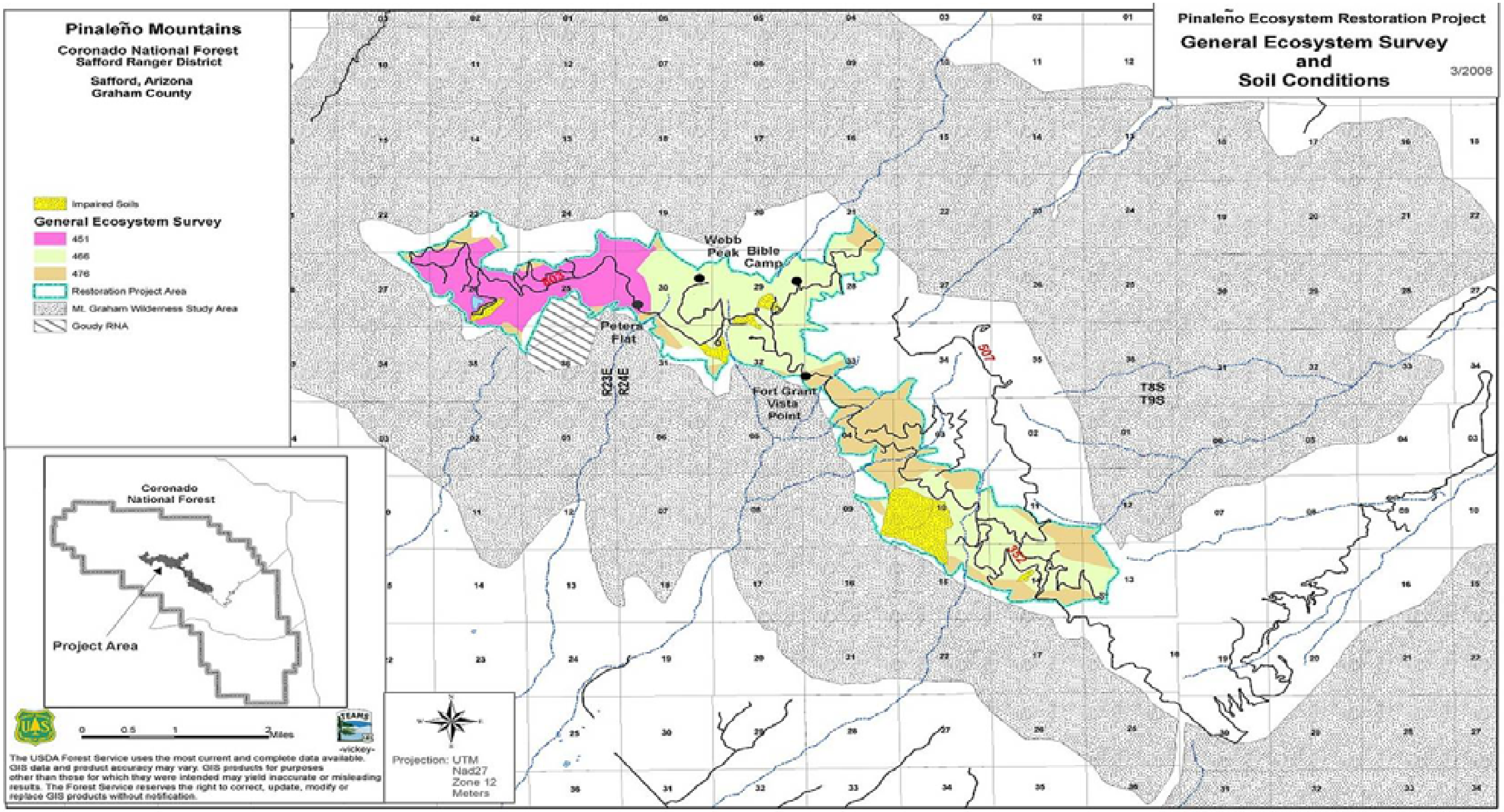


Figure 41. General ecosystem survey units and locations

- **Soil Stability.** The ability of the soil to resist erosion. Soil erosion is the detachment, transport, and deposition of soil particles by water, wind or gravity. Vascular plants, soil biotic crusts, and vegetation ground cover are the greatest deterrent to surface soil erosion. Visual evidence of surface erosion includes sheets, rills, and gullies; pedestalling, soil deposition, erosion pavement, and loss of the surface "A" horizon. Erosion models may also be used to predict onsite soil loss.
- **Nutrient Cycling.** The ability of the soil to accept, hold and release nutrients. This function is assessed by evaluating vegetative community composition, litter, coarse woody material, root distribution, and soil biotic crusts. These indicators are considered an important source of soil organic matter, which is essential in sustaining long-term soil productivity. It provides a carbon and energy source for soil microbes, stores and provides nutrients needed for the growth of plants and soil organisms, and by providing for cation and anion exchange capacities.

The definitions for soil condition ratings are as follows:

- **Satisfactory.** Indicators signify that soil function is being sustained and soil is functioning properly and normally. The ability of the soil to maintain resource values and sustain outputs is high.
- **Impaired.** Indicators signify a reduction in soil function. The ability of the soil to function properly and normally has been reduced and/or there exists an increased vulnerability to degradation. An impaired category indicates there is a need to investigate the ecosystem to determine the cause and degree of decline in soil functions. Changes in land management practices or other preventative measures may be appropriate.
- **Unsatisfactory.** Indicators signify that a loss of soil function has occurred. Degradation of vital soil functions result in the inability of the soil to maintain resource values, sustain outputs, or recover from impacts. Unsatisfactory soils are candidates for improved management practices or restoration designed to recover soil functions.

The project area was surveyed for soil impacts from past logging, road building, recreation, grazing, off-road vehicles, firewood cutting, wildfire, and fuel reduction. Total detrimental disturbance observed ranged from 0 to 70 percent. Observed soil disturbance included surface structure alteration, compaction, visible erosion, and poor root distribution. With the exception of the Grant Hill area (Big Creek and Grant Creek drainages), old logging areas were not identified as having impaired soils. Isolated locations outside impaired soil areas where old logging roads have washed out were identified by the project logging and removal specialist (Yurczyk 2008). Recreation was identified as the cause for soil compaction in the Riggs Flat Lake area (Babcock Canyon drainage) and Snow Flat area (Big Creek drainage), as was grazing in the meadow near Columbine Work Center (Soldier Creek drainage). Off-road vehicles have caused very limited compaction and soil surface disturbance in the vicinity of the Old Columbine summer home tract (Ash Creek drainage).

Present soil condition ratings are summarized in table 66. Data analysis indicates that satisfactory conditions cover about 93 percent of the project area, indicating that soils are functioning properly and retain their inherent productivity. The remaining 7 percent of the area is impaired, and is comprised of old logging areas, system roads, meadows, or campgrounds. These soils have a reduced ability to function properly, due to compaction from either historical or current use. There is no evidence of declining conditions.

Table 66. Soil condition ratings (acres)

Satisfactory Soil Condition		Impaired Soil Condition		Unsatisfactory Soil Condition		Total
Acres	Percent	Acres	Percent	Acres	Percent	Acres
5,331	93	420	7	0	0	5,751

No current detrimental disturbance of soil was attributed to firewood cutting, wildfire, or fuel reduction projects. Table 67 summarizes the amount of past harvest and burn severity within the project area. Big Creek has had almost 100 percent of its area harvested. Twenty-one percent of the drainage has impaired soils, but fires in 2004 and 2006 did not result in areas of high burn severity. Goudy Canyon is at the other end of the spectrum, with zero percent of the drainage involved in past harvest but 16 percent of its area rated as high burn severity after the 1996 fire. The other drainages are within these two extremes.

Table 67. Summary of past harvest and of burn severity in analysis drainages

Drainage	Percent of Drainage in Past Harvest	Year of Last Harvest	Percent of Drainage with High Burn Severity – 1996	Percent of Drainage with High Burn Severity – 2004	Percent of Drainage with Impaired Soil
Big Creek	99%	~1985	0%	0%	21%
Marijilda Creek	74%	1993	0%	1%	0%
Grant Creek (including Post and Soldier)	98%	Pre-1980	9%	0%	22%
Goudy Canyon	0%	Not logged	16%	0%	2%
Babcock Canyon	99%	1993	6%	2%	5%
Lefthand Canyon (including Hells Hole, and Blair)	99%	Pre-1980	<1%	3%	0%
Ash Creek	99%	Pre-1980	4%	0%	4%

All of the soils in the project area have slight or moderate erosion potential (table 64). Historic logging and recent wildfires have reduced ground cover in some areas, increasing the potential for accelerated erosion. The historic logging areas assessed had no observed difference in ground cover compared to unlogged areas.

Recent wildfires include the Clark Peak Fire in 1996, which occurred on 424 acres within the project area and the Nuttall-Gibson Complex in 2004, which occurred on 170 acres within the project area. Burn severity indicates the amount of heat energy released by a fire, and how it affects various resources. Burn severity is dependent upon the type of fuel and behavior when they burned. The BAER soils report for the Nuttall-Gibson Complex gave characteristics of high severity burn for that fire, as a complete consumption of canopy and ground fuels occurred (USDA Forest Service 2004b).

Areas of moderate burn severity are characterized by partial consumption of canopy and ground fuels, and scorched needles falling to the ground providing ground cover. In low burn severity, incomplete canopy and ground fuel consumption leaves adequate effective ground cover to prevent accelerated soil erosion. Field reconnaissance in the project area after the 2004 Nuttall-Gibson Fire found areas of high and moderate burn severity with reduced levels of ground cover (USDA Forest Service 2004b). These areas are in GES Unit 451, which has moderate erosion hazard, and GES Unit 466, which has slight erosion hazard. Figure 42 is an example of an area assessed as moderate burn severity in 2004. The photograph was taken in 2006. Table 68 shows the units with significant area that burned at moderate or high severity in 1996 and 2004.

Aerial seeding and some mulching was conducted in the summer of 1996 on the Clark Peak Fire and the summer of 2004 on the Nuttall-Gibson Complex on virtually all high-severity burn areas in the project area at levels that would be considered heavy (USDA Forest Service 2004b).

During field visits by the forest watershed program manager of recent fires such as the Nuttall, there was very little evidence of rilling or other signs of accelerated erosion on exposed mineral soil surface. Some very occasional evidence of overland sheet wash was seen in the windrowing effect of litter. Similarly, there was no overt sign of recent erosion such as deposits behind down wood, tree boles, etc., that could be differentiated from soil creep.

Table 68. Project units that burned in 1996 and/or 2004 and associated burn severity

Project Units	Year Burned	Burn Severity
80, 182, 184, 349, 367, 439, 477, 534, 535, 553	1996	Moderate
366	1996	High, Moderate
92, 103, 105, 108, 112, 113, 145, 156, 159, 203, 210, 299, 301, 309, 323, 324, 330, 331, 332, 334, 382, 384, 385, 402, 444, 448, 465, 476, 480, 481, 482, 487, 489, 490, 527, 528, 529, 530	1996	High
189, 224, 230, 445, 447, 451	1996 & 2004	High Moderate
3,4,6,9,10,17,182, 184,	2004	Moderate
4, 238, 243, 251	2004	High, Moderate
231, 232, 242	2004	High

Desired Condition - Soils

No desired future conditions for soil resources are directly identified in the Forest Plan. The Forest Plan standards and guidelines for soil resources, which are applicable to all areas of the forest, includes (Forest Plan, p. 38): “Through management services, provide information to minimize disturbance and improve already disturbed areas. BMPs would be used to minimize the time of recovery to a satisfactory erosion level, minimize soil productivity loss, improve water quality, and minimize channel damage.”

Figure 42. A moderate burn severity area in 2006 (2 years after the fire)

Monitoring

The Region 3 Nonpoint Source Intergovernmental Agreement with the State of Arizona (Arizona Department of Environmental Quality 1990) requires the forest to implement a best management practices (BMPs) monitoring strategy. This includes BMP implementation monitoring to ensure practices are correctly applied. In cooperation with the State of Arizona, the Coronado National Forest would use the following process:

1. Select and design BMPs based on site-specific conditions;
2. Implement and enforce BMPs; and
3. Monitor to ensure that practices are correctly applied as designed.

Units of measurements for monitoring are percent of activity area and percent of effective ground cover. The following monitoring tasks are similar to those of previous monitoring of forest activities that helped in analysis of this project, and are designed to assess adherence to forest plan standards and State water quality standards.

- Detrimental soil impacts would be monitored to check how closely they were predicted. About 25 percent of the ground-based removal units would be sampled within 3 years of completion of activities. This would show the cumulative effects of harvest plus fuels treatment.

- Five percent of activity areas by harvest system will be monitored to ensure BMPs are being implemented. Monitoring would be done by the district forester, forest hydrologist, silviculturist, or trained technicians after completion of the project.
- Monitor 10 percent of units adjacent to riparian areas to ensure adequate buffering of mechanized harvest/fuels reduction activities.

Forest Service soil and water conservation practices, or BMPs, have been designed to protect and restore watershed resources (USDA Forest Service 1990). BMPs have been approved by the Environmental Protection Agency (EPA) as the most effective way to protect water quality from impacts stemming from nonpoint sources of pollution. Throughout the Forest Service, BMPs have been developed over time based on research, monitoring, and modification to ensure the measures are effective (Burroughs and King 1985; Burroughs and King 1989; Burroughs 1990; Seyedbagheri 1996; Schuler and Briggs 2000; USDA Forest Service 2002a).

Consistency with Direction and Regulations

This project would be consistent with forest direction and with service-wide regulations for soil and water resource protection.

The Coronado National Forest Plan (Forest Plan) standards for soil conservation follow Region 3 guidelines. BMPs are used to ensure standards are met for this project (see appendix A). The Forest Service is directed to comply with State requirements in accordance with the Clean Water Act for protection of waters of the State of Arizona (ADEQ Contract No. HH-1037). This is accomplished through planning, application, and monitoring of BMPs, which are recognized as the primary means to control nonpoint source pollution on Forest Service lands. The proposed actions incorporate project design features that would ensure compliance with these regulations.

Environmental Consequences

Methodology

Region 3 soil quality protocols were used by the forest watershed and forest staff, and the project biomass removal specialist, to assess soils in tractor ground in the proposed project area (USDA Forest Service 1999a). This provided estimations of residual impacts from past harvest. Channel conditions within the project area were evaluated using data collected in 2003. Data was collected using the Region 3 Riparian Area Survey and Evaluation System (USDA Forest Service 1989a).

Spatial and Temporal Context for Effects Analysis

Direct and indirect effects discussion is for a period of less than 10 years. The analysis area for soil is the area within the project boundary.

Connected Actions, Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

This analysis considered actions listed at the beginning of chapter 3 as well as other foreseeable future activities in the project area including:

- firewood cutting
- recreation (camping, hunting);
- use and maintenance of forest roads
- communication sites and fire lookouts; recreation residences
- fire suppression
- grazing
- noxious weed spraying

Fire suppression occurs randomly. The other actions listed above occur more or less on a yearly basis, and do not directly and significantly impact soils either in the detrimental removal of soil organic matter and ground cover, or by adversely altering hydrologic function to cause accelerated compaction. These actions represent the majority of past actions and are within standards stated by the Forest Plan guidelines

Alternative 1 - No Action

Soil Erosion and Detrimental Disturbance

Residual impacts from past harvest would diminish over time. Areas burned in the 2004 Nuttall-Gibson and 1996 Clark Peak Fires would continue to recover, as indicated by existing substantial regrowth of native vegetation, resulting in improved cover.

Cumulative Effects

Future foreseeable actions in the project area are listed above. None of these actions in themselves or in combination with effects of the no action alternative would have a cumulative effect on soil condition.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Alternative 1 complies with the Forest Plan and other relevant laws, regulations, policies, and plans.

Alternatives 2 and 3

The proposed action has a variety of treatments proposed for units on each GES unit represented (table 69). Alternative 3 differs from Alternative 2 by limiting the thinning of live trees to those less than 9 inches in diameter at breast height (tables 70 and 71). Product removal and burning are components of the proposal that have the potential to modify soil characteristics. In these respects, yarding systems, slash disposal, harvest volume, and the treatment within units are very similar among Alternatives 2 and 3 (tables 72, 73, and 74).

Table 69. Alternative 2 acres of treatment types by GES unit

Treatment	GES Unit 451	GES Unit 466	GES Unit 476	Total
Forest Restoration – General Prescription	315	716	657	1,688
Forest Restoration – Modified Treatment Area	40	70	144	254
Important Wildlife Area – General Prescription	305	490	170	965
Important Wildlife Area – Modified Treatment Area	31	60	13	104
Fuels Treatment Only	153	377	147	677
No Treatment	356	1,192	515	2,063
Total	1,200	2,905	1,646	5,751

Table 70. Alternative 3 acres of treatment types in each GES unit

Silvicultural Treatment	GES Unit 451	GES Unit 466	GES Unit 476	Total
Forest Restoration – General Prescription	0	0	0	0
Forest Restoration – Modified Treatment Area	0	0	0	0
Important Wildlife Area – General Prescription	636	1,534	312	2,842
Important Wildlife Area – Modified Treatment Area	97	185	29	311
Fuels Treatment Only	140	364	134	638
No Treatment	327	822	1,171	2,320
Total	1,200	2,905	1,646	5,751

Table 71. Difference in silvicultural treatments between Alternatives 2 and 3

Silvicultural Treatment	Alternative 2 (acres)	Alternative 3 (acres)
No Treatment	2,743	2,958
Reduce mortality in snag pockets (0.25 to 1.25-acre group size) up to 18″ d.b.h. to 6 snags/acre; General Rx <18″ d.b.h.	85	0
Reduce mortality in snag pockets (0.25 to 1.25-acre group size) up to 18″ d.b.h. to 6 snags/acre; no live tree thinning.	153	0
Reduce mortality in snag pockets (0.25 to 1.25-acre group size) up to 18″ d.b.h. to 6 snags/acre; thin live <9″ d.b.h.	72	0
Reduce mortality in snag pockets (0.25 to 1.25-acre group size) up to 12″ d.b.h. to 6 snags/acre; no live tree thinning.	0	144
Reduce mortality in snag pockets (0.25 to 1.25-acre group size) up to 12″ d.b.h. to 6 snags/acre; thin live <9″ d.b.h.)	0	167
Thin trees <12″ d.b.h.; MSO Restricted (150 BA)	47	0
Thin trees <18″ d.b.h.; MSO Restricted (150 BA)	1,687	0
Thin trees <9″ d.b.h.; MSO Restricted (170 BA)	964	2,482
Total	5,751	5,751

Table 72. Difference in fuel treatments between Alternatives 2 and 3

Fuel Treatment	Alternative 2 (acres)	Alternative 3 (acres)
Lop and Scatter	124	105
Lop and Scatter, Hand Cut, Pile, and Burn	608	566
Lop and Scatter, Hand Cut, Pile, and Burn; Followup Underburn	1,004	966
Lop and Scatter; Underburn	1,357	1,312
Masticate	332	257
Masticate; Hand, Pile, and Burn Steep Slopes; Followup Underburn	128	128
No Fuels Treatment	2,063	2,320
Underburn	135	97
Total	5,751	5,751

Table 73. Difference in removal methods between Alternatives 2 and 3

Removal Method	Alternative 2 (acres)	Alternative 3 (acres)
No Removal	3,342	3,935
Whole-tree yard; Hand cut; Remove by cable	19	8
Whole-tree yard; Hand cut; Remove by ground-based equipment	18	16
Whole-tree yard; Hand cut; Remove by skyline	1,001	798
Whole-tree yard; Machine or hand cut; Remove by cable	58	46
Whole-tree yard; Machine or hand cut; Remove by ground-based equipment	1,238	901
Whole-tree yard; Machine or hand cut; Remove by skyline	75	47
Total	5,751	5,751

Table 74. Summary of ground-based removal units

Unit Number for Units that have Tractor Skidding	Watershed
116, 135, 354, 360, 362, 401, 403, 405, 411, 422, 427	Ash Creek
156, 165, 213, 222, 226, 232, 242, 243, 453, 454, 459	Babcock and Lefthand
124, 129, 170, 171, 192, 197, 200, 209, 218, 233, 234, 236, 237, 238, 239, 462	Babcock Canyon
11, 20, 30, 36, 40, 260, 269, 273, 274, 275, 276, 280, 281, 283, 288, 290, 292, 294, 329, 545	Big Creek
45, 49, 256, 262, 264, 268	Big Creek and Grant Creek
13	Big Creek and Marijilda
216	Goudy and Lefthand
194, 327, 330, 442, 445	Goudy Canyon
172, 475, 477, 479, 483	Goudy Creek and Grant Creek
42, 47, 91, 265, 368, 375, 380, 493, 495, 506, 511, 550, 552, 554	Grant Creek
174, 449	Lefthand Canyon

In addition to ground disturbance by product removal, burning may affect soils. Table 75 displays proposed burning for the action alternatives.

Table 75. Proposed burning

Fuel Treatment	Alternative 2 (Acres)	Alternative 3 (Acres)
Pile Burn or Underburn	4,236	4,035
No Burning	1,515	1,716
Total	5,751	5,751

Direct and Indirect Effects

Soil Erosion and Detrimental Disturbance

When heavy equipment including trucks, skidders, loaders, and bulldozers enter an area, compaction occurs, increasing bulk density, decreasing water infiltration and porosity, restricting root growth, and increasing erosion (Page-Dumroese et al. 2006). These changes reduce productivity and consequently ecosystem sustainability. Ground-based equipment would be restricted to designated trails spaced about 100 feet apart.

Units 7, 28, 37, 39, 42, 47, 93 114, 119, 139, 262, 263, 264, 265, 266, 268, 270, 271, 272, 273, 274, 288, 359, 361, 462, 463, 472, 473, 475, 476, 477, 536, and 545 are located in part on impaired soil. Silvicultural treatments are planned only on units 28, 42, 47, 93, 262, 264, 265, 272, 273, 274, 288, 462, 473, 475, 477, and 545. Ground-based removal is planned for units 42, 47, 265, 268, 273, 274, 288, 462, 475, 477, and 545 representing about 213 acres. There are landings proposed to be located in areas of impaired soils in units 7 (for yarding material from the adjacent unit), 47, 268, 273, 274, 462, 477, and 545. In these units, design features will ensure rehabilitation of the landings.

The proposed treatment units are considered as individual activity areas. Table 74 shows the units to be treated with ground-disturbing tractor skidding in each watershed. Based on project design, skid trailing in ground-based units is estimated to occur on 12 percent of an activity area. This is considerably less than the observed detrimental impacts to soil from past skidding activities which can be up to 70 percent. Total ground disturbance, including system roads, is projected to be 11.9 percent for Alternative 2 and 11.1 percent for Alternative 3 (tables 76 and 77). Current disturbance level is 9 percent. The rest of the project treatment units, not shown in table 74, employ cable or skyline yarding systems, and with few exceptions have no current road surface. The range of current impacts on those units is 0 to 5 percent with expected impacts not to exceed 6 to 7 percent.

Table 76. Percent of each GES unit and entire project area actually disturbed, Alternative 2

Removal Method	GES Unit 451 (Percent)	GES Unit 466 (Percent)	GES Unit 476 (Percent)	Percent of Entire Project Area
Cable	0.1	0.0	0.1	0.1
Skyline	0.3	0.6	1.6	0.8
Ground-based	3.3	2.0	1.2	2.0
Already Impaired Soils	2.5	11.6	3.4	7.3
Roads	1.9	1.9	1.4	1.7
Total	8.1	16.1	7.7	11.9

Table 77. Percent of each GES unit and entire project area actually disturbed, Alternative 3

Removal Method	GES Unit 451 (Percent)	GES Unit 466 (Percent)	GES Unit 476 (Percent)	Percent of Entire Project Area
Cable	0.0	0.1	0.1	0.0
Skyline	0.2	0.8	0.8	0.7
Ground-based	1.5	1.5	0.9	1.3
Already Impaired Soils	2.5	11.6	3.4	7.3
Roads	1.9	1.9	1.4	1.7
Total	6.1	15.9	6.6	11.1

In units to be treated using skyline logging, an estimated 5 percent of the harvest unit would experience soil or vegetation disturbance, primarily in the center of skyline corridors and at landings. In the proposed thinning units where generally intermediate and suppressed understory smaller diameter trees are proposed for cutting, leading end suspension and the use of intermediate rigged supports would result in low soil displacement in corridors on most sets (Curtis Timber Sale 2008).

There are landings proposed within the 150-foot streamside protection zones along roads in units 16, 254, and 504. Design features will ensure that these landings are placed in a manner that would minimize potential effects.

Landing slash would be disposed of. Skid trails and landings would be subsoiled or scarified where soils are compacted. Cross-drains or recontouring and seeding, with a certified weed-seed-free native plant seed, would be done after operations are complete. Additional skid trail mitigation includes blocking the trails with cull logs or trees, large rocks, or recontouring where effective to prevent motorized travel after operations are complete (Curtis Timber Sale 2008). New travelway development would be done using BMPs, leaving sufficient residual biomass to protect soils and not contribute to any decline in soil conditions. Forest Roads 4559 (Unit 275), 4535 (Unit 506), and 4551 (Grant Hill area), nonsystem road in Unit 491 and Trail 305 (Unit 509) provide access into some of the ground-based units and landings. Washouts associated with these roads would need to be repaired.

The reduced stand densities and use of prescribed fire to limit catastrophic fire would potentially cause positive gains in plant vigor, recruitment, and watershed stability. Adaptive management built into the proposed action would allow proactive management responses to changing resource conditions. The use of BMPs is expected to minimize or mitigate any potential negative effects from this alternative. BMPs and design criteria found in appendix A would be used to minimize soil disturbance. Given that BMPs and design criteria would be used to minimize soil disturbance, the proposed alternatives would meet Forest Plan standards.

Effects to Soils from Fire

When soil heating occurs during pile or broadcast burning, there is the potential for modifying soil characteristics. Soil organisms die when the soil temperature nears 100 °C. Water repellency (hydrophobicity) is increased if soil containing organic matter or covered with organic matter is heated between 176 and 204 °C. Soil erosion increases when organic matter protecting it is burned off, hydrophobicity increases, and structure changes (DeBano et al. 1998). Soil structure is modified in only rare instances due to fire.

Estimated number of acres where burning is planned are shown in table 78. All of these acres are planned for low-severity burning, where soil is not heated to temperatures that would result in hydrophobicity, dehydration, or alteration of soil structure. No acres are planned for burning at high severity.

Table 78. Difference in acres where burning is planned between action alternatives

Fuel Treatment	Alternative 2 (acres)	Alternative 3 (acres)
Pile Burn or Underburn	3,191	3,087
No Burning	2,563	2,667
Total	5,754	5,754

Cumulative Effects

Future foreseeable actions in the project area are listed above. The majority of the cumulative effects can be attributed to the project itself; the activities listed above have the potential to add a very small amount of disturbance, none of which will rise to the level of detrimental. When these activities are considered with the project effects, cumulative effects are not expected to exceed State or forest standards.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

A review of Alternatives 2 and 3 in the soils and hydrology report (Lefevre 2008) indicates that the alternatives comply with the Forest Plan and other relevant laws, regulations, policies, and plans.

Hydrology

Introduction

This analysis describes the desired and existing condition of the hydrologic resources within the project area and evaluates the potential direct, indirect and cumulative effects of the proposed action and no action alternatives.

Affected Environment

Watersheds

The project analysis area is located within the headwaters of three 5th-code watersheds: Gila River – Cottonwood Wash, Gila River – Stockton Wash, and Willcox Playa (table 79 and figure 43). The project area total is less than 1 percent for each of the 5th-code watersheds involved in the project area.

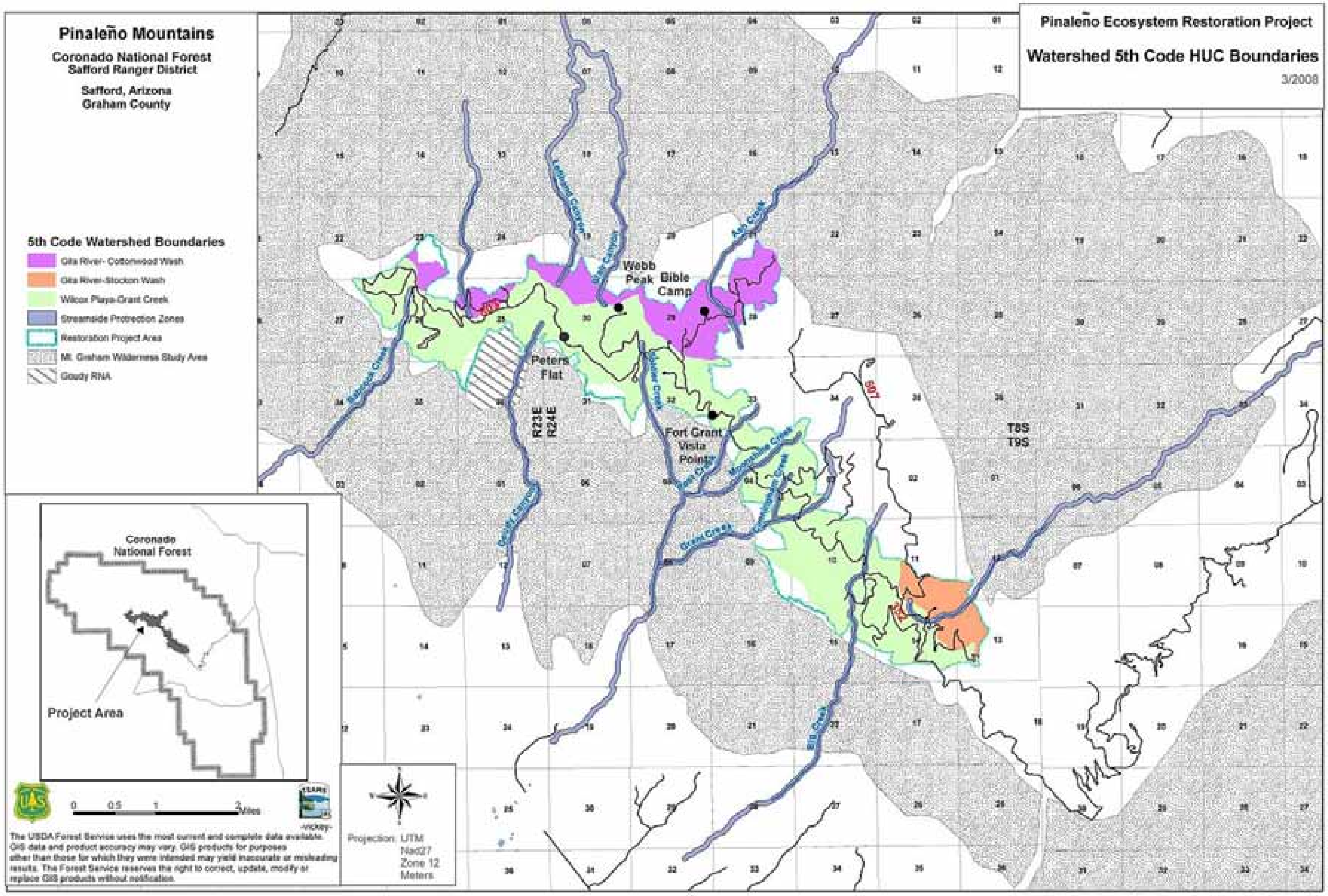


Figure 43. Headwater portions of fifth-code watershed

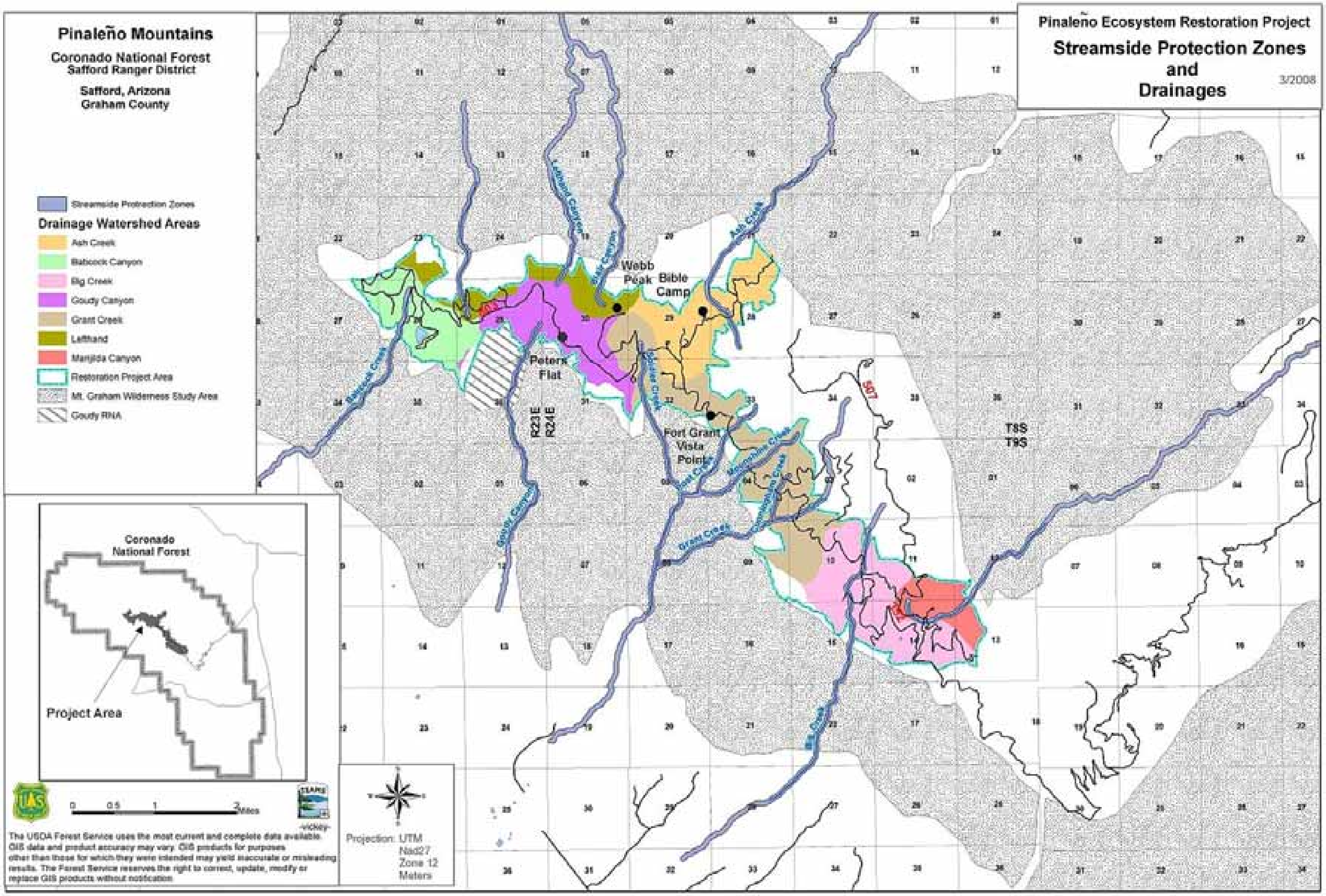


Figure 44. Drainages eligible for Wild and Scenic River status

Table 79. Project area acres by 5th-code watersheds

Gila River - Cottonwood Wash (HUC 1504000505)		Gila River - Stockton Wash (HUC 1504000504)		Willcox Playa (HUC 1505020100)		Total
Acres	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**	**Acres**
1,091	19	387	7	4,304	74	5,783

Existing Condition

Road densities range from 2.1 mi/mi^2 in the Lefthand Canyon drainage to 5.6 mi/mi^2 in Babcock Canyon. Roads covering only a small fraction of a watershed may have a significant effect on peak flow, as it essentially enlarges the stream network or area that contributes to surface runoff. Table 80 summarizes the percent of road area that is within 50 feet of a mapped channel, as an index of hydrologic connection to the road system. Washouts on Forest Roads 4559 (Unit 275), 4535 (Unit 506), and 4551 (Grant Hill area); nonsystem road in Unit 491; and Trail 305 (Unit 509) were observed.

Table 80. Summary information on road system in analysis drainages

Drainage	Drainage Area within Project (square miles)	Drainage Roads Miles	Road Density (miles/ square mile)	Estimated Drainage Area in Roads (acres)*	Percent of Road Miles Area in Riparian Area
Babcock Canyon	0.96	5.34	5.6	16	6
Lefthand Canyon (including Hells Hole, Blair)	0.70	0.09	2.1	4	20
Ash Creek	1.25	4.37	3.5	13	1
Marijilda Creek	0.53	1.63	3.1	5	17
Big Creek	1.72	7.01	5.0	26	2
Goudy Canyon	1.17	4.00	3.4	12	0
Grant Creek (including Cunningham Creek, Post, and Soldier)	2.32	7.97	3.4	24	12

*Based on 25-foot width for road prism.

Surface Flow

Peak flows within the project area have not been measured and there are no gauging stations on the Willcox Playa side of the mountain range. However, on the Gila River side of the Pinaleño Mountains, several gauging stations are located downstream of the project area, although not all of them are active. Data from these sites indicates that surface water quantity is controlled by both precipitation and base flow events. The flow data and other flow information can be found at the USGS National Water Information System Web site (http://waterdata.usgs.gov/nwis).

The most intense rainfall comes during summer storms. These events, however, appear as peak flows of the year in less than half the years of record (http://waterdata.usgs.gov/nwis).

Wild and Scenic River Eligibility

Several drainages contributing to the project area watersheds are eligible as wild and scenic rivers (USDA Forest Service 1993). Information about these drainages is found in table 81 and figure 44.

Table 81. Eligibility of drainages for wild and scenic river designation

Drainage	Watershed	Outstandingly Remarkable Values that Make this Stream Eligible for Designation as a Wild and Scenic River
Big Creek	Willcox Playa	None
Marijilda Creek	Gila River – Stockton Wash	None
Grant Creek	Willcox Playa	Scenic and Ecological
Post Creek	Willcox Playa	Scenic
Soldier Creek	Willcox Playa	None
Goudy Canyon	Willcox Playa	None
Babcock Canyon	Willcox Playa	None
Hells Hole Creek	Gila River – Cottonwood Wash	None
Lefthand Canyon	Gila River – Cottonwood Wash	None
Blair Canyon	Gila River – Cottonwood Wash	None
Ash Creek	Gila River – Cottonwood Wash	Scenic, Historic, and Ecological

Riparian Areas including Channel Morphology

Stream channel condition surveys were conducted by the forest staff in 2003 (USDA Forest Service 2003a). The surveys were within the Marijilda Creek, Grant Creek, Post Creek, Goudy Canyon, and Ash Creek drainages. The Ash, Post, and Grant surveys were done within the project area. Marijilda and Goudy surveys were done downstream of the project area. Marijilda was the only one surveyed following the Nuttall Complex Fire (Sanders 2006). Vegetation in these riparian areas is summarized in table 82.

Table 82. Existing condition of riparian areas (canyon bottom vegetation)

Stream Name	Survey Location	Year Data Collected	Tree Species Recruitment (species represented in young or seedling age class)	Tree Canopy (percent shade)	Vigor
Marijilda Creek	Downstream of project area	2006	Sycamore and ash	55 (from 2003 data)	Fair
Grant Creek	Within project area	2003	Douglas-fir, alder, spruce	50	Good
Post Creek	Within project area	2003	Walnut and ash	70	Good
Goudy Canyon	Downstream of project area	2003	No riparian recruitment recorded	no data	Fair
Ash Creek	Within project area	2003	Alder, spruce, white fir, maple	45	Good

Stream channel and streambank information was also collected at these same locations. Table 83 summarizes the field data. Present channel and riparian conditions as ascertained from riparian surveys indicate a channel network outside of high or moderate severity burn that is currently stable, with a viable riparian vegetative community and ample canopy closure. The channels are steep, armored by bank vegetation, and have competent energy gradient to transport fines.

Table 83. Existing condition of stream channels

Stream Name	Year Data Collected	Bank Protection (Percent of bank not occupied by bedrock, boulders, stones, or cobbles)	Pebble Count Summary: 50% of All Particles Less than the Stated Size
Marijilda Creek	2006	2% (down from 100% in 2003)	2 mm (down from 18 mm in 2003)
Grant Creek	2003	97%	2 mm
Post Creek	2003	94%	700 mm
Goudy Canyon	2003	82%	70 mm
Ash Creek	2003	98%	64 mm

Water Quality

Water quality is assessed by comparing existing conditions with desired conditions that are set by the states under the authority of the Clean Water Act. The Arizona Department of Environmental Quality (ADEQ) is the regulating authority for water quality in Arizona. The general classifications used for surface water quality by ADEQ are "attaining" and "impaired" for all beneficial uses, "inconclusive," and "not assessed." Presently, water quality has been assessed within the project area in two streams and two lakes.

According to the 2006 ADEQ report "Status of Water Quality in Arizona: The Integrated 305(b) Assessment and 303(d) Listings Report" (ADEQ 2006), the surface water of this area is found to have no exceedences for any samples taken, but most are classified as inconclusive because there have not been enough samples analyzed during the assessment period, or there are missing parameters (table 84).

Table 84. Water quality analysis

Water Body or Stream	Assigned Uses	Assessment	Comments
Ash Creek	FC, FBC, AgL, A&Ww	Attaining all uses	Low dissolved oxygen due to natural conditions.
Grant Creek	FC, FBC, DWS, AgL, A&Wc	Attaining some uses	Insufficient dissolved metals (cadmium, copper, zinc) data to assess attainment of A&W.
Riggs Flat Lake	FC, FBC, AgI, AgL, A&Wc	Inconclusive	Insufficient core parameters and sampling events, low dissolved oxygen due to natural conditions.
Snow Flat Lake	FC, FBC, AgI, AgL, A&Wc	Inconclusive	Insufficient core parameters and sampling events, no exceedances.

FC = Fish Consumption
AgL = Agriculture – livestock water
A&Wc = Aquatic and Wildlife coldwater
FBC = Full Body Contact
AgI = Agriculture – Irrigation
A&Ww = Aquatic and Wildlife warm water
DWS = Drinking Water Standard

Presently, there are no municipal uses of surface water within the project area. There are, however, springs and watercourses within the project area that supply water for domestic uses including Grant Creek, Columbine Spring, Ash Creek Spring, and Riggs Flat Spring.

Desired Condition-Hydrology

No desired future conditions for water resources are directly identified in the Forest Plan.

Federal, State and Local Regulations and Standards

Forestwide goals applicable to the project area and proposed action reinforce requirements under the Clean Water Act to meet state water quality standards and ensure favorable conditions of flow for downstream beneficial uses.

Forest Plan standards and guidelines, applicable to all areas of the forest, for water quality and riparian areas include:

- Page 38-5: "Through management services, provide information to minimize disturbance and improve already disturbed areas. BMPs will be used to minimize the time of recovery to a satisfactory erosion level, minimize soil productivity loss, improve water quality and minimize channel damage" and
- Page 73-2: Management Area 7B (found downstream) Watershed "Manage all programs to eliminate or minimize onsite and downstream water pollution."
- Page 39-8: "Manage riparian areas in accordance with legal requirements regarding floodplains, wetlands, wild and scenic rivers, and cultural and other resources. Recognize the importance and distinct values of riparian areas in Forest Plans."
- Page 39-9: "Manage riparian areas to protect the productivity and diversity of riparian-dependent resources by requiring actions within or affecting riparian areas to protect and, where applicable, improve dependent resources (FSM 2526). Emphasize protection of soil, water, vegetation, and wildlife and fish resources prior to implementing projects (FSM 2526)."

Environmental Consequences

Methodology

Information was gathered during field inspections by the forest watershed program manager, the General Ecosystem Survey (USDA Forest Service 1991), streamflow data (http://waterdata.usgs.gov/nwis) and climate data (http://www.wrcc.dri.edu/index.html). Effects of fuel treatment and removal on water quality and riparian areas were drawn from review of research and from previous experience of the forest watershed program manager. Cumulative effects on surface flow were assessed by considering the proportionate areas of treatment, past events (wildfire, harvest), road density and location, and existing condition of channels.

The forest geographical information systems (GIS) database was utilized to assess project drainages for fire and harvest history, current road status, vegetation cover, and topography.

Spatial and Temporal Context for Effects Analysis

The hydrologic effects analysis covers a short-term period of less than 10 years. The analysis area for surface flow is the drainage area. The analysis area for wild and scenic river eligibility is the eligible area. The water quality and riparian analysis area is defined by the project boundary because those areas make up only about 1 percent of the project area.

Connected Actions, Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

Connected actions, past, present and foreseeable actions are the same as those discussed for the soils analysis. With the exception of fire suppression, which is a randomly occurring factor, the other actions occur more or less on a yearly basis.

All these actions, again with the exception of fire suppression, do not directly and significantly impact hydrology by adversely altering hydrologic function to cause changes in surface flow, riparian areas, wild and scenic river eligibility, or water quality. Taken together these actions represent the bulk of past actions that are within standards stated by the Forest Plan guidelines.

Alternative 1 - No Action

Direct and Indirect Effects

Surface Flow including Wild and Scenic River Eligibility

Under this alternative, no treatments would occur to reduce fuels or restore stand structures, and the chance of a severe wildfire occurring would remain high. Runoff from wildfire areas, particularly high severity burns, can be 1 to 3 orders of magnitude above normal or baseline peaks under comparable conditions (Neary et al. 2005). Elevated runoff would continue for 5 to 7 years, while ground cover and hydrologic conditions recover and approach pre-fire conditions. These findings from research agree well with modeling calculations from the BAER hydrology report (USDA Forest Service 2004b).

Several forest roads in the project area with washouts would not be repaired. There would be no changes to existing base flow levels.

Grant Creek, Post Creek, and Ash Creek would remain eligible as none of the outstandingly remarkable values will be affected.

Riparian Areas and Channel Morphology

Existing riparian vegetation conditions would continue. If a wildfire did occur, stream channels would move fine materials through the drainage system as uplands recovered from the fire.

Water Quality

Vegetative recovery, primarily grasses and forbs, on the Nuttall-Gibson Complex would improve, reducing the risk of hillslope overland flow, accelerated erosion and the possibility of channel debris flows or excessive fines from entering flowing channels.

Some excessive amounts of silt and sand have entered lower Marijilda Creek in a reach downstream of a high to very high burn severity area. This material will continue to move through the channel system.

Cumulative Effects

No foreseeable actions by themselves or in combination with effects of the no action alternative are considered to have a significant effect to surface flow, riparian areas, wild and scenic river eligibility, or water quality.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Alternative 1 complies with the Forest Plan and other relevant laws, regulations, policies, and plans.

Alternatives 2 and 3

Direct and Indirect Effects

The action alternatives have a variety of treatments proposed for units in each drainage area. Temporary road construction, skid road construction, skyline yarding, cable yarding, and burning are components of the proposal that have the potential to change surface flow, wild and scenic river eligibility, riparian areas, channels, or water quality. See table 85 for a display of expected total disturbance or impacts due to proposed skidding or temporary road construction. The soils and hydrology report (Lefevre 2008) details the number of skyline, cable, and tractor corridors by unit and summarizes the differences in amount of skyline, cable, and tractor corridors between the two alternatives.

Sixty of the 63 acres that were previously burned in the Nuttall Fire are proposed for forest product removal. None of the units are located within a streamside protection zone or on impaired soil. Table 86 displays removal methods for burned units where these 63 acres occur.

Surface Flow and Wild and Scenic River Eligibility

Road prisms and ditches intercept and concentrate overland and subsurface flow providing increased sediment and water where they intercept stream drainages. Skid trails typically have less of an effect on surface flow as they are not connected directly to streams. Subsurface flow is rarely intercepted by a skid trail, and they are generally less compact than roads and smaller in width.

BMPs would be incorporated in order to reduce flow routing from trails, to dissipate water energy, and to insure adequate infiltration of surface water into the soil. Additional BMPs incorporated into the project include slope limitations, water bars, limited skidding across draw bottoms, and seeding, mulching, or slashing on steeper skid trails (See FSH 2509.22 in appendix B of the hydrology and soils report, Lefevre 2008).

Although the general effect of stormflow routing by roads and trails may be to accentuate peaks for small storms in small watersheds (thereby potentially effecting channel stability), this is not expected to happen or be of concern in the project area. Surveys indicate channel stability is generally good and point toward the resiliency expected in well-armored mountain streams.

Table 85. Summary of impacts to hydrologic function (acres and percent of total drainage area)

Drainage (Entire drainage area including "no treatment units")	Roads (acres and percent of drainage area)	Residual Impacts (impaired soil acres and percent of drainage area)	Current Total Impact (acres and percent of drainage area)	Proposed Action (acres skid roads, cable and skyline corridors, landings, and temporary roads on satisfactory soil)		Total: Post Action (Sum of current total impacts and proposed action impacts in acres)	
				Alt. 2	Alt. 3	Alt. 2	Alt. 3
Ash Creek (791 acres)	13 (1.6%)	32 (4.0%)	45 (5.6%)	18	18	63 (7.9%)	63 (7.9%)
Big Creek (1,188 acres)	26 (2.4%)	166 (15.1%)	192 (17.4%)	48	42	240 (20.2%)	234 (19.7%)
Marijilda Creek (340 acres)	5 (1.5%)	0 (0%)	5 (1.5%)	3	3	8 (2.5%)	8 (2.5%)
Grant Creek (including Post and Soldier) (1,487 acres)	24 (1.6%)	177 (11.9%)	201 (13.5%)	44	24	245 (16.5%)	225 (15.1%)
Goudy Canyon (796 acres)	12 (1.6%)	15 (2.0%)	27 (3.6%)	7	5	34 (4.2%)	32 (4.1%)
Babcock Canyon (651 acres)	16 (2.6%)	29 (4.7%)	45 (7.3%)	40	22	85 (13.1%)	67 (10.2%)
Lefthand Canyon (including Hells Hole and Blair) (501 acres)	4 (<1%)	0 (0%)	4 (<1%)	10	8	14 (2.7%)	12 (2.3%)
Total			519 acres (9.0%)			677 acres (11.8%)	640 acres (11.1%)

Table 86. Removal methods for burned units

Unit	Year Burned	Burn Severity	Removal Method
105	1996	high	Whole-tree yard; machine or hand cut; remove by skyline.
108	1996	high	Whole-tree yard; machine or hand cut; remove by ground-based equipment with cable.
113	1996	high	Whole-tree yard; machine or hand cut; remove by ground-based equipment with cable.
156	1996	high	Whole-tree yard; machine or hand cut; remove by skyline and ground-based equipment.
238	2004	high, moderate	Whole-tree yard; machine or hand cut; remove by ground-based equipment.
239	2004	moderate	Whole-tree yard; machine or hand cut; remove by ground-based

Table 86. Removal methods for burned units

Unit	Year Burned	Burn Severity	Removal Method
			equipment.
242	2004	high	Whole-tree yard; machine or hand cut; remove by ground-based equipment
243	2004	high, moderate	Whole-tree yard; Machine or hand cut; Remove by ground-based equipment
323	1996	high	Whole-tree yard; Hand cut; Remove by skyline
330	1996	high	Whole-tree yard; Machine or hand cut; Remove by ground-based equipment
331	1996	high	Whole-tree yard; Hand cut; Remove by skyline
332	1996	high	Whole-tree yard; Machine or hand cut; Remove by ground-based equipment and cable

Peak flow increases from wildfire effects are potentially much greater than the contribution by the road system, and may cause long-term instability or morphologic change and function of channels.

No new system roads would be constructed for the project. Approximately 4.5 miles of temporary roads would be constructed for the project and then rehabilitated and closed under Alternative 2. Haul road improvements and maintenance would consist of 22.2 miles under Alternative 2 and there would be 6.3 miles of Swift Trail road maintenance.

Alternative 3 would construct, use and then close and rehabilitate 3.5 miles of temporary road. Alternative 3 proposes to use and maintain 21.8 miles of system roads. The amount of Swift Trail road maintenance is the same as Alternative 2 (table 87). Road washouts on closed roads, even those not needed for this project, would be repaired.

Table 87. Miles of proposed road work for Alternatives 2 and 3

Activity	Alternative 1	Alternative 2	Alternative 3
Haul road improvements and maintenance	0	22.2	21.8
Swift Trail road maintenance	0	6.3	6.3
Temporary road construction	0	4.5	3.5

The overall effect of roads is expected to be similar to the existing condition. Maintenance of running surfaces and crossings may attenuate response to storms insofar as concentrations of flow in rutted roads and plugged or damaged culverts would be corrected.

The proposed action alternatives would develop no significant increase in contributing area for runoff or surface erosion in the scope of catchments as summarized in the soils and hydrology report. Detrimental disturbance for the proposed action is based on GIS analysis. The resultant totals are given as an index of the degree of impacts to hydrologic function (infiltration and water holding capacity) in the project drainages, as a proportion of total area. This is not to imply that all this area is hydrologically connected with area streams and could be considered extensions of the runoff network.

Grant Creek, Post Creek, and Ash Creek would remain eligible as the outstandingly remarkable values that would be protected by using BMPs and design criteria.

Riparian Areas and Channel Morphology

Absence of new road construction, closing of temporary and nonsystem roads after project completion, and repair and maintenance of roads and channel crossing structures within the project area would continue present disturbance levels or eventually ameliorate them. Adequate streamside protection zones and BMP implementation should effectively prevent rilling, channelized flow and fine sediment from entering channels above what would occur under the no action alternative.

Heavy equipment in the riparian area or the watershed contributing to the riparian area can reduce riparian area sustainability (Dahms and Geils 1997). As a result, project area streamside protection zones have been set at a minimum of 150 feet. Project streamside protection zones prohibit ground-based removal and equipment entry except where open and closed roads, and skyline or cable corridors already exist. BMPs would also be implemented to protect ephemeral draws within ground-based system units, where there is evidence of surface flow. Figure 45 is a photograph of a typical riparian area within the project area that would be protected by a streamside protection zone implemented as part of this project.

Figure 45. A typical riparian area to be protected with a streamside protection zone

The primary effect of timber harvest and roads are on small, high frequency storms events that are well within the natural range of annual peak flows. The proposed action alternatives would have little or no significant effects to runoff or to channel stability.

Potential effects of wildfire to runoff and sedimentation of streams is orders of magnitude greater than effects of roads and harvest, and well outside the range of pre-burn conditions. Channel morphology would be altered by the increased amount of sediment and runoff associated with a moderate to severe wildfire. Existing condition of ground cover is adequate to prevent accelerated erosion in project area slopes.

Water Quality

BMPs (appendix A) are the primary means of controlling nonpoint pollution, and would mitigate effects of road maintenance, opening of roads, and road work within riparian areas and near streams. The project streamside protection zones, in conjunction with BMPs within ground-based units, would prevent or reduce the risk of accelerated erosion and delivery of fines to channels from project activities to acceptable limits. Particular efforts would be made to avoid gully erosion starts in ephemeral draws, and conservative slope limitations would be implemented due to the project area's generally high elevation and moist soil conditions.

Sediment may be introduced where skid trails cross certain stream bottoms (Units 16, 20, 33, 36, 197, 223, 233, 236, 254, 380, 411, 475, 477, 495, and 506 as shown in table 74 above). However, the amounts are expected to be within the natural range of variability due to the effectiveness of BMPs. Cable and skyline corridors that enter or cross streamside protection zones would have negligible effects on the amount of sediment introduced to streams.

About 5 percent of the proposed treatment area would be treated by tree felling with no tree removal. Disturbance of the ground and ground cover in these areas is considered incidental to the felling of trees and a very minor component of the total area. The majority of ground-based removal units is outside areas of impaired soil, within low severity or unburned portions of the project area, and/or are more than 150 feet removed from flowing streams. The exceptions to this are in units 42, 47, 265, 268, 273, 274, 288, 462, 475, 477, 545, and 7, which are in areas of impaired soil. Units 238, 239, 242, 243, and 332 are in areas moderately or severely burned in 1996 or 2004. Units 16, 20, 24, 25, 33, 34, 36, 51, 53, 54, 55, 56, 61, 62, 63, 64, 66, 69, 70, 83, 150, 197, 223, 233, 236, 254, 255, 380, 411, 418, 456, 475, 477, 479, 495, 504, and 506, are in or adjacent to proposed streamside protection zones. However, with the implementation of BMPs, increased erosion and sedimentation is expected to be prevented or minimized such that any increases are within the natural range of sediment variability for this project area. As a result, no changes to existing water quality conditions would be expected with the implementation of the action alternatives.

The total impaired soil areas proposed for treatment is about 300 acres, about 5 percent of the drainage area of Babcock Creek drainage (including Riggs Flat Lake Campground), about 9 percent of the drainage area of Grant Creek in Soldier Creek Campground and in Cunningham Creek tributary, about 4 percent of Ash Creek in the Old Columbine and Grant Hill areas, and about 11 percent of the drainage area of Big Creek (in the Grant Hill and Snow Flat Lake vicinity). Bare surface erosion potential for soil types of the units is moderate. At the time of the field visits, potential risk of overland flow, rilling or gullying was considered to be negligible.

Planned road re-closures, and repair and maintenance of access and haul roads for ground-based units and cable and skyline landings would serve to eventually improve the present condition of the road system by reducing long-term, road-associated surface runoff, erosion and sedimentation. Short-term effects would primarily consist of sediment introduction at stream crossings. Short-term effects would be expected to last only one to two seasons. BMPs would be implemented in association with all project-related activities, including those associated with work within riparian areas or by stream channels (appendix A). Maintenance on principle haul routes would consist of armoring of channel culvert outlets. This would reduce bed and bank instability and sediment production over the long term.

The potential effects of wildfire to impact existing water quality in streams is greater than effects of roads and harvest, and would result in increased degradation compared to current conditions. The degree to which impacts would occur would be a function of wildfire severity. Existing condition of ground cover is adequate to prevent accelerated erosion in project area slopes.

Water Quantity

The primary effects of timber harvest and roads are on small, high frequency storms that are well within the natural range of annual peak flows. The proposed action alternatives would have little or no significant effects to runoff and would not affect existing water quantity in stream drainages. Surface runoff would be expected to increase as a result of wildfire; however the increase would be a function of wildfire severity, which cannot be predicted at this time.

Cumulative Effects

Seven subwatersheds were identified to have potential direct and indirect effects from the action alternatives. These watersheds represent the geographic boundaries of potential cumulative effects. The actions are anticipated to create effects for 3 to 5 years following treatments; therefore, the temporal scale of this analysis is 15 years. Past, present, and reasonable foreseeable actions considered within these extents are detailed in the project soils and hydrology specialist report (Lefevre 2008) and many are summarized at the beginning of chapter 3 of this DEIS.

Table 88. Acres and percent of each subwatershed affected cumulatively by the proposed action and past actions

Drainage (Entire drainage area including "no treatment units")	Sum of Current Total Impacts and Proposed Action Impacts in Acres and Percent	
	Alternative 2	Alternative 3
Ash Creek (791 acres)	63 (7.9%)	63 (7.9%)
Big Creek (1,188 acres)	240 (20.2%)	234 (19.7%)
Marijilda Creek (340 acres)	8 (2.5%)	8 (2.5%)
Grant Creek (including Post and Soldier) (1,487 acres)	245 (16.5%)	225 (15.1%)
Goudy Canyon (796 acres)	34 (4.2%)	32 (4.1%)
Babcock Canyon (651 acres)	85 (13.1%)	67 (10.2%)
Lefthand Canyon (including Hells Hole and Blair) (501 acres)	14 (2.7%)	12 (2.3%)
Total	677 acres (11.8%)	640 acres (11.1%)

Table 88 shows the impacts of the action alternatives in combination with past, present and reasonable foreseeable actions considered in this analysis. None of foreseeable actions, discussed above, by themselves or in combination with effects of Alternatives 2 and 3, would be considered to have an additional measurable effect to surface flow, riparian areas, wild and scenic river eligibility, or water quality.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Alternatives 2 and 3 comply with the Forest Plan and other relevant laws, regulations, policies, and plans.

Recreation

Introduction

This analysis describes the recreation resources in the project area, and the benefits and impacts of the proposed project. The proposed project lies in Management Areas 2, 2a, 3a, and 8. Management emphasis and intensity for Management Areas 2 and 2a is to “Manage for dispersed recreation opportunities” (Forest Plan, pp. 50 and 54). Management emphasis and intensity for Management Area 3a is to “Manage for a variety of developed recreation opportunities” and “Other activities will maintain or enhance the recreational opportunities” (p. 59). Management Area 8 allows for nonmotorized, semiprimitive dispersed recreation (p. 75).

Affected Environment

The Pinaleño Mountains are valued for their wide range of recreational opportunities. Within the project area are campgrounds, trailheads and hiking trails, a lake, a visitor center, summer homes, and many undeveloped recreation areas. The Swift Trail (AZ 366) is a scenic drive that provides public access to the many recreation opportunities within the project area, including:

Developed Public Recreation Sites

- Shannon Campground
- Hospital Flat Campground
- Cunningham Camp
- Columbine Corrals
- Soldier Creek Campground
- Riggs Flat Campground
- Clark Peak Corrals

Trails

- Arcadia National Recreation Trail 328
- Heliograph Trail 328A
- Hospital Flat Trail 326
- Cunningham Loop Trail 316
- Grant Hill Loop Trail 322
- Grant Creek Trail 305
- Ash Creek Trail 307
- Round the Mountain Trail 302
- Grant Goudy Ridge Trail 310
- Webb Peak Loop Trail 345
- Riggs Flat Lake Trail 340
- Trail 321
- Trail 319
- Clark Peak Trail 303

Recreation Special Use Permits

- Southern Arizona Bible Camp (Organization site)
- 14 summer homes at Old Columbine

Popular Dispersed Sites

- Snow Flat
- Treasure Park
- Upper Hospital Flat
- Grant Creek
- Moonshine Creek
- Soldiers Camp
- Large Rock
- Peter's Flat
- Chesley Flat
- Hells Hole
- Riggs Flat
- Jesus Goudy
- Clark Peak

Other Recreation Resources

- Columbine Visitor Center
- Riggs Lake

Recreation Opportunity Spectrum (ROS) Settings

The ROS system is a framework to describe recreation settings that range from easy access and highly developed to remote and natural. The majority of the project area is ROS setting roaded natural, with nodes of urban (heliograph electronic site and Mount Graham astrophysical complex) and rural (campgrounds), and areas of semiprimitive, nonmotorized along the edges. The Mount Graham Wilderness Study Area is primitive ROS setting. Definitions of each setting follow.

The existing condition of recreation settings and sites within the project area are generally good, though there are many dead and diseased trees in the project area, some burned areas, some overused areas with bare ground and erosion, many aging facilities need repair or replacement, and few recreation sites meet accessibility guidelines.

Recreation Opportunity Spectrum (ROS) Definitions

Primitive: Settings are large wilderness-like areas where people seek a totally natural setting, challenge, and solitude. These areas have no facilities other than trails and very few visitors.

Semiprimitive Nonmotorized: Roadless areas that people use for a wide variety of activities, but primarily for dispersed uses. These areas have no facilities other than trails and are similar to primitive areas except that they can be smaller, are typically closer to roads, and sometimes have more visitors.

Roaded Natural: Road corridors where people drive to enjoy the scenery and are often on their way to a developed site such as a campground, picnic area, or visitor center. The natural setting is the focus, but nodes of ROS urban and rural are commonly found along these corridors.

Rural: Most developed recreation areas as well as many other developed areas. The natural setting is the attraction but there are facilities such as buildings, roads, walkways, and picnic tables.

Urban: Areas of concentrated use and areas where facilities dominate the natural setting.

Environmental Consequences

Alternative 1

Direct and Indirect Effects

Alternative 1 (no action) would not cause any direct or indirect effects and would not provide any long-term benefits to recreation. Forest health would continue to decline and risks of severe wildfire would grow.

Cumulative Effects

Since there would be no direct and indirect effects, there would be no cumulative effects from this alternative.

Alternatives 2 and 3

Direct and Indirect Effects

The proposed project will provide long-term benefits to recreation by lowering the risk of major wildfires and helping create a healthier forest. A healthy green forest is crucial to providing quality recreation settings in the Pinaleño Mountains. However, because the proposed project involves cutting trees and fire, there would be short-term impacts.

Both Alternatives 2 and 3 would create short-term impacts during and immediately following treatments, but both would provide long-term benefits to recreation. Alternative 2 (proposed action) would provide the greatest long-term benefits to recreation because treatments would improve forest health and make the forest the most resistant to catastrophic wildfire (including reduction of crown fuels). Alternative 3 would provide lower benefits to recreation than Alternative 2 because treatments would have fewer benefits to forest health and would not lower wildfire risks nearly as much (crown fuels would be virtually unaddressed).

Impacts from the project to recreation include noise, dust, smoke, damaged trees and other vegetation, stumps, slash and debris, bare ground and temporary roads, loss of visual screening, and blackened areas due to burning. Most of these impacts are relatively short term, but could easily last a year or more. Additionally, if work is completed during the recreation season, recreation sites may need to be closed temporarily.

ROS settings are not expected to change. Mitigation measures will help lessen impacts to recreation during and immediately following treatments.

Benefits of this project to recreation include a lower risk of large, damaging wildfire and a healthier forest with greater diversity. The project will result in a mosaic of forest conditions, including some patches of more widely spaced trees and a grassier understory.

Cumulative Effects

Past actions in the project area include the construction of roads and trails that provide access to recreation opportunities, and developed recreation sites which provide desirable facilities. The Columbine Visitor Center provides visitor information. Wildcat roads and OHV damage in the area are minor. The astrophysical facilities atop Mount Graham and their impact on the Mount Graham red squirrel, has restricted recreational use in the highest portions of the Pinaleño Mountains, though this area may be opened to hike-in recreational use in the future.

A present action that is underway is the Pinaleño Ecosystem Management (PEM) Project. Effects from this project are relatively short term, and work is nearly complete. Once slash is treated, recreational use should not be affected. Spruce planting in the Refugium will have no effect on recreation.

Reasonably foreseeable future actions include the recreation residence special use permit renewal, which is a part of the Coronado’s recreation program, and Arizona Department of Transportation’s implementation of a corridor management plan, which is largely focused on recreation benefits.

Since the actions described above do not contribute substantial effects to recreation, the proposed project, when added to past, present, and reasonably foreseeable future actions, is not expected to cause noticeable cumulative effects beyond those described for the alternatives.

Visual Quality

Introduction

This analysis describes the visual resources in the project area, and the benefits and impacts of the proposed project. This analysis also recommends a short-term, nonsignificant, site-specific amendment of visual quality standards and guidelines in the Forest Plan to allow impacts from tree removal and prescribed burning to be visible to the "casual observer" for slightly longer periods. Although the visual quality standards and guidelines would not be met in the short term, the proposed project is expected to better meet visual quality objectives for the long term.

In recent years, there has been conflicting direction regarding the assessment of visual resources on the Coronado National Forest. The Coronado National Forest Plan refers to Visual Quality Objective (VQO) maps created under the 1974 Visual Resource Management System (VRMS), yet since the mid-1990s, national forests have been directed to use the improved Scenery Management System (SMS) (Reynolds, 2380, August 22, 1994; McDougle, 2380, March 10, 1997; and Furnish, 1920/2380, June 11, 2001). In 2001, SMS mapping of scenic classes, which show the relative importance of scenic resources on the Coronado National Forest, was completed. As soon as the forest began using SMS in environmental analyses, some problems became apparent because the new system is different than what is in the Forest Plan. This should be resolved when SMS is likely to be implemented as part of the upcoming forest plan revision.

Although on-the-ground maps for the two systems are quite different, the components of both systems are similar, and analysis (affected environment, environmental consequences, mitigation, cumulative effects, etc.) for the project proposal yields largely the same results. To be consistent with the Forest Plan, this report provides an analysis of the proposed Pinaleño Ecosystem Restoration Project using the VRMS and VQOs.

Current direction in the Forest Plan (1986, as amended) includes (Visual Resource Management forestwide standards and guidelines, page 28):

- Maintain and protect the visual integrity of the landscape.
- Rehabilitate or enhance the existing visual quality in the process of accomplishing other resource management practices.

The proposed project lies in Management Areas 2, 2a, 3a, and 8. Standards and guidelines for Management Area 2 requires that "Visual quality objectives will be met" (see Management Emphasis and Intensity, and Management Practice Activity Visual Resource Management A03, on page 50). Standards and guidelines for Management Area 8 provide direction to manage for VQO Retention (see Management Practice Activity Visual Resource Management A03, on page 75).

Affected Environment

Landscape character in the upper elevations of the Pinaleño Mountains is a cool, shady, relatively dense mixed-conifer forest, broken by rocky mountainside topography, grassy meadows, and past wildfires. There are many stands of aspen trees, a number of mountain streams, and a lake. Swift Trail (AZ 366), which runs through the project area, has been designated a scenic parkway by the State of Arizona because of its spectacular scenery. Along this route, there are occasional broad vistas of the valley below. A wilderness study area surrounds much of the project area, and a research natural area lies along a portion of the Swift Trail; both areas provide relatively pristine forest landscapes. Developed sites include six public campgrounds, one organization camp, numerous trailheads, several summer homes, the Columbine administrative area (which includes a visitor center), and the Mount Graham astrophysical complex. There are also many popular "dispersed" (undeveloped) recreation areas with no facilities.

The existing condition of visual quality in the project area is generally good. Although there are many dead and diseased trees in the project area, a number of "thickets," and some burned areas, the overall impression of a visitor driving through the project area is a beautiful forest, a cool and magical place very different from the broad desert landscapes where their journey began. Recreation facilities are generally fairly well screened from the Swift Trail, and most other structures (summer homes, Columbine Administrative Site, etc.) are in character with the setting. A major impact to visual quality is due to a 167-foot-tall telescope structure that is white and boxy, that affects visual quality in all locations where it is visible.

Visual quality objectives are based on two components:

1. **Variety Class:** A measure of the visual variety or diversity of landscape character. The three variety classes are A (Distinctive), B (Common), and C (Minimal).
2. **Sensitivity Levels and Distance Zones:** Sensitivity levels are a measure of the viewer interest in scenic qualities of a landscape. The three levels are 1 (Highest), 2 (Average), and 3 (Lowest). Distance zones include foreground (up to 1/2 mile), middle ground (1/2 mile to 5 miles), and background (over 5 miles).

The project area is Variety Class A, Distinctive.

There are no maps of sensitivity levels for the project area. However, a review of the VQO maps indicates that Swift Trail, Bible Camp Road (FR 508), and the road into Riggs Lake were identified as Sensitivity Level 1 areas. A project-level review of sensitivity levels confirms that these are appropriate, but that most hiking trails in the project area should have also been identified as Sensitivity Level 1, and it is not clear whether roads into recreation areas (such as Treasure Park), were considered, but these should have been classified Sensitivity Level 1. Additionally, it is unclear whether any Sensitivity Level 2 travelways or areas were identified in the VQO mapping. A project-level review reveals that the 315/319 trail (Nuttall) loop would qualify. All other roads and trails in the project area are considered Sensitivity Level 3.

Visual Quality Objective (VQO) Definitions

Retention: Management activities should not be evident to the casual forest visitor.

Partial Retention: Management activities must be visually subordinate to the characteristic landscape.

Existing visual quality objectives for the proposed project are retention for the foreground along Swift Trail, Bible Camp Road, and the road into Riggs Lake. Most of the remaining project area is retention as seen in the middle ground and background from these roads. There are very small portions of the project area that are VQO partial retention in areas that cannot be seen from sensitive travelways.

Environmental Consequences

Direct and Indirect Effects

Alternative 1

Alternative 1 (no action) would not cause any direct or indirect effects and would not provide any long-term benefits to visual quality. Forest health would continue to decline and risks of severe wildfire would grow.

Alternatives 2 and 3

Impacts to visual resources from the project would include damaged trees and other vegetation, stumps, slash and debris, bare ground and temporary roads, loss of visual screening, and blackened areas due to burning. Most of these would be relatively short term, but could easily impact visual quality for a year or more.

Both Alternatives 2 and 3 would create short-term impacts during and immediately following treatments, but both would provide long-term benefits to visual quality. Alternative 2 (proposed action) would provide the greatest long-term benefits to visual quality because treatments would improve forest health, make the forest the most resistant to catastrophic wildfire (including reduction of crown fuels), and encourage diversity such as aspen. Alternative 3 would provide lower benefits to visual quality than Alternative 2 because treatments would have fewer benefits to forest health, would not lower wildfire risks nearly as much (crown fuels would be virtually unaddressed), and treatments would not release aspen stands.

Benefits from this project on visual resources include a lower risk of large, damaging wildfires and a healthier forest with greater diversity. Proposed treatments along Swift Trail would result in a mosaic of forest conditions, with some patches of widely spaced larger trees and a grassier understory. In ponderosa pine forests, these more open conditions are referred to as “parklike,” and research shows that people prefer these conditions to the dense thickets and heavy debris on the forest floor that typify much of the project area. Although this area is primarily a mixed-conifer forest, some areas with more open conditions would improve visual quality for travelers through the area.

Just over 13½ miles of Swift Trail Parkway lie within the project area, and treatments are proposed along nearly the entire length. While this is a relatively long stretch of proposed treatments along a popular and scenic public roadway, the overall effect would be lessened by the following:

1. The project would occur over the course of 10 or more years. Only limited portions of the project along Swift Trail will be underway at any one time.

2. Proposed treatments should provide a mosaic of visual conditions. As travelers pass through the area, they would move through lighter and heavier treatments, and some areas with different treatments on each side of the road. This will help provide visual variety and minimize the possibility of long stretches of heavy treatment or the same condition on both sides of the road.

Mitigation measures would help lessen visual impacts during and immediately following treatments.

Forest Plan Amendment

Although the proposed project would better meet VQOs for the long term, treatments may not meet visual quality standards and guidelines of the Forest Plan in the short term. Specifically, treatments in the foreground along Sensitivity Level 1 and 2 travelways are not likely to meet VQO retention. Vegetation removal (and associated slash, stumps, stacked logs, and skid roads) and blackened vegetation and tree trunks from fuel reduction treatments would be visible to "casual visitors."

It is recommended that the following standards and guidelines in the Forest Plan be amended as follows:

For Management Areas 2, 2a, and 3a

- **Current:** "Visual quality objectives will be met."
- **Revise to:** "Visual quality objectives will be met, except in areas with VQO foreground retention within the Pinaleño Ecosystem Restoration Project area in the Pinaleño Mountains. Thinning and underburning work included in the project is expected to result in visible changes noticeable by the casual observer. The objectives would be met over the long term by reducing the risk of large, damaging wildfires and helping create a healthier forest, a visual mosaic of forest conditions, large trees, and patches of open ("parklike") stands. Slash, stumps, logs, and skid roads in the foreground along system roads and trails would generally be cleaned up within 1 year. Effects from prescribed fire (blackened, scorched vegetation and tree trunks) could be visible for about 2 to 3 years following treatments."

Management Area 8

- **Current:** "Manage the following acres at the indicated VQO: 2,170 Acres Retention 57% (RNAs)."
- **Add the following language:** "Visual quality objectives will be met, except in areas with VQO foreground retention within the Pinaleño Ecosystem Restoration Project area in the Pinaleño Mountains. Thinning and underburning work included in the project is expected to result in visible changes noticeable by the casual observer. The objectives would be met over the long term by reducing the risk of large, damaging wildfires and helping create a healthier forest, a visual mosaic of forest conditions, large trees, and patches of open ("parklike") stands. Slash, stumps, logs, and skid roads in foreground along system roads and trails would generally be cleaned up within 1 year. Effects from prescribed fire (blackened, scorched vegetation and tree trunks) could be visible for about 2 to 3 years following treatments."

Cumulative Effects

Past actions in the project area include the construction of existing roads and trails, which are used as viewing platforms and, therefore, are generally not considered negative visual elements. Recreation sites (such as campgrounds, picnic areas, summer homes, and the bible camp) have not resulted in substantial impacts to visual resources. The Columbine Administrative Site has a small impact to visual quality, but its facilities blend well with the landscape. Most visitors to the area traveling on major roadways would not notice impacts from wildcat roads or OHV damage, though some of this has occurred. The largest impacts to visual quality near the project area are the astrophysical facilities atop Mount Graham and the electronic site atop Heliograph Peak. Past wildfires and insect infestations have affected visual quality in numerous areas in the Pinaleño Mountains; these are natural disturbances in the landscape and, therefore, generally not considered in effects analyses, but the scale of some are beyond historic norms.

A present action that is underway is the Pinaleño Ecosystem Management (PEM) Project. Effects from this project are relatively short term, and work is nearly complete. Once slash is treated, landscapes should appear natural again, and visual quality should ultimately be higher than it is currently. Another present action is spruce planting in the Refugium; this work should have a beneficial effect on visual quality.

Reasonably foreseeable future actions include the recreation residence special use permit renewal and Arizona Department of Transportation’s implementation of a corridor management plan (CMP). Renewal of the special use permits will not result in any new impacts to visual quality. The CMP identifies visual quality as an important issue along Swift Trail and includes recommendations to protect it.

Since the actions described above do not contribute substantial effects to visual quality, the proposed project, when added to past, present, and reasonably foreseeable future actions, is not expected to cause cumulative effects beyond those described in the analysis of the alternatives.

Social Considerations

Introduction

This analysis describes the desired and existing condition of the social trends within the project area and evaluates the potential effects of the proposed action and no action alternatives on local communities and populations.

Overview of Issues

There is a concern that the proposed project could negatively affect low-incomeand minority populations. The measurement indicator for this issue will be a qualitative discussion of local populations, demographics and trends, and a disclosure of compliance with Executive Order 12898.

Affected Environment

The Coronado National Forest (CNF) lies within six counties in southern Arizona and New Mexico; Cochise, Graham, Pima, Pinal and Santa Cruz counties in Arizona, and Hidalgo County in New Mexico. The Pinaleño Ecosystem Restoration Project is located in the Pinaleño Mountains in Graham County, Arizona, northwest of Stockton Pass Road (Highway 266) and southeast of North and South Taylor Roads (Forest Road 156 and Forest Road 509). Not all of the counties that overlap the CNF are included in the study area. Given interest in the project, which is located in the Safford Ranger District (figure 46), this discussion and analysis will focus on Graham County, which surrounds the project area. The description of Graham County is presented to provide recognition of the social lifestyle and context of the Pinaleño Ecosystem Restoration Project.

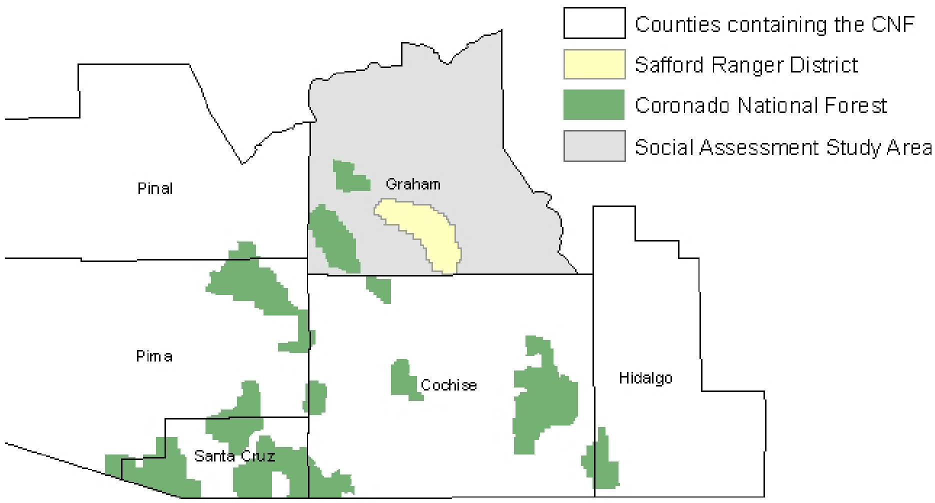


Figure 46. Project study area within the Graham County Arizona

Existing Condition

Certain defining features of every area influence and shape the nature of local social activity. Among these are the local history, population, the presence of or proximity to large cities or regional population centers, types of longstanding industries such as agriculture and forestry, area racial and cultural characteristics, predominant land and water features, and unique area amenities. The CNF operates as a steward of many of these area resources and opportunities and thus plays a principal role in the community. This discussion gives further insight on the character and extent of these community connections.

History

The history of human occupation of the Pinaleño Mountains began long before European entry into the region. The Coronado National Forest recognizes ancestral, cultural, physical, social and spiritual affiliations and ties of 12 tribal entities including the Ak-Chin Indian Community, Pascua Yaqui Tribe, Gila River Indian Community, Tohono O'odham Nation, Salt River Pima-Maricopa Indian Community, Hopi Tribe, Zuni Pueblo, White Mountain Apache Tribe, San Carlos Apache Tribe, Mescalero Apache Tribe, and Yavapai-Apache Nation to lands managed by Coronado National Forest. In reference to the proposed project area, the Pinaleño Mountain range and surrounding areas extending well beyond the areas managed by Coronado National Forest are areas of outstanding significance to the Western Apache (White Mountain and San Carlos) as well as the Tohono O'odham, Hopi and Zuni Tribes.

The Pinaleño Mountains have been known by many names over the years (Wilson 1995: 10-11). However, they are the ancestral and contemporary homeland of the Western Apache since time immemorial who refer to it as *Dzil Nchaa Si'an*. For a more complete history on Apache naming of Mt. Graham, see Gillespie (2000).The Apache groups resisted Euro-American encroachment, subjugation and colonization efforts until the second half of the 19th century. The Treaty of Guadalupe-Hidalgo was signed in 1848, ending the U.S. war with Mexico and bringing California, New Mexico and Arizona north of the Gila River under U.S. control. However, even though the Western Apache were forced from their homelands through Federal Indian policy and governmental actions, Apache people still claim powerful ties to the Pinaleño Mountain range and surrounding areas. For a more complete discussion of Apache affiliation and history and a history of the Pinaleño Mountains, see Gillespie (2000), Spoerl (2001), McDonald (2008) and Welch (1997).

The name "Mount Graham" was first applied to the Pinaleño in 1846 when the Army of the West under General Stephen Watts Kearny followed the Gila Valley on its way west to California. The name appears in the journal of an officer of the expedition, Lieutenant William Emory. The lieutenant also used the name "Pinaleños," describing them as on the north side of the Gila, but mapping them in their current location. It was not until surveys for a Pacific Railroad route commenced in 1854 that maps began to consistently locate Mount Graham and the Pinaleños in their present locations (Spoerl n.d.: 15). The first documented Euro-American visit to the top of the Pinaleños occurred in 1871, when a survey party under George M. Wheeler left a stone monument on the summit (Mount Graham).

Commercial logging of the range began in the last quarter of the 19th century, with the establishment of settlements in the Gila Valley. Sawmills were established in accessible canyons on the north side of the range, and the Army cut timber in the Fort Grant vicinity following its establishment in 1873. A military hospital was built at Hospital Flat and used during the summer months. In 1889-1890, the Army established a heliograph signaling station on Heliograph Peak. However, military use of the range was in decline after 1880 and ceased when Fort Grant was abandoned in 1895 (Spoerl n.d. 25).

By that time, residents of the Gila Valley had begun to escape the summer heat by visiting the mountains. The Turkey Flat, Arcadia and Columbine areas became popular recreation sites in the early 1890s with families building summer cabins in these localities. Riggs Flat became the headquarters for summer cattle grazing in the early 1900s, while Chelsey Flat was used for growing potatoes. In 1902, the increasing use of the mountains was regulated through establishment of the Mount Graham Forest Reserve, with the objective of protecting the water supply and timber reserves. The reserve became part of Crook National Forest in 1908, and in 1953, was transferred to the Coronado National Forest (Spoerl n.d. 25).

In 1984, the Smithsonian and University of Arizona astronomers proposed to build an astronomical facility atop the Pinaleño Mountains (Welch 1997:76). In 1988, the first of two congressional riders were passed along with Federal legislation allowing the first phase of astronomical facility construction known as the Mount Graham International Observatory (MGIO). However, in 1989 the Apache Survival Coalition "asserted that the battery of telescopes would desecrate the sacred Pinaleños and interfere with their religion" (Welch 1997:76). The Western Apache continue to oppose the MGIO as incompatible with the spiritual values of Mount Graham/*Dzil nchaa Si' an.* The MGIO and other modern developments on the mountain have precipitated aggressive firefighting techniques, and inhibited the restoration of the natural ecosystem processes. The affected area is a place of the greatest importance to Western Apache belief systems and worldviews. Therefore, any projects potentially having adverse effects to the mountain range need to be completed with respect and in compliance with applicable cultural heritage resource legislation.

Population and Demographic Change

According to the U.S. Census Bureau, population growth in Graham County was slower than the state but faster than the nation between 1970 and 2005, increasing by 51 percent from 16,722 to 33,089 (figure 47). The overall increase over this period masks a slight decrease from the high in 2001 of 33,518. Population projections suggest Graham County and the State of Arizona will continue to increase in the next 20 to 25 years. According to these projections, Graham County will increase by 39 percent while the state will increase by 86 percent from 2005 to 2035.

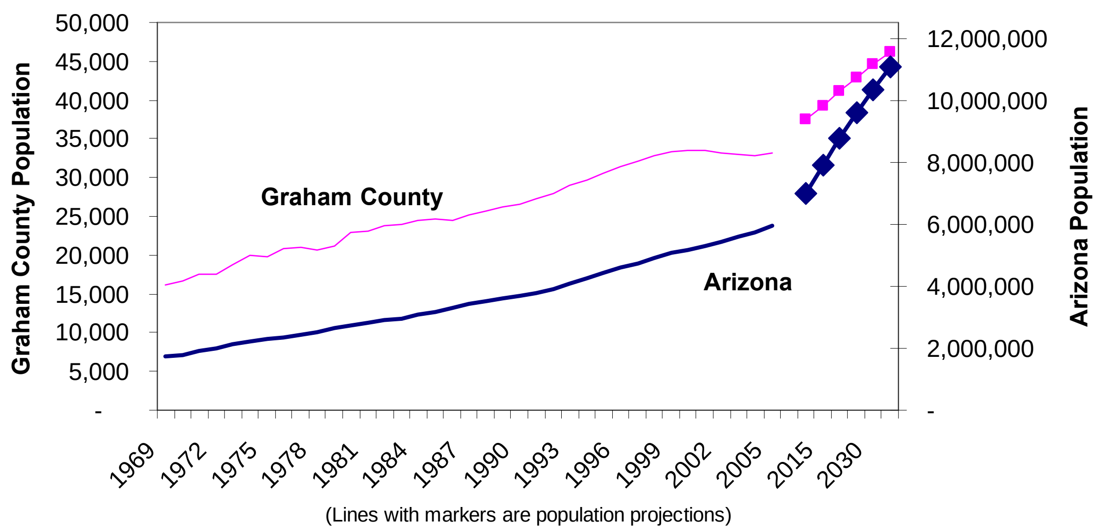


Figure 47. Population change and projections for Graham County and Arizona (Source: U.S. Department of Commerce 2005; Arizona Department of Economic Security 2006)

The population in the study area has aged slightly between 1990 and 2000, with the median age increasing from 29.4 to 30.9. Between 1990 and 2000, age groups between 40 and 59—which include the baby boomer population—showed increases in their shares of total population with the fastest growing age group of 45 to 49, which rose by 1.3 percent. Those aged 15 to 29 also increased, while those aged 25 to 34 and less than 14 years showed decreases in their share of the total population. The largest decreases for all age categories were seen for those aged 5 to 9 years old, decreasing by 1.9 percent (U.S. Census Bureau 1990 and 2000).

For the State of Arizona and Graham County, the share of total population of all non-white races and Hispanics increased between 1990 and 2000, except for Native Americans which decreased by less than 1 percent in both the state and the county (table 89). Since Hispanics can be of any race, the totals in the table below do not add to 100 percent. The share of American Indian and Alaska Native, those of some other race, and those identified as Hispanics were greater than the state share in the year 2000, indicating the possible presence of environmental justice populations as defined by Executive Order 12898 (see below for further discussion).

Graham County is Arizona's fifth least dense county, containing 7.2 persons per square mile (U.S. Department of Commerce 2005). Population density does not indicate if the people living in the area are in more urban or rural areas. The U.S. Census Bureau classifies urban areas and their populations. In 2000, Graham County's population was somewhat more rural (56 percent) than urban (44 percent), however, its urban population is located entirely inside urban clusters, reflecting pockets of urbanization across the predominantly rural landscape (U.S. Census Bureau 2000).

Table 89. Racial and Hispanic composition of 2000 population and the change in share from 1990

	White	Black or African American	American Indian & Alaska Native	Asian, Native Hawaiian & Other Pacific Islander	Some Other Race	Hispanic
Arizona	75.5%	3.1%	5.0%	1.9%	11.6%	25.3%
Percent change from 1990	-5.5%	0.1%	-0.6%	0.5%	2.7%	6.7%
Net change	905,929	48,811	51,290	44,842	268,006	614,989
Graham County	67.0%	2.2%	14.3%	0.6%	13.3%	26.8%
Percent change from 1990	-10.6%	0.5%	-0.4%	0.01%	7.9%	2.3%
Net change	1,823	291	886	47	3,030	2,470

Source: Census 1990 and Census 2000

Commuting data for Graham County suggests the area can be classified as a bedroom community, since income from people commuting out of the county to work exceeds the income from those commuting into the county by 11 percent (U.S. Department of Commerce 2005). In this manner, the area depends to a greater degree on surrounding counties for income generation. While commute times may be greater, there is a net gain in personal income that would not occur otherwise.

Between 2000 and 2006, the number of all housing units increased by 18 percent in the State of Arizona but only by 4.6 percent in Graham County (the fourth smallest rate of increase for all Arizona counties; U.S. Census 2006). Understanding whether an area has absentee landowners (housing units that are for seasonal, recreational, or other occasional use) in the area indicates if there may be a lack of understanding of how the national forest is managed. These housing units may be owned by other Arizona state residents, other county residents, or out-of-state residents. Seasonal housing increased between 1990 and 2000 in Graham

County by 35 percent; however, this increase was exceeded by the State and other counties in the CNF area (USDA Forest Service 2007).

Educational attainment is a good indication of area human capital. The percent of those 25 years and over who had completed high school or an equivalency was higher in Graham County than in the State of Arizona. However, the percent of those with a bachelor's degree or higher was twice as much in the State than in Graham County (table 90).

Economic Well-Being and Poverty

Personal income and per capita income are useful measures of economic well-being. From 1970 to 2005, personal income in the analysis area increased by $394 million and per capita income rose from $14,109 to $19,034 (all measures adjusted for inflation). Levels of per capita income in Graham County were lower than the State ($30,019) and the Nation ($34,471) in 2005, which can be explained by differences in cost of living in metropolitan verses the predominantly non-metropolitan analysis area. Differences in non-metropolitan and combined metropolitan/non-metropolitan per capita income levels for the State and the Nation explain the lower levels seen in the analysis area (non-metropolitan for the State was $22,183 and for the Nation was $26,115 in 2005; which are lower than the metropolitan/non-metropolitan combined levels shown above). So while per capita income in Graham County ranked 13th of Arizona's 15 counties, the lower cost of living in this non-metropolitan county explains most of the difference (U.S. Department of Commerce 2005).

Table 90. Number and percentage of people with different levels of educational attainment in Graham County and Arizona

	Graham County		Arizona	
	Number	**Percent**	**Number**	**Percent**
Population 25 years and over	19,302	100	3,256,184	100
Less than 9th grade	1,703	8.8	254,696	7.8
9th to 12th grade, no diploma	3,011	15.6	364,851	11.2
High school graduate (includes equivalency)	5,811	30.1	791,904	24.3
Some college, no degree	4,782	24.8	859,165	26.4
Associate degree	1,711	8.9	219,356	6.7
Bachelor's degree	1,234	6.4	493,419	15.2
Graduate or professional degree	1,050	5.4	272,793	8.4
Percent high school graduate or higher	-	75.6	-	81
Percent bachelor's degree or higher	-	11.8	-	23.5

From 1990 to 2006, unemployment in Graham County has remained above both national and State levels (fgure 48). Since 1990, the unemployment rate varied from a high of 10 percent in 1996 to a low of 4.9 percent in 2006 (U.S. Department of Labor 2006). New jobs created in an area are filled from two principal sources; local unemployment and in-migration. If unemployment remains high, new jobs are likely to be filled by local area residents, however, if unemployment continues to fall, new jobs could be filled more often by new area residents.

The share of the Graham County population living below the poverty level decreased from 27 to 23 percent between 1989 and 1999. This is greater than the 1999 State population share living below poverty of 14 percent (U.S. Census Bureau 2000).

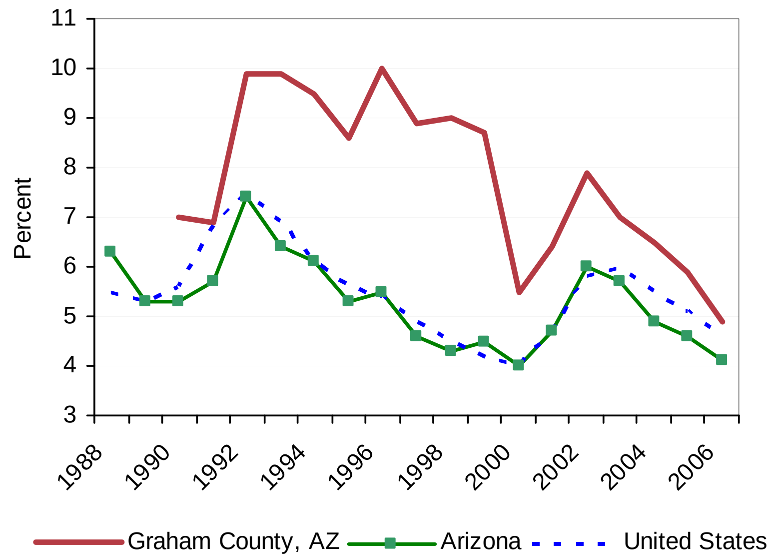


Figure 48. Unemployment Rate of Graham County, Arizona and the U.S. (Source: U.S. Department of Labor 2006)

Community Relationships

Historic and current communities surrounding the project area have depended on the landscape's resources, tourism opportunities, and traditional and cultural uses. The low rate of area absentee landowners discussed above may reflect the higher degree of area residents involved with natural and cultural resources. These connections have further fostered relationships with Federal agencies and the landscape in the form of formal partnerships and informal volunteer projects. Examples of organizations involved in these efforts include the USDI Fish & Wildlife Service, Arizona Game & Fish Department, University of Arizona Laboratory for Tree Ring Research, University of Arizona Red Squirrel Monitoring Program, Pinaleño Partnership, and Pinaleño Science Collaborators.

With increasing social and cultural diversity (table 89) of the area, the CNF social and economic sustainability report (USDA Forest Service 2007) noted the Forest Service is making a concerted effort to address the needs and desires of historically underserved communities. Additional communities of interest should be considered. Communities of interest bring together stakeholders from different backgrounds to solve a problem of common concern (Fischer 2001, p. 4). Brown and Duguid describe communities of interest as "communities-of-communities" (Brown and Duguid 1991, p. 53). They provide unique opportunities to explore the linkages between people and public land that may transcend geographically defined communities.

The Coronado National Forest has undertaken some assessment of area community relationships for the entire CNF (USDA Forest Service 2007). This uncovered community interests relevant to the project area such as the use and management of natural resources, cultural resources, wildlife, regional water supplies, and concern regarding fire control and prevention. Additionally, a forum convened with area tribes in 2004 indicated desires for more accommodation of traditional uses and cultural uses in decisionmaking and planning, clarification of the role of cultural and other non-economic values in decisionmaking about such issues as Mount Graham, the incorporation of traditional knowledge in management and planning, attention to site protection and privacy issues in the management of cultural resources, and a desire for cooperative management of resources of mutual interest to tribes and the Forest Service (USDA Forest Service 2007).

Desired Condition

Federal, State and Local Regulations and Standards

Environmental Justice - Environmental justice refers to the fair treatment and meaningful involvement of people of all races, cultures, and incomes with respect to the development, implementation and enforcement of environmental laws, regulations, programs, and policies. Executive Order 12898 requires Federal agencies to "identify and address the disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."

According to the Council on Environmental Quality's (CEQ) Environmental Justice Guidelines for NEPA (1997) "minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis." Table 89 above shows that Graham County shares of American Indian and Hispanic populations were greater than the state in 2000. Thus, the U.S. Census data suggest minority populations within the study area might meet the CEQ's Environmental Justice criterion.

CEQ guidance on identifying low-income populations states "agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect." The discussion above noted the share of people living below the poverty level decreased between 1989 and 1999; however, the level in Graham County remained above the State level.

Environmental Consequences

Methodology

Data for this analysis was researched from many Federal, State and local agencies, including (but not limited to) the U.S. Census Bureau, the U.S. Department of Labor, the Arizona Department of Economic Security, and Graham County. It should be noted that because we are focusing on overall county level data, specific community level information may not be highlighted or represented. However, an effort has been made to examine the community interests that involve the Pinaleño Ecosystem Restoration Project, beyond the geographic scope of just Graham County.

Alternative 1 - No Action

Direct and Indirect Effects

Under this alternative, no fuels treatments are planned. The current fuel load and the threat of large-scale wildfire would remain. The impact of transitory smoke and haze from fuels treatments under the action alternatives would be avoided; however, with increased threat of large-scale wildfire, area communities could experience greater threats to air quality and human health than the action alternatives. As noted above, area communities interested in fire control and prevention value the decreased risk associated with treated fuels. Under the no action alternative, these untreated fuels would likely pose a greater threat to life, property and human health than the action alternatives. The lack of fuels treatments could also result in greater risk than the action alternatives to wildlife habitat and area natural resources, valued in the area by those interested in the management of wildlife and those interested in the management of natural resources.

As noted in the “Hydrology” section, runoff from wildfires in high severity burns can be greater than normal or baseline peaks and will continue for several years. Also, several roads in the project area have washouts that will continue to go unmaintained under the no action alternative. Thus, the action alternatives could provide resource protection valued by area individuals and groups interested in management of natural resources. To the extent that water quality impacts available quantity, the action alternatives could also provide integrity of water supply valued by individuals and groups in the area interested in the management of regional water supplies.

Effects Common to Alternatives 2 and 3

Direct and Indirect Effects

No disproportionately high and adverse human health or environmental effects on minority or low-income populations are anticipated under the action alternatives. As a result of either Alternative 2 or 3, actions taken could provide jobs and income for minority or low-incomepopulations, but are not likely to impact their quality of life or social values.

Both alternatives would comply with the Mount Graham Red Squirrel Recovery Plan and could provide habitat improvements, valued by area individuals and groups interested in wildlife management. Thus, habitat improvements under the action alternatives could foster a social value identified in the area to a greater degree than the no action alternative.

Some transitory effects from temporary nuisance smoke could occur as a result of lower intensity fire from fuels treatments under the action alternatives; however, these effects would likely be less than the human health effects that could occur from smoke produced by a large-scale wildfire (see air quality report). In addition, with a reduction in fuels there would be less of a threat to firefighter and public safety, private property, and facilities in the area.

Alternative 2

Under Alternative 2, greater protection of property, human health and firefighter safety can be expected because flame length and the likelihood of passive crown fires would be reduced in treated areas, resulting in smaller and less severe fires (there would be a 46 percent reduction in flame lengths greater than 11 feet and a 28 percent combined reduction in passive and active crown fire as compared with Alternative 1). In addition, the reduced range of fire behavior would lessen the risk to important ecological and wildlife habitat, valued in the area by those interested in wildlife management.

Alternative 3

Modeling suggests there would be a 26 percent reduction in flame lengths greater than 11 feet and a 20 percent combined reduction in passive and active crown fire as compared with Alternative 1. Therefore, it would not be quite as effective as Alternative 2, but more effective than the no action alternative. Thus, the threat to firefighter safety and risk to private property would be less than Alternative 2 but greater than the no action alternative.

The range of possible fire behavior would be less than the no action alternative, thereby reducing the risk to ecological and wildlife habitat, valued by area communities identified as interested in wildlife management. However, the range of fire behavior would be greater that the proposed action thereby possibly increasing risk to habitat.

Direct and Indirect Effects Common to All Alternatives

While minority and low-income populations may exist in the area, none of the alternatives are expected to have disproportionately high and adverse human health or environmental effects on these communities. Predicted adverse effects described to resources analyzed in this DEIS would be generally limited to the project area, therefore, impacts to local communities would be negligible. The actions associated with the project could support employment and income in the area, which could benefit area minority and low-income populations.

Under all the alternatives, the Mount Graham Red Squirrel Recovery Plan, and standards and guides (under the Forest Plan) for goshawk and Mexican spotted owl would apply. Thus, the integrity of their habitat under all the alternatives would likely be maintained, which was a social value identified in the area of those interested in the management of wildlife.

Under all the alternatives, traditional and cultural uses have been considered. Additionally an effort has been made to incorporate attention to site protection and privacy issues in the management of cultural resources. These efforts will likely foster cooperative management of resources of mutual interest to tribes and the Forest Service, hopefully strengthening tribal interest and involvement.

Cumulative Effects

As discussed above, projected population increases in the area (figure 47) will ensure community relationships with the CNF will continue to grow and change. Anticipating the variety of values of the future population is unrealistic; however, if current trends continue, existing opportunities for public involvement and collaboration will continue. This will enable future public involvement and consideration of future social values.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

All alternatives would comply with Executive Order 12898, as no low-incomeor minority populations are expected to be adversely affected.

Cultural Heritage Resources

Introduction

This analysis describes the desired and existing condition of cultural heritage resources within the project area and evaluates the potential effects of the proposed action and no action alternatives.

Overview of Issues

Protection and preservation of the Pinaleño Mountain range (*Dzil Nchaa Si'an*) is of the utmost importance to various tribal entities that have ongoing spiritual, physical, social, and cultural ties to the mountain since time immemorial. Moreover, various prehistoric and historical-period cultural heritage resources of remarkable value are located within the area of interest. Therefore, protection, preservation, and mitigation of cultural heritage resources from any adverse affects to *Dzil Nchaa Si'an* is of the highest priority to the Coronado National Forest heritage staff.

Affected Environment

The Pinaleño Mountains are important for their history and cultural significance. The entire range is a traditional cultural property for the Western Apache, and the public land administered by the Forest Service has been determined eligible for listing on the National Register of Historic Places as the Western Apache Mount Graham (*Dzil Nchaa Si'an*) Traditional Cultural Property (Spoerl 2001, 2002a, 2002b). The boundary of the historic property is the Forest Service administrative boundary of the Pinaleño Mountains unit, some 198,879 acres in size.

The White Mountain and San Carlos Apache Tribes have a distinct and integral relationship to *Dzil Nchaa Si'an*. The mountain acts as the resting place for the Apache *ghaan* and a source of Apache strength, energy, and wisdom. Any major projects disturbing the mountain will cause Apache people great harm, pain and deep sorrow (Cassadore Davis 2003). The mountain range has been used since time immemorial by the *Ndee* as a place of spiritual worship, resource procurement, and a central part of Western Apache belief systems and worldviews. In collaboration with the San Carlos Apache Tribe, the White Mountain Apache Tribe, and the Yavapai-Apache Nation, the Forest Service determined the entire Pinaleño Mountains within the forest boundary eligible for the National Register of Historic Places as the Western Apache Mount Graham/*Dzil Nchaa Si'an* traditional cultural property in 2001. The keeper of the National Register concurred in 2002. Traditionally, the cultural property extends beyond the forest boundary, but the formal determination of eligibility was confined to the approximately 198,000 acres of public land administered by the Forest Service. The mountain range also has traditional religious and cultural significance for the Hopi, Zuni, Mescalero Apache, and Fort Sill Apache Tribes.

Within the project area, the Forest Service's Columbine Administrative Site is listed on the National Register of Historic Places, and some summer cabins at Columbine and Turkey Flat have been determined eligible for listing. Twenty archaeological and historic sites are known within the proposed project area. Additional sites are likely to be present because to date, only about 25 percent (~1,500 acres) of the project area has been surveyed for cultural resources.

Implementation of the proposed action would likely benefit Pinaleño heritage resources over the long term, because it would reduce the potential for catastrophic fires. The action would also begin the restoration of the ecosystem to pre-1870 conditions, an objective recommended by the White Mountain Apache Tribe. Reduction of the risk of catastrophic fire would particularly aid in the preservation of fire sensitive sites, including historic cabins and other historic wooden structures. Because we plan to survey areas of proposed ground disturbance, and any discovered eligible sites would be avoided, there should be no direct effects on archaeological sites. However, prescribed burning has the potential to adversely affect archaeological and historic sites that contain heat-sensitive resources, should a fire escape control. Some traditionally important plants may be damaged by fire.

Desired Condition

Federal, State and Local Regulations and Standards

Implementation of the proposed action would likely benefit Pinaleño (*Dzil Nchaa Si'an*) heritage resources over the long term, as it would begin the restoration of the pre-1870 resource conditions and ecosystem processes, as recommended by the White Mountain Apache Tribe. The tribe recommends that the desired condition of *Dzil Nchaa Si'an* should be returned to pre-1870s conditions before reservation confinement of Western Apache groups.

Under Section 106 of the National Historic Preservation Act (NHPA), the Forest Service has the responsibility, in consultation with the State Historic Preservation Officer, tribes, and other interested parties, to identify historic properties within the area of potential effect, and to determine the effects that the proposal could have on historic properties. The process for identifying historic properties, potential effects, and possible mitigation is outlined in the NHPA's implementing regulations in the Code of Federal Regulations, Title 36 Section 800. The Advisory Council on Historic Preservation (ACHP) oversees the process. Under Section 106 of the National Historic Preservation Act, the protections are the same for eligible sites as for listed sites.

Other legislation is also mandated for projects with potential adverse effects to various cultural heritage resources (e.g. The American Indian Religious Freedom Act, The National Environmental Protection Act, Executive Order 13007, Indian Sacred Sites, Archaeological Resources Protection Act, and the Native American Graves Protection and Repatriation Act).

Environmental Consequences

Models and Methodology

A records search of the Coronado National Forest project and site atlas revealed that from 1976 to the present, 51 surveys and assessments of varying quality have been conducted (table 91). The previous survey components have covered less than 25 percent of the proposed project area. Even though many of these surveys are not up to current standards, these older surveys did result in documentation of archaeological sites and information related to the types of sites and density of sites that would be expected in the area.

Table 91. Previous cultural resource surveys and assessments

FS Report Number	Acres	Survey Name
R19760305017	0	Heliograph Cabin Lookout Site
R19760305018	10	Swift Trail Road, Alternative D
R19760305021	106	Treasure Park Timber Sale
R19760305023	1	Columbine Corral Project
R19760305026	10	Hospital Flat Recreation Area
R19780305060	80	Columbine Thinning Project
R19780305083	132	Riggs Flat and Clarks Peak Prescribe Burn
R19800305070	8	Pima Ward Organization Camp
R19800305071	3	Grace Tabernacle Organization Camp
R19820305038	1	U of A Lizard Study Plots
R19830305046	1	Riggs Dam Rehabilitation Project
R19840305051	94	Cunningham Timber Sale
R19840305068	9	Grant Hill Salvage Timber Sale
R19840305100	21	Treasure Park Salvage Timber Sale
R19840305105	18	Treasure Park Salvage Timber Sale #2
R19840305108	3	Hospital Flat Trail
R19850305070	15	Pinaleño Mts. Timber Sales (4) FY 1985
R19850305108	105	Goudy Salvage Sale
R19850305110	1	Heliograph Peak
R19860305036	36	Swift Trail Sanitation Timber Sale
R19860305068	45	Swift Trail Sanitation Sale
R19860305074	1	Chesley Flat Road Closure
R19860305097	1	Ash Creek Trail Realignment
R19870305113	100	Ash Canyon Logging System
R19880305024	87	Developed Recreation Sites - High Elevation Pinal
R19880305158	83	Emerald Pk Area - Supplemental Survey
R19880305178	15	Columbine Cabins Inventory and Evaluation
R19890305127	1	Motorola Conduit Installation
R19890305146	0	Routine Road Maintenance FS 507
R19890305179	33	Pinaleño Trail Construct/Reconstruct
R19900305106	0	Pinaleño Recreation Sites
R19910305080	1	Swift Trail Material Storage
R19910305083	1	Columbine Hazmat Removal
R19920305085	1	Heliograph Peak Border Patrol Tower
R19920305086	5	Heliograph Trail
R19930305054	12	Shannon-Arcadia Trail Maintenance/Relocation
R19930305075	0	Treasure Park Water Storage
R19930305076	55	Pinaleño Fuel Hazard Reduction
R19940305009	0	CNF Annual Survey Plan, FY '94
R19940305107	8	Cp Flat Loop Road Rehabilitation
R19940305121	1	SGCTVA Antenna Location

Table 91. Previous cultural resource surveys and assessments

FS Report Number	Acres	Survey Name
R19950305029	12	Snow Flat Extension
R19960305001	1	Columbine Diesel Spill Drilling
R19960305040	0	Columbine Bathhouse Removal
R19960305076	1	Rock Storage Site - Swift Trail
R20010305061	88	Swift Trail Row Survey
R20010305079	0	Mt. Graham TCP Determination of Eligibility
R20020305045	184	Cultural Resource Survey of 7.6 Miles of SR 366
R20020305063	0	Mt. Graham – Boundary Considerations
R20020305067	0	Eligibility Criteria for the NRHP and Mt. Graham TCP
R20040305067	25	Nuttall Fire BAER- Heritage

In addition to the surveys referenced above, approximately 400 acres were surveyed in 2005 and 2007 for the purpose of collecting information to develop the survey strategy for this project. During this survey, the accuracy of the previous surveys was determined to be adequate. Within the previously surveyed areas, one unrecorded archaeological site was discovered. This site was not previously recorded because it did not meet the age requirement of 50 years when last surveyed. Four archaeological sites were identified and recorded during this survey. Each of the sites was recorded with particular emphasis on the potential impacts of the proposed actions.

Table 92. Previously recorded cultural resource sites

AR03-05-04-	Site Description	NR Status*
104	Mogollon Shrine/Sherd Scatter	Y
105	Chesley Family Summer Cabin Site	U
116	Heliograph Lookout Complex	L
117	Webb Peak Lookout Tower	L
148	Treasure Park CCC Camp (F-14-A)	U
150	Columbine CCC Camp (F-74-A)	U
165	Possible Hospital Tent Site	U
194	Columbine Work Station	L
195	Columbine Summer Home Lot 2	Y
196	Columbine Summer Home Lot 10	Y
200	Merrill Peak Lookout	U
201	Historic Cabin/Camp Site	U
239	SR 366/Swift Trail (AZ CC:5:24 ASM)	Y
281	Mount Graham (*Dził Nchaa Si'an*) Western Apache Traditional Cultural Property	Y

* NR Status = Eligibility for the National Register of Historic Places, per the Region 3 Programmatic Agreement. See discussion below. L = listed, site is listed on the National Register of Historic Places; Y = yes, site is considered eligible; U = unevaluated, site would need more investigation to determine eligibility.

Previous surveys have recorded 20 heritage sites in the proposed project area (table 92). As noted above, Heliograph and Webb Peak Lookouts and the Forest Service's Columbine Administrative Site are listed on the NRHP. Six sites, though not listed on the NRHP, are determined eligible, and 11 sites are unevaluated.

The National Register listed lookouts remain in service; however, Heliograph Lookout was badly damaged by the Nuttall-Gibson Fire Complex of 2004. They are usually staffed only during periods of high fire danger. Nevertheless, they are subject to maintenance on an as-needed basis and are generally in good condition. Likewise, the Columbine Ranger Station remains in use as a work center and visitor center, and is maintained as needed to assure the continued utility of the buildings.

Two sites are representative of Native American use of the area, including the *Dzil Nchaa Si'an* Western Apache Traditional Cultural Property, and the potential Mogollon Shrine. The 18 historic period sites in the project area range from the possible 1870s hospital tent site at Hospital Flat, to a mid-20th century recreation site at Lower Columbine.

Alternative 1 - No Action

Direct, Indirect, and Cumulative Effects

There would be no direct impacts to heritage resources under the no action alternative. However, any modifications to current management plans that continue to guide management of the project area need to be reported to the Coronado National Forest heritage program for evaluation in accordance with mandated legislation.

Alternatives 2 and 3

Direct and Indirect Effects

Each of the action alternatives has 20 (prehistoric and historical-period) sites within or near the proposed treatment units that have the potential to be affected by the project. The most severe impacts would be from using heavy equipment (machine cut, removal by ground-based equipment) to skid or drag logs (whole-tree yard) through a heritage site. Heavy equipment activity (dozer) can affect sites by redistributing artifacts and destroying feature and site contexts. Intense heat from pile burning or underburning would also damage historical-period sites constructed of organic perishable wood materials or could severely damage older sites through spalling and discoloration of surface materials. Felling both live and dead trees near heritage sites could also severely damage material remains including structures and artifacts associated with both prehistoric and historical-period cultural heritage sites.

Removing trees by skyline yarding systems could also potentially severely impact cultural heritage resources, especially if ground contact occurs. Large felled trees could be dragged over cultural heritage sites severely damaging or destroying site integrity. Piles should be located well away from heritage sites, particularly if they are going to be burned. Impacts to cultural heritage resources would be avoided by designating sites in need of protection as part of a "no-treat patch" or changing unit boundaries to exclude cultural heritage resources.

Public firewood gathering may affect cultural heritage resources through unsupervised intrusions into heritage sites not recognized by the general public. Modification and damage to sites could occur in the form of artifact and feature disturbance. Both firewood gathering and Christmas tree procurement activities should occur well away from cultural heritage resources in previously designated areas where the public will not have access to sites. Cutting and transporting of firewood and Christmas trees may potentially damage sites through surface alteration and vehicle damage.

Stewardship contracting activities may be utilized for cultural heritage resources protection and monitoring of firewood gathering and Christmas tree procurement activities. However, stewards should be well aware of the importance of *Dzil Nchaa Si'an* to Western Apache tribes and should monitor the mountain range with this recognition as a guiding agent.

To the Western Apache each action alternative directly affects *Dzil Nchaa Si'an*. Therefore, any project having adverse affects to *Dzil Nchaa Si'an* should be conducted in a responsible and respectful approach, and Western Apache groups have to be consulted regarding such projects. In reference to material remains, indirect effects on cultural heritage resources could be increased by movement of artifacts due to erosion after treatment, and increased visibility of resources due to vegetation reduction, which may increase collecting or site disturbance activities.

Cumulative Effects

Under all the action alternatives all potential effects are expected to be avoided or mitigated, resulting in no net negative cumulative effects to cultural heritage resources within the project area. However, it must be continually re-emphasized that the mountain range is an integral part of Western Apache worldviews and continued modification and desecration will cause Apache people great harm and deep sorrow.

Past effects to cultural heritage resources in the area include the development of large binocular telescopes (MGIO) on Mount Graham, which desecrated the sacred mountain in the view of many Western Apache people. The MGIO is still an ongoing issue and the Western Apache tribes continue to oppose the MGIO. Wildland fire has also damaged cultural heritage resources within the project area. Both prehistoric and historical-period cultural heritage resources were damaged during the Nuttall-Gibson Fire Complex of 2004. Various activities including road maintenance, fire suppression, vegetation and forest management, natural disturbances, and development of utilities have also affected cultural heritage resources.

At this point in the analysis, the potential effects of the proposed action alternatives are considered in combination with the past effects to cultural heritage resources to determine an overall cumulative effect on *Dzil Nchaa Si'an*. It cannot be overstated that to the Western Apache the affected area, *Dzil Nchaa Si'an*, is a place of the greatest importance to Western Apache belief systems and worldviews and that they strongly believe the construction of the Mount Graham International Observatory has desecrated the sacred mountain and continues to harm Western Apache people. However, implementation of the proposed action would likely benefit Pinaleño cultural heritage resources over the long term, and begin restoring the ecosystem to pre-1870 conditions as recommended by the Western Apache tribes. Western Apache tribes support this type of ecosystem restoration, provided that it is completed with respect and in compliance with applicable cultural heritage resource legislation.

Economic Analysis

Introduction

This analysis provides the estimated costs of the alternatives, compares economic efficiency, and evaluates the use of prison crews to accomplish some of the project work.

Environmental Consequences

Methodology

The following assumptions were used in calculating the estimates for this analysis.

- The proposed treatments would occur over a 10-year period.
- For discounting purposes, the midpoint of the project was set at 6 years from the current time.
- Treatment costs were estimated by the Forest Service.
- Wood product volumes (sawlogs, chips, and firewood) were estimated by the Forest Service.
- The planning costs were estimated by the Forest Service.
- The no action alternative will incur planning costs.
- A real interest rate of 4 percent was used for discounting purposes.
- Trees 9 inches d.b.h. and larger are considered sawlogs. Trees 6 to 9 inches d.b.h. are considered firewood. Chips consist of tops, limbs, and other material processed on landings during the tree removal process.
- Revenues for the removed wood products (such as sawlogs, chips and firewood) were estimated based on local markets and Forest Service policy. Currently, the only viable local market appears to be the firewood market estimated at $20 per cord. Sawlog and chip revenue will be estimated by the established minimum rates set by the Forest Service (Region 3) for these products. Currently, the minimum rates are $6 per CCF for sawlogs and $1 per CCF for chips. One CCF equals 100 cubic feet.

Estimated Treatment and Associated Costs

Table 93 displays the estimated treatment and associated costs by alternative. These costs were estimated by the Forest Service and stated in 2008 dollars.

Estimated Project Revenues

Revenues for the removed wood products (such as sawlogs, chips and firewood) were estimated based on local markets and Forest Service policy. These products will be generated during the removal process by logging machinery. Table 94 below displays the estimated revenues generated by the alternatives. These revenues were estimated by the Forest Service and stated in 2008 dollars.

Economic Efficiency

The economic efficiency of the alternatives as a whole is summarized below. This analysis includes not only estimated project costs and revenues, but also the cost associated with planning the project. The proposed treatments would occur over a 10-year period. For discounting purposes, the midpoint of the project was set at 6 years from the current time. A 4 percent real discount rate was used. Table 95 summarizes overall economic efficiency resulting from the alternatives.

Table 93. Estimated treatment costs

Treatment and Associated Cost Type	Alternative 1 Estimated Cost	Alternative 2 Estimated Cost	Alternative 3 Estimated Cost
Masticate	0.00	118,020	99,270
Prescribed fire	0.00	528,400	500,400
Hand cut trees	0.00	348,000	332,000
Removal	0.00	2,452,271	1,462,168
Haul (including sawlogs)	0.00	2,546,796	984,728
Alternative haul (with all sawlogs converted to firewood)	0.00	1,999,912	984,728
Lop and scatter	0.00	541,100	516,075
Tree pruning	0.00	95,000	95,000
Chip	0.00	178,296	90,924
Hand pile and burn	0.00	739,500	705,500
Road reconstruction and mobilization	0.00	220,489	214,454
Road improvement	0.00	1,389	1,318
Temporary road construction and decommissioning	0.00	29,362	16,117
Swift Trail road maintenance	0.00	6,875	6,875
Close, rehabilitate skid trails and landings	0.00	10,746	8,792
Grass seed landings and skid trails	0.00	20,371	16,667
Planning	500,000	500,000	500,000
Total Estimated Cost	**500,000**	**8,336,615**	**5,550,288**
Total Estimated Cost (with all sawlogs converted to firewood)	**500,000**	**7,789,731**	**5,550,288**

Table 94. Estimated project revenues

Alternative	Alternative 1		Alternative 2		Alternative 3	
	Volume	Revenue	Volume	Revenue	Volume	Revenue
Sawlogs (volume in CCF)	0	0	10,953	65,718	0	0
Firewood (volume in cords)	0	0	8,007	160,140	8,150	163,000
Firewood (volume in cords, all sawlog volume converted to firewood)	0	0	12,170	243,400	8,150	163,000
Chips (volume in CCF)	0	0	5,212	5,212	2,564	2,564
Total Revenue		**0**		**231,070**		**165,564**
Total Revenue (all sawlog volume converted to firewood)		**0**		**408,752** (with no sawlog volume)		**165,564**

Table 95. Economic efficiency calculations

Alternative	Discounted Costs	Discounted Revenues	Net Present Value	Benefit/Cost Ratio
Alternative 1 (no action)	500,000	0	-500,000	0.000
Alternative 2 (proposed action)	6,684,897	182,618	-6,502,279	0.027
Alternative 2 (with all sawlogs converted to firewood)	6,252,687	323,043	-5,929,644	0.052
Alternative 3	4,484,368	130,848	-4,353,520	0.029

Alternative 1 (no action) would have a negative present net value because no benefits are produced to offset the cost of planning the project. Alternatives 2 and 3 both have negative present net values due to the high cost of the treatments and associated projects. The small amount of estimated revenue from the sale of sawlogs, chips, and firewood does not offset the estimated costs of project implementation.

Prison Crew Use

The use of a local prison crew to work on selected projects has been discussed in order to save a significant amount of project costs. The areas of work include the following treatments:

- Hand cut trees
- Pruning
- Lop and scatter
- Hand pile and burn

The cost saving on the above project work is estimated in table 96 below.

Table 96. Prison crew cost saving

Alternative	Project Cost Savings
Alternative 1 (no action)	0
Alternative 2 (proposed action)	1,017,900
Alternative 3	1,094,975

Economic Efficiency with Prison Crew

The economic efficiency of the alternatives as a whole with the prison crew is summarized in table 97 below.

Table 97. Economic efficiency calculations with prison crew

Alternative	Discounted Costs	Discounted Revenues	Net Present Value	Benefit/Cost Ratio
Alternative 1 (no action)	500,000	0	-500,000	0.000
Alternative 2 (proposed action)	5,880,436	182,618	-5,697,818	0.031
Alternative 2 (with all sawlogs converted to firewood)	5,448,226	323,043	-5,125,183	0.059
Alternative 3	3,715,234	130,848	-3,584,386	0.035

Short-term Uses and Long-term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

Actions associated with the Pinaleño Ecosystem Restoration Project are short-term uses designed to provide for long-term productivity that will set forested stands and wildlife habitat within the project area on a trajectory for long-term sustainability.

Optimality and Appropriateness of Harvest Method

Choosing the optimum harvest method for regenerating a given stand is influenced by the silvicultural requirements of the species on the site, existing stand conditions, issues raised during the analyses, prior experiences in the area, and Forest Plan direction. A silvicultural prescription is assigned to each stand after a field examination has been completed. The prescription is based primarily upon the biological requirements of the stand and the objectives of the management area. The prescription is then subject to interdisciplinary analysis, with special consideration given to the issues raised during scoping and development of the alternatives. Just as the objectives for each alternative are different, the harvest method for a given stand may also differ. In some cases, prescriptions may be modified in order to mitigate other resource concerns such as wildlife habitat, visual quality, water quality, or composition guidelines. Regardless of the alternative, the proposed harvest method would always be sufficient to ensure adequate regeneration stocking of a stand. There are no regeneration harvests associated with the proposed project.

Unavoidable Adverse Effects

Conclusions drawn in chapter 3 under each resource section do not identify any adverse effects that cannot be avoided except for those to the endangered Mount Graham red squirrel and the threatened Mexican spotted owl. In each case, the adverse effects are expected to be short term in nature and will not affect the viability of the populations.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the destruction of a heritage site. The effects analyses identified no irreversible commitments of resources for any of the issues that were analyzed. None would occur because Forest Plan standards and guidelines and mitigation measures identified in appendix A would be implemented as part of the proposed actions.

Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line right-of-way or a road. These are opportunities that are foregone for the period of time when the resource can't be used. The effects analyses did not identify irretrievable commitments of resources resulting from any activities.

Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with other environmental review laws and executive orders."

- Fish and Wildlife Service under the Fish and Wildlife Coordination Act for causing water to be impounded or diverted;
    - No actions would impound or divert water and, therefore, consultation is not required.
- National Historic Preservation Act for causing ground-disturbing actions in historical places;
    - Section 106 compliance and consultation with the Arizona State Heritage Preservation Officer will be required prior to signing a decision to implement any of the action alternatives;
- U.S. Fish and Wildlife Service and the National Marine Fisheries Service in accordance with the ESA implementing regulations for projects with threatened or endangered species; and
    - Formal Section 7 consultation will be required with the U.S. Fish and Wildlife Service prior to signing a decision to implement any action alternative.

Chapter 4. Consultation and Coordination

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The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this draft environmental impact statement.

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Pima Post Office
Portal Library
Safford Post Office
Solomon Post Office
Thatcher Post Office
Willcox Post Office
American Museum of Natural History
Sky Island Alliance
WildEarth Guardians
Benson Library
Bisbee Library
Cochise County Board of Supervisors
Graham County Board of Supervisors
Green Valley Library
Northern Arizona University Library
Tucson Public Lib. / Marana Branch
Tucson Public Lib. / Valencia Branch
Western Lands Project
Huachuca Hiking Club
Little Outfit Ranch
American Museums of Natural History
Arizona Desert Bighorn Sheep Society
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Glossary

Alternative One set of possible solutions to the collection of management problems identified in the purpose and need. A number of alternatives, which address the purpose and need to varying degrees, are identified and evaluated for their effects on people and the environment. Every alternative addresses each of the management problems to some degree.

Basal Area A measurement of how much of a site is occupied by trees, determined by estimating the cross-sectional area of the boles of all the trees in an area at breast height (4.5 feet). Basal area is used because it is correlated with crown area, but is more easily measured.

Buffer Area surrounding a treatment area, trail, road, or landform that protects the area (or areas outside of it) from what occurs outside of it (or within it).

Canopy The more or less continuous cover of branches and foliage formed by the crowns of adjacent trees. A canopy may consist of several layers, depending upon the structure of a particular forest stand.

Desired Condition A portrayal of the land and resource conditions which are expected to result if goals and objectives are fully achieved.

Ecosystem A community of living plants and animals interacting with each other and with their physical environment. A geographic area where it is meaningful to address the interrelationships with human social systems, sources of energy, and the ecological processes that shape change over time.

Edge The places where two ecosystems meet; it can also refer to the meeting of two similar communities of differing ages, such as the edge between young aspen and old aspen.

Endangered In danger of extinction throughout all or a significant portion of its range.

Environmental Consequences The consequences incurred to the environment or ecosystem, positive or negative, that a particular project could inflict.

Environmental Justice Fair treatment for people of all races, cultures, and incomes, regarding the development of environmental laws, regulations, and policies.

Even-aged Management The establishment, tending, and harvest of forest stands where trees are of essentially the same age. A stand is considered even-aged if the age difference among trees forming the main canopy level does not exceed 20 percent of the rotation age. Even-aged management often uses a series of thinnings to improve diameter growth until the stand reaches maturity. When rotation age is reached, the stand is harvested and regenerated over a relatively short time using the clearcut or shelterwood systems. Regeneration may be natural (from seed or sprouts) or artificial (from planted seedlings). Even-aged methods are particularly suited to shade intolerant species. Intermediate treatments that maintain even-age stands until maturity include commercial thin and overstory removal.

Forest Plan The "Coronado National Forest Land and Resource Management Plan" (Forest Plan) is a document that guides all natural resource management activity and establishes management standards and guidelines for a national forest, embodying the provisions of the Forest and Rangeland Renewable Resources Planning Act of 1974 as amended by the 1976 National Forest Management Act.

Forest Road A road wholly or partly within or adjacent to, and serving the National Forest System and which is necessary for the protection, administration, and utilization of the National Forest System and the use and development of its resources.

Forest Type A descriptive classification of forest land based on present tree species composition.

Fragmentation The process by which larger areas of similar community type or age are broken into smaller fragments of that type or age, with varying degrees of isolation from each other. Examples include areas of extensive hardwood forests being broken into small woodlots by agricultural and urban development, or extensive native prairie being lost to cropland.

Gap A small opening created in a forest canopy, generally from windthrow. Gaps may result from loss of a single tree, or from a larger group of downed trees. Gap formation is an important aspect of change and regeneration in many forests.

Goal A concise statement that describes a desired condition to be achieved sometime in the future. It is normally expressed in broad, general terms and is timeless in that it has no specific date by which it is to be completed. Goal statements form the principle basis from which objectives are developed.

Guideline A required course of action or level of attainment that promotes the achievement of forest plan goals and objectives, but which can be adjusted or modified if site-specific project conditions warrant a deviation. Guidelines are developed when:

- Professional expertise is needed to address resource management questions;
- Site conditions are variable; and
- They contribute to the achievement of goals.

A project-level analysis and a signed decision (by the responsible official) are required in order to deviate from an established guideline.

Habitat The environment in which an organism (plant or animal) lives.

Habitat Type A system that provides a method of site classification using the floristic composition of plant communities (understory species as well as trees) as an integrated indicator of those environmental factors that affect species reproduction, growth, competition and, therefore, community development.

Harvest (Timber) Cutting and removal of trees from the forest for utilization.

Interior Forest An area of late successional or old-growth forest that is large enough and of an appropriate shape to provide conditions that minimize predation, parasitism, and microclimate fluctuations associated with forest edges. These interior forest conditions provide critical habitat for a diversity of wildlife and plant species.

Intolerant Species Those plant species that do not grow well in shade.

MBF One thousand board feet of timber.

MMBF One million board feet of timber.

Monitoring The process of collecting information to evaluate whether the objectives and anticipated or assumed results of a management plan are being realized, and whether implementation is proceeding as planned.

Nonnative Invasive Species Species that are not native to a particular place and are causing disruption of the natural process of that place, displacing native plant and animal species, and degrading natural communities, among other disruptions.

Objective A concise, time-specific statement of measurable planned results that respond to pre-established goals. An objective forms the basis for further planning by defining both the precise steps to be taken and the resources to be used in achieving identified goals. Objectives identify quantities of items within the 15-year forest plan timeframe. Objectives are action oriented, and specifically describe measurable results or desired conditions.

Off-road Vehicle (ORV) Any motor vehicle which can be operated cross country without benefit of a road or trail over land, snow, and other natural terrain, and includes all of the following: multi-track and multi-wheeled vehicles; all-terrain vehicles (ATV); motorcycles and related 2-, 3-, and 4-wheeled vehicles; amphibious machines (water to land and back); hovercraft; and any other vehicles that use mechanical power, including 2- and 4-wheel drive (4WD) vehicles that are highway registered, when operated off highways and roads. This definition includes snowmobiles.

Open Road Density The linear measure of all roads open to public traffic per unit area, commonly expressed in units of miles of open road per square mile of land.

Patch A structural component of a landscape. Landscapes have three structural components: a matrix (the most connected portion of similar vegetation within the landscape); patches (isolated portions of similar vegetation within the matrix); and corridors (relatively narrow areas that connect patches).

Permanent Upland Opening A specific area where shrubs, forbs, grasses, and/or sedges predominate and that is maintained in the open state either naturally or through active maintenance. A permanent opening would include maintained openings, small barrens communities, frost pockets, and other natural openings.

Perennial Stream A stream that flows throughout most (greater than 50 percent) of the year.

Present Net Value (PNV) Expresses a future stream of costs and revenues in current dollar value. The sum of all discounted costs and benefits.

Recreation Opportunity Spectrum (ROS) A formal Forest Service process designed to delineate, define, and integrate outdoor recreation opportunities in land and resource management planning. ROS classes are used to describe all recreation opportunity areas; from natural, undisturbed, and undeveloped to heavily used, modified and developed. ROS designations attempt to describe the kind of recreation experience one may expect to have in a given part of the national forest. The ROS classes, which apply to the CNF, range from semiprimitive settings to rural settings.

Regional Forester's Sensitive Species A species of plant or animal from one or more forests or grasslands that is officially designated as such by one or more Regional Foresters on the basis of: (1) it is declining in numbers or occurrences and there is evidence indicating that it could be proposed for Federal listing as threatened or endangered if action is not taken to reverse or stop the downward trend; (2) its habitat is declining and continued loss could result in population declines that lead to Federal listing as threatened or endangered if action is not taken to reverse or stop the decline; and/or (3) its population or habitat is stable, but limited.

Riparian The zone of land and vegetation adjacent to streams, lakes, and wetlands; close enough to the water's edge to affect and be affected by the aquatic community.

Roads A motor vehicle travelway over 50 inches wide, unless designated and managed as a trail. A road may be classified, unclassified, or temporary (36 CFR 212.1).

Authorized Roads - Roads wholly or partially within or adjacent to National Forest System lands that are determined to be needed for long-term motor vehicle access, including State roads, county roads, privately owned roads, National Forest System roads, and other roads authorized by the Forest Service (36 CFR 212.1).

Temporary Roads - Roads authorized by contract, permit, lease, other written authorization, or emergency operation not intended to be part of the forest transportation system and not necessary for long-term resource management (36 CFR 212.1).

Unauthorized Roads - Roads on National Forest System lands that are not managed as part of the forest transportation system, such as unplanned roads, abandoned travelways, and off-road vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization (36 CFR 212.1).

Road Closure - Process of closing a National Forest System road to public vehicle traffic. Closures are used on NFS roads for the purpose of limiting or prohibiting particular types of travel. National Forest System roads may be closed to all motorized traffic, or they may be closed to specified types of vehicles and remain open to others (such as snowmobiles or ATVs). Gates may be used as closure devices when the intent is to restrict public traffic, but permit administrative traffic, or to restrict traffic periodically or seasonally. Less flexible closure devices, such as berms, rocks, tank traps, or downed trees may be used when the intent is to close the road to any vehicle traffic and essentially “mothball” the road until it is needed again some years in the future. Temporary roads may be closed periodically during their period of operation, but will be obliterated when their utility is complete.

Road Decommissioning - Activities that result in the stabilization and restoration of unneeded roads to a more natural state.

Road Density The quantity of road mileage per unit area, commonly measured as miles of road per square mile of land area.

Road Management The Forest Service classifies road standards primarily as a function of traffic level and maintenance. The terminology used to describe these classifications includes:

Maintenance Levels (ML):

ML1 - Road closed to motorized traffic. This road may be any traffic service level; however, while it is in ML1, it is closed and not receiving any maintenance.

ML2 - Road suitable and open for high-clearance vehicles; passenger car traffic is not a consideration.

ML3 - Road open and maintained for prudent passenger car travel; user comfort and convenience are not a maintenance consideration; most roads are single lane with spot surfacing.

ML4 - Road open for travel at moderate speeds with moderate user comfort and convenience.

ML5 - Road open and provides high degree of user comfort and convenience; most roads are double lane, paved; or aggregate with dust abatement.

Road Obliteration Process of removing a road from the landscape. Obliterations are used on system and temporary roads, which are to be removed from service (decommissioned). Obliteration can include removing evidence of any access points; removing any structures from the roadbed (such as culverts, bridges, signs, and guide rails); and restoring wetlands and riparian areas.

Rotation Age The age at which a tree or stand is considered mature and ready for harvest.

Rut A depression made by the passage of a vehicle or equipment.

Sawtimber Trees containing at least one 8-foot sawlog and meeting forest specifications for freedom from defect. Softwood trees must be at least 9 inches in diameter at breast height (d.b.h.) (4.5 feet above the ground), and hardwood trees must be at least 11 inches d.b.h.

Scarification The process of removing the forest floor or mixing it with the mineral soil to prepare a site for seeding or planting of tree seedlings.

Scenic Integrity Objective (SIO) The visual objective for management of an area of the forest, defining its permissible variation from the landscape’s valued scenic character. Scenic integrity is the state of naturalness of an area, and is stated in degrees of deviation from the existing landscape character. The degrees of deviation are used to describe the existing scenic integrity and the Forest Plan’s scenic integrity objectives.

Sediment Soil that has eroded from the land surface, often by overland waterflow, and is then transported and deposited away from its original location.

Seed Cut The first cutting of a two-cut shelterwood system. Its purpose is to control seed sources, provide growing space for new seedlings, maintain enough shade to discourage shrub competition, and provide optimum germination conditions for the desired species.

Selection A harvest method used for the creation, maintenance, and regeneration of uneven-aged stands. Individual mature trees are removed from the stand at periodic intervals (usually 10 to 15 years), and a light thinning is done across all diameter classes. The intent is to produce a desired stand structure containing many age or size classes. There is no final harvest; a fully stocked overstory is always present. Regeneration is an ongoing process that occurs in the small canopy gaps created through the removal of individual mature trees. A selection harvest typically removes 25 to 35 percent of the overstory trees.

Species Viability The occurrence or maintenance of self-sustaining and interacting populations that are well distributed through a species range.

Stand Density A quantitative measure of how completely a stand of trees occupies a site, usually expressed in terms of number of trees, or tree basal area per acre or per hectare. See “basal area” and “stocking.”

Standard A required course of action, or level of attainment that promotes the achievement of Forest Plan goals and objectives. Standards are developed when:

- Unacceptable impacts are expected (without the standard);
- They are critical to Forest Plan objectives; and/or
- Laws or policies do not address a proposed course or when they need further clarification.

Standards are mandatory and a forest plan amendment is required in order to deviate from an established standard.

Succession The natural change from one ecological community to another. Stages are transitory in nature, and describe a plant community from its earliest growth condition (early successional) to a condition of full maturity (late successional).

Suitable Forest Land Lands on a forest that constitute the land base for determining the allowable sale quantity and which are managed for timber production on a regulated basis.

Super Canopy Refers to an individual tree position in a forest canopy. A tree crown almost entirely above the main canopy receiving light from all sides. Also called an emergent tree.

Threatened Likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Total Road Density The linear measure of all roads (whether open or closed to vehicular traffic) per unit area, commonly expressed in units of miles of road per square mile of land.

Uneven-aged Management The creation and maintenance of many age or size classes within a given forest stand. A balanced uneven-aged stand contains all size classes from seedlings through maturity, with equal amounts of growing space allotted to each size class. The selection system is generally used to harvest individual trees as they mature, and obtain regeneration in the small canopy gaps. Uneven-aged management is best suited to shade-tolerant species. Treatments are intended to maintain and improve age and species diversity. Examples include:

Viable Population A species population that has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area.

Watershed A watershed is defined as an area of land that intercepts and drains precipitation through a particular river system or group of river systems.

6th-level Watershed - Also known as a 6th level hydrologic unit (HU), is a drainage area delineated at the 6th-level in a national, multi-level, hierarchical drainage system. Sixth-level HUs are nested within 5th-level HUs and are typically 10,000 to 40,000 acres (16-63 square miles) in size. Each individual unit in the hierarchy has a unique hydrologic unit code (HUC) with two digits for each level, thus 6th-level HUCs are also known as 12-digit HUCs.

Wetlands Areas where water is at, near, or above the land surface long enough to be capable of supporting aquatic or water-loving vegetation and has soils indicative of wet conditions.

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Appendix

A – Design Features and Mitigation Measures

B – Project Monitoring Plan

C – Silvicultural Models, Methodologies, and Thinning Regime Descriptions

D – Fire Modeling Methodology, Assumptions, Fire History and Fire Risk

E – Migratory Bird Effects Findings

F – Transportation System Analysis

G – Alternative 2 Proposed Treatment Unit Table

H – Alternative 3 Proposed Treatment Unit Table

A – Design Features and Mitigation Measures

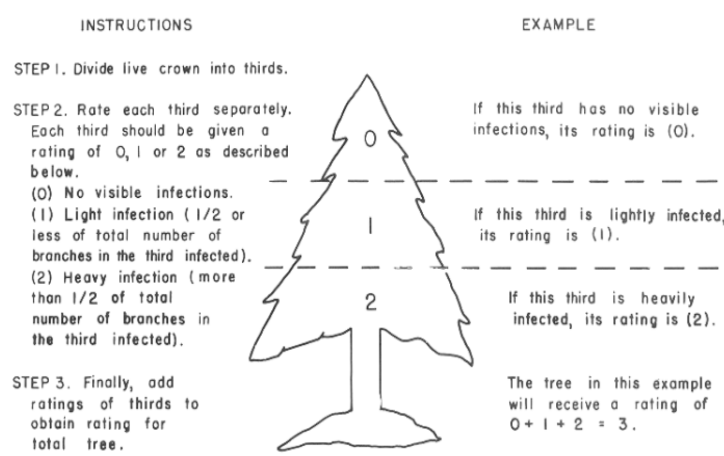
Note: Design features that apply to specific units are detailed in the project record by unit number.

Resource and Design Number	Projectwide (P) Site-Specific (S)	Design Feature
Wildlife		
Wildlife P1	P	Retain all hardwoods of all sizes, unless removal is necessary for use as staging/landing sites or for equipment passage.
Wildlife P2	P	Allow regeneration of all tree species by leaving some smaller than the diameter cut limit.
Wildlife P3	P	In any area where treatments (cutting or fire or removal of dead/down) are planned, that area must be swept for squirrel middens before treatment. If middens are found, a biologist must consider whether to extend the midden protection zone to include this midden (or these middens). At the very minimum, a 92-foot buffer will be provided around any midden site.
Wildlife P4	P	In areas where most effective, require MCH pheromone treatment after broadcast burning in mixed-conifer stands.
Wildlife P5	P	Don't treat more than 50 percent of the important wildlife treatment units within the first 5 years.
Wildlife R1	S	Retain a minimum of six of the largest logs per acre; if six logs per acre are not available, consider using felled snags as logs (if burning, consider dropping snags after burn).
Wildlife R2	S	Retain six of the largest snags per acre.
Wildlife W1	S	Retain ALL logs greater than16 inches in diameter; if there are not at least 6 logs per acre of greater than 16 inches, then leave 12-inch logs; if still not 6 logs per acre, then stack logs or leave slash piles at least 2 per acre.
Wildlife W2	S	Retain ALL snags greater than 9 inches.
Wildlife W3	S	Road Buffer: Within owl MSO core areas, default back to standard wildlife emphasis area treatment.
Wildlife W4	S	MSO Core: No work will be conducted within owl core areas between March 1 and August 31.
Wildlife W5	S	MSO Cores, if prescribed for underburning, unit must first meet MSO retention standards per microhabitat monitoring in adjacent PAC.
Wildlife WR1	S	After treatment is applied (allowing for snag and log retention based on site prescription), remove or treat slash within 1 year (pile and burn during cool season, October to March).
Wildlife WR2	S	Prior to Rx burning, create blackline or scratchline along boundary with midden protection zones; burnout from midden protection zone (if possible); rehabilitate lines after the burn.
Wildlife WR3	S	In those areas where skid roads will be created, all roads will be rehabbed through re-contouring, re-seeding, dragging brush over them, and blocking further entry for public use. Downed trees will be placed perpendicular to and across the skid trails to allow for red squirrel travelways.
Wildlife WR4	S	Rehab landing piles and landing zones left after removal operations.

Resource and Design Number	Projectwide (P) Site-Specific (S)	Design Feature
Recreation and Visuals/Scenery Management		
Recreation 1 and Visual Quality 1	P	Protect trees and vegetation to remain from damage, especially along roads and trails, and near recreation areas. (Select experienced operators to minimize damage).
Recreation 2 and Visual Quality 3	P	Avoid removing or burning vegetation that screens unsightly elements (especially buildings and utility structures) or provides screening of roadways from popular developed and dispersed recreation areas.
Visual Quality 2	P	Select trees to cut (near recreation sites, trails, and roads) with care to protect visual quality. Remove trees in irregular patches, avoiding treatments that result in linear edges. Remove trees in a way that retains natural “clumpiness” (groups of trees) rather than removal to obtain even spacing of trees. Leave many big trees, especially in the foreground along Swift Trail.
Recreation 3 and Visual Quality 4	P	Cut stumps visible from roads, trails, and recreation areas low (flush with ground if possible), and angle faces away from views. A second cutting of the stump to reach desired height may be necessary. Stumps adjacent to recreation areas should be scored or roughened to aid decomposition, and covered with a shovel of dirt or ash.
Recreation 4 and Visual Quality 5	P	Minimize the number of felled trees to remain on the ground (near roads, trails, and recreation sites). If any felled trees are left, place them so the cut end faces away from viewing areas.
Recreation 5 and Visual Quality 6	P	Where possible, build slash piles away from travelways, and burn or chip them as quickly as possible. Avoid burning slash in a way that it burns surrounding vegetation to remain.
Recreation 6	P	Whenever possible (near roads, trails, and recreation sites), avoid burning or blackening large trees and other major vegetation to remain.
Recreation 7 and Visual Quality 8	P	Obliterate all temporary roads and fire lines visible from system roads, trails, and recreation areas. Naturalize all disturbed ground in these areas by restoring grades if necessary, then tilling and seeding with native species. Place logs or boulders where needed to discourage people from driving vehicles into new openings. Boulders shall be placed in a random, non-linear fashion and partially buried to appear natural.
Visual Quality 7	P	Whenever possible, avoid burning or blackening large trees and other major vegetation to remain, especially along Swift Trail.
Recreation 8 and Visual Quality 9	P	Interpret project activities. Place interpretive signs along Swift Trail and/or within recreation areas where treatment is visible.
Recreation 9	P	Minimize delays for forest visitors. Schedule work that will require periodic road closures on days when roads are closed and/or days when fewer visitors will be traveling (i.e., weekdays, etc.).
Recreation 10	P	Protect visitors from hazards during project activities and from conditions following work.
Visual Quality 10	P	Where treatments along Swift Trail are highly visible (i.e., where numerous logs, debris, or slash piles are seen, or where blackened areas from fire is obvious), try to avoid treating over 1 continuous mile in any 1 year.
Recreation 11	P	Reconstruct trails damaged by project activities; ensure that project activities do not negatively affect planned trail work.
Visual Quality 11	P	Complete tree pruning along Swift Trail with care; utilize proper pruning techniques that preserve tree form.
Recreation 12	P	Where treatments near recreation sites would significantly change the character of the vegetation, leave some individual trees, clusters of trees, and/or islands of vegetation if this will not pose a ladder fuel risk.

Resource and Design Number	Projectwide (P) Site-Specific (S)	Design Feature
Visual Quality 12	P	Along Swift Trail, encourage aspen, “parklike” conditions in ponderosa pine forest (widely spaced mature trees), and recovery of previously burned areas.
Recreation 13	P	Along trails, within 50 feet on both sides of the trail, retain more understory vegetation.
Visual Quality 13	P	Reduce long-term effects of marking paint along roads and trails and near recreation sites.
Visual Quality 14	P	Where clearings for landings or staging areas are visible from roads, trails, or recreation sites, remove vegetation in a way that mimics natural openings.
Visual Quality 15	P	If after 1 year, piles or lines around piles are still visible from Swift Trail, rehabilitate by scattering slash or covering with duff to reduce visual impact.
Watershed Management		
Watershed 1	S	Identify streamside management zones and protect as required.
Watershed 2	S	Use proper skid pattern management including locating skid trails to avoid stream courses and restricting skidders to designated trails. Two complementary methods of complying with water standards when tractor skid trails are designed: (a) Endlining; (b) Felling to the Lead.
Watershed 3	S	Do not locate landings in streamside management zones.
Watershed 4	S	Skid trails and landings will be treated by spreading slash or wood chips or by placing logs on portions of skid trails and landings.
Watershed 5	S	Skid trails and landings will be treated by scarifying the soil and then applying native seed mixtures.
Watershed 6	S	Stream course crossings must be designated prior to construction.
Watershed 7	S	Equipment shall not operate within streamside management zone. Streamside management zone boundaries may be modified by the sale administrator to meet unforeseen operation conditions.
Watershed 8	S	Logs will be endlined out of streamside management zones.
Watershed 9	S	Logs will be fully suspended in cable log harvesting operations within the streamside management zone.
Watershed 10	S	Construct water bars in fire lines
Watershed 11	S	Reduce fuel loading in drainage channels.
Watershed 12	S	Maintain the integrity of the streamside management zone.
Watershed 13	S	Retain or plan for sufficient groundcover to prevent erosion of the burned site.

Resource and Design Number	Projectwide (P) Site-Specific (S)	Design Feature
Silviculture		
Silv 1	P	General species retention preference for thinning conifer trees would be: ponderosa pine, Douglas-fir, southwestern white pine, white fir, Engelmann spruce and corkbark fir in descending order of preference. This order of preference may be modified for individual stands to take into account site-specific factors and that order of preference given in design criteria, or stand/unit prescriptions supersedes this order.
Silv 2	P	No live hardwoods would be cut, except as needed for safety and operational purposes.
Silv 4	S	Where possible, slash created by thinning operations should be pulled from around aspen stems and scattered for underburning away from the aspen, or hand piled and burned no closer than 15 feet from the stem.
Silv 5	S	During underburning, fire ignition should be halted outside of aspen regeneration and then a backing fire allowed to burn through the regeneration.
Silv 6	P	During thinning operations, trees should be directionally felled outside of the clone and where necessary pulled out from the clone by cable to minimize mechanical damage to the aspen.
Silv 8	P	No trees over 18 inches d.b.h. should be cut unless they are considered a safety hazard or as needed for purposes associated with equipment or implementation operations.
Silv #9 - #17 Design Criteria are the Modified Prescriptions Detailed in the Proposed Action.		
Silv 18	P	In units planned for lop and scatter of slash prior to underburning, slash concentrations should be pulled back from around the bases of leave trees.
Silv 19	P	**Tree selection** - Tree selection during thinning would be based upon treatment objectives as well as tree hazard rating, health and vigor, species, and size/age in descending order of importance. These factors would all be weighed when selecting cut and leave trees for thinning. **Hazard Trees** - All dead or dying trees that have the potential to fall into or roll onto campgrounds, roadways, utility lines, structures, facilities or other improvements would be considered hazard trees and removed. Green trees would be considered a hazard if: (1) they lean more than 20 degrees from vertical and are leaning toward and are within reach of an area to be protected; (2) one-third or more of their supporting roots are exposed, rotten, or damaged, and the trees are leaning toward and within reach of areas to be protected; or (3) they have evidence of stem rot and are leaning toward and within reach of areas to be protected. This applies to trees of all sizes and species. **Tree Health and Vigor** - Trees should be considered for removal if vigor is low and declining as indicated by a partially dead and/or fading crown, they have fresh bark beetle activity, are damaged, or are infected by dwarf or leafy mistletoe at undesirable levels. This applies to trees less than 9 or 18 inches d.b.h. depending upon the prescription being applied. Trees that exhibit the following characteristics would be removed: Pine Trees: Trees with at least 50 percent of the live crown exhibiting current, active, contiguous, crown fade or dieback from the top. Trees with less than 50 percent of the live crown exhibiting current, active, contiguous, crown fade or dieback from the top with one or more of the following: Pitch tubes: numerous (>10) pink to reddish pitch tubes over at least 50

Resource and Design Number	Projectwide (P) Site-Specific (S)	Design Feature
		percent of the circumference of the bole, at or above 3 feet from the ground and extending for some distance up the bole. Do not include trees with only whitish pitch tubes that are not colored by pinkish or reddish boring dust. Note that because of drought stress, pitch tubes may or may not be present in trees currently infested with bark beetles. Boring dust or frass: pink to reddish, fine granular to dust-like boring dust or frass collected in bark crevices, webbing along the bole, or at the tree base, present over at least one-third of the bole circumference. Do not include trees that only have boring dust or frass associated with old wounds or fire scars. Criteria 2a and 2b do not include basal attacks by the red turpentine beetle. Red turpentine beetle attacks are characterized by very large pitch tubes with coarse boring dust that are generally restricted to the lower 2 to 3 feet of the bole. Note that during periods of stress such as droughts, red turpentine beetle attacks may extend above the 2 to 3 foot level along the bole. Douglas-fir and True Fir Trees: Trees with at least 50 percent of the live crown exhibiting current, active, contiguous, crown fade or dieback from the top. Trees with less than 50 percent of the live crown exhibiting current, active, contiguous, crown fade or dieback from the top with whitish, fibrous, boring dust in bark crevices and/or webbing along the bole and around at least 75 percent of the bole circumference. Mechanical Damage: Trees on which bark has recently been removed from 25 percent or more of the bole. Mistletoe Infection Levels: Trees which have a “Hawksworth Rating” of two or greater, mistletoe in the upper two-thirds of the crown, or have mistletoe infections of the bole at least 16 feet above the ground and greater than one-quarter of the bole’s circumference (Figure 1).  Figure 1. The Hawksworth six-class dwarf mistletoe rating system (Hawksworth 1977)
Silv 20	P	In areas where dwarf mistletoe infected trees in the overstory pose a high risk of infecting the understory, species preferences for retaining during thinning may be adjusted to favor non-host species.

Resource and Design Number	Projectwide (P) Site-Specific (S)	Design Feature
Fire and Fuels Management		
Fuels 1	P	Hand piles will be no larger than 6 feet high and 8 feet in diameter.
Fuels 2	P	Hand piles will be placed as far from the canopy drip line of trees as possible to prevent scorch.
Fuels 3	P	Individual hand piles or groups of hand piles may be handlined or wetlined to minimize fire creep.
Fuels 4	P	If handlines are constructed, they can be up to 3 feet in width and down to mineral soil.
Fuels 5	P	Handlines will be rehabbed which may include water baring, pulling woody debris and duff litter over the lines, etc.
Fuels 6	P	A prescribed burn plan would be developed and approved prior to initiating any burning operation. The burn plan generally includes several elements, a unit description, specific prescribed burn objectives, public notification procedures, coordination with other resource specialists, hazard analysis, contingency plans, firing procedures, risk assessment, mitigation measures, estimated fire behavior, acceptable weather variables and prescribed burn organization.
Fuels 7	P	Snags and down logs identified for retention may be handlined or wetlined as necessary to prevent them from burning.
Fuels 8	P	Encourage the removal, such as whole-tree yarding of activity generated woody debris, to reduce that amount of material to be treated onsite.
Fuels 9	S	Existing dead and activity-generated fuels down to 1 inch in diameter will be piled and burned. Trees will be pruned no higher than 10 feet or one-third the tree height whichever is less. This treatment would be applied for a distance not to exceed 150 feet from the road's edge. This would be applied in treatment units along the following roads: Swift Trail (State Road 366, FS Road 803), Riggs Lake Road (FS Road 287), and Bible Camp Road (FS Road 508). Adhere to the snag and log criteria in the wildlife treatment areas within the MSO protected areas. This treatment will not occur within midden protection areas or MSO core areas.
Heritage Management		
Her1	P	Survey treatment units per Section 106 and forest guidelines.
Her2	P	If unanticipated resources are discovered during project implementation, all work will stop in the vicinity until cleared by a professional cultural resources manager.
Her3	P	Protect all unevaluated sites and eligible sites per 36 CFR 800.
Her4	P	Evaluate each site for proactive protection measures (design criteria) or site avoidance. The heritage resources within the project area are at risk from wildfire, wildfire suppression activities, and ground-disturbing project activities. Certain site types are also at risk from prescribed fire (e.g. historic sites with wood or other flammable materials, rock art, and sandstone or limestone shelters). Not treating sites would create untreated vegetative "islands" in treated stands. Such stands may affect the overall treatment goal of wildfire risk reduction and may increase the potential for vandalism.

Resource and Design Number	Projectwide (P) Site-Specific (S)	Design Feature
Her5	S	Allow thinning within the following heritage site boundaries, provided: cutting is accomplished using hand tools only (no mastication, pile burning or ground disturbance within heritage site boundaries); no mechanized equipment or staging of equipment within site boundaries; large diameter trees are felled away from all features; and thinned material is hand carried outside the site boundary. Existing roads can be used for hauling or skidding within the site boundaries.
Her6	S	Avoid treatment activities within heritage site boundaries.

Additional Mitigation Measures for Heritage Resources

Heritage personnel must be informed prior to any changes in machinery type or usage so that a determination of effect may be made.

Certain classes of properties may be determined eligible for the National Register of Historic Places for Section 106 purposes based on survey information without further, case-by-case SHPO consultation. The eligibility of other properties may remain unevaluated, but the sites would be treated as eligible, unless the Forest Service chooses to consult with the SHPO on individual eligibility determinations or adverse effects cannot be avoided. The FS shall consult with the SHPO and appropriate tribes concerning the eligibility of any traditional cultural properties identified by the tribes that cannot be protected from project effects.

No mechanical thinning or use of mechanized equipment is to occur within site boundaries of eligible sites, features, or artifact concentrations. No staging of equipment within site boundaries, peaks, meadows, or springs. No slash piles within site boundaries, peaks, meadows, or springs. Archaeologists will use flagging tape to delineate all avoidance areas.

The purpose of post-treatment monitoring is to gather data that will be used to improve planning for protection of heritage resources in future phases and similar projects. Site-specific monitoring requirements will be documented in the inventory report. Archaeologists will monitor sites treated by hand and address the findings in a followup report. After the area has been treated, archaeologists will resurvey a portion of the project area and include the results in the final report.

There is some potential for encountering previously unrecorded properties or for affecting properties in an unanticipated manner during the course of restoration treatments. Previously unrecorded properties that are encountered during the course of a project shall be protected in the same manner as other properties. If the FS determines that a property has been damaged, the FS shall halt all activities that could result in further damage to the property and shall notify the appropriate SHPO concerning proposed actions to resolve adverse effects. The SHPO shall respond within 48 hours of notification. The FS shall carry out the agreed-upon actions.

The FS shall incorporate survey and site information gathered during the inventories conducted for this project into its corporate tabular and spatial database for heritage resources and shall make these data available to the SHPO.

The FS shall ensure that work completed for this project is carried out under the supervision of a person or persons meeting the professional standards in 36 CFR 296.8 or in the Secretary of the Interior's Historic Preservation Professional Qualifications Standards.

B – Monitoring Requirements Common to Both Management Alternatives

Project Objectives

Monitoring would be conducted to estimate whether project objectives for forest and Mount Graham red squirrel habitat restoration have been adequately met.

- Meeting project objectives for forest health will be ensured indirectly during project implementation. During timber marking and thinning operations, marking and thinning activities will be monitored periodically to ensure that they are meeting silvicultural prescription, tree marking guidelines, and contract specifications. Measures such as tree density and tree species selection will be related to forest health objectives for increasing tree growth and vigor and reducing bark beetle risk. Tree species selection and the removal of mistletoe infected trees will be related to forest health objectives for retarding the spread of the parasite.
- Coronado National Forest personnel will informally monitor insect and disease activity in treated and untreated stands annually and qualitatively assess whether project forest health objectives were met.
- Annual forest health aerial detection surveys will continue to be taken in the area to monitor insect and disease activity.
- Selected stands will be sampled following all treatment activities to quantify stand attributes such as ladder fuels, crown base heights, species composition and stand density to assess whether forest health objectives concerning tree growth and vigor, reducing bark beetle risk, and increasing resiliency to fire effects were met.
- Photo points will be established in selected stands within each forest type to compare fuel conditions before and after treatment.

Effectiveness

A professional determines if our objectives (desired SDI, fuel loading, etc.) are met.

Fuel Loading - As described above, stands will be sampled following treatment to quantify stand fuels characteristics to determine if desired fuels conditions were attained.

Stand Density and Forest Health - As described above, stands will be sampled following treatment to quantify stand characteristics such as tree density and disease presence for comparison with pre-treatment data to determine the efficacy of treatments and if desired conditions were attained.

Mount Graham Red Squirrel Monitoring

1 – Pre-implementation Area Sweeps

All areas will be surveyed prior to the onset of work. While the majority of squirrel occupied areas have been delineated on maps and protected from entry, solitary middens have been known to occur within other areas of the Pinaleño Mountains. Each implementation block will be thoroughly surveyed prior to thinning/burning work, and any active or inactive middens will be marked and provided a 300-foot radius buffer within which no thinning will occur. This should serve to reduce potential direct impacts to the endangered Mount Graham red squirrel.

2 – Crew Briefings

All implementation crews will be informed about the presence of Mount Graham red squirrels, instructed on how to identify a squirrel midden, and given contact information for the local district. Should any midden be found after implementation has begun, work will halt in the area immediately and contact will be made to the Forest Service district biologist. The midden will be marked, given a buffer, and the biologist will contact the U.S. Fish and Wildlife Service. This is a secondary measure designed to prevent and/or minimize direct effects to red squirrels.

3 – Monitoring Squirrel Ratio (Red Squirrel vs. Abert's presence)

The proposed project is designed, in part, to change the amount of forest canopy and its distribution throughout the project area. There is the potential for this change in canopy to benefit Abert's squirrels. Abert's squirrels are nonnative to the area, but they were introduced in the 1940s and 1950s to provide hunting opportunities. They may be competing with endangered red squirrels for food sources and space, particularly through kleptoparasitism (Edelman, A. J., J. L. Koprowski, and J. L. Edelman. 2005. Kleptoparasitic behavior and species richness at Mount Graham red squirrel middens. USDA Forest Service Proceedings RMRS-P-36: 395 - 398). As such, there is a need to evaluate whether this project favors Abert's squirrels, which could be detrimental to endangered red squirrels.

Monitoring would begin before treatments and proceed throughout implementation of this project. Monitoring for this measure will involve a modification of previously designed track plate research (Drennan, J. E., P. Beier, and N. Dodd. 1998. Use of track stations to index abundance of sciurids. Journal of Mammalogy, Vol. 79, No. 1. (Feb., 1998), pp. 352-359). This research was based on 60-ha (~150-acre plots), and was found to serve well in detecting large changes in abundance estimates. Due to the power being significantly increased when looking for large changes, I think the best we can hope for is a detection of changes ranging from 15 to 20 percent of abundance. We will use approximately 12 plots (an increase from the study's 8), with placement both inside treatment areas, inside squirrel areas that aren't treated, and in areas outside of the project boundary. In order to get "voucher tracks," we will need to work with the University of Arizona students who are live-trapping to get known squirrel species to run across pre-set track plates to aid in future identifications.

While the detectable percent change (15 to 20 percent) is high, this will not be the only monitoring effort occurring. However, we should plan to stop working in an area that results in a 15 to 20 percent decrease in red squirrels, or greater than 20 percent increase in Abert's squirrel abundance.

This measure is designed to assess potentially negative effects as quickly and efficiently as possible, allowing the Forest Service and cooperating agencies to modify treatments should the project show benefits to Abert's squirrels at the expense of native red squirrels.

4 – Research Efforts to be Designed and Conducted by the University of Arizona

Funding has recently been approved to provide the University of Arizona the means to design and implement research to be completed in conjunction with the project. Because the funding has just come through, the design is not currently available. However, there will be a necessity for project design to be formulated in conjunction with other land and wildlife managers, including the U.S. Fish and Wildlife Service, Arizona Game and Fish Department, and Forest Service. Particular goals of this study are to determine the effects of this project on individual Mount Graham red squirrels, including to determine if the squirrels:

- move into new areas,
- persist in new areas,
- survive in or near treated areas,
- abandon areas in or near treatments,
- home range size increases or decreases,
- population size around treated areas increases or decreases, and/or
- juvenile recruitment increases or decreases.

Resulting information should provide a basis for ongoing treatment or, should it prove necessary, modifying treatments to reduce harmful impacts or increase benefits to Mount Graham red squirrels. Such changes could include a reduction of the amount of trees removed, an increase in the amount of woodpiles left scattered throughout the area, etc. Any changes will directly reflect the impacts being observed. Any changes would also be determined cooperatively with the agencies mentioned above.

5 – Ongoing Interagency Squirrel Surveys

This ongoing effort involves the surveying of a subsample of Mount Graham red squirrel middens within the known occupied areas of the Pinaleño Mountains. Although the surveys will not give us the finely tuned data we would need to respond quickly for adaptive management, continued surveying of population trends will give us added information about the status of the species. In addition, ongoing survey and monitoring data provide valuable data for completing population viability analysis (PVA) models, which are thought to be essential to predict the potential for persistence by this species (U.S. Fish and Wildlife Service. 1992. Mount Graham Red Squirrel Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, NM. 172 pp.).

Mexican Spotted Owl Monitoring

1 – Pre-implementation Area Sweeps

All areas will be surveyed prior to the onset of work. While the majority of owl nesting areas have been delineated on maps and protected from high diameter cutting, it is possible that new nest areas could be found during the implementation phase. Each implementation block will be thoroughly surveyed prior to thinning/burning work, and any large tree nests will be surveyed and observed at night in order to rule out spotted owl activity. If an active owl nest is found, the area will immediately be withheld from high diameter cutting, and surrounded with a 100-acre “core,” in which only trees less than 9 inches d.b.h. will be removed.

2 – Crew Briefings

All implementation crews will be informed about the presence of Mexican spotted owls, instructed on how to identify a spotted owl, and given contact information for the local district. Should any owls be found after implementation has begun, work will halt in the area immediately, the location marked, and the area swept for nest sites. If a nest site is found, the area will be given a buffer, and contact will be made to the U.S. Fish and Wildlife Service.

3 – Ongoing Surveys According to Monitoring Protocol

This ongoing effort involves the surveying of 19 PACs in the Pinaleño Mountains. These surveys include all PACs that occur within the project area. Each year, four surveys of each PAC are conducted, leading to a determination of pair occupancy, single occupancy, or absence. In PACs where pairs are located, there are attempts to locate nests and/or to observe how many juveniles/fledglings are attributed to the pair. There are inherent difficulties in depending on this type of monitoring data, particularly due to low detectability of nests, irregular breeding cycles, and inaccessibility of some areas on the mountain that would otherwise be surveyed. Surveys of all PACs in the project area were begun in 2006, and they will continue throughout the implementation phase and for 2 years afterward.

4 – Microhabitat Monitoring

This measure will involve implementation of the Mexican Spotted Owl Microhabitat Monitoring Protocol, designed by the Mexican Spotted Owl Recovery Team in conjunction with the USDA Rocky Mountain Research Station. The number of plots used is generally based on an estimate of 1 plot per 20 acres of treatment, with a maximum of 200 plots. According to this protocol, 200 microhabitat plots (the maximum number allowable) should be established within protected and restricted habitat for the Mexican spotted owl. However, the Pinaleño Ecosystem Restoration Project is unique in that we are also planning treatments for areas inside Mexican spotted owl core areas, which are—under the recovery plan—deferred from treatment. Because we have 8 identified core areas of 100 acres each that fall within or partially within the project boundary, I would recommend that we add an additional 40 plots to be placed within the core areas, spaced throughout those cores so that areas inside and outside the project boundary are both included in monitoring efforts. Per the protocol, monitoring should be conducted prior to implementation in each treatment block, and then repeated within 3 years of treatment for post-treatment assessment. Because of the size and sensitivity of the area being treated, I would suggest monitoring to take place within 1 year post-treatment so that results can be assessed and recommendations made in an adaptive manner. Monitoring data is essentially a compressed stand exam protocol using variable-radius plots, and should be collected by individuals with training/supervision provided by the silviculturist. Monitoring protocol information is discussed and recommended in the Mexican Spotted Owl Recovery Plan (U.S. Fish and Wildlife Service. 1995. Recovery plan for the Mexican spotted owl: Vol. I. Albuquerque, NM. pp. 105-107.).

Additional Wildlife Monitoring Requirements

Northern Goshawks

Known nests of northern goshawks are monitored yearly, using site visits to known nest sites and callback surveys. These birds are known predators of Mount Graham red squirrels; as such, monitoring their continued presence and nest success will provide information to land managers about potential predators of the endangered species this project was designed to protect. In addition, goshawks are listed as a Forest Service Sensitive Species in their own right. Continued monitoring will allow some assessment of whether the species is being affected positively or negatively by the Pinaleño Ecosystem Restoration Project.

C – Silvicultural Models, Methodologies, and Thinning Regime Descriptions

Forest Vegetative Simulator/Fire Fuels Extension

The Forest Vegetation Simulator (FVS) consists of a number of integrated models including those for predicting large tree height and diameter increment, small tree height and diameter increment, tree mortality, crown change, tree regeneration establishment, shrub development, shrub and tree vertical canopy distribution, and fire effects. FVS uses stand exam data containing measurements for tree attributes such as diameter-at-breast-height, diameter-at-root-crown, tree height, percent crown, and tree species as well as site attributes to model tree growth and mortality. FVS enables users to model changes to stand attributes such as stocking levels due to management activities such as tree thinning and prescribed fires.

Fire effects are modeled in FVS through the Fire and Fuels Extension (FFE) which simulates fuel dynamics and potential fire behavior over time in the context of stand development and management (Reinhardt and Crookston 2003). The FFE uses existing fire fuel models for fire behavior and effects and adds new submodels for snag and fuel dynamics. The FFE uses Rothermel's fire behavior model as implemented by Albini (1976) in FIREMOD and subsequently by Andrews (1986) in BEHAVE to predict fire intensity, approaches developed by Van Wagner (1977) and Scott and Reinhardt (2001) to predict the onset of crowning, and methods from FOFEM (Reinhardt and others 1997) for predicting tree mortality, fuel consumption and smoke production.

In this analysis we used stand exam data collected during 1995, 1996, and 1997 in the project analysis area. Exam data was available for 216 of the forested stands. For several forested stands without exam data, we used data from nearby stands with a similar appearance. Fuels transect data was available for seven representative combinations of forest type and age, and was assigned to individual stands for modeling purposes based on stand type and age.

Since the stand data predated the Clark Peak Fire, Nuttall Fire, Pinaleño Ecosystem Analysis Project (PEM) thinning, and recent insect related mortality, we used FVS to model the effects of these occurrences. For modeling the fires we used available fire severity GIS spatial data, and weather conditions representative of the times the fires burned. To model the effects of recent bark beetle activity on Engelmann spruce and corkbark fir mortality, we modeled 51 percent basal area morality for spruce and 63 percent of basal area mortality for fir in the year 2000 (Koprowski et al. 2005).

All stands were modeled using FVS to "grow" the stands and the effects of fires, PEM, and insect mortality to describe the existing condition. With FVS we also modeled proposed tree removals (thinning) and fuels treatments to describe the effects of treatments and non-treatment on the forest stands. The FVS modeling serves as the basis for all stand characteristics discussed in this analysis. We modeled fuel loading and fire behavior using FVS-FFE and Flammap (Hall 2008).

Stands were classified into vegetation structural stages (VSS) using the Rocky Mountain VSS classification scheme as described in "User's Guide to the Post Processors for the Forest Vegetation Simulator" (Van Dyck 2005).

For FVS modeling and alternative comparison purposes in this analysis, we classified the forests by forest type based upon the dominant post-treatment species and assigned a maximum SDI (table 98).

Table 98. SDI for forest types

Forest Type	Maximum SDI
Douglas-fir	595
Ponderosa pine	450
Subalpine-fir	735
Engelmann spruce	670
White fir	830
Southwest white pine	645
Aspen	600
Other	450

Percent Canopy Cover

A number of means to measure and model percent canopy cover have been developed over the years. The means to measure and model do not often produce the same values and some argue that some of the means to measure and model are not directly comparable because they are measuring or modeling two different things. Jennings et al. (1999) discusses the two basic ways of measuring forest canopies. The first way is to measure “canopy closure” which is the proportion of the sky hemisphere obscured by vegetation when viewed from a single point. Canopy closure is often called “canopy density.” The opposite of canopy closure is often called the “canopy openness” which is the proportion of the sky hemisphere not obscured by vegetation. The second way is to measure “canopy cover” which is the proportion of the forest floor covered by the vertical projection of tree crowns.

Unfortunately, some authors have over the years considered the two ways to measure forest canopies synonymous and there has been some confusion created when values using different measures to measure and model are compared. Instruments such as spherical densiometers, hemispherical photography, and moosehorns measure canopy closure, while instruments such as sighting tubes in which the operator looks straight up and measures coverage at a point. Line transects are also used to measure canopy cover. FVS models percent canopy cover by computing crown width and area for each tree in the stand dataset, randomly locating the trees on a “virtual forest,” and then computing and subtracting crown overlap. Remote sensed data measures canopy cover.

Instruments such as spherical densiometers have been used for many years to measure canopy closures and values they have produced have been used in research and are reflected in many management guidelines. Unfortunately, much of the time these values are expressed as the percent canopy cover. In this analysis, we use FVS to model percent canopy cover and changes to canopy cover due to treatments.

In using any measurement technique, there is always some variation in the measurements and operator bias. One instrument commonly used but found to be difficult to use without a great deal of variation and bias is the spherical densitometer (Cooke et al. 1995). Cooke et al.

(1995) found concave and convex spherical densiometers to produce similar results but that they "overestimated cover substantially and were insensitive to substantial variations in forest cover." They also concluded that: "Spherical densiometers are not suitable for estimating forest cover for most applications in forest ecology and management." Ganey and Block (1994) also found the accuracy and precision of spherical densiometers to be "questionable." Bunnell and Vales (1989) compared 13 techniques for measuring canopy closure and found a degree of observer bias but mostly the values and variation produced by the techniques varied due to the width of the angle of view in which forest canopy coverage was being measured.

Fiala et al. (2006) compared five means of measuring forest canopies, including means that measured closure (moosehorn, densitometer, hemispherical photography) and cover (line intercept) as well as FVS's computed canopy cover. They found that FVS produced values less than all other methods for five forest stand structures. In the mature and old-growth structures, FVS computed canopy cover values that were from 11.37 to 27.40 percent cover below the other means with an average of about 21 percent cover.

Since we have available stand exam data and are using FVS in this analysis to characterize stands and compare alternative effects, we adjusted the values for percent canopy cover required to meet management guidelines, such as old-growth classification down to reflect FVS's lower computed canopy covers relative to those derived by other means and used in management guidelines.

Limitations of the Models

"It should be noted a model is a simplification or approximation of reality and hence will not reflect all of reality (Stratton 2006)." The use of models such as FVS depends upon sample data, validity of the model itself and assumptions made by the modeler. All three affect the results. The use of FVS in this analysis is to generally characterize and display existing conditions and the nature and magnitude of treatment effects to support decisions to be made. The modeling results are not to be taken as reality.

Tree Stocking and Bark Beetle Hazard

There are a number of measures for tree stocking levels; some that are very easy to measure and apply, and others that are very difficult to measure and apply. When prescribing a stocking level, foresters generally attempt to take into account a number of factors including site quality, tree size, and tree numbers. The simplest measures of stocking—trees per acre (TPA) and basal area (BA) in terms of square feet per acre—are commonly used by foresters for stand-level prescriptions and marking guides because they are the easiest to measure and implement. When prescribing a stocking level for a stand in terms of BA or TPA, a forester has already taken into account factors such as site quality, tree species, and tree sizes. It is very difficult, however, to use these measures for multiple stands or for landscape-level stocking recommendations because diameter distributions (tree sizes) and site quality within and between stands vary. These measures alone give little information as to what the forester is fundamentally managing, that is, how site resources are being utilized and allocated. These simple measures, without additional information of tree size, can be very biased. For example, a stand of 100 TPA that are 10 inches in diameter at breast height (d.b.h.) use a lot less site resources than 100 TPA that are 20 inches d.b.h. Conversely, a BA of 100 square feet of trees that are 10 inches d.b.h. uses a lot more site resources than a BA of 100 square feet of trees that are 20 inches d.b.h.

Quadratic Mean Diameter

Quadratic mean diameter has a long history of use in forestry and is often seen in literature as the "average diameter" and is the diameter of the tree with the average basal area. It differs from the arithmetic mean tree diameter in that the quadratic mean diameter (DBH_q) is the average diameter of trees in the stand expressed as the diameter of the tree of the mean basal area. It is computed by converting the individual diameters (DBH_i) to basal area, multiplying the basal area times the expansion factor (TPA), summing the basal area, dividing by the total TPA to get mean basal area, then converting that mean basal area back to diameter.

The arithmetic average (AveDBH) is computed by summing the diameters multiplied by the expansion factor (TPA) for each record and then dividing by the total TPA.

Quadratic mean diameter gives greater weight to large trees and is equal to or greater than the arithmetic mean (Curtis & Marshall 2000). If the primary interest in diameter is to permit calculation of basal area or volume, then a better average is the quadratic mean (Husch et al. 2003). It is also stable for modeling purposes, being better correlated to stand density and directly convertible to basal area. The Forest Vegetation Simulator (FVS) uses DBH_q in many of its growth and mortality equations.

Stand Density Index

The Reineke Stand Density Index (SDI) takes into account both tree size (d.b.h.) and numbers (TPA) to determine better than BA and TPA how site resources are being used. The SDI equation is $SDI=TPA(DBH_q/10)-1.6$ where DBH_q is the "quadratic mean diameter" of a stand. Although originally developed for even-aged stands, SDI has been applied to uneven-aged stands. For uneven-aged stands, SDI is computed by summing values for individual trees or for d.b.h. classes (Cochran 1992). The method of computing current or desired stocking for uneven-aged stands by apportioning SDI to size classes should be done carefully, however, because SDI may overpredict site occupancy for reverse J-shaped diameter distributions with more small trees than large ones, and it may underpredict occupancy with non-reverse J-shaped diameter distributions (Woodall 2003).

Reineke developed the SDI in about 1933 from empirical observations. He apparently plotted data (TPA versus DBH_q on log-log paper) for fully stocked, even-aged stands and drew a free hand line skimming the highest data points. He proposed that the slope of the line (-1.605) was the same for all species but that the y-intercept value differed with species. Since that time, evidence has suggested that slope, as well as the intercept varies with species (Puettmann et al. 1993). Evidence also suggests that differences in intercept values for plant associations for a given species indicate that the density of a fully stocked stand changes with site conditions (Cochran et al. 1994).

There are at least two ways to express SDI, the maximum SDI (SDI_{max}) and normal SDI (SDI_n). If you plot TPA (x-axis) against DBH_q (y-axis), as Reineke did for many observations, and draw a line along the outside of all of the observations, you are establishing the SDI_{max} for the species. If you draw the line through the middle of the observations, you would be establishing the SDI_n. Both means are commonly used in forestry; FVS uses SDI_{max} whereas Cochran uses SDI_n in his research concerning stocking levels required to reduce bark beetle risk. For this analysis, we will generally be using FVS and SDI_{max}, but may refer occasionally to SDI_n where necessary.

Several general SDI points of interest have been established for managing stand stocking levels. In terms of SDI, trees are not competing for site resources until stand density reaches about 25 percent of maximum SDI (Long 1985). This point is about 40 percent of SDI_n, and Long (1985) considered the point to be that at which the stand has reached crown closure. Long (1985) considered crown closure to be the maximum amount of crown cover expected for the species and site. Since that time, other authors have used the term crown closure with at least somewhat different meaning. At about 35 percent of maximum SDI (50 percent SDI_n), site resources are fully being utilized and trees in the stand are competing for those site resources. This is the point of "full site occupancy." At about 60 percent of maximum SDI (75 percent SDI_n), the stand has reached the "zone of self thinning" or the "zone of imminent mortality" where a suppressed layer of trees begins developing (Long 1985). In this zone, for some trees to continue to grow, other trees have to die. In the Central Rockies variant of FVS, the zone of imminent mortality is set at 55 percent of maximum SDI. Above this point, FVS's "mortality model" begins computing tree mortality and "killing trees" from the modeled stands above a constant background level. Bark beetle risk and activity increase far before stand stocking reaches the zone of imminent mortality (Cochran et al. 1994, Oliver 1995).

Tree Growth and Vigor

Individual tree growth is inversely proportional to stand stocking except at low stocking levels. Trees that are growing at greater rates are considered more vigorous and able to combat the effects of insects and diseases. Increases in growth rates also mean that the time required to grow large trees to meet management objectives is reduced. More open-grown trees also tend to retain deeper crowns with larger limbs.

Thinning to Reduce Bark Beetle Risk

Bark beetles are characterized by foresters as primary and secondary. Aggressive bark beetles thought of as primary killers of trees are those that attack and kill apparently healthy trees. These primary killers include Douglas-fir beetle, mountain pine beetle, western pine beetle, pinyon *ips*, roundheaded pine beetle, spruce beetle, and fir engraver. Secondary bark beetles infest severely stressed, dying, or freshly dead trees as well as stressed treetops and branches. Pine engraver, red turpentine beetle (*Dendroctonus valens*) and striped ambrosia beetle (*Trypodendron lineatum*) are mostly considered secondary bark beetles. Depending upon stand conditions and beetle population levels, some bark beetles that typically act in a secondary role can act as a primary killer of trees. Pine engraver, for example, normally reproduces in logging slash, windblown trees, broken limbs, and severely stressed trees like other secondary bark beetles, but when populations increase due to an abundance of host material, it frequently invades and kills small live trees or the tops of larger trees. Bark beetle risk concerns in the project area involve primary bark beetles, not secondary, and the following discussion addresses only those listed above as primary bark beetles.

Researchers began to recognize the importance of tree stocking control to reduce bark beetle activity in about 1941 (Eaton 1941 in Oliver 1995). In 1953, Clements was the first to recognize the relationship between stand density and mountain pine beetle activity (Clements 1953 in Oliver 1995). Since then, Sartwell (1971), Sartwell and Stevens (1975), and Sartwell and Dolph (1976) worked to further establish the links between tree stocking levels and bark beetle activity. Based upon the works of Sartwell and others, Oliver (1995) investigated the relationship between the stand density index (SDI) threshold of self-thinning mortality due to competition and SDI thresholds for mortality due to bark beetles. Oliver (1995) concluded that stand density for ponderosa pine stands was limited by Dendroctonus bark beetles to lower levels than the level of self thinning.

Within the last several decades, a number of studies examined the relationships between tree thinning to reduce bark beetle activity and risk. Many of the studies observed decreased bark beetle activity with decreased tree stocking levels. These studies include: (1) observations of low bark beetle activity within thinned stands during long-term stocking studies (Cochran and Barrett 1995, Cochran and Barrett 1999a, Cochran and Barrett 1999b, Cochran and Dahms 2000); (2) control studies measuring bark beetle mortality within pine stands thinned to various stocking levels and unthinned areas (Amman 1988a, Amman 1988b, Amman et al. 1988a, Amman et al. 1988b, Cole and McGregor 1985, Cole et al. 1983, Fiedler and Morgan 2002, Fiddler et al. 1995, McGregor et al. 1987, Mitchell et al. 1983, Safranyik et al. 2004, Schmid and Mata 2005, Whitehead and Russo 2005); and (3) control studies measuring bark beetle activity as a function of the number of beetles trapped in stands thinned to various stocking levels as well as unthinned (Bartos and Booth 1994, Sanchez-Martinez and Wagner 2001, Schmitz et al. 1981, Zausen et al. 2005). Of the mortality studies, only Mitchell et al. (1983) did not demonstrate a difference in mortality between lightly thinned stands and unthinned controls, but they did observe that the heavily thinned stands had no mortality. Only one trapping study, Sanchez-Martinez and Wagner (2001), did not observe fewer trapped beetles in thinned stands compared to unthinned. Sanchez-Martinez and Wagner's (2001) measurements found no significant difference between bark beetles trapped in thinned and unthinned ponderosa pine stands on the Coconino plateau in Arizona. However, their data was collected during low levels of bark beetle activity (endemic) in the area and they observed that the average tree size within the unthinned stands was very small, (22.2 cm) making the trees undesirable habitat for the most aggressive bark beetles found in the area—western pine beetle and mountain pine beetle. Available research provides strong evidence for the utility of thinning to reduce tree stocking to lower the level of bark beetle mortality and the risk of epidemic levels of mortality.

Bark Beetle Hazard Rating

The major tree species of concern in the project area is Douglas-fir. Unfortunately, Douglas-fir hazard (risk) rating models are not well developed or tested and may be marginally applicable to the Central Rocky Mountains. Two Douglas-fir bark beetle rating systems have been developed in USDA Forest Service Region 1 and one in British Columbia. This analysis uses a Douglas-fir bark beetle hazard rating system developed by Region 1 (Randall and Tensmeyer 1999) to characterize the existing condition. This hazard rating system uses stand stocking, percent stand stocking of Douglas-fir, stand age, and average Douglas-fir d.b.h. to access hazard. Table 99 displays Douglas-fir bark beetle hazard using this rating system for the existing condition in terms of the percent of forested area in each hazard rating.

Table 99. Existing condition Douglas-fir bark beetle hazard rating

Douglas-fir Bark Beetle Hazard	Existing Condition (Percent of Area)
Extremely Low	2
Very Low	14
Low	22
Moderate	12
High	43
Very High	7

Unfortunately, the hazard rating system does not work well in comparing the effects of treatments. Because it is based largely on the proportion of stand stocking in Douglas-fir and total stand stocking, thinning regimes that do not reduce total stand stocking sufficiently to move the stand into a lower hazard rating, but do increase the proportion of the stocking in Douglas-fir can result in a higher hazard rating.

Thinning Regime Descriptions

Thinning regimes prescribed above are described as a combination of variable density thinning, thinning from below, and group selection. General treatment categories are described above as: (1) Forest Restoration Treatment Area-General Prescription, (2) Forest Restoration Areas-Modified Prescriptions, (3) Important Wildlife Treatment Area-General Prescription, and (4) Important Wildlife Treatment Area-Modified Treatments. Within these general categories there are eight more specific prescriptions defining thinning from below to 9, 12, or 18 inches and dead tree removal. Specifics of these treatment regimes are given above and will not be discussed here except as needed. In this section, we will discuss the meaning and general effects of variable density thinning, thinning from below, and group selection treatments and how the combination would maintain current stocking diversity in larger size class trees and increase stocking diversity in smaller size class trees in the project area.

Group Selection

With the group selection method, stands would be subdivided into five size/age classes (not counting the grass-forb/seedling stage) with the size/age classes based upon the vegetative structural stage (VSS) size class breaks. Groups would range in size from 0.25 to 1.25 acres.

The group selection method typically contains a regeneration component. During an entry into a stand, one set of groups—usually the oldest—is selected for complete or near complete removal in order to establish a new cohort of trees. During the same entry into the stands, other groups may be thinned. Under this system, an uneven-aged stand that is composed of varying-sized, even-aged groups is the result. Figure 49 displays a conceptual drawing of a landscape treated using a group selection method including small openings created for the establishment of a new even-aged cohort.

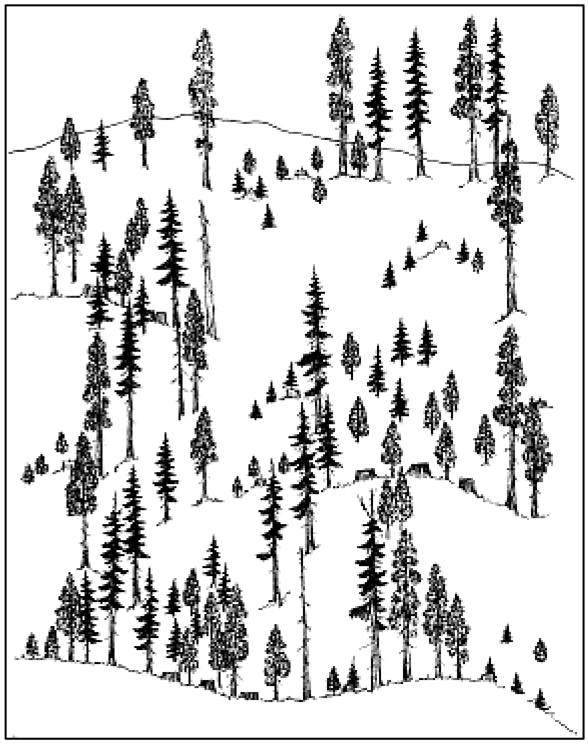


Figure 49. Group selection example

Due to the abundant number of small trees that have become established due to fire exclusion in the project area, the regeneration phase is generally not necessary. In the treatments proposed in this project, all groups would be thinned only, but the nature of the thinning would change within the groups to emphasize one of the size/age classes. Some groups would be thinned heavily, however, and in these areas, tree stocking would be reduced sufficiently to induce trees to be established. These heavily thinned areas would be around aspen clones, ponderosa pine patches, and relics of ponderosa pine patches, or old-growth Douglas-fir patches.

In some of the treatments, trees up to 18 inches d.b.h. would be thinned, and in other treatments, trees up to 9 inches d.b.h. would be thinned. In those stands thinned to 18 inches d.b.h., the current and natural distribution of the mature and old trees would not be affected by the treatments. In thinning treatments with a 9-inch maximum thinning diameter, the current distribution of mid-aged, mature and old trees would not be affected. In any stand, the group size and mosaic of size/age class groups would be guided, if not controlled, by the current stocking in the larger size trees that would not be removed. The final group mosaic would resemble a more historic or "natural" condition.

Variable Density Thinning

Variable density thinning is a thinning regime in which post-thinning tree stocking is deliberately varied throughout the thinned stand. The variation in stocking can be at a group level, as defined above, or can be at a much smaller scale—that of only a few trees. In these treatments, density would be varied between groups such that in any one stand, one could find groups in each of the size/age classes that have been thinned to a wide spacing (open canopy groups) and groups that are thinned to a close spacing or not thinned at all (close canopy groups). In general, the widely spaced group density would range from 25 percent to 45 percent of the maximum stand density index (SDI) for Douglas-fir. About two-thirds of the stand areas would be in closed canopy groups. The closed canopy groups would average greater than 45 percent of the maximum SDI for Douglas-fir. In addition, to enhance the growth and vigor of shade intolerant trees and old trees, heavily thinned groups would be located around aspen clones, sugar pine patches, ponderosa pine patches, relics of ponderosa pine patches, or old-growth Douglas-fir patches.

In treatments with a 9-inch maximum cut diameter limit, whatever variation in stocking currently exists in trees greater than 9 inches would not be affected by the treatments. In mid-aged, mature, and old-aged groups, the only opportunity to vary stocking would be to reduce understory stocking. In these groups, variable thinning would result in: (1) groups of larger trees that have had most, if not all, of the smaller trees removed giving them a more open and single story appearance, and (2) groups of larger trees with understory trees remaining, giving the group a less open and multistory appearance. There would also be present: (1) groups of smaller diameter sapling and young forest trees that are very open and single story in appearance, and (2) groups of sapling and young forest trees that are dense in appearance.

In treatments with an 18-inch maximum cut diameter limit, whatever variation in stocking currently exists in trees greater than 18 inches would not be affected by the treatments. So in mature and old forest groups, the opportunity to vary stocking would be to reduce understory and mid-story stocking. Within the stand group mosaic there would be: (1) groups of larger trees with an open and single story appearance, (2) groups of larger trees that are less open and multistory, (3) groups of mid-sized trees that are open and single story in appearance, (4) groups of mid-sized trees that are less open and multistory in appearance, (5) groups of mid-sized trees that are less open and single story in appearance, (6) groups of smaller sapling and young forest trees that are very open and single story in appearance, and (7) groups of sapling and young forest trees that are dense in appearance.

Thinning from Below

Thinning from below in this project would essentially mean that larger trees are favored for retaining over smaller trees during tree selection while thinning or marking trees for removal. “Thin from below” treatments generally result in a flatter diameter distribution. The result of thinning from below in these treatments will generally be to reduce stand understories, making the stands more open and reducing fire hazard.

Other factors also affect the results of thinning from below. Two of those factors that would influence which trees get removed and left are: (1) disease presence, and (2) species preference. In implementing these treatments, these factors mean that on occasion smaller, less diseased trees may be retained while larger trees are removed, and smaller trees of a more preferred species, e.g. ponderosa pine, may be retained while larger trees of a less preferred species, e.g. white fir, would be removed.

D – Fire Modeling Methodology, Assumptions, Fire History, and Fire Risk

Stand exam data was collected within the project analysis area (Amell 2008). Fuel loading was examined on representative forest types using a combination of photo series handbooks used for quantifying forest residue (Maxwell and Ward 1980, Maxwell, Wayne and Ward 1976, Blonski and Schramel 1981). This information was then extrapolated across units with similar vegetation composition and processed through the Forest Vegetation Simulator and Fire and Fuels Extension (FVS/FFE) model (Reinhardt and others 2003). Outputs from FVS/FFE such as canopy cover and canopy base height were applied as appropriate through the FlamMap model to display potential (flame length, fire line intensity, surface, passive and active crown fire types) over the project analysis area. FlamMap is a model used for evaluating fire behavior over a landscape (Finney 2003). Surface fuel models were assigned in the FVS/FFE and FlamMap models based on projected stand structure, shrub cover, grass cover, and fuel load conditions (Scott and Burgan 2005, Anderson 1982).

Fire behavior and effects were modeled in FVS/FFE under 90th and 97th percentile weather conditions. Ninetieth and 97th percentile weather represent high and extreme fire weather, respectively. Weather data from April 1 through July 31 was selected because this timeframe represents that period in which large fires have occurred within the project area. Percentile weather was computed using Fire Family Plus (Main and others 1990). Twenty-nine years (1976-2005) of weather data from the most representative weather station site was analyzed to determine percentile weather conditions. The weather data parameters used for modeling are listed in the following table.

Table 100. Weather and fuel moisture data used to model wildfire fire behavior

	1 hr 0 -0.25″ Diameter Percent	10 hr 0.26-1.00″ Diameter Percent	100 hr 1.1-3.0″ Diameter Percent	1000 hr 3″+ Diameter Percent	Live Fuel Moisture Percent	20-foot Wind Speed mph	Air Temp
90th percentile	2.9	3.4	5.4	6.7	60	10	73
97th percentile	2.2	2.5	4.6	5.0	60	13	77

FVS/FFE was used to model surface fuel loading, torching index (TI), crown fire index (CI), canopy base height (CBH), canopy bulk density, (CBD), and potential torching (P-Torch) of the proposed treatment areas. This analysis focused primarily on the effects on fuel loading, fire line intensity, and fire type. I evaluated TI, CI, CBH, CBD and P-Torch to help validate potential fire behavior generated for the FlamMap model and did not discuss these outputs in detail in my report. These values are defined as follows:

- Torching Index (TI): Torching index is the 20-foot wind speed (in miles per hour) at which a surface fire is expected to ignite the crown layer. Torching index depends on surface fuels, surface fuel moisture, canopy base height, slope steepness, and wind reduction by the canopy. As surface fire intensity increases (with increasing fuel loads, drier fuels, or steeper slopes) or canopy base height decreases, it takes less wind to cause a surface fire to become a crown fire. Lower index numbers indicate torching can be expected to occur at lower wind speeds, so torching is greater at lower index values.

- Crown Fire Index (CI): Crowning index (CI) is the 20-foot wind speed (in miles per hour) at which crown fire is possible. Crowning index depends on canopy bulk density, slope steepness, and surface fuel moisture content. As a stand becomes denser, active crowning occurs at lower wind speeds and the stand is more vulnerable to crown fire. Lower index numbers indicate that crown fire can be expected to occur at lower wind speeds, so crown fire hazard is greater at lower index values. The complete algorithms for determining torching and crowning index are described in Scott and Reinhardt (2001).
- Canopy Base Height (CBH): The height above ground of the first canopy layer where density of the crown mass within the layer is high enough to support vertical movement of a fire.
- Canopy Bulk Density (CBD): The bulk density of the canopy (kg/m^3). Canopy fuel characteristics are determined by examining the vertical distribution of canopy fuels. Based on fire behavior during large wildfires in central Washington State in 1994, Agee (1996) established a threshold value of 0.100 kg/m^3 (0.00615 lbs/ft^3) for canopy bulk density in ponderosa pine and Douglas-fir forests, above which crown fire behavior was likely under a wildfire condition and below which no crown fire activity occurred.
- Potential Torching (P-Torch): It is the probability of finding a small place where torching can happen in a forest stand. A torching situation is generally defined as one where tree crowns of significantly large trees can be ignited by the flames of a surface fire or flames from burning crowns of small trees that reach the larger trees.

Scott et al. (2005) show that effective techniques for reducing crown fire occurrence and severity are those that: (1) increase canopy base height, (2) reduce canopy bulk density, (3) reduce forest canopy continuity, and (4) reduce surface fuels. The following table displays the modeled fire behavior and stand characteristics of the treatment areas by alternative. There are some anomalies because of differences in treatment units being proposed for the action alternatives.

TI and CI moderately increased for all action alternatives, which indicates the need for more wind speed to initiate and maintain crown fire. This is favorable as it relates to potential fire behavior.

Modeling shows an improvement in all action alternatives as compared with no action. Modeling favors Alternative 2 over Alternative 3 as shown in the table. This would lead to an increase in forest resiliency to wildfire (Peterson 2007).

Table 101. Modeled fire behavior and stand characteristics of the treatment areas

Comparison of FVS/FFE Fire Behavior	Torching Index (mph)			Crown Index (mph)			Canopy Base Height (Feet)			Crown Bulk Density (kg/m^3)			Potential Torch		
	Alternative			Alternative			Alternative			Alternative			Alternatives		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Treatment areas 2008 90th	17	35	35	19	23	20	11	18	17	.148	.110	.127	.58	.35	.37
Treatment areas 2008 97th	17	33	35	20	22	20	11	17	17	.148	.114	.127	.58	.46	.46
Treatment areas 2018 90th	17	72	64	19	25	23	12	21	19	.149	.097	.110	.60	.20	.22
Treatment areas 2018 97th	17	69	64	19	25	19	12	21	19	.149	.098	.110	.60	.28	.31
Treatment areas 2048 90th	23	48	47	24	29	25	15	23	22	.145	.102	.115	.57	.17	.14
Treatment areas 2048 97th	23	47	47	24	27	25	15	23	22	.145	.105	.115	.57	.28	.25

LANDFIRE

LANDFIRE is a multiagency, interdisciplinary mapping project designed to develop a consistent, mid-scale inventory of current vegetation and fuel conditions, and the associated natural or historical reference conditions for forest and rangeland biophysical settings. LANDFIRE uses satellite imagery to map the land and its vegetation, and uses a suite of models to provide more detailed information (i.e., fuel models, forest canopy details, existing vegetation, vegetation structure, potential vegetation, fire regime condition classes, fire return intervals, historical fire regimes, climate, fire ecology, topography, soil depth, soil moisture, etc.). Data from LANDFIRE was also used in evaluation assumptions used in the FlamMap model. LANDFIRE data and information can be found online at http://www.landfire.gov/index.php

Prescribed Underburning

The following table shows weather and fuel moisture assumptions used for modeling prescribed burn treatments being applied in the action alternatives.

Table 102. Weather and fuel moisture data used to model prescribed underburning

Prescribed Underburn	1 hr 0 -.25″ Diameter Percent	10 hr .26-1.00″ Diameter Percent	100 hr 1.1-3.0″ Diameter Percent	1000 hr 3″+ Diameter Percent	Live Fuel Moisture Percent	20-foot Wind Speed mph	Air Temp
Before green-up	6	8	10	15	100	8	70

Limitations of the Models

"It should be noted a model is a simplification or approximation of reality and hence will not reflect all of reality (Stratton 2006). Be mindful that a model is a decision support tool, not a tool that makes decisions."

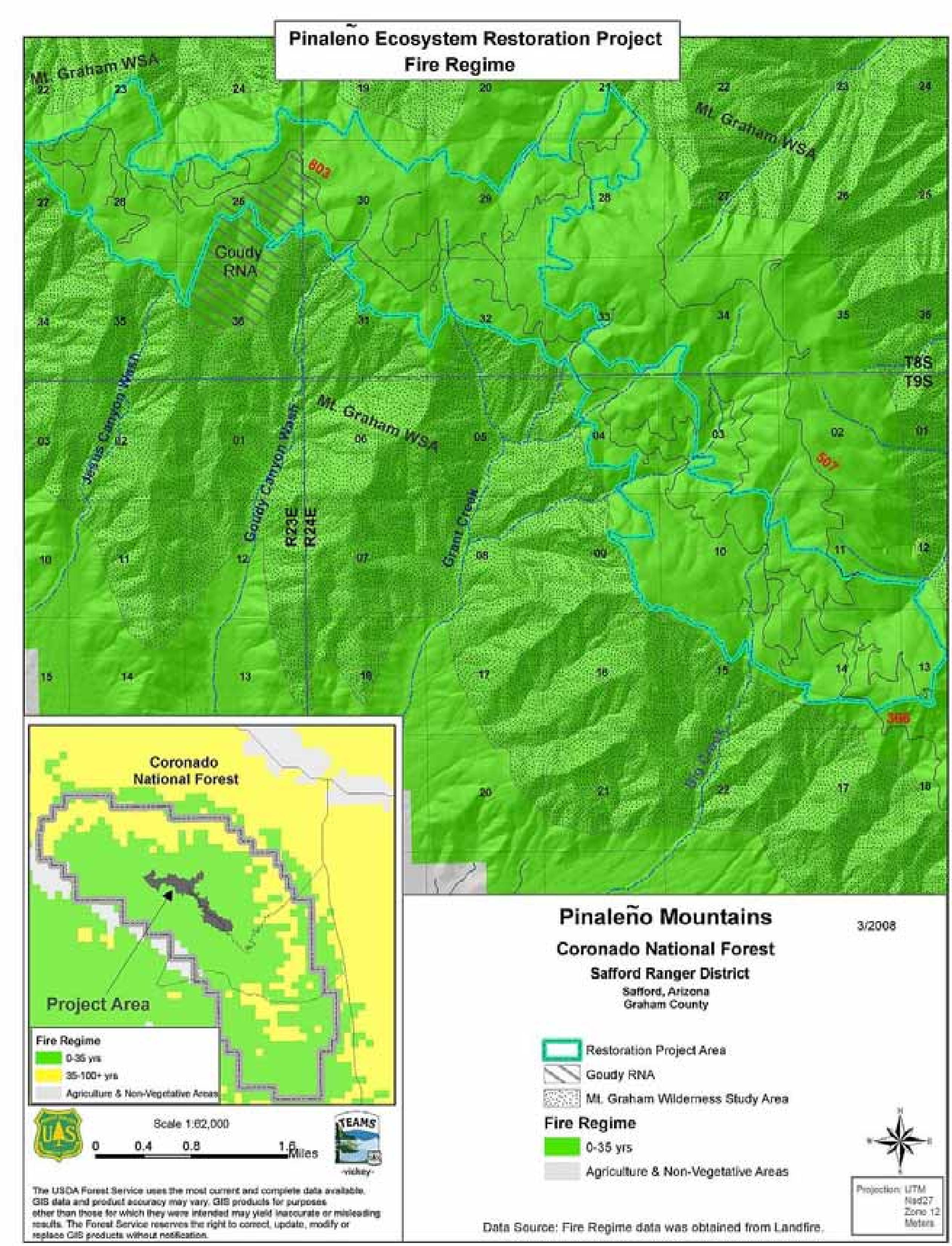


Figure 50. Fire regime for the Pinaleño Mountains and the project area

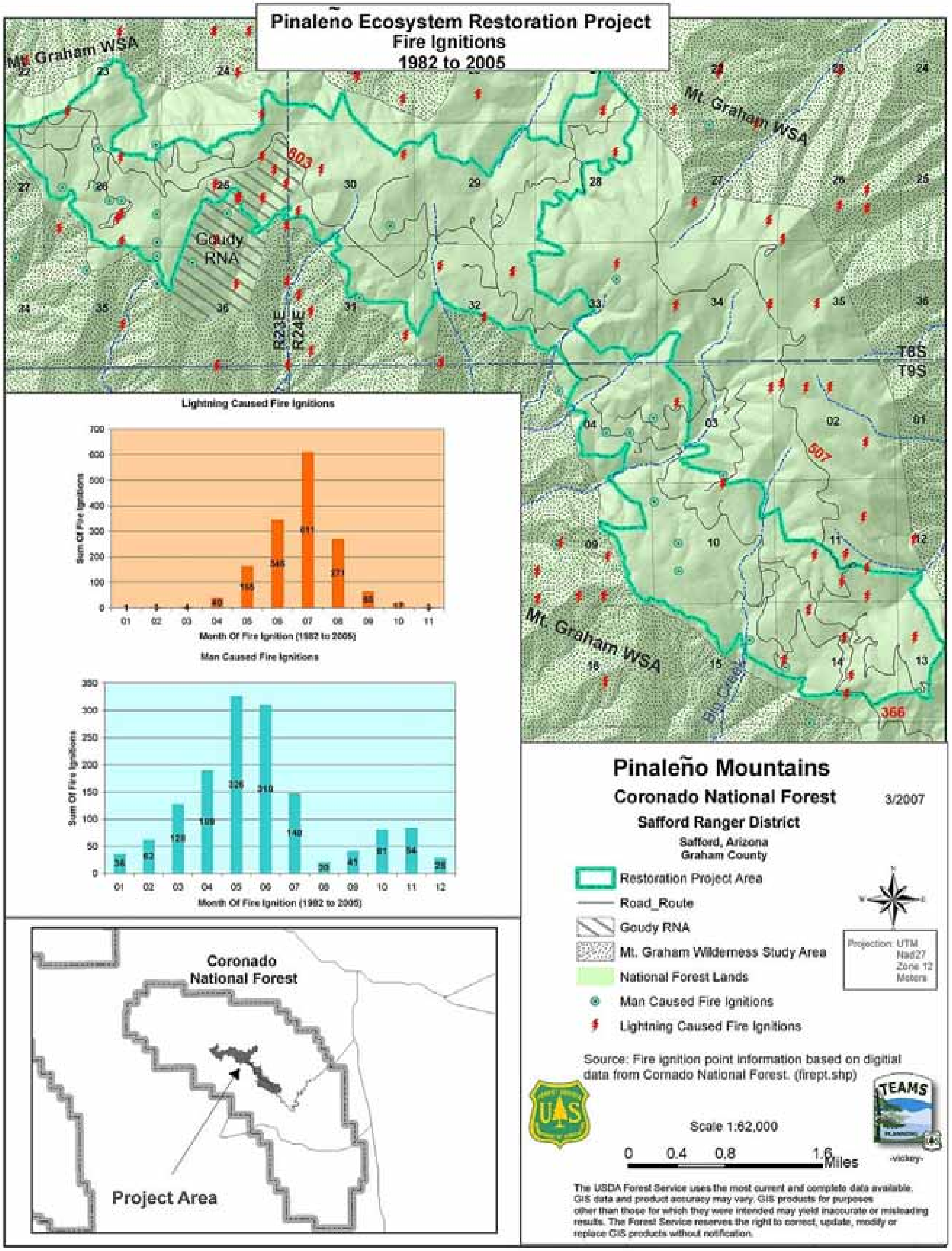


Figure 51. Fire ignitions in the Pinaleño Mountains between 1982 and 2005

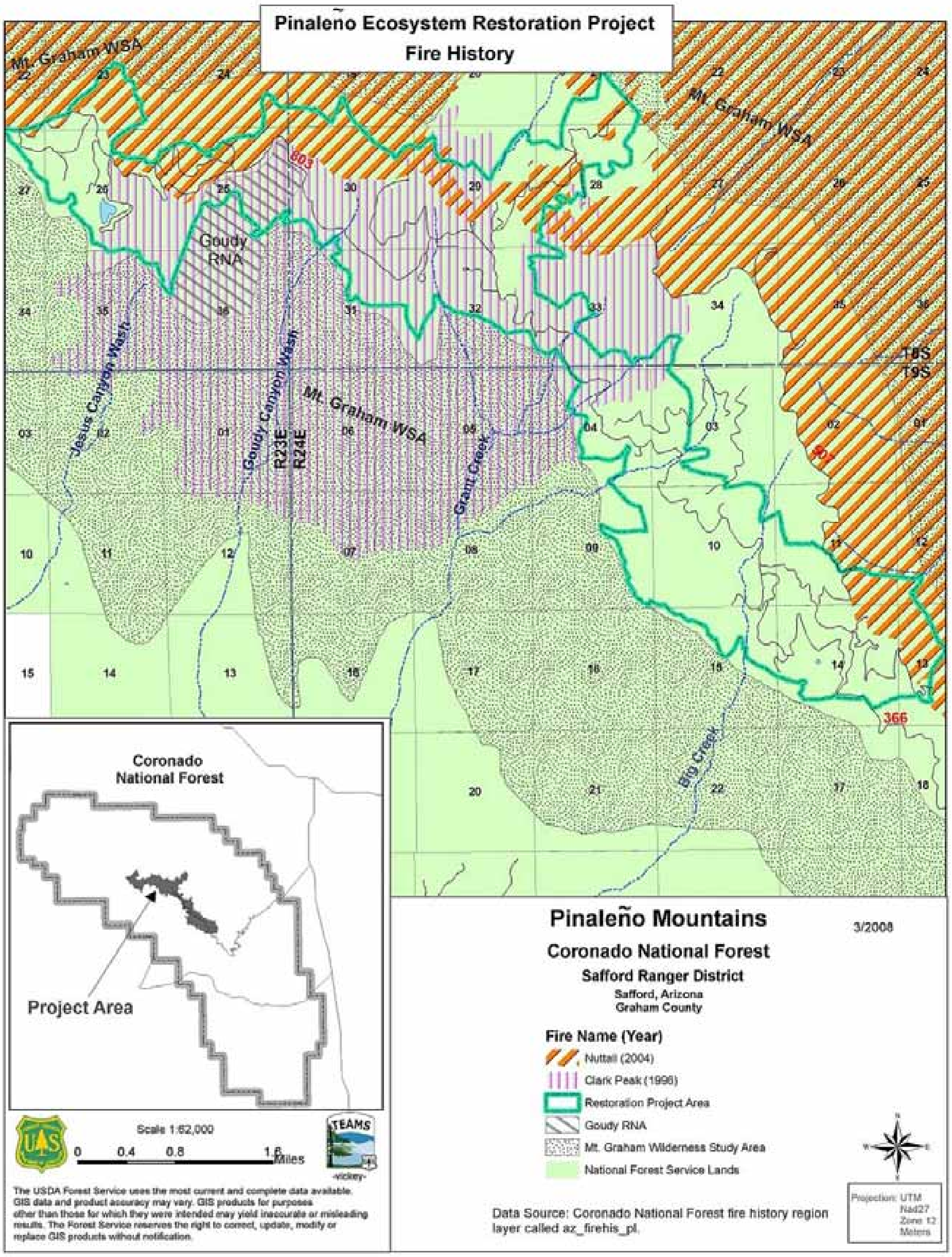
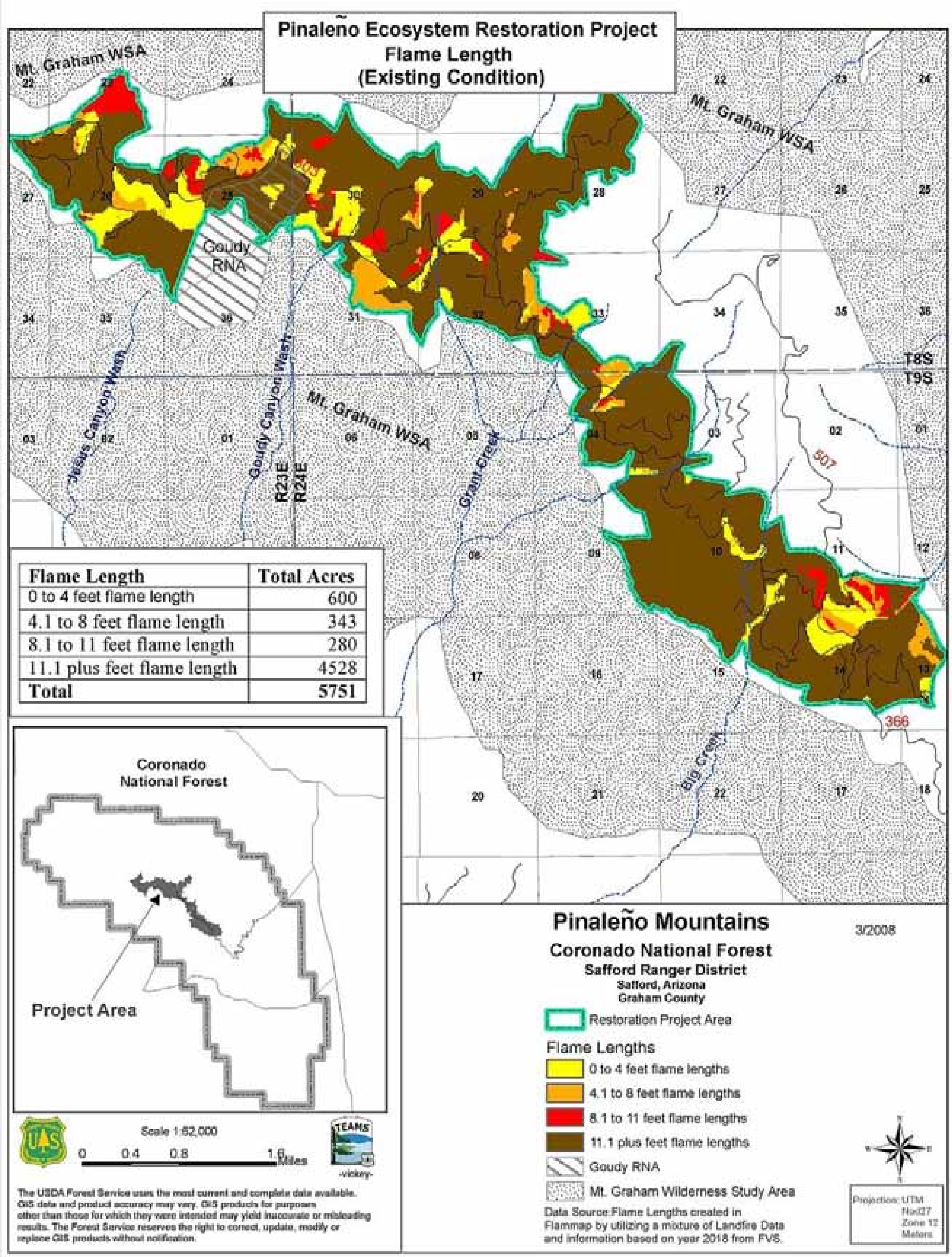
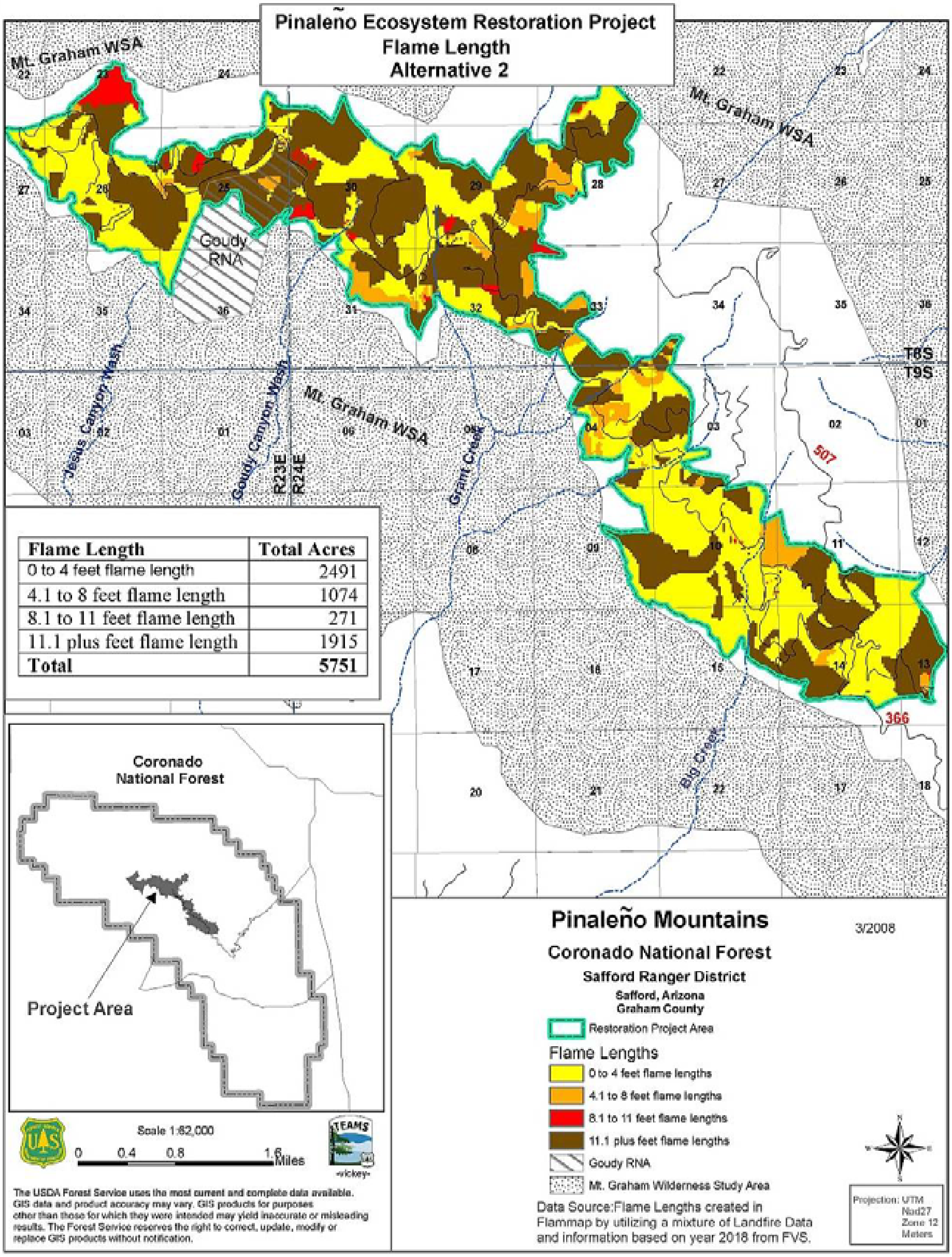


Figure 52. Fire history in the Pinaleño Mountains



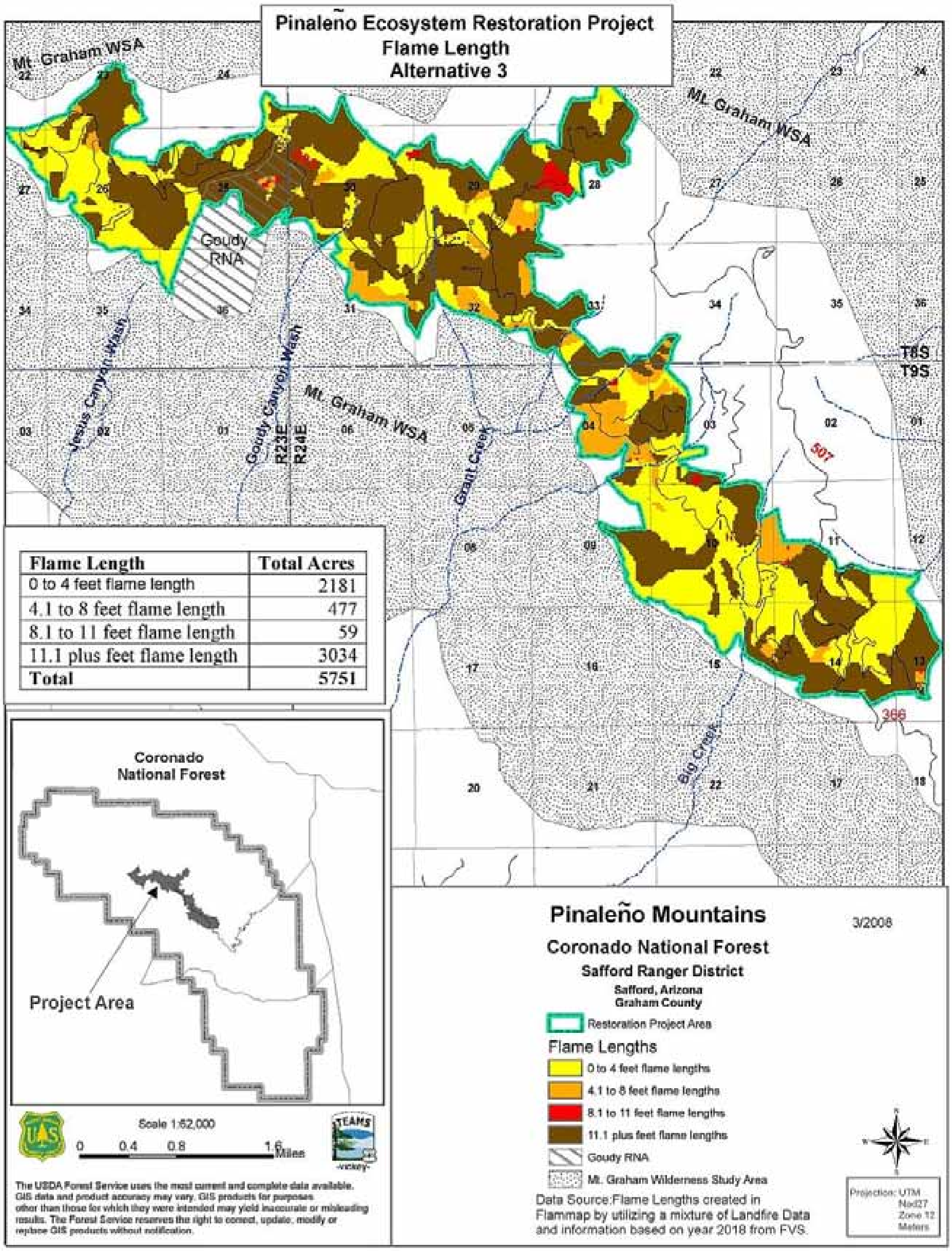
Flame Length	Total Acres
0 to 4 feet flame length	600
4.1 to 8 feet flame length	343
8.1 to 11 feet flame length	280
11.1 plus feet flame length	4528
Total	**5751**

Figure 53. Existing condition of potential flame length in the project area should a wildfire occur



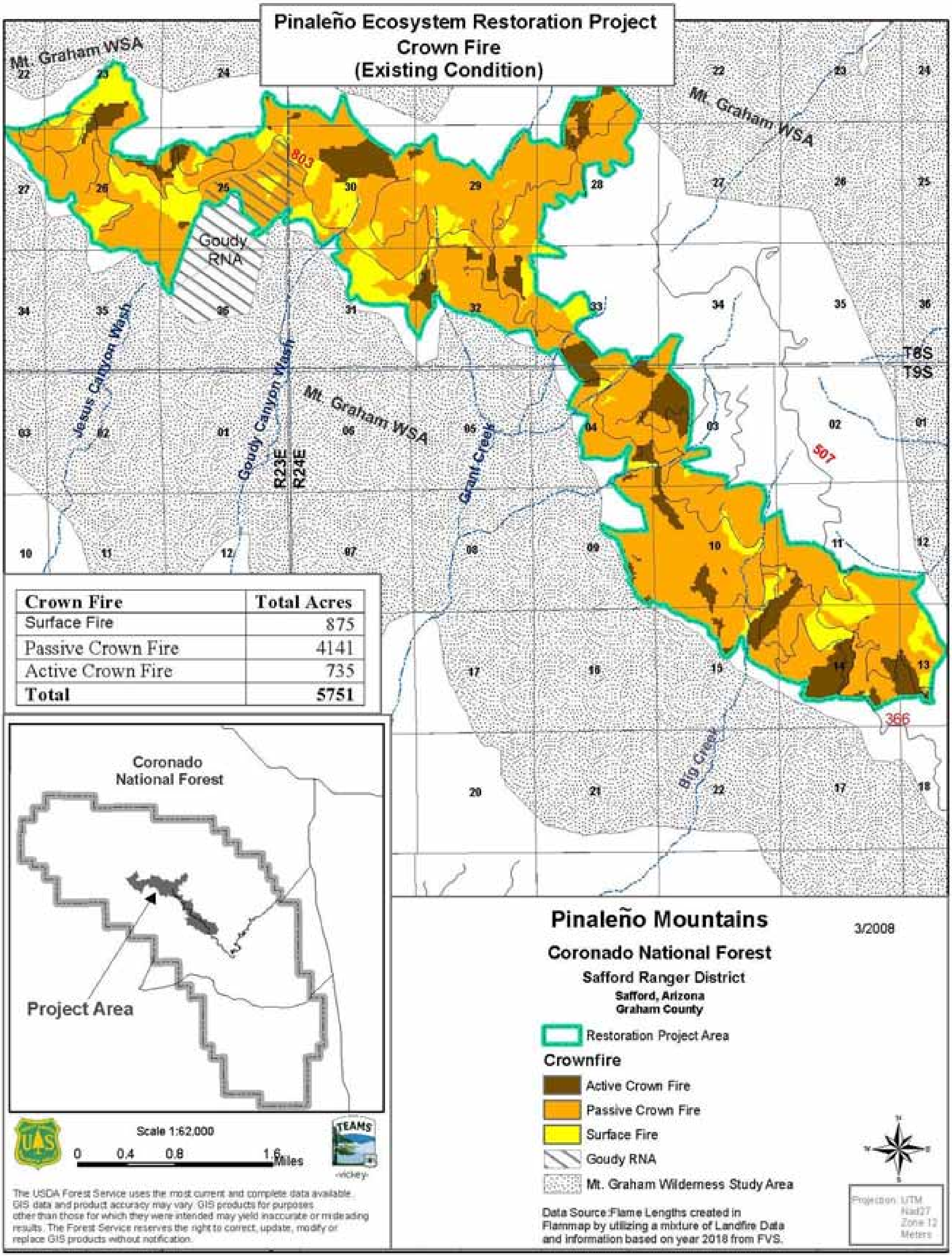
Flame Length	Total Acres
0 to 4 feet flame length	2491
4.1 to 8 feet flame length	1074
8.1 to 11 feet flame length	271
11.1 plus feet flame length	1915
Total	**5751**

Figure 54. Predicted flame length after implementation of Alternative 2



Flame Length	Total Acres
0 to 4 feet flame length	2181
4.1 to 8 feet flame length	477
8.1 to 11 feet flame length	59
11.1 plus feet flame length	3034
Total	5751

Figure 55. Predicted flame length after implementation of Alternative 3



Crown Fire	Total Acres
Surface Fire	875
Passive Crown Fire	4141
Active Crown Fire	735
Total	**5751**

Figure 56. Existing crown fire potential in the project area

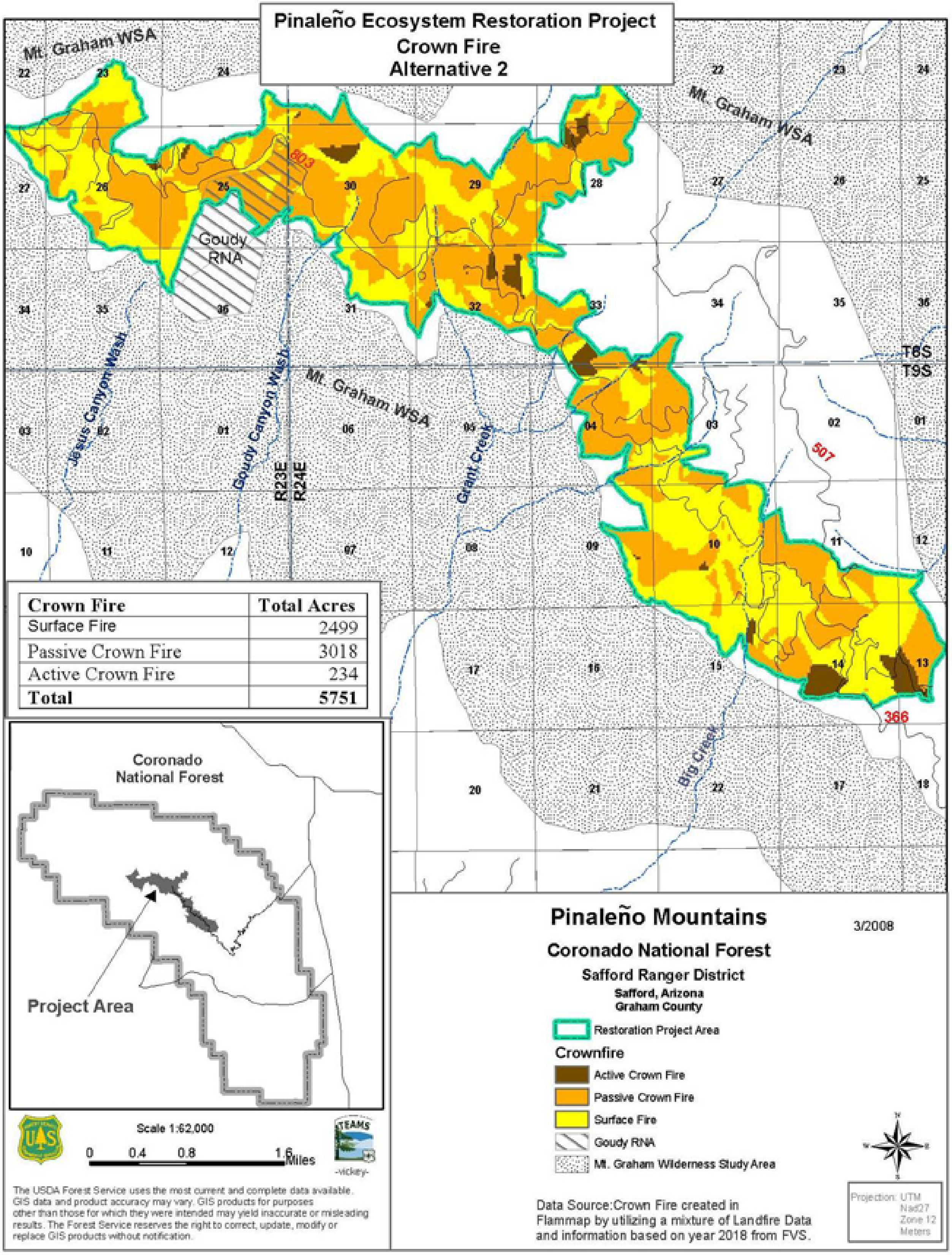
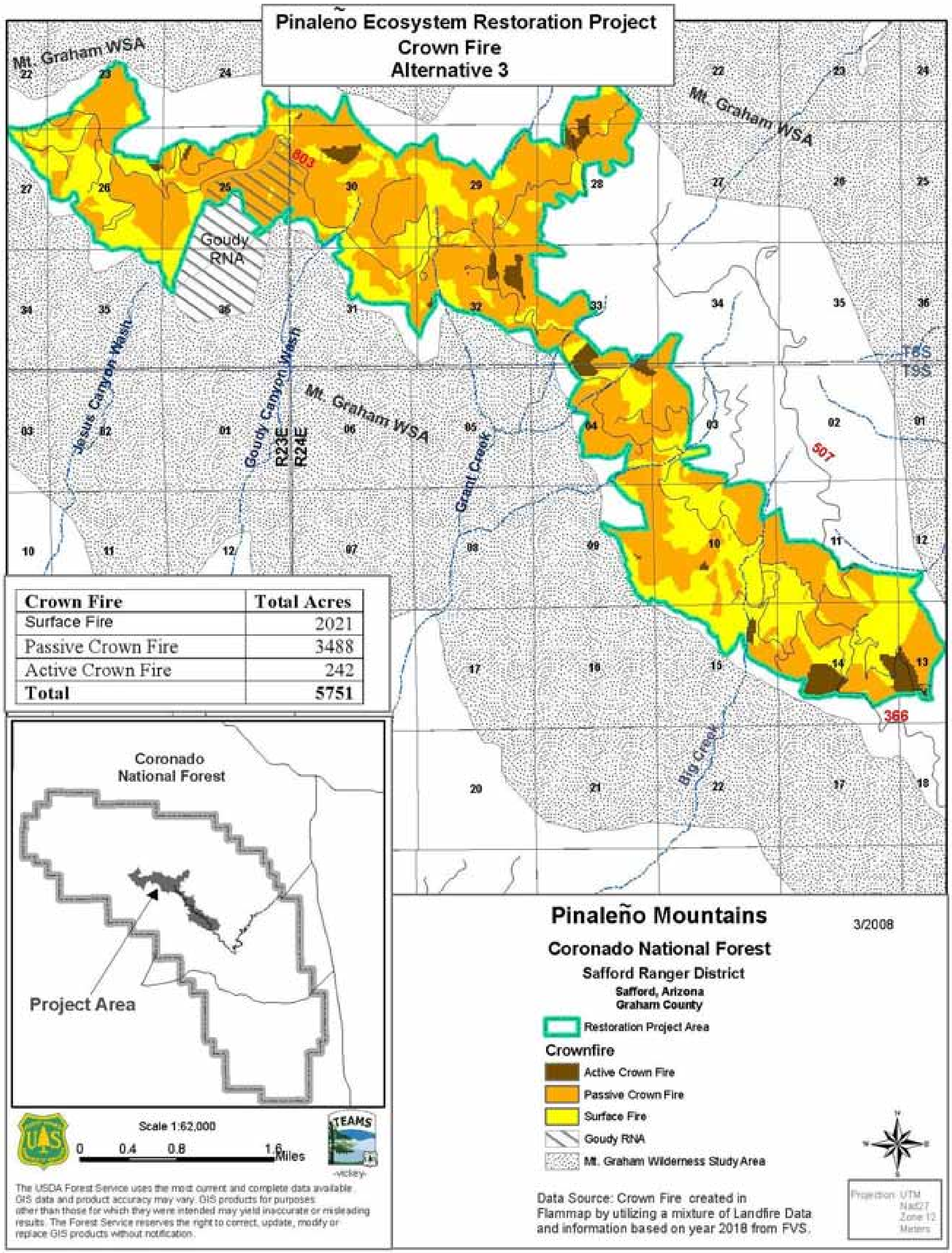


Figure 57. Predicted crown fire potential after implementation of Alternative 2



Crown Fire	Total Acres
Surface Fire	2021
Passive Crown Fire	3488
Active Crown Fire	242
Total	**5751**

Figure 58. Predicted crown fire potential after implementation of Alternative 3

E – Migratory Bird Effects

Migratory Bird Effects Analysis

for the

Pinaleño Ecosystem Restoration Project

Coronado National Forest
Safford Ranger District
Graham County, Arizona

Introduction

Executive Order 13186, of January 10, 2001, directs Federal agencies to support migratory bird conservation and to "ensure that environmental analyses of Federal actions required by the NEPA or other established environmental review processes evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern." Advice from the Forest Service Southwestern Regional Office is to analyze effects in the following manner: (1) effects to Species of Concern listed in the Arizona Partners in Flight Bird Conservation Plan; (2) effects to important bird areas (IBAs) identified by the National Audubon Society; and (3) effects to important overwintering areas.

This report analyzes effects on migratory birds of a proposal to implement a thinning and prescribed burn project within the Pinaleño Mountains, Graham County, Arizona. The project's proposed action is described in detail in the Scoping Notice prepared in August 2007, and is incorporated by reference. Effects to some of the species identified in the following analysis are also considered in other specialist reports prepared for this analysis. These include the wildlife specialist report, biological assessment, and management indicator species analysis.

Species of Concern

The Arizona State Partners in Flight Bird Conservation Plan (Latta 1999) lists priority species of concern by vegetation type. I reviewed all species of concern for vegetation types found in this project area. The following table displays the species that may occur in or near the project area.

I did not consider the **Swainson's thrush** (spruce/fir), **Pine grosbeak** (spruce/fir), **Three-toed woodpecker** (spruce/fir), or **Olive-sided flycatcher** (mixed conifer habitat) because they are uncommon migrants or do not occur this far south in Arizona. I did not consider the **Southwest willow flycatcher** (high elevation riparian) because they are uncommon migrants in the project area. I did not consider the **Common black hawk** (high elevation riparian), **Elegant trogon** (high elevation riparian), or **Southwestern willow flycatcher** (high elevation riparian) because they do not occur in the project area.

Summary of effects of the proposed action on migratory bird species of concern and habitat types in the project area

Species	Habitat Type	Habitat Description	Effects
Golden-crowned Kinglet	Spruce/Fir	Spruce/fir, mixed-conifer, deciduous, or single-species stands. Goals: No net loss of mature, moist, old-growth spruce/fir with a lichen component and canopy cover >40%. Manage forests to reduce fire risk. Minimize human activities during breeding seasons.	Based on the habitat goals for this species, this project should not significantly reduce spruce/fir habitat availability. The project is lower in elevation, and remains mostly within the mixed-conifer. The project goal is to reduce fire risk in the upper elevations, and focuses mainly on understory and midstory tree removals. Some disturbance will be caused by thinning and burning activities; however, the use of treatment blocks should allow large areas of the mountain range to be undisturbed while treatments occur in smaller areas.
Northern Goshawk	Mixed-Conifer Pine	Mature forests with a mosaic of dense stands and openings	While some disturbance from human activities is likely to occur during the implementation phase of this project, goshawks are unlikely to abandon the area permanently. Past monitoring shows high tolerance of local birds to firefighting and thinning activities. The project should result in an increased mosaic of vegetation, while remaining a more conservative prescription than has been recommended in other guidelines. (See wildlife specialist report.)
Mexican Spotted Owl	Mixed-Conifer	Mature forests with dense canopy and midstory. Woody debris in understory. Cool, steep sided canyons.	Design criteria created to maintain habitat components for this species. Thinning will focus on understory and midstory removals, to maintain the largest trees while reducing fuel loading. One of the major threats to this species is wildfire, the risk of which should be reduced by treatments. (See wildlife specialist report, biological assessment.)
Red-naped Sapsucker	Aspen	Groups of large aspen. Dead or live trees with heartrot. A diverse deciduous or deciduous/coniferous forest structure providing suitable diameter trees for nesting, insect diversity, and sap sources are selected.	Aspens are favored for retention within the silvicultural prescriptions for this thinning project. Prescribed fire is part of the treatment in the majority of the project area and should encourage regeneration of aspen clones.

Species	Habitat Type	Habitat Description	Effects
Cordilleran flycatcher	Pine	Spruce, fir, aspen, and pine forests, preferably in moist and shaded forests. > 2 snags per acre. > 383 ponderosa pines per acre in pine types. Avoid mechanical thinning of canopy and snags, and prescribed fires that may reduce canopy.	Design criteria include the retention of 6 logs and snags per acre, which exceeds goals for this flycatcher. The majority of thinning will be in the understory and midstory layers, with largest trees retained. Prescribed fires are planned to be low-intensity surface fires to reduce fuel loading, rather than high-intensity fires that would affect canopy cover.
Purple Martin	Pine	Open meadows and cut-over areas. High snag densities.	This project will reduce the density of snags in some areas; however, 6 of the largest snags per acre will be retained. Due to recent and ongoing insect activity and wildfire potential, there are new snags being created on a regular basis. Snag availability is not expected to be a limiting factor on this mountain range. Meadows are expected to be widened somewhat and improved in quality due to thinning and prescribed burning techniques.
MacGillivray's Warbler	High Elevation Riparian	Dense low shrubs and trees. Suggested: reintroduce natural fire regimes and remove excessive fuel loading prior to fires.	Some areas of treatment may receive some treatment, such as removals of the small tree component. However, no removals of hardwoods are incorporated into treatments, so many shrubs should be retained. This project is designed to reduce current fuel loading and to reintroduce fire into the ecosystem, as requested for this species.
Red-faced Warbler	High Elevation Riparian	High elevation canyons, pine-oak forest, spruce/fir stands. Habitat loss and human disturbance are major concerns.	Based on the habitat goals for this species, this project should not significantly reduce spruce/fir habitat availability. The project is lower in elevation and remains mostly within the mixed-conifer. The project goal is to reduce fire risk in the upper elevations, and is focused on conserving the local flora by reducing fuel loading and risk of catastrophic wildfire. These measures should assure the continued existence of habitat for this species. Some disturbance will be caused by thinning and burning activities; however, the use of treatment blocks should allow large areas of the mountain range to be undisturbed while treatments occur in smaller areas.

Important Bird Areas

No important bird areas have been designated within Graham County, Arizona.

Important Overwintering Areas

The Pinaleño Mountains are located, as are many of the Coronado National Forest mountain ranges, in an intersection zone where Rocky Mountain forests, Sierra Madrean woodlands, Chihuahuan and Sonoran deserts and plains grasslands converge. The mountains are located in an important migratory corridor for numerous avian species. More than 300 species of birds nest in or migrate through the mountain range.

The proposed action is for silvicultural thinning and prescribed burning approximately 3,500 acres in the upper elevations of the Pinaleño Mountains. The proposal is expected to reduce risks of catastrophic fires, thereby reducing threats to the endangered Mount Graham red squirrel, the threatened Mexican spotted owl, and many other species inhabiting the mountain range. The project should lead to increased health of the mixed-conifer ecosystem, increased resistance to insect infestation, and improved resilience to natural ignition fires. Assuring that the ecosystem itself is healthy should provide improved conditions for all of the breeding and wintering species of birds in this area.

Report prepared by: /s/ Anne L. Casey Date: December 31, 2008

Anne L. Casey
Safford District Biologist & Recreation Staff
Coronado National Forest

F – Transportation and Operations

The purpose of this transportation and operations analysis is to determine the most efficient and environmentally sound methods to access, remove, and treat onsite biomass fuels on the proposed Pinaleño Ecosystem Restoration Project while maintaining water quality, soil productivity and protecting other resource values. Vegetation removal and treatment methods are consistent with the "Coronado National Forest Land and Resource Management Plan" (LRMP) and with the Pinaleño Mountains Ecosystem Management Area Transportation Analysis Plan, January 2008 (TAP) that addresses maintenance level 1-5 roads, which are located in the Pinaleño Mountains Ecosystem Management Area.

Access to the project area from Safford is via State Highway 191 and Swift Trail Highway 366. Swift Trail (Hwy. 366) is paved from Hwy. 191 up to Shannon Campground, where it becomes a level 3 maintained dirt (native surface) road. Swift Trail provides access for part-time residents of Turkey Flat, Old Columbine, nearby recreation residences and organization camp, and Mount Graham International Observatory.

Primary tributary roads within the project area include the following National Forest System Roads: Heliograph Peak Road 352, Snow Flat Road 472, Treasure Park Road 89, Grant Hill Road 4550, Old Columbine Road 508, Webb Peak Road 88, and Riggs Lake Road 287. The arterial, collector, and local roads are native surface suitable for proposed operations and fuel removal under dry conditions. Arterial or major collector roads have highest priority for seasonal maintenance. Secondary roads are maintained for high-clearance vehicles. Road maintenance funding is limited with primary roads receiving highest maintenance priority. Limited maintenance has resulted in washouts on some closed roads. The project area has about 38 miles of existing roads. Access for resource management includes consideration for soil and water protection, public safety, efficiency of access, and effects on wildlife and other resources.

Primary road use within the project area is summer recreation traffic. The Pinaleño Mountains offer opportunities to hunt, fish, and camp at high elevations. Swift Trail is closed to the public in winter just past the Shannon Park and Heliograph Peak Road junctions. Snow removal and all-season use on Swift Trail to the Columbine Work Center includes University of Arizona access to the observatory site on Mount Graham, access to study areas, and national forest administration. The road system has provided access for limited sawtimber harvest, firewood gathering, fuels management and other forest management activities.

The project area is in mixed-conifer vegetation cover. Douglas-fir, ponderosa pine, white fir, and Engelmann spruce over 9 inches d.b.h., proposed for removal, would have potential sawlog value. Smaller diameter trees (6 to 9 inches d.b.h.) would be suitable for firewood or other small, round wood products.

Felling, Skidding, Processing, and Hauling

The Pinaleño Ecosystem Restoration Project was designed for ground-based skidding (fuel removal) areas with less than 35 percent favorable slope; adverse ground-based skidding is planned for 25 percent or less slopes. External ground-based yarding distance is 1,200 feet or less except for small long corners. Cable skidding is planned for areas with slopes over 35 percent or for areas over 25 percent not accessible for favorable tractor skidding. External cable yarding distance is less than 350 feet. Skyline yarding is planned for yarding cut trees from areas over 35 percent slope with longer than 350 feet external yarding distance (EYD). Most skyline sets would be less than 850 EYD with long corners up to 1,200 feet. There are blind lead sets on some units where multispan rigging would be required. The lower end of a few long ridge points in some units may need to be treated onsite. Whole-tree yarding, with limbs and tops attached is planned to reduce onsite fuels. Designated cut trees 6 inches d.b.h. and larger would be processed, slash chipped at the landings, and boles and chips removed from the area.

Modeling and Assumptions

Felling, stump-to-truck, and hauling costs were determined using R6 LOGCOST Models.[8] Fell and buck, skid, process, load and haul Logcost are for the Arizona geographic area. Machine felling is included in mechanized stump-to-truck costs. Hand felling cost is included in the skyline and cable Logcost model.

- Tractor swing skidding is planned, with cost allowance, for some skyline and cable sets.
- Slash swing hauling is planned to minimize adverse skidding effects to remove fuels from improved recreation areas, slash swing haul costs are included for removal.
- Cost allowance for potential sawlog volume (9 inches d.b.h. and larger trees) includes haul to prospective mills within a 250-mile radius from the project area.
- Cut trees 6 to 9 inches d.b.h., small round wood, and chip haul allowance is to the Safford area or other site within a 40-mile haul.

Additional cost details and assumptions for felling, mechanized, cable, skyline, swing skidding and slash swing hauling are included in the “Pinaleño Ecosystem Restoration Project Transportation and Operations Report” (Yurczyk, 2008).

Road Improvements, Maintenance and Temporary Road Construction Costs

Road construction, reconstruction, and improvement costs are from the March 2007 “Intermountain Southwest Rocky Mountain Regions Engineering Cost Estimating Guide for Road Construction” (USDA Forest Service 2007b).

Detailed costs associated with improvements and maintenance for haul routes are displayed in the “Pinaleño Ecosystem Restoration Project Transportation and Operations Report” (Yurczyk, 2008).

Temporary road construction and road reconstruction or improvement costs are calculated for two slope categories: 20 percent average and 35 percent average. These costs were applied to specific road segments based on site-specific side slopes. Adjusted costs were applied for road segments reconstructed on existing closed roads, two tracks, or trails where part of the clearing and road prism exists.

[8] Fall and Buck Appraisal Version 6.0, LOGCOST Version 8.0 3/15/2007, Haul Cost Appraisal Version 6.1.

Road reconstruction, improvements, and maintenance costs for all existing system roads to be used for haul routes are included in the haul_rds cost spreadsheets. Temporary road construction and rehabilitation or restoration costs are included in the temp_rds_costs spreadsheets. Costs associated with improvements and restoration on unclassified roads to be used for fuel removal are included in the unclass_rds_cost spreadsheets, in the "Pinaleño Ecosystem Restoration Project Transportation and Operations Report" (Yurczyk, 2008). Site-specific cost per mile and total road cost by road number and road segment for existing clearings and existing road or trailbed widths are included in the spreadsheets. Haul roads, unclassified roads, and proposed temporary road locations are shown on Alternative 2 Removal Methods Map and on Alternative 3 Removal Methods Map in the "Pinaleño Ecosystem Restoration Project Transportation and Operations Report" (Yurczyk, 2008).

Onsite Treatments, Contract Costs

Costs for hand cutting trees less than 6 inches d.b.h., pruning, lopping and scattering, hand piling and burning, prescribed burning, and mastication were derived from recent experienced costs on similar projects. Unit cost and acres by alternative and treatment method are included in the "Pinaleño Ecosystem Restoration Project Transportation and Operations Report" (Yurczyk, 2008), PERP 04-04-08 cost summary. Contract costs include: hand felling $200/acre, pruning $200/acre, lop and scatter $175/acre, hand piling $300/acre, burn piles $125/acre, prescribe burn or broadcast burn $200/acre, and masticate $250/acre.

Onsite Treatments, Prison Crew Costs

A comparison project cost summary was developed for Alternatives 2 and 3 using prison crew labor cost for onsite treatment work. Prison crew production estimates are based on a 20-person crew at $500/day with the following costs: hand felling $100/acre, hand pilling $100/acre, pruning $100/acre, and pile burning $45/acre. Prison crew production estimates and cost details are included in the "Pinaleño Ecosystem Restoration Project Transportation and Operations Report" (Yurczyk, 2008).

Alternatives

Removal Methods Description

Trees over 6 inches d.b.h. proposed for cutting would be felled and whole-tree yarded to landings for limbing and bucking to remove slash from the removal treatment areas to reduce onsite fuels and reduce risk of residual tree mortality during burning operations. Top and limb slash would be chipped or ground (tub grinder) at landings, with chips and boles removed from the project area. Alternative 2 would remove 21,201 CCF of bole wood and 14,333 tons of tops and limb chips. Alternative 3 would remove 10,432 CCF of bole wood and 5,861 tons of tops and limb chips. Cut trees less than 6 inches d.b.h., pruned limbs and other slash would be treated onsite.

Machine Felling

Machine felling could be done on 1,369 acres in Alternative 2 and on 994 acres in Alternative 3. A feller-buncher with self-leveling cab such as a Timbco, Prentice, or Timberjack could be used for felling and bunching fuels on mechanized ground-based removal units or on skyline and cable removal units with 35 percent or less slopes. These machines are capable of operating on slopes up to 50 percent. Using a feller-buncher would reduce removal costs by prebunching the small trees designated for cutting, for more efficient skidding operations. Hand cutting would be acceptable in proposed machine cutting units.

Hand Fell

Hand felling is proposed for fuel removal areas with slopes over 35 percent: 1,036 acres in Alternative 2 and 822 acres in Alternative 3. Trees over 6 inches d.b.h. designated for removal would be hand felled with chain saws.

Ground-based Removal

Tractors, skidders, or forwarders, would be used on 35 percent or less slopes, generally within 1,200 feet or less of existing roads or proposed temporary roads, to transport trees to landings. Feller-bunchers or harvesters could be used with ground-based mechanized removal systems. Ground-based external yarding distance is generally less than 1,200 feet with a few longer corners (Unit 403). There are small area inclusions, less than 100 feet slope distance, with greater than 35 percent slope in some ground-based skidding units. On these steeper pitches, logs or whole trees would be skidded from the steeper slope areas by directional felling and winching while the tractor or skidder operates from existing trails or roads or from less than 35 percent slope ground adjacent to the steeper pitch. Feller-bunchers could be used to reach in on short, steep pitches to cut and remove trees and then place trees (or bunches) on 35 percent or less slopes for skidding equipment to transport to landings.

Ground-based skidding is proposed for 1,256 acres in Alternative 2 and 917 acres in Alternative 3. Unit numbers and acres, by yarding system are included in the "Pinaleño Ecosystem Restoration Project Transportation and Operations Report" (Yurczyk, 2008). Based on resource protection needs identified during IDT analysis and size of trees proposed for removal; tractors, skidders, forwarders or other mechanized harvesting equipment would be suitable for ground-based removal.

Ground-based equipment would be restricted to designated trails spaced about 75 feet apart. Equipment operations could cause vegetation and soil disturbance or compaction (detrimental soil conditions) on approximately 12 percent of removal treatment areas. Landing slash would be disposed, skid trails and landings ripped or scarified where soils are compacted, cross drained or re-contoured, and seeded with a certified weed-seed-free seed mix after operations are complete (FSH 2509.22 - Soil and Water Conservation Practices Handbook R3 and FP page 35, Coronado National Forest Plan, Replacement page 35). Skid trails would be blocked with cull logs or trees, large rocks, woody debris or re-contoured where effective to prevent motorized travel after operations are complete.

Cable Removal

Cable skidding is proposed for 77 acres in Alternative 2 and for 54 acres in Alternative 3. Cable skidding units have slopes over 35 percent or have areas too steep for adverse tractor skidding, external yarding distances are generally less than 350 feet. On cable removal units, equipment would operate from existing roads and trails, or from less than 30 percent side slopes using an off-road line machine. On the off-road skidding areas, cut trees would be tractor-swing skidded to landings located adjacent to existing roads for processing and hauling. Tractor-swing skidding is planned for 530 CCF for Alternative 2 and for 346 CCF for Alternative 3 cable removal volume. On parts of cable units with less than 150 feet EYD, a winch-equipped tractor could transport trees directly to landings.

On cable removal units or ground-based removal units with steep road cut slopes along Swift Trail, the cable yarder or winch equipped tractor would operate from the road. No equipment would cross or travel over the road cut slope. Cable skidding areas and ground-based removal units where winching would be required, are displayed on GIS cable-skid shape files in the "Pinaleño Ecosystem Restoration Project Transportation and Operations Report" (Yurczyk, 2008). A tractor or skidder equipped with synthetic bull line would facilitate line pulling where a skidder is used. Cable removal unit numbers, acres, and volumes are included in the "Pinaleño Ecosystem Restoration Project Transportation and Operations Report" (Yurczyk, 2008).

Typically, cable or ground lead yarding would result in disturbed soil or vegetation on approximately 5 percent of the treatment unit. With small diameter trees proposed for cutting, low volume/acre, short skidding distance and existing ground cover, soil displacement from line skidding logs would be low.

Skyline Removal

Skyline yarding is proposed for areas with slopes over 35 percent within 1,200 feet or less of existing roads or proposed temporary roads. Skyline yarding for most skyline removal units is about 850 feet external yarding distance (EYD) with some long corners up to 1,200 feet.

Skyline yarding is proposed for 1,076 acres in Alternative 2 and 845 acres in Alternative 3, unit numbers and acres are included in the "Pinaleño Ecosystem Restoration Project Transportation and Operations Report" (Yurczyk, 2008). Skyline yarding units would require a skyline yarder with carriage capable of maintaining a fixed position on the skyline while lateral yarding with leading end suspension during inhaul. All proposed skyline yarding is uphill. Multispan rigging and a haulback may be needed on some sets depending on yarder tower height. A three-drum yarder would be needed on some units with low chord slope sets.

Skyline yarder sets, whole-tree processing, decking, loading and slash chipping is proposed along Swift Trail. The road would be closed during operations. In most areas, equipment would operate from one lane and periodically allow limited controlled travel in the open lane. On some skyline sets where space is limited, with steep road fill slopes, yarded trees and tops would be swing skidded or swing hauled to a larger landing for processing.

Landings would be located along existing roads and proposed temporary roads at each skyline set, spaced about 150 feet apart. Landings or hot decking sites would generally be within existing road and corridor clearings with minor additional openings required for decking high volume sets. Fan sets on ridge points, where volume is concentrated, could require larger landing areas, up to ½ acre, for material handling. On sets with high volumes where landing space is limited and to meet visual quality objectives, logs or bucked trees with limbs and tops attached would be hot loaded and hauled with a forwarder or swing skidded with a grapple skidder or similar machine to a larger landing site for processing, decking and loading. The additional cost for the estimated swing volume is included in operation costs. Swing skid volume for Alternative 2 is 1,497 CCF and for Alternative 3 is 641 CCF.

Off-road skyline yarding is proposed for yarding about 160 acres in parts of Units 289, 286, 58, 59, 205, and 458. On these off-road yarder areas, the off-road yarded would “walk” to the unit on a skid trail, whole trees would be skyline yarded up and tractor swing skidded to the landing for processing and hauling. A small track or trailer mounted yarder or yoader could operate from the skid trails. The south 23 acres of Unit 289, proposed for off-road yarding, would require a constructed trail on about 25 percent side slope to operate the off-yarder. EYD for the south end of Unit 289 is 1,100 feet. An off-road yarder could be used to skid the north 5 acres of Unit 548 with tractor swing to Road 4551 for processing and hauling. This would eliminate the need for temporary road 548-01.

Tail trees could be rigged outside of treatment units. Nylon straps or similar protective devices would be required for rigging to prevent residual tree damage. Trees outside of some treatment units may be needed for machine guyline anchors. To meet OSHA safety requirements, these anchor trees would need to be felled if they could reach the yarder, if pulled. In those areas that require anchor trees to be felled, guylines would be anchored to the stumps. Equipment could be used for artificial anchors on some sets where terrain permits access. Intermediate supports would be needed for efficient turns on sets with low deflection. Profiles would be run and analyzed for payload and yarder requirements during implementation (unit layout). Intermediate support trees would be protected with nylon straps or other protective devices when rigged to prevent damage.

Examples of suitable skyline equipment include the Koller K300 or Koller 500 trailer mounted yarder, Christy Heavy Duty, Thunderbird TSY50 (larger than needed for most units), aftermarket yoader with 1,500 feet skyline or Bitterroot yarder or Clearwater yarder developed by the Missoula Technology and Development Center would be adequate for the small diameter trees to be removed on some units with short external yarding distance. For the generally small diameter trees proposed to be removed with small yarding equipment operating from roads with low cut slopes and no tail swing, 12-foot-wide roads would be adequate for yarding and hauling fuels.

Typically, skyline yarding results in disturbed soil or disturbed vegetation on approximately 5 percent of the treatment unit. Vegetation and detrimental soil disturbance could occur in the center of skyline corridors and at landings. With cut tree diameter limits, understory small diameter trees proposed for cutting, leading end suspension, and intermediate supports rigged where needed, soil displacement in corridors would be low on most sets.

Swing Skidding

Ground-based or tractor swing skidding is planned for off-road skyline and cable yarding sets and on some skyline skidding sets along Swift Trial where there would not be enough open or flat areas to deck and process whole trees and meet other resource protection needs. Swing skidding areas, methods and volume are described under cable skidding and skyline yarding above.

Slash Swing Haul

Slash swing haul is proposed for high volume skyline and cable sets along Swift Trail and from ground-based removal units adjacent to Shannon, Cunningham, Big Creek and Riggs Flat Campgrounds, where there are insufficient openings or creating a large landing would not meet visual quality objectives. Skyline units with slash swing haul include Units 83, 286, 262, 263, 508, 285, 287 about 144 acres, 1,014 tons (table 103). Ground-based units with slash swing haul including parts of Unit 16, 260, 83, 475, and 462; about 70 acres, 500 tons for Alternative 2. No trees over 9 inches d.b.h. would be cut on Alternative 3, 790 tons of slash would be swing hauled.

Table 103. Swing skid and slash swing haul volume for Alternatives 2 and 3

Action	Alternative 2	Alternative 3
Swing Skid	2,009 CCF	988 CCF
Slash Swing Haul	1,514 Tons	790 Tons

Landings

All landing slash would be chipped (or ground) and removed from the project area or piled and burned before landing sites are restored. Project cost estimates include slash chipping and hauling chips to the Safford area. Landings would be rehabilitated after operations are complete. Disturbed areas would be recontoured and drainage restored, scarified where soils are compacted, and seeded with a forest approved certified noxious weed-seed-free seed mix. Skid trails to landings would be restored, blocked with large rocks, logs, trees or woody debris, or recontoured where effective to discourage off-road motorized travel. Landing locations are shown in the “Pinaleño Ecosystem Restoration Project Transportation and Operations Report” (Yurczyk, 2008).

Onsite Treatment Operations

Hand Fell, Pile and Burn

Hand felling, piling and pile burning would be done on 1,740 acres in Alternative 2 and on 1,660 acres in Alternative 3. Thinned cut trees, shrubs, and pruned limbs would be hand piled for burning when risk of fire spread is low and when smoke dispersal is acceptable.

Prune

Lower limbs of leave trees would be hand cut as close to the tree bole as possible without damaging the bole to a specified height. Pruning is proposed for 475 acres on Alternative 2 and Alternative 3. Pruning would be done for 150 feet each side of Swift Trail Road, Riggs Lake Road and Bible Camp Road to reduce wildfire risk along the public travel routes. Trees would be pruned to 10 feet above the ground, or up to one-third of the tree height, whichever is less. This treatment would be applied only in the proposed treatment units along these roads and not in Mexican spotted owl cores or nontreatment areas.

Lop and Scatter

Lop and scatter slash is proposed for 3,092 acres in Alternative 2 and for 2,949 acres in Alternative 3. Slash would be lopped to reduce slash depth and scattered to distribute concentrations and reduce risk of hot spots and torching during prescribed burning.

Prescribed Burning

Prescribed burning is proposed for 2,642 acres in Alternative 2 and for 2,502 acres in Alternative 3 to reduce hazard.

Mastication

Mastication is proposed for 460 acres on Alternative 2 and for 385 acres on Alternative 3. Slash, tops, limbs and small trees and shrubs would be chopped, shredded or ground up by machine and left onsite with a mobile brush cutter or shredder.

Mastication equipment may have a vertical or horizontal shaft and the head may have fixed or free swinging cutters. The heads may be machine mounted, boom mounted, or machine pulled. A brush-cutter head mounted on a tracked excavator can operate on slopes up to 35 percent. A shredder head could be mounted on an excavator boom for more selective mastication. A tracked feller-buncher type of machine with brush-cutter head and self-leveling cab could operate on slopes up to 50 percent. Leave tree spacing must be considered when selecting equipment. Tail swing on conventional excavators could damage leave trees with close spacing, newer feller-bunchers have zero tail swing. Feller-buncher machines make excellent platforms for mounting brush-cutting or mastication heads.

Vertical-shaft machines are generally more productive than horizontal-shaft machines. Vertical-shaft machines produce a coarse, splintered stem and require a larger safety zone than horizontal-shaft machines. There is some indication there may be more damage to leave trees when a vertical-shaft design with free swinging cutters rather than a drum shredder with free swinging cutters is used.

Soil disturbance on an estimated 12 percent of the area could be affected by mastication equipment depending on tons of fuel/acre and type of equipment used. A cutter head mounted on a tracked feller-buncher or excavator type of machine would create less ground disturbance than a front mounted cutter head. The excavator can pivot and reach into areas with the cutter head without moving the machine. In large fairly open areas, production could be slower with a boom mounted shredder head than with a larger front mounted masticator.

Operations Safety

Any potential conflict between fuel removal and public use would be handled with signs, barricades, temporary area closure, or operations and fuel haul timing restrictions (“Transportation and Operations Design Criteria,” appendix A). All fuel removal and onsite treatment operations would follow required safety provisions.

Alternative 1, No Action

With Alternative 1 there would be no road improvement or fuel treatment activities. Road maintenance would continue under the annual road maintenance plan as funds are available. There would be no changes in road use.

Alternatives 2 and 3

Proposed treatment and removal methods, volumes and acres are from Perpalt2volume032808.xls and Perpalt3volume032808.xls in the "Pinaleño Ecosystem Restoration Project Transportation and Operations Report" (Yurczyk, 2008). Removal operations, transportation, and onsite treatment activities are summarized by alternative in table 104.

Table 104. Activity acres and volumes for Alternatives 2 and 3

Activity	Alternative 2	Alternative 3
Total removal treated acres	2,409	1,816
Onsite treated acres	2,082	977
Total treated acres	4,491	2,793
Mechanized fell, > 6″ d.b.h. trees, acres (removal)	1,370	995
Hand fell > 6″ d.b.h. acres (removal)	1,038	822
Ground-based skid acres	1,256	917
Cable skid acres	77	54
Skyline yard acres	1,076	845
Tractor swing skid acres	228	172
Swing haul slash tons	1,514	790
Hand cut < 6″ d.b.h. trees, acres	1,740	1,660
Prune acres	475	475
Lop and scatter acres	3,092	2,949
Hand pile acres	1,741	1,660
Burn hand piles acres	1,741	1,660
Prescribe burn acres	2,642	2,502
Haul road improvements and maintenance miles	22.22	21.81
Unclassified roads used miles	0.69	0.64
Temporary road construction miles	3.8	2.9
Swift Trail road maintenance miles	6.25	6.25
Removal volumes		
Sawlogs CCF	10,451	0
ES house logs	502	0
Small round wood CCF	10,249	10,432
Chips tons	14,333	5,881

Alternatives 2 and 3 Road Improvements

Existing system roads would be used for hauling sawlogs, small round wood and chips. Existing roads needed for hauling, that are now closed would be improved and maintained for fuel removal operations. After operations are complete on the closed roads, drainage would be restored and the roadbeds seeded and closed. Roads that are now used as trails would be restored and retained for trail use after operations. Hauling would be restricted to dry conditions. Hauling operations on native surface roads, including Swift Trail would be stopped if road use is causing rutting of the road surface, ponding of water on the road, failure of any drainage structure, or any other action occurs that increases sediment delivery to a stream. Hauling would not be permitted during periods of daily alternating freezing and thawing over a several day period. Haul would be allowed on completely frozen or snow covered roads. About 6.25 miles of Swift Trail, from Columbine to the northwest end, would be maintained to meet BMPs. The east segment of Swift Trail is maintained by the county. Temporary roads would be constructed for removal operations and rehabilitated (closed to motorized travel) and revegetated after use. Road BMP improvements and maintenance, proposed for haul routes, are displayed for each road in table 105 for Alternative 2 and in table 108 for Alternative 3. Road improvement miles and costs by alternative are summarized in table 111. Cost details are included in the "Pinaleño Ecosystem Restoration Project Transportation and Operations Report" (Yurczyk, 2008).

Alternative 2: Roads

Haul Roads

Table 105 displays information about the roads to be used for the project and associated costs.

Table 105. Alternative 2 haul road improvements and maintenances costs

Road Number	Miles	Clear/ grub $/Mile	Excavate $/Mile	Realign $/Mile	Cross Drain $/Mile	Blade $/Mile	Seed $/Mile	Total $/mile	Total Cost
4559	0.557	578	348	0	6,500	650	816	8,892	4,951.87
unclass	0.23	0	0	0	3,250	350	816	4,416	1,013.89
89	0.909				6,500	650		7,150	6,498.77
4554	0.296	867	348		6,500	350	816	8,881	2,624.52
4559	1.319	578	348		3,250	650	816	5,642	7,440.40
472	0.719	0			6,500	650		7,150	5,137.39
137	0.199				6,500	650		7,150	1,420.26
107 trail	0.313	868	348		3,250	350	816	5,632	1,761.26
352	1.371	0	0	0	13,000	650		13,650	18,717.31
352	0.174	0	0	0	13,000	650		13,650	2,380.56
4553	1.07	578	348		6,500	650	816	8,892	9,510.37
4551	0.877	578	348		13,000	650	816	15,392	13,496.29
4551	0.111	578	348		6,500	350	816	8,592	950.44
4550	0.605	0	0		3,250	650	816	4,716	2,854.76
4541	0.206	0	0		6,500	650		7,150	1,472.90
4549	0.751	0	0		3,250	350	816	4,416	3,316.51
4561	0.139	0	0		3,250	650		3,900	540.33
4539	0.476	0	0		13,000	650	816	14,466	6,891.39
4538	1.509	867	348		6,500	650	816	9,181	13,854.80
4535	1.51	867	348		3,250	350	816	5,631	8,501.06
4577	0.122	0	0		1,300	650	816	2,766	338.38
508	2.412	867	348		13,000	650		14,865	35,853.91
4529	0.579	578	348		6,500	350	816	8,592	4,972.86
88	1.552	578	348	555	13,000	650		15,131	23,476.77
4521	0.692	578	348		6,500	350	816	8,592	5,941.39

Table 105. Alternative 2 haul road improvements and maintenances costs

Road Number	Miles	Clear/ grub $/Mile	Excavate $/Mile	Realign $/Mile	Cross Drain $/Mile	Blade $/Mile	Seed $/Mile	Total $/mile	Total Cost
4522	0.215	578	348		6,500	350	816	8,592	1,845.03
4521	0.096				3,250	350	816	4,416	424.86
4519	0.55	1,156	465		3,250	350	816	6,037	3,319.38
287	1.321							0	0
730	0.944	0	0		6,500	650		7,150	6,750.07
4516	0.269	578	465		6,500	350	816	8,709	2,341.06
4543	0.131	0	0		3,250	350	816	4,416	578.50
Total	22.22								$199,177.30

Drive through cross drains on open roads = $650/drain 5 to 20/mile depending on road grade and use.
Clearing and grubbing = $3,468/mile X feet/12 feet roadbed, 3 feet edge clearing = 3,468 X 3/12 = $867/mile.
Excavate = $1,394/mile X feet/12 = $1,394 X 3/12 = $348.
Road 88, Webb Peak realignment to increase switchback radius to 35 feet, 300 feet clear, grub, excavate.
Seeding cost = 14 foot cleared roadbed (with shoulder) X 5,280/43,560 = 1.68 acres/mile, adjust cost guide $889/mile X 1.68/1.83 acres/mile = $816/mile.
Numbers were calculated, summed and rounded in xls spreadsheets.

Unclassified Roads

Unclassified roads proposed for improvements for hauling that would be rehabilitated after operations are complete are included in table 106.

Table 106. Alternative 2 unclassified road improvements

Road No.	Miles	Clear/Grub $/mile	Blade $/mile	Closure	Seeding $/mile	Total $/mile	Total Cost
286-01	0.047	0	650	opened	842	1,492	70.57
58-01	0.194	867	350	gated	842	2,059	400.49
197-01	0.208	578	650	opened	842	2,070	430.47
38-01	0.237	867	350	gated	842	2,059	487.45
Total	0.69						$1,389

Temporary Road Construction

Temporary roads are authorized by contract, permit, lease, other written authorization or emergency operation not intended to be a part of the forest transportation system and not necessary for long-term resource management. Temporary roads would be constructed for timber harvest operations and would be obliterated and restored by scarifying or subsoiling to reduce soil compaction, and planted to re-establish vegetation cover. Woody debris would be placed on the roadbed clearing to discourage off-road vehicle use and to restore soil organic material after operations are complete. Construction and restoration work would generally be done within one season. Twelve-foot-wide temporary roads would be adequate for equipment needed to harvest the small diameter timber proposed for removal. Temporary road construction on 20 percent side slopes or less would average 1.8 acres clearing per mile. Temporary roads constructed on 25 to 35 percent side slope would average 2.5 cleared acres per mile. Some temporary road segments would have grades over 10 percent suitable for hauling on native surfaces under dry conditions.

Temporary roads would not become part of the long-term road system. Temporary roads needed for harvest operations are identified and described below by treatment unit (see table 107).

286-01

A 2,180-foot long temporary road is proposed to access the lower part of Unit 286 for skyline yarding. This road is generally on less than 25 percent side slope except for the south 800 feet, which is on a 35 percent side slope where it crosses the draw. The road joins Road 472 at Snow Flat.

38-01

A 680-foot temporary road is needed to access the north part of Unit 38 on the east side of Big Creek for skyline yarding. This area is over 25 percent slope, too steep for adverse ground-based skidding. The proposed road joins an existing earth barricaded road near Treasure Park Road 89. The road would be located on less than 25 percent side slope. Multispan sets may be required to reach over the convex slope. Tail holds could be rigged across the draw for deflection.

58-01

A 750-foot temporary road is proposed to access Units 58, 59, and 52 for skyline yarding. This road is located on less than 25 percent side slope. These units have 850 feet EYD, multispan sets may be required on the long corners. Some sets may require the yarder to set 50 to 75 off the road for adequate deflection on the rounded ridgetop. Yarded trees from these sets would be ground-based swing skidded to the landing on the proposed road for processing and loading. The proposed road joins an existing grown-in road off of Road 4539 near the east boundary of Unit 58.

59-01

A 150-foot temporary spur road is proposed to access part of Unit 59 for skyline yarding. This short spur road is located on less than 25 percent side slope and needed to access the north side of the convex ridgetop in Unit 59, EYD is about 650 feet. This proposed road joins temporary road 58-01 near the southwest corner of Unit 52.

548-01

A 640-foot temporary spur road is proposed to access about 5 acres, too steep for adverse ground-based skidding in the north part of Unit 548, for skyline yarding. This spur road is located on less than 25 percent side slope southwest of Grant Hill. The small area with 450-foot EYD could be off-road skyline yarded and tractor swing skidded to Road 4550 for processing and hauling. This proposed temporary road starts at the end of Road 4550.

55-01

A 1,000-foot long temporary road is proposed to access Units 51, 53, and 55 for skyline yarding. This ridgetop road is located on less than 25 percent side slope. These units have 1,200-foot EYD long corners and multispan rigging would be needed near the rounded ridgetop. Tail hold lift trees could be located across the draw to improve deflection. This proposed road joins Road 4549 near the northwest corner of Unit 46.

66-01, 66-02, and 66-03

Proposed temporary roads 66-01, 820 feet; 66-02, 240 feet; and 66-03, 500 feet long would be needed for skyline yarding access in Unit 66. These are short stub spurs located on ridgetops with less than 25 percent side slope. Some sets in this unit would require multispan rigging. Roads 66-01 and 02 connect to Road 4538, 66-03 connects to 4535.

70-01

A 550-foot temporary road is proposed to access part of Units 70 and 508 for skyline yarding. This road is located on less than 25 percent side slope. These units have 800-foot EYD (external yarding distance) long corners, multispan sets would be required. This proposed road joins Road 4549 near the northwest corner of Unit 46 and connects to Road 4535.

508-01

A 720-foot temporary road is proposed to access the north tip of Unit 508 and the south part of Unit 69 for skyline yarding. This road is located on less than 25 percent side slope. This is a proposed short spur off of temporary road 509-01.

508-02

A 1,280-foot temporary road is proposed to access the south part of Unit 508 for skyline yarding. This road is located on less than 25 percent side slope. This proposed road connects to Swift Trail.

509-01

A 2,660-foot temporary road is proposed to access Unit 509 and the west part of Unit 508 for skyline yarding. About 2,360 feet of this road is located on less than 25 percent side slope, 300 feet is on 35 percent side slope. This proposed road connects to Swift Trail on 25 percent side slope at the road junction, end haul and fill at the temporary road junction would minimize disturbance to Swift Trail cut and fill slopes.

427-01

A 1,335-foot temporary road is proposed to access Unit 427 for skyline yarding. This road is located on less than 25 percent side slope, connects to Bible Camp Road 508 in Unit 426.

181-01

A 780-foot temporary road is proposed to access Unit 181 for skyline yarding as the area is too steep for adverse ground-based skidding. This road is located on less than 25 percent side slope and connects to Bible Camp Road 508 in Unit 350.

205-01

A 1,335-foot temporary road is proposed to access Units 205, 201, 194, and 532 northwest of Webb Peak, for skyline yarding. This road is located on less than 25 percent side slope, connects to Webb Peak Road 88 in Unit 532.

531-01

A 875-foot temporary road is proposed to access Unit 531 for skyline yarding as the area is too steep for adverse tractor skidding. This road is located on less than 25 percent side slope and connects to Webb Peak Road 88 in Unit 532.

Units 333, 332 and the west part of Unit 150 is proposed for off-road skyline yarding with grapple skidder swing to the proposed landing on Road 4577 near the Columbine Corrals recreation site. Off-road yarder skidding is proposed due to the amount of temporary road that would be needed to access these units for hauling (these units were changed to treat onsite).

156-01

A 1,050-foot temporary road is proposed to access the south part of Unit 156 for skyline yarding as the area is too steep for adverse tractor skidding. This road is located on less than 25 percent side slope and connects to Swift Trail Road in Unit 145. The area proposed for skyline skidding is about 35 percent slope but one or two excavated skid trails would be needed to remove cut trees from the main draw above Riggs Lake and from the small side draws. There are large granite rocks to locate the proposed temporary road around, but effects of temporary road construction on soil and water would be less than tractor trail construction and lateral skid trails needed on the 34 percent slopes.

458-01

A 400-foot temporary road is proposed to access part of Unit 458 for skyline yarding. This road is located on less than 25 percent side slope and connects to Swift Trail in Unit 459.

458-02

A 230-foot temporary road is proposed to access the north part of Unit 458 for skyline yarding. This road is located on less than 25 percent side slope and connects to Swift Trail in Unit 242.

235-01

A 900-foot temporary road is proposed to access the north part of Units 458 and 235 for skyline yarding. This road is located on less than 25 percent side slope and connects to Swift Trail in Unit 226.

34-01

A 540-foot temporary road is proposed to access part of Units 25 and 34 for skyline yarding. This road is located on 25 percent side slope just below the spur ridgetop due to rock outcrops, it connects to Road 4553 in Unit 34. Part of Unit 34 is over 35 percent slope and adjacent to Big Creek, the top part of Unit 25 is too steep for adverse ground-based skidding. Skyline yarding up would avoid skidding across Big Creek.

93-01

A 400-foot temporary road is proposed to access part of Unit 93 for skyline yarding. This road is located on a spur ridgetop on less than 25 percent side slope and connects to Swift Trail in Unit 473. External yarding distance from the long corner is about 650 feet but may require multispan sets and a haulback from the rounded ridgetop with low chord slope.

486-01

A 230-foot temporary spur road is proposed to access the west tip of Unit 486 for skyline yarding. This road is located on a spur ridgetop on less than 25 percent side slope, connects to Swift Trail in Unit 36. External yarding distance is 430 feet for the small 4-acre area.

Table 107. Alternative 2 proposed temporary roads length and costs

Temporary Road No.	Road Length Ft	Side Slope 0 - 25%	Cost/ Mile	Total Road Segment Cost	Side Slope 25 - 35%	Cost/ Mile	Total Segment Cost	Total Road Cost
93-01	410	210	7,572	301	200	9,177	347.61	649
235-01	900	900	7,572	1,291			0	1,291
156-01	1,050	800	7,572	1,147	250	9,177	434.52	1,582
205-01	1,335	1,335	7,572	1,915			0	1,915
181-01	780	780	7,572	1,119			0	1,119
486-01	230	230	7,572	330			0	330
509-01	2,660	2,360	7,572	3,384	300	9,177	521.42	3,906
508-01	350	350	7,572	502				502
508-02	1,280	1,280	7,572	1,836				1,836
70-01	550	550	7,572	789				789
66-03	500	500	7,572	717				717
66-02	240	240	7,572	344				344
55-01	1,000	1,000	7,572	1,434				1,434
58-01	720	720	7,572	1,033				1,033
59-01	150	150	7,572	215				215
548-01	640	640	7,572	918				918
38-01	680	680	7,572	975				975
286-01	2,180	872	7,572	1,251	1,308	9,177	2,273.39	3,524
34-01	540	540	7,572	774			0	774
66-01	820	0	7,572	0	820	9,177	1,425.22	1,425
458-01	406	406	7,572	582				582
458-02	233	233	7,572	334				334
531-01	875	875	7,572	1,255				1,255
427-01	1,335	1,335	7,572	1,915				1,915
Total	19,886	16,986		24,359	2,878		5,002.16	29,362

0 to 25% side slope road cost/mile:
clear & grub = 3,468; excavate = 1,394; blade = 350; obliterate = 1,471; seed = 889; total =7,572

25 to 35% side slope road cost/mile:
clear & grub = 4,757; excavate = 3,752; blade = 350; obliterate = 1,913; seed = 1,304; total = 9,177

Alternative 3 Roads

Alternative 3 road lengths and cost are summarized in 108.

Table 108. Alternative 3 haul road improvements and maintenances costs

Road No.	Miles	Clear/ grub $/Mile	Excavate $/Mile	Realign $/Mile	Cross Drain $/Mile	Blade $/Mile	Seed $/Mile	Total $/Mile	Total Cost
4559	0.557	578	348	0	6,500	650	816	8,892	4,951.87
unclass	0.23	0	0	0	3,250	350	816	4,416	1,013.89
89	0.909				6,500	650		7,150	6,498.77
4554	0.296	867	348		6,500	350	816	8,881	2624.52
4559	1.319	578	348		3,250	650	816	5,642	7440.40
472	0.719	0			6,500	650		7,150	5,137.39
137	0.199				6,500	650		7,150	1,420.26
107 trail	0.313	868	348		3,250	350	816	5,632	1,761.26
352	1.371	0	0	0	13,000	650		13,650	18,717.31
352	0.174	0	0	0	13,000	650		13,650	2,380.56
4553	1.07	578	348		6,500	650	816	8,892	9,510.37
4551	0.877	578	348		13,000	650	816	15,392	13,496.29
4551	0.111	578	348		6,500	350	816	8,592	950.44
4550	0.605	0	0		3,250	650	816	4,716	2,854.76
4541	0.206	0	0		6,500	650		7,150	1,472.90
4549	0.751	0	0		3,250	350	816	4,416	3,316.51
4539	0.476	0	0		13,000	650	816	14,466	6,891.40
4538	1.509	867	348		6,500	650	816	9,181	13,854.80
4535	1.51	867	348		3,250	350	816	5,631	8,501.06
4577	0.122	0	0		1,300	650	816	2,766	338.379
508	2.412	867	348		13,000	650		14,865	35,853.91
4529	0.579	578	348		6,500	350	816	8,592	49,72.857
88	1.552	578	348	555	13,000	650		15,131	23,476.77
4521	0.692	578	348		6,500	350	816	8,592	5,941.39
4522	0.215	578	348		6,500	350	816	8,592	1,845.03
4521	0.096				3,250	350	816	4,416	424.86
4519	0.55	1,156	465		3,250	350	816	6,037	3,319.37
287	1.321							0	0
730	0.944	0	0		6,500	650		7,150	6,750.07
4516	0.269	578	465		6,500	350	816	8,709	2,341.06
4543	0.131	0	0		3,250	350	816	4,416	578.50
Total	21.81								$194,740.00

Haul Road Costs

Haul roads conditions and needed improvements for hauling are described under existing conditions.

Unclassified Road Improvement Costs

Unclassified road conditions and needed improvements for hauling are described under existing conditions. Costs are shown in table 109.

Table 109. Alternative 3 unclassified road improvement costs

Road No.	Miles	Clear/Grub $/Mile	Blade $/Mile	Closure	Seeding $/Mile	Total $/Mile	Total Cost
58-01	0.195	867	350	gated	842	2,059	400.49
197-01	0.208	578	650	open	842	2,070	430.47
38-01	0.237	867	350	gated	842	2,059	487.45
Total	0.639						1,318.41

Temporary Road Construction and Rehabilitation

Temporary road details are shown in table 110 described under Alternative 3, locations are shown in the "Pinaleño Ecosystem Restoration Project Transportation and Operations Report" (Yurczyk, 2008).

Table 110. Alternative 3 proposed temporary roads length and costs

Temporary Road No.	Road Length ft	Side Slope 0-25%	Cost/ mile	Total Road Segment Cost	Side Slope 25-35%	Cost/ mile	Total Segment Cost	Total Road Cost
235-01	900	900	7,572	1,291			0	1,291
156-01	1,050	800	7,572	1,147	250	9,177	434.517	1,582
205-01	1,335	1,335	7,572	1,915			0	1,915
181-01	780	780	7,572	1,119			0	1,119
486-01	230	230	7,572	330			0	330
509-01	2,660	2,360	7,572	3384	300	9,177	521.4205	3,906
508-01	350	350	7,572	502				502
508-02	1,280	1,280	7,572	1,836				1,836
70-01	550	550	7,572	789				789
66-03	500	500	7,572	717				717
66-02	240	240	7,572	344				344
55-01	1,000	1,000	7,572	1,434				1,434
58-01	720	720	7,572	1,033				1,033
59-01	150	150	7,572	215				215
548-01	640	640	7,572	918				918
38-01	680	680	7,572	975				975
34-01	540	540	7,572	774			0	774
66-01	820	0	7,572	0	820	9,177	1,425.216	1,425
458-01	406	406	7,572	582				582
458-02	233	233	7,572	334				334
531-01	875	875	7,572	1,255				1,255
427-01	1,335	1,335	7,572	1,915				1,915
Total	17,274							25,189

0 to 25% side slope road cost/mile:
clear & grub = 3,468; excavate = 1,394; blade = 350; obliterate = 1,471; seed = 889; total = 7,572

25 to 35% side slope road cost/mile:
clear & grub = 4,757; excavate = 3,752; blade = 350; obliterate = 1,913; seed = 1,304; total = 9,177

Alternatives 2 and 3 Road Miles Summary

Table 111. Alternative 2 and 3 roads summary

Road Work	Alternative 2		Alternative 3	
	Miles	Cost	Miles	Cost
Haul Road Improvements	22.22	199,177	21.81	194,740
Unclassified Road Improvement and Rehabilitation	0.69	1,389	0.64	1,318
Temporary Road Construction and Rehabilitation	3.80	29,362	2.90	16,117
Road Maintenance, Swift Trail	6.25	6,875	6.25	6,875

Effects Associated with Treatment Operations

Effects on soil, water, and other resources associated with felling, skidding, landing construction and use, haul road improvements, temporary road construction and rehabilitation, and onsite treatments associated with the activities are covered under each interdisciplinary resource specialist's report. As noted under removal operations, expected soil disturbance effects from ground-based skidding is 12 percent, and cable and skyline skidding is 5 percent. Vegetation and soil displacement from temporary road construction is estimated at 1.83 acres/mile for an average 20 percent side slope, and 2.5 acres/mile for a 35 percent side slope. Haul road and unclassified road widening for hauling would average 0.60 acres/mile. Mastication could affect about 12 percent of the surface area and pile burning about 10 percent of the area. These effects would be added to other past, present and reasonably foreseeable future disturbances for each resource analyzed. Table 112 shows predicted soil and vegetation disturbed areas by activity.

Table 112. Alternatives 2 and 3 soil and vegetation disturbed areas by activity

Activity	Alternative 2		Alternative 3	
	Total Area	Disturbed Acres	Total Area	Disturbed Acres
Ground-based skid	1,256 acres	151	917 acres	110
Cable skid	77 acres	4	54 acres	3
Skyline skid	1,076 acres	54	845 acres	42
Haul road improvement	13.9 miles	8.4	13.5 miles	8.2
Unclassified road improvement	0.69 mile	0.4	0.64 mile	0.4
Temporary road construction	3.8 miles	7.0	2.9 miles	5.3
Mastication	460 acres	55.2	385 acres	46.2
Pile Burning	1,741 acres	174	1,660 acres	160
Total		454.0		375.1

Ground based skidding—12% disturbed area includes landings and skid trails

Cable skidding—5% includes skidding corridors and landings

Skyline yarding—5% includes skidding corridors and landings.

Temporary road construction soil disturbance is estimated at 1.83 acres/mile cleared area on an average 20% side slope.

Road improvement soil disturbed area estimate is based on an average 20% side slope for the roads planned to be used, average additional widening clearing is 4 feet, 4/12 = 0.33, 0.604 acres/mile.

Mastication disturbed area is based on an estimated 12% of the acres treated.

With 25 tons of fuel/acre, vegetation on an estimated 10% of the area could be affected by burning piles.

Dust raised by traffic along dirt roads may settle onto plants adjacent to the road, blocking photosynthesis and can be introduced into water systems as sediment and contaminants to ecosystems.

Total Haul Miles

Total haul miles were calculated to determine effects of hauling products from the project area from road dust, truck exhaust particulates, and noise. Miles were determined based on these assumptions:

- Sawlog = 250 loaded miles
- Small round wood = 40 loaded miles
- Chips haul = 40 loaded miles

Native surface (dirt) road haul miles is 13.5 miles from the Swift Trail gate to the north end of the project area and 1.25 miles average haul on lateral roads = 13.5 miles total/2 = 6.75 + 1.25 = 8 miles or 16 round trip miles average native surface road haul/load. Haul mile details are included in the "Pinaleño Ecosystem Restoration Project Transportation and Operations Report" (Yurczyk, 2008).

Table 113. Alternative 2; total haul miles

Product Haul	Native Surface Miles	Paved Surface Miles	Total Haul Miles
Sawlogs (includes house log volume)	19,920	602,580	622,500
Small Round Wood	32,648	130,560	163,208
Chips	11,472	45,888	57,360
Total	64,040	779,028	843,068

Table 114. Alternative 3 total haul miles

Product Haul	Native Surface Miles	Paved Surface Miles	Total Haul Miles
Sawlogs	0	0	0
Small Round Wood	17,392	69,568	86,960
Chips	4,704	18,816	23,520
Total	22,096	88,384	110,480

Product Volumes

Designated cut trees 6 to 9 inches d.b.h. and larger would be whole-tree yarded to landings for fuel reduction. Pine, juniper, oak and softwoods 6 to 9 inches d.b.h. would be removed and offered for sale as firewood. Tops and limbs from whole-tree yarding would be chipped at the landings and removed. Trees less than 6 inches d.b.h. would be lopped and scattered where volumes are light, or piled and burned onsite, masticated or prescribed burned. Cost summary table 116 includes treatment costs and acres to be treated for Alternatives 2 and 3.

Sawlog volume to be removed includes ponderosa pine, Douglas-fir, white fir, and Engelmann spruce larger than 9 inches d.b.h.

Potential house log volume to be removed under Alternative 2 includes Englemann spruce:

- 12 – 18 inches = 418 CCF
- Larger than 24 inches = 84 CCF

There would be no potential house logs removed under Alternative 3. Firewood volume includes removed pine, juniper, and oak larger than 6 inches d.b.h. Product volumes for Alternatives 2 and 3 are displayed in table 115.

Alternative 2 and 3 volumes to be removed are displayed in the "Pinaleño Ecosystem Restoration Project Transportation and Operations Report" (Yurczyk, 2008).

Table 115. Alternatives 2 and 3 product volumes to be removed

Product	Alternative 2	Alternative 3
Sawlogs	10,451 CCF	0
House logs	502 CCF	0
Firewood	16,324 CCF	8,699 CCF
Chips	14,333 Tons	5,881 CCF

Alternatives 2 and 3 Activities Summary

Treatment activity costs are summarized in table 116 below.

Table 116. Alternatives 2 and 3 activity cost summary

PERP 04-08-08; Contract Costs Summary						
Activity	**Alternative 2**			**Alternative 3**		
Total CCF	21,202			10,432		
Total acres, removal	2,409			1,816		
Total onsite treated acres	2,082			977		
Total treated acres	4,491			2,793		
Activity (unit of measure)	**Unit**	**Cost/Unit $**	**Total Cost $**	**Unit**	**Cost/Unit $**	**Total Cost $**
GB remove, mechanized, CCF	10,459	102.71	1,074,244	5,577	125.15	697,962
Cable, CCF	883	68.73	60,688.59	577	70.8	40,851.60
Skyline remove, CCF	9,860	128.15	1,263,559	4,278	161.23	689,742
Swing sky/tractor, CCF	2,009	24.38	48,979.42	988	29.77	29,412.76
Slash swing haul, tons	1,514	16	24,224	790	16	12,640
Clean off road equipment	48	100	4,800	42	100	4,200
Haul 9"+ sawlogs (PP,DF,WF) CCF	10,953	121.38	1,329,475	0	121.38	0
Haul 6 to 9" firewood, CCF	10,249	71.45	732,291	10,432	71.45	745,366.4
Mobilize chipper or tub grinder	10	630	6,300	10	630	6,300
Chip/grind tops and limbs at landing, tons	14,333	12	171,996	7,052	12	8,4624
Haul chips, tons	14,333	32.15	460,805.9	7,052	32.15	226,721.8
Hand cut trees < 6" d.b.h., acres	1,740	200	348,000	1,660	200	332,000
Prune, acres	475	200	95,000	475	200	95,000

Table 116. Alternatives 2 and 3 activity cost summary

PERP 04-08-08; Contract Costs Summary						
Lop and scatter, acres	3,092	175	541,100	2,949	175	516,075
Hand pile, acres	1,740	300	522,000	1,660	300	498,000
Burn piles, acres	1,740	125	217,500	1,660	125	207,500
Prescribe burn, acres	2,642	200	528,400	2,502	200	500,400
Mobilize masticator, each	4	630	2,520	4	630	2,520
Clean off road masticator	4	125	500	4	125	500
Masticate, acres	460	250	115,000	385	250	96,250
Close, rehab skid trails and rehab landings, acres	55	195.38	10,745.9	45	195.38	8,792.1
Grass seed landings, skid trails, acres	55	175	9,625	45	175	7,875
Total Activity Cost			7,567,754			4,802,732
Road reconst. on existing rds/trails, close/rehab., miles	22.22	8,963.86	199,177	21.81	8,928.93	194,740
Road, unclassified improve/rehab, miles	0.69	2,013.04	1,389	0.64	2,059.38	1,318
Temporary road const./rehab.	3.8	7,528.72	29,362	2.9	5,557.59	16,117
Road maintenance Swift Trail, miles	6.25	1,100	6,875	6.25	1,100	6,875
Mobilize road equipment (9%)	1	21,312	21,312	1	19,714	19,714
Total Road Costs			258,115			238,764
TOTAL All Costs			7,825,869			5,041,496
Total treat acres and cost/acre	4,491		1,742.57	2,793		1,805.05

Project summary table for prison crew cost for onsite operations are included in the “Pinaleño Ecosystem Restoration Project Transportation and Operations Report” (Yurczyk, 2008).

Ground-based Removal Units

327, 445, 550, 554, 552, 11, 116, 124, 129, 13, 135, 156, 165, 170, 171, 172, 174, 192, 194, 197, 20, 200, 209, 213, 216, 218, 222, 226, 232, 233, 234, 236, 237, 238, 239, 242, 243, 256, 260, 262, 264, 265, 268, 269, 273, 274, 275, 276, 280, 281, 283, 288, 290, 292, 294, 30, 329, 330, 354, 36, 360, 362, 368, 375, 380, 40, 401, 403, 405, 411, 42, 422, 427, 442, 449, 45, 453, 454, 459, 462, 47, 475, 477, 479, 483, 49, 493, 495, 506, 511, 545, 91

Cable Removal Units

437, 447, 491, 16, 450, 456, 85

Skyline Removal Units

134, 152, 195, 201, 205, 33, 412, 413, 14, 142, 176, 181, 235, 24, 25, 254, 255, 272, 28, 282, 285, 286, 287, 289, 291, 297, 322, 323, 331, 34, 418, 431, 44, 458, 46, 461, 486, 494, 502, 504, 508, 509, 51, 52, 53, 531, 532, 54, 548, 55, 56, 58, 59, 61, 62, 63, 64, 66, 69, 70, 71, 72, 83

Forest Plan and Other Legal Consistency

Coronado National Forest Land and Resource Management Plan

The Pinaleño Ecosystem Restoration Project proposed management activities comply with the "Coronado National Forest Land and Resource Management Plan" (LRMP), which guides management for the project area, and includes goals, objectives, and standards and guidelines. LRMP standards and guidelines applicable to transportation, removal, and onsite treatment activities are included below:

Regionwide Standards and Guidelines (Page 15)

The following standards and guidelines were added to the Coronado National Forest Plan by a regionwide amendment process documented in a Record of Decision issued by the Regional Forester on June 5, 1996. The standards and guidelines guide the management of Mexican spotted owl, northern goshawk, old growth and grazing utilization.

Mexican Spotted Owl (These S&Gs are superseded by red squirrel S&Gs when necessary only in red squirrel habitat on Mount Graham in Management Areas 2 or 2A.)

Standards: Provide three levels of habitat management—protected, restricted, and other forest and woodland types to achieve a diversity of habitat conditions across the landscape.

> *Allow no timber harvest except for firewood and fire risk abatement in established protected activity centers. For protected activity centers destroyed by fire, windstorm, or other natural disaster, salvage timber harvest or declassification may be allowed after evaluation on a case-by-case basis in consultation with U.S. Fish and Wildlife Service.*

> *Allow no timber harvest except for fire risk abatement in mixed conifer and pine-oak forests on slopes greater than 40 percent where timber harvest has not occurred in the last 20 years.*

Actions proposed under the Pinaleño Ecosystem Restoration Project area are in LRMP Management Area 2 (non-wilderness study area, mixed-conifer), Management Area 2a (non-wilderness study area, enhanced wildlife) and Management Area 8 (non-wilderness study area, RNA).

The purpose of the project is to protect the existing Mount Graham red squirrel population by changing forest composition, structure, and density, and to reduce the potential for severe wildfire. The project is also designed to improve forest health and reduce risk of future insect infestations and disease.

Page 16 - *Forest Plan Amendment No. 8, June 1996 (Replacement Page 15)*

> *Road or trail building in protected activity centers should be avoided but may be permitted on a case-by-case basis for pressing management reasons.*

Alternatives 2 and 3 propose temporary road construction. Alternative 3 has no proposed temporary road construction or removal treatment activities in Mexican spotted owl protected activity centers.

Page 20 - E. Vegetation Management

> *1. Landscapes outside Goshawk post-fledging family areas*
>
> *The order of preferred treatment for woody debris is: (1) prescribed burning, (2) lopping and scattering, (3) hand piling or machine grapple piling, (4) dozer piling.*

The proposed project vegetation treatments on landscapes outside goshawk post-fledging family areas propose prescribed burning, lopping and scattering, hand piling and mastication, no machine grapple piling or dozer piling is proposed.

Page 22 - *G. Ground Surface Layer (All forested cover types)*

> *Manage road densities at the lowest level possible. Where timber harvesting has been prescribed to achieve desired forest condition, use small skid trails in lieu of roads.*

The project proposes ground-based skidding for 1,256 acres in Alternative 2 and for 917 acres in Alternative 3. Ground-based equipment would be restricted to designated trails spaced about 75 feet apart. Based on resource protection needs identified during IDT analysis and size of trees proposed for removal; tractors, skidders, forwarders or other mechanized harvesting equipment would be suitable for ground-based removal. No system road construction is planned, all temporary roads would be rehabilitated, closed roads used for operations would again be closed or restored to a trail after operations are complete. Road density would not change.

Unit 403 east of Columbine is proposed for ground-based skidding. About 25 acres has a long skidding distance, 2,000 feet EYD to the long corner. A forwarder could be used to transport cut trees to the proposed landing on Road 508. This long skidding distance is planned to avoid the need for temporary road construction.

Unit 548 is proposed for skyline yarding, yarding distance varies from 450 feet to 50 feet (EYD) at the south end of the unit. A temporary road would access the 450-foot EYD skyline sets at the north end. The plan includes an off-road yarder with tractor or skidder swing for part of the unit to avoid temporary road construction. The middle of the unit, with 250 feet or less EYD, could be cable skidded with no carriage or lateral skidding required. Cut trees from the south end of the unit with 50 to 150 feet EYD could be winched with a skidder. No road construction is proposed or would be needed to remove fuels with this proposed operation.

Unit 289 has about 25 acres proposed for off-road skyline yarding with tractor swing to the Heliograph Peak access road. Off-road yarding with tractor swing would avoid the need for temporary road construction on the side slope near the top of the unit.

The standard and guideline for road density on the forest is 1 mile per square mile (Coronado National Forest Plan; USDA Forest Service, August 1988, page 34). Existing road density in the Pinaleño Mountains Ecosystem Management Area is 0.484 miles/square mile and would not change when the project is implemented.

The “Pinaleño Ecosystem Restoration Project Transportation and Operations Report” (Yurczyk, 2008) displays units where skyline or cable yarding and tractor swings would be done and where tractors equipped with a winch would be used for winching cut trees from steep pitches to avoid temporary road construction.

Page 22 - Standards and Guidelines

> *Piling of debris should be limited. When necessary, hand or grapple piling should be used to minimize soil compaction within piles and to minimize forest floor and herbaceous layer displacement and destruction.*
>
> *Limit dozer use for piling or scattering of logging debris so that the forest floor and herbaceous layer is not displaced or destroyed.*

The project proposed vegetation treatments include prescribed burning, lopping and scattering, hand piling and mastication; no machine grapple piling or dozer piling is proposed.

Management Prescription Applicable to all Areas of the Forest (Continued): Management Practices Activities, Standards and Guidelines, Page 27-1

19. *The standards and guidelines pertaining to travel and use of motor vehicles within the Forest are by area designation as follows: Designations are shown on the ORV map. The signing of areas open or closed to motor vehicle use will be in accordance with standards and guidelines contained in the Regional Guide for the Southwestern Region.*

    a. *Designation: Closed to all motorized travel.*

    Guidelines: Closed to all motorized vehicles at all times, except those uses authorized by law, permits, and orders in connection with resource management and public safety.

    b. *Designation: Restricted. Generally closed to all cross-country motorized travel. Roads and trails are open to travel except when posted closed.*

    Guidelines: Closed to cross-country travel by all motorized vehicles except those uses authorized by law, permits, and orders in connection with resource management and public safety.

All roads and trails are open to motorized travel unless posted as closed. Roads and trails are those listed in the transportation system inventory physically evident on the ground and recognizable as roads or trails. After the project is complete, current road use would not change.

Page 11 - Facilities (L)

> *Maintain all facilities to maintain health and safety standards. Provide administrative improvements to meet resource and activity needs.*
>
> *Provide transportation systems to meet land management and resource needs.*

Insure that improvements will meet pollution abatement standards.

The project proposed improvements on haul routes used to remove fuels would meet best management practices and resource needs to assure operator and public safety. Road improvements and costs by road number are displayed in table 105 (Alternative 2) and table 108 (Alternative 3) and in the “Pinaleño Ecosystem Restoration Project Transportation and Operations Report” (Yurczyk, 2008).

c. Designation: Restricted. Generally closed to all cross-country motorized travel. Roads are open to travel except when posted closed. All trails are closed to motorized travel.

Guidelines: Closed to cross-country travel by all motorized vehicles except those uses authorized by laws, permits, and orders in connection with resource management and public safety.

All roads are open to motorized travel unless posted as closed. All trails are closed to motorized travel. A trail is defined as “a way for purposes of travel by foot, stock or trail vehicles, 40 inches wide or less.” Roads or trails are listed in the transportation system inventory or physically evident on the ground and recognizable as roads. They will be identified with standard route markers to accommodate all users. Vehicles may pull off roads up to 300 feet for parking or camping.

Project roads to be used for fuel removal that are open for motorized travel would remain open. Roads that are closed or used as trails would be returned to pre-operation conditions, closed, or restored as trails after operations are complete. There would be no change in road density or travel management objectives.

Page 34 - Management Practices Activities Standards and Guidelines

d. Roads

(1) Limit density of existing and new road construction to 1 mile of road or less per square mile.

There would be no change in road densities or travel management objectives in the Pinaleño Ecosystem Restoration Project.

Page 35 - Management Practices Activities Standards and Guidelines

(2) Close and reseed temporary fuelwood roads after harvest.

Temporary roads would be constructed for fuel removal operations and would be obliterated and restored by scarifying or subsoiling to reduce soil compaction, and planting to re-establish vegetation cover. Woody debris would be placed on the roadbed clearing to discourage off-road vehicle use and to restore soil organic material after operations are complete. Construction and restoration work would generally be done within one season. Temporary road construction on 20 percent side slopes or less would average about 1.8 cleared acres per mile. Temporary roads constructed on 25 to 35 percent side slope would have an average 2.5 cleared acres per mile.

Temporary roads would not become part of the long-term road system. Temporary roads needed for removal operations are identified and described by treatment unit under the “Temporary Roads” section above and summarized in table 107 (Alternative 2) and in table 110 (Alternative 3). Some temporary road segments would have grades over 10 percent acceptable for dry conditions use on native surface roads.

Page 50 - Management Area 2

> *Management Emphasis and Intensity:*
>
> *Manage for dispersed recreation opportunities. Uses such as electronic sites and observatories will be permitted on special sites. Sawtimber and firewood harvest will be done to enhance recreation, visual quality, and wildlife values. Visual quality objectives will be met. Watershed conditions will be maintained or improved.*
>
> *Management Area Description: Coniferous forest lands that are suitable for a wide variety of recreational and special uses - Slopes generally less than 40 percent - Includes both suitable and unsuitable timber producing lands. Located in the Chiricahua, Pinaleño, Santa Rita, and Santa Catalina Mountain Ranges.*

Page 50 - *Dispersed Recreation A14, A15 L23 O&M (DU 1)*

> *1. Maintain trails to level 3. See the “Pinaleño Ecosystem Restoration Project Transportation and Operations Report” (Yurczyk, 2008).*

Existing closed roads used as trails, proposed for reconstruction, and used for removal operations would be restored as trails after operations are complete.

> *2. Road 507 will be closed to public motorized vehicles at the junction with Swift Trail. Nonmotorized activities will be permitted along the first 1.8 miles to the red squirrel refugium boundary.*

Road 507 would remain closed to public motorized use during fuel removal and treatment operations.

Page 52 - Timber Sale Preparation & Administration

> *E061 E05 E07, 478, 479 (DU 19, 21) TSI-KV (DU 60)*
>
> *3. Reduce slash from wood harvest by offering logging residue as firewood. Residual slash will be treated within 2 years. Within suitable habitat for the Mount Graham red squirrel (Pinaleño Mountains), dead, and down material will not be removed for firewood except for onsite recreational use.*

Trees proposed for cutting on the project, over 6 inches d.b.h. would be felled and whole-tree yarded to landings for limbing and bucking to remove slash from the removal treatment areas to reduce onsite fuels and the risk of residual tree mortality during burning operations. Trees would be limbed, topped and bucked at the landings. Boles removed for sawlogs or other round wood products, tops and limbs (slash) chipped or ground at landings and removed from the project area. Alternative 2 would remove 21,201 CCF of bole wood and 14,333 tons of tops and limb chips. Alternative 3 would remove 10,432 CCF of bole wood and 5,861 tons of tops and limb chips. Cut trees less than 6 inches d.b.h. pruned limbs and other slash would be treated onsite.

Page 53 - Road & Trail (L19, DU 48, 50)

> *1. Bring existing roads and trails that are to be retained on the system maintenance to a maintainable standard which is suitable for the planned use and provides for safety, resource protection and user comfort. Maintain 40 percent of roads to level 3; and 50 percent to level 4 and 10 percent to level 5. See the "Pinaleño Ecosystem Restoration Project Transportation and Operations Report" (Yurczyk, 2008) for a definition of levels.*

Haul roads for the project would be improved and maintained for fuel removal operations. After operations are complete, there would be no change in current road maintenance levels. Haul road improvements by road number are included in table 105 for Alternative 2 and in table 108 for Alternative 3.

> *2. Close, drain and re-vegetate existing roads and trails that are determined to be unneeded for further use. This should be a cost of the initiating resource element.*

Haul roads that are now closed would be improved and maintained for fuel removal operations. After operations are complete, drainage would be restored, the roadbeds seeded and again closed. Roads that are now used as trails would be restored as trails and retained for trail use after operations are complete.

> *3. Between approximately November 15 and April 15 each year, Swift Trail (State Road 366), beginning at its intersection with Forest Road 507 to its terminus, will be closed to all motorized vehicles except those officially authorized.*

Swift Trail seasonal road closure would not change during the project fuel treatment and removal operations.

> *4. All access roads leading off Swift Trail above Forest Road 507 and including Road 352 (Heliograph Peak Road) will be closed to all motorized vehicles except those officially authorized. This does not include access roads into developed public recreation sites.*

As noted above under "Dispersed Recreation," Road 507 would remain gated and closed. Road 352 to Heliograph Peak would remain closed to public motorized travel during project fuel treatment operations.

Fire & Fuels (P08, P09, DU 56, 57, P14, P15)

> *1. The management area is in fire suppression zone 1 based on resource Management P11, P12 objectives. See Section 5 for definition of zones.*

> *2. Require 100 percent slash treatment within cleared right-of-way boundaries.*

No system road construction is planned for the project. Temporary road construction slash and slash created from haul road improvements would be removed or treated onsite. Trees over 6 inches d.b.h. would be skidded to landings and processed for removal. Trees less than 6 inches d.b.h. would be piled for burning, lopped or masticated onsite.

3. Within foreground distance zones of sensitivity level 1 and 2 (trails, roads, use areas, and water bodies), require 100 percent treatment of all activity slash.

4. Fuel treatment may consist of chipping, broadcast burning, piling and burning, or lopping and scattering.

Cut trees over 6 inches d.b.h. would be skidded to landings and processed for removal. Cut trees less than 6 inches d.b.h. would be piled and burned, lopped, prescribed burned or masticated onsite.

5. Prescribed fire will be used to reduce fuel hazard and enhance wildlife habitat.

6. All projects that include prescribed fire will include specific burning prescriptions that will insure the fire can be controlled within established boundaries and that the burning meets the desired resource objectives,

7. Burn logging slash and debris piles in locations and at times that will minimize scorching of adjacent trees and shrubs.

Hand felling, piling and pile burning would be done on 1,740 acres in Alternative 2 and on 1,660 acres in Alternative 3. Thinned cut trees and shrubs would be hand piled for burning when risk of fire spread is low and when smoke dispersal is acceptable. Prescribe burning is proposed for 2,642 acres in Alternative 2 and 2,502 acres in Alternative 3.

Forest Plan Standards and Guides Summary

Listed below is a summary of Forest Plan standards and guides applicable to transportation and operations on the project.

Table 117. Applicable Forest Plan standards and guidelines summary

Page Number	Goal, Standard or Guide	Geographic Applicability (General or Area Specific)
Forest Plan Amendment No. 8, June 1996 (Additional Page 22)	Piling of debris should be limited. When necessary, hand or grapple piling should be used to minimize soil compaction within piles and to minimize forest floor and herbaceous layer displacement and destruction. Limit dozer use for piling or scattering of logging debris so that the forest floor and herbaceous layer is not displaced or destroyed.	General (Hand piling is proposed)
Forest Plan Amendment No. 8, June 1996 (Additional Page 44)	Road maintenance activities will be conducted primarily for protection of road investment, resource protection, user safety, and user economy.	General
Forest Plan Amendment No. 8, June 1996 (Additional Page 52)	Reduce slash from wood harvest by offering logging residue as firewood. Residual slash will be treated within 2 years.	MA 2

Table 117. Applicable Forest Plan standards and guidelines summary

Page Number	Goal, Standard or Guide	Geographic Applicability (General or Area Specific)
Forest Plan Amendment No. 8, June 1996 (Additional Page 57)	Require trees to be cut as close to ground level as practical. Within foreground distance zones of sensitivity level 1 and 2 areas (roads, trails, use areas, and water bodies), the angle of cut will be away from the most common view angle.	MA 3 (Campgrounds/recreation areas)
Forest Plan Amendment No. 8, June 1996 (Additional Page 57)	Road Maintenance: Close, drain, and re-vegetate existing roads that are determined to be unneeded.	General (closed roads that are opened and used for operations, closed after use)
Forest Plan Amendment No. 8, June 1996 (Additional Page 22) Goshawk direction Page 22	Manage road densities at the lowest level possible. Where timber harvesting has been prescribed to achieve desired forest condition, use small, skid trails in lieu of roads.	General (Off-road skyline yarding is proposed where access is limited on slopes over 35 percent or adverse areas over 25 percent).
Forest Plan Amendment No. 8, June 1996 (Additional Page 39)	Restrict equipment use to terrain and climatic conditions where soil damage will be minimal.	General (All units, ground-based operations limited to 35 percent slope or less)

The standard and guideline for road density on the forest is 1 mile per square mile (Coronado National Forest Plan (USDA Forest Service, August 1988, page 34)). Existing road density in the Pinaleño Mountains Ecosystem Management Area is 0.484 miles/square mile.

G - Alternative 2 Proposed Treatments by Unit

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
1	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.2
2	No Treatment	Underburn	No Removal	Non-Forest Prescribed Burn	Shannon	1.2
3	No Treatment	No Fuels Treatment	No Removal	No treatment areas		8.5
4	No Treatment	No Fuels Treatment	No Removal	No treatment areas		6.9
5	No Treatment	No Fuels Treatment	No Removal	No treatment areas		7.0
6	No Treatment	No Fuels Treatment	No Removal	No treatment areas		7.8
7	No Treatment	Underburn	No Removal	Non-Forest Prescribed Burn	Treasure Park	8.3
8	No Treatment	No Fuels Treatment	No Removal	No treatment areas		30.4
9	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.0
10	No Treatment	No Fuels Treatment	No Removal	No treatment areas		6.9
11	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Treasure Park	8.7
12	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.0
13	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Shannon	11.6
14	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; General Rx <18 in d.b.h.	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-Modified Treatment Area	Shannon	43.6
15	No Treatment	Lop and scatter; underburn	No Removal	Forest Restoration-Modified Treatment Area	Shannon	4.1
16	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; Remove by cable	Forest Restoration-General Rx	Shannon	19.2
17	No Treatment	No Fuels Treatment	No Removal	No treatment areas		34.9
18	No Treatment	Lop and scatter; underburn	No Removal	Forest Restoration-Modified Treatment Area	Shannon	15.2
19	No Treatment	Lop and scatter; underburn	No Removal	Forest Restoration-Modified Treatment Area	Shannon	8.9

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
20	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Treasure Park	14.8
21	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Shannon	23.9
22	No Treatment	Lop and scatter; underburn	No Removal	Forest Restoration-Modified Treatment Area	Shannon	30.5
23	No Treatment	Lop and scatter; underburn	No Removal	Forest Restoration-Modified Treatment Area	Shannon	15.2
24	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Treasure Park	48.3
25	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Treasure Park	7.3
26	No Treatment	Lop and scatter; underburn	No Removal	Forest Restoration-Modified Treatment Area	Shannon	52.5
27	No Treatment	Lop and scatter; underburn	No Removal	Forest Restoration-Modified Treatment Area	Shannon	3.4
28	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Treasure Park	15.7
29	No Treatment	Lop and scatter; underburn	No Removal	Forest Restoration-Modified Treatment Area	Shannon	21.9
30	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Treasure Park	14.2
31	No Treatment	Lop and scatter; underburn	No Removal	Forest Restoration-Modified Treatment Area	Shannon	7.6
32	No Treatment	underburn	No Removal	Non-Forest Prescribed Burn	Treasure Park	28.0
33	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by skyline	Forest Restoration-General Rx	Treasure Park	7.3
34	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Treasure Park	14.9
35	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Shannon	23.7
36	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Treasure Park	39.1

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
37	No Treatment	No Fuels Treatment	No Removal	No treatment areas		21.2
39	No Treatment	No Fuels Treatment	No Removal	No treatment areas		10.4
40	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Treasure Park	15.2
41	No Treatment	No Fuels Treatment	No Removal	Non-Forest Prescribed Burn	Treasure Park	22.9
42	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Grant Creek	6.0
43	No Treatment	No Fuels Treatment	No Removal	Non-Forest Prescribed Burn	Cunningham	2.0
44	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Grant Creek	7.5
45	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Grant Creek	25.9
46	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Grant Creek	5.4
47	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Grant Creek	33.6
48	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Cunningham	17.8
49	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Cunningham	29.7
50	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter	No Removal	Important Wildlife Area-General Rx	Cunningham	13.0
51	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Grant Creek	14.0
52	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Cunningham	4.1
53	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Grant Creek	15.9
54	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Grant Creek	3.0

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
55	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Grant Creek	17.6
56	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Grant Creek	4.1
57	No Treatment	No Fuels Treatment	No Removal	Non-Forest		3.0
58	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Cunningham	34.5
59	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Cunningham	25.9
60	No Treatment	Underburn	No Removal	Non-Forest Prescribed Burn	Grant Creek	7.8
61	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Grant Creek	4.0
62	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Grant Creek	8.9
63	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Grant Creek	21.5
64	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Grant Creek	7.4
66	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Cunningham	43.6
69	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Grant Creek	19.1
70	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Grant Creek	29.9
71	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Grant Creek	19.3
72	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Grant Creek	6.2
77	No Treatment	No Fuels Treatment	No Removal	No treatment areas		23.2
79	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter	No Removal	Important Wildlife Area-General Rx	Cunningham	2.4
80	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Columbine	14.3
82	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Columbine	10.1

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
83	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Columbine	26.0
85	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by cable	Forest Restoration-General Rx	Columbine	19.0
88	No Treatment	No Fuels Treatment	No Removal	No treatment areas		2.8
90	No Treatment	No Fuels Treatment	No Removal	No treatment areas		42.0
91	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Columbine	6.0
92	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Forest Restoration-Modified Treatment Area	Columbine	10.4
93	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn	No Removal	Forest Restoration-Modified Treatment Area	Columbine	14.3
95	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn	No Removal	Forest Restoration-Modified Treatment Area	Columbine	2.7
97	No Treatment	No Fuels Treatment	No Removal	No treatment areas		1.1
102	No Treatment	No Fuels Treatment	No Removal	No treatment areas		0.9
103	No Treatment	No Fuels Treatment	No Removal	No treatment areas		12.5
105	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn	No Removal	Forest Restoration-Modified Treatment Area	Columbine	25.9
106	No Treatment	No Fuels Treatment	No Removal	No treatment areas		13.6
108	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn	No Removal	Forest Restoration-Modified Treatment Area	Columbine	2.0
112	No Treatment	Underburn	No Removal	Forest Restoration-Modified Treatment Area	Columbine	3.3
113	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn	No Removal	Forest Restoration-Modified Treatment Area	Columbine	13.5

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
114	No Treatment	No Fuels Treatment	No Removal	Non-Forest		12.3
115	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn	No Removal	Forest Restoration-Modified Treatment Area	Columbine	4.4
116	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Columbine	10.1
119	No Treatment	No Fuels Treatment	No Removal	Non-Forest		3.7
120	No Treatment	No Fuels Treatment	No Removal	No treatment areas		22.4
121	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn	No Removal	Forest Restoration-Modified Treatment Area	Columbine	5.6
124	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate; hand cut, pile, and burn steep slopes; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Clark Peak	19.6
125	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Clark Peak	3.0
129	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Clark Peak	16.5
130	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.4
134	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by skyline	Important Wildlife Area-General Rx	Clark Peak	10.6
135	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-Modified Treatment Area	Bible Camp	6.1
137	No Treatment	No Fuels Treatment	No Removal	Lake		20.4
138	No Treatment	No Fuels Treatment	No Removal	No treatment areas		5.2
139	No Treatment	No Fuels Treatment	No Removal	No treatment areas		9.1
142	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Clark Peak	3.8
145	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Clark Peak	16.7

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
148	No Treatment	No Fuels Treatment	No Removal	Non-Forest		1.8
149	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Ash Creek	5.9
150	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Ash Creek	8.1
151	No Treatment	No Fuels Treatment	No Removal	No treatment areas	Webb Peak	17.5
152	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by skyline	Important Wildlife Area-General Rx	Clark Peak	17.3
154	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Webb Peak	7.1
155	No Treatment	No Fuels Treatment	No Removal	No treatment areas		17.4
156	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Clark Peak	9.5
159	No Treatment	Underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Clark Peak	19.5
160	No Treatment	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-Modified Treatment Area	Lefthand	6.3
163	No Treatment	No Fuels Treatment	No Removal	No treatment areas		21.1
165	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Lefthand	8.3
166	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.0
167	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Webb Peak	2.9
168	No Treatment	No Fuels Treatment	No Removal	No treatment areas		2.8
169	No Treatment	No Fuels Treatment	No Removal	No treatment areas		7.5
170	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Clark Peak	6.0

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
171	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Clark Peak	15.3
172	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; General Rx <18 in d.b.h.	Masticate; hand cut, pile, and burn steep slopes; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-Modified Treatment Area	Webb Peak	2.6
174	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Lefthand	2.3
176	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Clark Peak	20.8
177	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Ash Creek	16.3
179	No Treatment	No Fuels Treatment	No Removal	No treatment areas		7.4
180	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Webb Peak	13.8
181	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; General Rx <18 in d.b.h.	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-Modified Treatment Area	Ash Creek	18.7
182	No Treatment	No Fuels Treatment	No Removal	No treatment areas		39.2
183	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Webb Peak	13.3
184	No Treatment	No Fuels Treatment	No Removal	No treatment areas		9.5
185	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; General Rx <18 in d.b.h.	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Forest Restoration-Modified Treatment Area	Webb Peak	4.5
187	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Masticate; hand cut, pile, and burn steep slopes; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Ash Creek	9.1
189	No Treatment	Underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Clark Peak	50.3
190	No Treatment	No Fuels Treatment	No Removal	No treatment areas		6.3

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
192	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Clark Peak	5.1
193	No Treatment	No Fuels Treatment	No Removal	No treatment areas		24.7
194	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; General Rx <18 in d.b.h.	Masticate; hand cut, pile, and burn steep slopes; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-Modified Treatment Area	Webb Peak	4.9
195	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; General Rx <18 in d.b.h.	Masticate; hand cut, pile, and burn steep slopes; followup underburn	Whole-tree yard; machine or hand cut; remove by skyline	Forest Restoration-Modified Treatment Area	Webb Peak	2.6
196	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Webb Peak	9.4
197	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Clark Peak	24.0
198	No Treatment	No Fuels Treatment	No Removal	No treatment areas		8.8
200	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Clark Peak	28.5
201	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by skyline	Important Wildlife Area-Modified Treatment Area	Ash Creek	4.7
203	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.8
204	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Webb Peak	7.9
205	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Masticate; hand cut, pile, and burn steep slopes; followup underburn	Whole-tree yard; machine or hand cut; remove by skyline	Forest Restoration-Modified Treatment Area	Webb Peak	10.1
206	No Treatment	No Fuels Treatment	No Removal	No treatment areas		21.7
209	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Clark Peak	7.5
210	No Treatment	No Fuels Treatment	No Removal	No treatment areas		5.3

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
213	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Clark Peak	3.7
215	No Treatment	No Fuels Treatment	No Removal	No treatment areas		18.0
216	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Lefthand	24.8
217	No Treatment	Lop and scatter; underburn	No Removal	Forest Restoration-Modified Treatment Area	Lefthand	14.8
218	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Clark Peak	9.9
219	No Treatment	No Fuels Treatment	No Removal	No treatment areas		46.5
220	No Treatment	No Fuels Treatment	No Removal	No treatment areas		21.8
221	No Treatment	No Fuels Treatment	No Removal	No treatment areas		7.4
222	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Clark Peak	45.5
223	No Treatment	Underburn	No Removal	Non-Forest Prescribed Burn	Clark Peak	0.8
224	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Lefthand	4.2
226	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Clark Peak	10.4
227	No Treatment	No Fuels Treatment	No Removal	No treatment areas		14.5
228	No Treatment	No Fuels Treatment	No Removal	No treatment areas		31.8
229	No Treatment	No Fuels Treatment	No Removal	No treatment areas		37.2
230	No Treatment	Underburn	No Removal	Non-Forest Prescribed Burn	Lefthand	5.4
231	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Forest Restoration-Modified Treatment Area	Clark Peak	5.3
232	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Clark Peak	18.2
233	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Clark Peak	37.0

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
234	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Clark Peak	2.8
235	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Clark Peak	10.3
236	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Clark Peak	5.7
237	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Clark Peak	16.9
238	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-Modified Treatment Area	Clark Peak	8.1
239	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Clark Peak	13.2
240	No Treatment	No Fuels Treatment	No Removal	No treatment areas		21.8
242	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Clark Peak	5.9
243	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-Modified Treatment Area	Clark Peak	4.4
244	No Treatment	No Fuels Treatment	No Removal	No treatment areas		67.2
248	No Treatment	No Fuels Treatment	No Removal	No treatment areas		25.5
251	No Treatment	No Fuels Treatment	No Removal	No treatment areas		13.9
253	Thin trees <12 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Forest Restoration-Modified Treatment Area	Ash Creek	13.2
254	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Cunningham	17.9
255	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Cunningham	11.1

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
256	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Cunningham	14.8
257	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	No Removal	Important Wildlife Area-General Rx	Cunningham	18.5
259	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter	No Removal	Important Wildlife Area-General Rx	Cunningham	10.2
260	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Cunningham	55.8
261	No Treatment	No Fuels Treatment	No Removal	No treatment areas		14.5
262	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Treasure Park	5.7
263	No Treatment	No Fuels Treatment	No Removal	No treatment areas		10.1
264	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Treasure Park	9.7
265	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Grant Creek	6.5
266	No Treatment	No Fuels Treatment	No Removal	No treatment areas		37.5
267	No Treatment	No Fuels Treatment	No Removal	No treatment areas		12.5
268	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Grant Creek	31.4
269	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Treasure Park	3.9
270	No Treatment	No Fuels Treatment	No Removal	No treatment areas		5.3
271	No Treatment	No Fuels Treatment	No Removal	No treatment areas		8.2
272	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Treasure Park	16.1
273	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Treasure Park	10.4

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
274	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Treasure Park	48.0
275	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Treasure Park	37.4
276	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Treasure Park	43.4
277	No Treatment	No Fuels Treatment	No Removal	No treatment areas		8.3
278	No Treatment	No Fuels Treatment	No Removal	No treatment areas		9.2
279	No Treatment	No Fuels Treatment	No Removal	No treatment areas		29.2
280	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Treasure Park	6.4
281	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Treasure Park	7.8
282	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Treasure Park	40.8
283	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Treasure Park	15.7
285	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Treasure Park	14.5
286	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Treasure Park	48.2
287	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Treasure Park	17.5
288	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Treasure Park	16.1
289	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Shannon	53.8
290	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Shannon	6.3

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
291	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Shannon	11.7
292	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Shannon	5.6
294	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Shannon	14.4
295	No Treatment	No Fuels Treatment	No Removal	No treatment areas		20.5
296	No Treatment	No Fuels Treatment	No Removal	No treatment areas		17.2
297	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Shannon	15.3
298	No Treatment	No Fuels Treatment	No Removal	No treatment areas		14.8
299	No Treatment	No Fuels Treatment	No Removal	No treatment areas		6.1
301	No Treatment	No Fuels Treatment	No Removal	No treatment areas		13.3
303	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Webb Peak	6.1
305	No Treatment	No Fuels Treatment	No Removal	No treatment areas		11.2
307	No Treatment	No Fuels Treatment	No Removal	No treatment areas		18.1
308	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn	No Removal	Forest Restoration-Modified Treatment Area	Columbine	8.0
309	No Treatment	No Fuels Treatment	No Removal	No treatment areas		16.6
310	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.9
311	No Treatment	No Fuels Treatment	No Removal	No treatment areas		22.7
314	No Treatment	Underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Ash Creek	4.5
315	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.6
316	No Treatment	Masticate; hand cut, pile, and burn steep slopes; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Ash Creek	3.5
318	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Columbine	38.9
319	No Treatment	No Fuels Treatment	No Removal	No treatment areas		8.3

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
320	No Treatment	No Fuels Treatment	No Removal	No treatment areas		11.0
321	No Treatment	No Fuels Treatment	No Removal	No treatment areas		33.0
322	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Columbine	14.0
323	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-Modified Treatment Area	Columbine	5.7
324	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Forest Restoration-Modified Treatment Area	Columbine	10.2
325	No Treatment	No Fuels Treatment	No Removal	No treatment areas		2.6
326	No Treatment	No Fuels Treatment	No Removal	No treatment areas		31.8
327	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Columbine	4.4
328	No Treatment	No Fuels Treatment	No Removal	No treatment areas		32.0
329	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Treasure Park	11.9
330	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-Modified Treatment Area	Columbine	5.8
331	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-Modified Treatment Area	Columbine	2.8
332	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Masticate; hand cut, pile, and burn steep slopes; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Ash Creek	3.3
333	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Masticate; hand cut, pile, and burn steep slopes; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Ash Creek	4.2
334	No Treatment	No Fuels Treatment	No Removal	No treatment areas		6.3

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
335	No Treatment	underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Ash Creek	4.4
339	No Treatment	No Fuels Treatment	No Removal	No treatment areas		5.5
340	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate; hand cut, pile, and burn steep slopes; followup underburn	No Removal	Important Wildlife Area-General Rx	Ash Creek	3.2
342	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.5
345	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate; hand cut, pile, and burn steep slopes; followup underburn	No Removal	Important Wildlife Area-General Rx	Ash Creek	4.4
346	No Treatment	Masticate; hand cut, pile, and burn steep slopes; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Ash Creek	10.0
348	No Treatment	No Fuels Treatment	No Removal	No treatment areas		5.0
349	No Treatment	Masticate; hand cut, pile, and burn steep slopes; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Ash Creek	17.3
350	No Treatment	No Fuels Treatment	No Removal	No treatment areas		15.8
354	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-Modified Treatment Area	Bible Camp	7.1
355	No Treatment	No Fuels Treatment	No Removal	No treatment areas		2.7
359	No Treatment	Masticate; hand cut, pile, and burn steep slopes; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Ash Creek	19.7
360	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Ash Creek	17.9
361	No Treatment	No Fuels Treatment	No Removal	No treatment areas		12.3
362	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-Modified Treatment Area	Bible Camp	6.0
363	No Treatment	No Fuels Treatment	No Removal	No treatment areas		5.5
365	No Treatment	No Fuels Treatment	No Removal	No treatment areas		11.2

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
366	No Treatment	No Fuels Treatment	No Removal	No treatment areas		18.6
367	No Treatment	No Fuels Treatment	No Removal	No treatment areas		22.4
368	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Columbine	4.5
369	No Treatment	No Fuels Treatment	No Removal	No treatment areas		30.7
372	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.8
375	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Columbine	8.3
380	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Columbine	13.8
381	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.0
382	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Columbine	3.0
384	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.3
385	No Treatment	No Fuels Treatment	No Removal	No treatment areas		7.2
386	No Treatment	No Fuels Treatment	No Removal	No treatment areas		6.0
387	No Treatment	No Fuels Treatment	No Removal	No treatment areas		2.8
388	No Treatment	No Fuels Treatment	No Removal	No treatment areas		7.3
390	No Treatment	No Fuels Treatment	No Removal	No treatment areas		8.6
391	No Treatment	No Fuels Treatment	No Removal	No treatment areas		10.5
395	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Webb Peak	17.1
397	No Treatment	No Fuels Treatment	No Removal	No treatment areas		8.2
401	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Bible Camp	1.4
402	No Treatment	No Fuels Treatment	No Removal	No treatment areas		14.5
403	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Bible Camp	10.2

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
405	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-Modified Treatment Area	Bible Camp	23.8
407	No Treatment	No Fuels Treatment	No Removal	No treatment areas		9.3
408	No Treatment	No Fuels Treatment	No Removal	No treatment areas		14.5
411	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Bible Camp	16.2
412	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by skyline	Forest Restoration-General Rx	Bible Camp	7.3
413	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by skyline	Important Wildlife Area-General Rx	Ash Creek	14.8
417	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.6
418	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Ash Creek	18.7
419	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Ash Creek	4.4
420	No Treatment	No Fuels Treatment	No Removal	No treatment areas		22.4
421	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Ash Creek	7.0
422	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Bible Camp	9.3
425	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.5
426	No Treatment	No Fuels Treatment	No Removal	No treatment areas		28.6
427	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Ash Creek	7.1
428	Thin trees <12 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Forest Restoration-Modified Treatment Area	Ash Creek	16.1
430	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.5
431	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Ash Creek	16.5
432	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Webb Peak	40.7

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
433	No Treatment	No Fuels Treatment	No Removal	No treatment areas		20.2
434	No Treatment	No Fuels Treatment	No Removal	No treatment areas		6.4
436	No Treatment	No Fuels Treatment	No Removal	No treatment areas		8.1
437	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by cable	Important Wildlife Area-General Rx	Lefthand	3.3
439	No Treatment	No Fuels Treatment	No Removal	No treatment areas		13.3
440	No Treatment	No Fuels Treatment	No Removal	No treatment areas		18.4
441	No Treatment	No Fuels Treatment	No Removal	No treatment areas		14.6
442	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Lefthand	11.0
443	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Forest Restoration-Modified Treatment Area	Lefthand	12.2
444	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.6
445	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Lefthand	2.0
446	No Treatment	No Fuels Treatment	No Removal	No treatment areas		22.8
447	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by cable	Important Wildlife Area-General Rx	Lefthand	10.8
448	No Treatment	No Fuels Treatment	No Removal	No treatment areas		51.0
449	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Lefthand	5.6
450	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by cable	Important Wildlife Area-General Rx	Lefthand	11.3
451	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Lefthand	11.4
453	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Lefthand	6.8
454	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Lefthand	3.9
455	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.0

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
456	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by cable	Important Wildlife Area-General Rx	Lefthand	8.2
457	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.6
458	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Clark Peak	19.3
459	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Clark Peak	5.5
460	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Clark Peak	11.6
461	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Clark Peak	1.7
462	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Clark Peak	24.3
463	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.5
464	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Clark Peak	33.3
465	No Treatment	No Fuels Treatment	No Removal	No treatment areas		61.0
467	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Columbine	12.4
468	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Columbine	4.0
469	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.0
470	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.7
471	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Columbine	11.8
472	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.2
473	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Columbine	5.5
475	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-Modified Treatment Area	Columbine	7.2
476	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.0

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
477	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Columbine	16.5
479	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Columbine	2.0
480	No Treatment	No Fuels Treatment	No Removal	No treatment areas		8.3
481	No Treatment	No Fuels Treatment	No Removal	No treatment areas		2.7
482	No Treatment	No Fuels Treatment	No Removal	No treatment areas		6.1
483	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Columbine	4.2
484	No Treatment	No Fuels Treatment	No Removal	No treatment areas		13.8
485	No Treatment	No Fuels Treatment	No Removal	No treatment areas		10.1
486	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-Modified Treatment Area	Columbine	9.8
487	No Treatment	Lop and scatter; hand cut, pile, and burn	No Removal	Forest Restoration-Modified Treatment Area	Columbine	3.4
488	No Treatment	No Fuels Treatment	No Removal	No treatment areas		13.3
489	No Treatment	No Fuels Treatment	No Removal	No treatment areas		14.0
490	No Treatment	No Fuels Treatment	No Removal	No treatment areas		28.2
491	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by cable	Forest Restoration-General Rx	Grant Creek	4.6
492	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.2
493	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Grant Creek	7.9
494	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Grant Creek	5.9
495	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Grant Creek	15.9
496	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter	No Removal	Important Wildlife Area-General Rx	Cunningham	20.9

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
497	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.9
498	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter	No Removal	Important Wildlife Area-General Rx	Cunningham	10.2
499	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.8
500	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter	No Removal	Important Wildlife Area-General Rx	Cunningham	14.0
502	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Cunningham	44.7
503	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Cunningham	25.6
504	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Cunningham	6.7
505	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Cunningham	2.2
506	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Grant Creek	32.3
508	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Grant Creek	61.3
509	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Grant Creek	17.4
510	No Treatment	Underburn	No Removal	Forest Restoration-Modified Treatment Area	Grant Creek	1.6
511	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Grant Creek	4.8
516	No Treatment	No Fuels Treatment	No Removal	No treatment areas		5.2
517	No Treatment	No Fuels Treatment	No Removal	No treatment areas		15.0
518	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.3
519	No Treatment	No Fuels Treatment	No Removal	No treatment areas		2.6
520	No Treatment	No Fuels Treatment	No Removal	No treatment areas		8.1
521	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Lefthand	16.0
522	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Lefthand	8.0

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
523	No Treatment	Lop and scatter; underburn	No Removal	Forest Restoration-Modified Treatment Area	Shannon	37.0
524	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Shannon	21.5
525	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter	No Removal	Important Wildlife Area-General Rx	Cunningham	17.5
526	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter	No Removal	Important Wildlife Area-General Rx	Cunningham	5.9
527	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Forest Restoration-Modified Treatment Area	Columbine	24.3
528	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Columbine	10.2
529	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Forest Restoration-Modified Treatment Area	Columbine	6.8
530	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Columbine	4.0
531	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Masticate; hand cut, pile, and burn steep slopes; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-Modified Treatment Area	Webb Peak	5.3
532	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; General Rx <18 in d.b.h.	Masticate; hand cut, pile, and burn steep slopes; followup underburn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-Modified Treatment Area	Webb Peak	8.6
533	No Treatment	Lop and scatter; hand cut, pile, and burn	No Removal	Forest Restoration-Modified Treatment Area	Clark Peak	34.5
534	No Treatment	No Fuels Treatment	No Removal	No treatment areas		37.0
536	No Treatment	No Fuels Treatment	No Removal	No treatment areas		23.0
538	No Treatment	No Fuels Treatment	No Removal	No treatment areas		54.6
545	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Treasure Park	29.7
548	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by skyline	Forest Restoration-General Rx	Treasure Park	14.8
549	Thin trees <12 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Forest Restoration-Modified Treatment Area	Treasure Park	17.7

Unit No.	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
550	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Cunningham	4.2
551	No Treatment	No Fuels Treatment	No Removal	No treatment areas		6.7
552	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Cunningham	3.8
553	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Ash Creek	8.9
554	Thin trees <18 in. d.b.h.; MSO Restricted (150 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by ground-based equipment	Forest Restoration-General Rx	Cunningham	3.4
555	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 18 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Ash Creek	2.8

H - Alternative 3 Proposed Treatments by Unit

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
1	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.2
2	No Treatment	No Fuels Treatment	No Removal	No treatment areas		1.2
3	No Treatment	No Fuels Treatment	No Removal	No treatment areas		8.5
4	No Treatment	No Fuels Treatment	No Removal	No treatment areas		6.9
5	No Treatment	No Fuels Treatment	No Removal	No treatment areas		7.0
6	No Treatment	No Fuels Treatment	No Removal	No treatment areas		7.8
7	No Treatment	Underburn	No Removal	Non-Forest Prescribed Burn	Heliograph	7.7
8	No Treatment	No Fuels Treatment	No Removal	No treatment areas		30.4
9	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.0
10	No Treatment	No Fuels Treatment	No Removal	No treatment areas		6.9
11	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Treasure Park	8.7
12	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.0
13	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Heliograph	11.6
14	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-Modified Treatment Area	Heliograph	43.6
15	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Heliograph	4.1
16	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by cable	Important Wildlife Area-General Rx	Heliograph	19.2
17	No Treatment	No Fuels Treatment	No Removal	No treatment areas		34.9
18	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Heliograph	15.2
19	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Heliograph	8.9

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
20	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Treasure Park	14.8
21	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Heliograph	23.9
22	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Heliograph	30.5
23	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Heliograph	15.2
24	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Grant Hill	22.8
25	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Treasure Park	7.3
26	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Heliograph	52.5
27	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Heliograph	3.4
28	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Grant Hill	15.7
29	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Heliograph	21.9
30	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Treasure Park	14.2
31	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Heliograph	7.6
32	No Treatment	Underburn	No Removal	Non-Forest Prescribed Burn	Treasure Park	28.0
33	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by skyline	Important Wildlife Area-General Rx	Treasure Park	7.3
34	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Treasure Park	14.9
35	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Heliograph	23.7

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
36	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Treasure Park	39.1
37	No Treatment	No Fuels Treatment	No Removal	No treatment areas		21.2
39	No Treatment	No Fuels Treatment	No Removal	No treatment areas		10.4
40	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Treasure Park	15.2
41	No Treatment	No Fuels Treatment	No Removal	Non-Forest Prescribed Burn	Treasure Park	22.9
42	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Lower Cunningham	6.0
43	No Treatment	No Fuels Treatment	No Removal	Non-Forest Prescribed Burn	Lower Cunningham	2.0
44	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Lower Cunningham	7.5
45	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Lower Cunningham	25.9
46	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Lower Cunningham	5.4
47	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Lower Cunningham	33.6
48	No Treatment	No Fuels Treatment	No Removal	No treatment areas		17.8
49	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Lower Cunningham	29.7
50	No Treatment	No Fuels Treatment	No Removal	No treatment areas		13.0
51	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Lower Cunningham	14.0
52	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Lower Cunningham	4.1
53	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Lower Cunningham	15.9
54	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Lower Cunningham	3.0

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
55	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Lower Cunningham	17.6
56	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Lower Cunningham	4.1
57	No Treatment	No Fuels Treatment	No Removal	Non-Forest		3.0
58	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Lower Cunningham	34.5
59	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Lower Cunningham	25.9
60	No Treatment	Underburn	No Removal	Non-Forest Prescribed Burn	Lower Cunningham	7.8
61	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Lower Cunningham	4.0
62	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Lower Cunningham	8.9
63	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Lower Cunningham	21.5
64	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Lower Cunningham	7.4
66	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Upper Cunningham	43.6
67	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Lower Cunningham	13.9
69	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Grant-Vista/Webb Peak	5.2
70	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Upper Cunningham	29.9
71	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Upper Cunningham	19.3
72	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Upper Cunningham	6.2
73	No Treatment	No Fuels Treatment	No Removal	No treatment areas		0.6
77	No Treatment	No Fuels Treatment	No Removal	No treatment areas		23.2
79	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter	No Removal	Important Wildlife Area-General Rx	Upper Cunningham	2.4

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
80	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Grant-Vista/Webb Peak	14.3
82	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Grant-Vista/Webb Peak	10.1
83	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Grant-Vista/Webb Peak	26.0
85	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by cable	Important Wildlife Area-General Rx	Grant-Vista/Webb Peak	19.0
88	No Treatment	No Fuels Treatment	No Removal	No treatment areas		2.8
90	No Treatment	No Fuels Treatment	No Removal	No treatment areas		42.0
91	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Grant-Vista/Webb Peak	4.3
92	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	9.9
93	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	14.3
94	No Treatment	No Fuels Treatment	No Removal	No treatment areas	Grant-Vista/Webb Peak	1.6
95	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	2.7
97	No Treatment	No Fuels Treatment	No Removal	No treatment areas		1.1
102	No Treatment	No Fuels Treatment	No Removal	No treatment areas		0.9
103	No Treatment	No Fuels Treatment	No Removal	No treatment areas		12.5
105	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	25.9
106	No Treatment	No Fuels Treatment	No Removal	No treatment areas		13.6

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
108	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	2.0
112	No Treatment	Underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	3.3
113	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	17.9
114	No Treatment	No Fuels Treatment	No Removal	Non-Forest		12.3
116	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Grant-Vista/Webb Peak	10.1
119	No Treatment	No Fuels Treatment	No Removal	Non-Forest		3.7
120	No Treatment	No Fuels Treatment	No Removal	No treatment areas		22.4
121	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	5.6
124	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate; hand cut, pile, and burn steep slopes; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Riggs Lake	19.6
125	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.0
129	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Riggs Lake	16.5
130	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.4
134	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Riggs Lake	10.6
135	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-Modified Treatment Area	Ash Creek	6.1

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
137	No Treatment	No Fuels Treatment	No Removal	Lake		20.4
138	No Treatment	No Fuels Treatment	No Removal	No treatment areas		5.2
139	No Treatment	No Fuels Treatment	No Removal	No treatment areas		9.1
142	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Riggs Lake	3.8
144	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Chesly Flat/Goudy Canyon	14.5
145	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Riggs Lake	2.3
148	No Treatment	No Fuels Treatment	No Removal	Non-Forest		1.8
149	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	5.9
150	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	8.1
151	No Treatment	No Fuels Treatment	No Removal	No treatment areas	Chesly Flat/Goudy Canyon	17.5
152	No Treatment	No Fuels Treatment	No Removal	No treatment areas		13.4
153	No Treatment	No Fuels Treatment	No Removal	No treatment areas		5.5
154	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Chesly Flat/Goudy Canyon	7.1
155	No Treatment	No Fuels Treatment	No Removal	No treatment areas		17.4
156	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Riggs Lake	9.5
157	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Riggs Lake	3.9

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
159	No Treatment	Underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Riggs Lake	14.0
160	No Treatment	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-Modified Treatment Area	Chesly Flat/Goudy Canyon	6.3
163	No Treatment	No Fuels Treatment	No Removal	No treatment areas		21.1
164	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.5
165	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Riggs Lake	3.8
166	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.0
167	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Chesly Flat/Goudy Canyon	2.9
168	No Treatment	No Fuels Treatment	No Removal	No treatment areas		2.8
169	No Treatment	No Fuels Treatment	No Removal	No treatment areas		7.5
170	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Riggs Lake	6.0
171	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Riggs Lake	15.3
172	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Masticate; hand cut, pile, and burn steep slopes; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-Modified Treatment Area	Chesly Flat/Goudy Canyon	2.6
174	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Chesly Flat/Goudy Canyon	2.3
176	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Riggs Lake	20.8
177	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	16.3
179	No Treatment	No Fuels Treatment	No Removal	No treatment areas		7.4

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
180	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Chesly Flat/Goudy Canyon	13.8
181	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-Modified Treatment Area	Mill Site	18.7
182	No Treatment	No Fuels Treatment	No Removal	No treatment areas		39.2
183	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Chesly Flat/Goudy Canyon	13.3
184	No Treatment	No Fuels Treatment	No Removal	No treatment areas		9.5
185	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Chesly Flat/Goudy Canyon	4.5
187	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Masticate; hand cut, pile, and burn steep slopes; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Mill Site	9.1
188	No Treatment	No Fuels Treatment	No Removal	No treatment areas		30.3
189	No Treatment	Underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Riggs Lake	20.0
190	No Treatment	No Fuels Treatment	No Removal	No treatment areas		6.3
192	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Riggs Lake	5.1
193	No Treatment	No Fuels Treatment	No Removal	No treatment areas		24.7
194	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Masticate; hand cut, pile, and burn steep slopes; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-Modified Treatment Area	Chesly Flat/Goudy Canyon	4.9

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
195	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Masticate; hand cut, pile, and burn steep slopes; followup underburn	Whole-tree yard; machine or hand cut; remove by skyline	Important Wildlife Area-Modified Treatment Area	Chesly Flat/Goudy Canyon	2.6
196	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Chesly Flat/Goudy Canyon	9.4
197	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Riggs Lake	24.0
198	No Treatment	No Fuels Treatment	No Removal	No treatment areas		8.8
200	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Riggs Lake	28.5
201	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by skyline	Important Wildlife Area-Modified Treatment Area	Mill Site	4.7
203	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.8
204	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Chesly Flat/Goudy Canyon	7.9
205	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Masticate; hand cut, pile, and burn steep slopes; followup underburn	Whole-tree yard; machine or hand cut; remove by skyline	Important Wildlife Area-Modified Treatment Area	Chesly Flat/Goudy Canyon	10.1
206	No Treatment	No Fuels Treatment	No Removal	No treatment areas		21.7
209	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Riggs Lake	7.5
210	No Treatment	No Fuels Treatment	No Removal	No treatment areas		5.3
213	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Riggs Lake	3.7
215	No Treatment	No Fuels Treatment	No Removal	No treatment areas		18.0

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
216	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Chesly Flat/Goudy Canyon	24.8
217	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Chesly Flat/Goudy Canyon	14.8
218	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Riggs Lake	9.9
219	No Treatment	No Fuels Treatment	No Removal	No treatment areas		46.5
220	No Treatment	No Fuels Treatment	No Removal	No treatment areas		21.8
221	No Treatment	No Fuels Treatment	No Removal	No treatment areas		7.4
222	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Riggs Lake	45.5
223	No Treatment	Underburn	No Removal	Non-Forest Prescribed Burn	Riggs Lake	0.8
224	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Chesly Flat/Goudy Canyon	4.2
226	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Riggs Lake	10.4
227	No Treatment	No Fuels Treatment	No Removal	No treatment areas		14.5
228	No Treatment	No Fuels Treatment	No Removal	No treatment areas		31.8
229	No Treatment	No Fuels Treatment	No Removal	No treatment areas		37.2
230	No Treatment	Underburn	No Removal	Non-Forest Prescribed Burn	Chesly Flat/Goudy Canyon	5.4
231	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Riggs Lake	5.3
232	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Riggs Lake	18.2
233	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Riggs Lake	37.0
234	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Riggs Lake	2.8

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
235	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Riggs Lake	10.3
236	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Riggs Lake	5.7
237	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Riggs Lake	16.9
238	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-Modified Treatment Area	Riggs Lake	8.1
239	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Riggs Lake	13.2
240	No Treatment	No Fuels Treatment	No Removal	No treatment areas		21.8
241	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Treasure Park	25.6
242	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Riggs Lake	5.9
243	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-Modified Treatment Area	Riggs Lake	4.4
244	No Treatment	No Fuels Treatment	No Removal	No treatment areas		67.2
245	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Heliograph	29.1
248	No Treatment	No Fuels Treatment	No Removal	No treatment areas		25.5
251	No Treatment	No Fuels Treatment	No Removal	No treatment areas		13.9
252	No Treatment	No Fuels Treatment	No Removal	No treatment areas		20.8
253	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Ash Creek	13.2
254	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Upper Cunningham	16.6
255	No Treatment	No Fuels Treatment	No Removal	No treatment areas		11.1

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
256	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Lower Cunningham	14.8
257	No Treatment	No Fuels Treatment	No Removal	No treatment areas		18.5
258	No Treatment	No Fuels Treatment	No Removal	No treatment areas		1.3
259	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter	No Removal	Important Wildlife Area-General Rx	Heliograph	10.2
260	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Treasure Park	5.9
261	No Treatment	No Fuels Treatment	No Removal	No treatment areas		14.5
262	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	No Removal	Important Wildlife Area-General Rx	Grant Hill	5.7
263	No Treatment	No Fuels Treatment	No Removal	No treatment areas		10.1
264	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	No Removal	Important Wildlife Area-General Rx	Grant Hill	9.7
265	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Lower Cunningham	6.5
266	No Treatment	No Fuels Treatment	No Removal	No treatment areas		37.5
267	No Treatment	No Fuels Treatment	No Removal	No treatment areas		12.5
268	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Lower Cunningham	31.4
269	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Lower Cunningham	3.9
270	No Treatment	No Fuels Treatment	No Removal	No treatment areas		5.3
271	No Treatment	No Fuels Treatment	No Removal	No treatment areas		8.2
272	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Grant Hill	16.1
273	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Lower Cunningham	10.4
274	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Grant Hill	48.0

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
275	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Treasure Park	37.4
276	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Treasure Park	43.4
277	No Treatment	No Fuels Treatment	No Removal	No treatment areas		8.3
278	No Treatment	No Fuels Treatment	No Removal	No treatment areas		9.2
279	No Treatment	No Fuels Treatment	No Removal	No treatment areas		29.2
280	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Treasure Park	6.4
281	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Treasure Park	7.8
282	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Heliograph	40.8
283	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Treasure Park	15.7
284	No Treatment	No Fuels Treatment	No Removal	No treatment areas		34.8
285	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Treasure Park	14.5
286	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Heliograph	13.4
287	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Heliograph	17.5
288	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Heliograph	16.1
289	No Treatment	No Fuels Treatment	No Removal	No treatment areas		53.8
290	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Heliograph	6.3
291	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Heliograph	11.7

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
292	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Heliograph	5.6
294	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Heliograph	14.4
295	No Treatment	No Fuels Treatment	No Removal	No treatment areas		20.5
296	No Treatment	No Fuels Treatment	No Removal	No treatment areas		17.2
297	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Heliograph	15.3
298	No Treatment	No Fuels Treatment	No Removal	No treatment areas		14.8
299	No Treatment	No Fuels Treatment	No Removal	No treatment areas		6.1
301	No Treatment	No Fuels Treatment	No Removal	No treatment areas		13.3
303	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Chesly Flat/Goudy Canyon	6.1
305	No Treatment	No Fuels Treatment	No Removal	No treatment areas		11.2
307	No Treatment	No Fuels Treatment	No Removal	No treatment areas		18.1
308	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	8.0
309	No Treatment	No Fuels Treatment	No Removal	No treatment areas		16.6
310	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.9
311	No Treatment	No Fuels Treatment	No Removal	No treatment areas		22.7
314	No Treatment	Underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	4.5
315	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.6
316	No Treatment	Masticate; hand cut, pile, and burn steep slopes; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	3.5
318	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	38.9
319	No Treatment	No Fuels Treatment	No Removal	No treatment areas		8.3

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
320	No Treatment	No Fuels Treatment	No Removal	No treatment areas		11.0
321	No Treatment	No Fuels Treatment	No Removal	No treatment areas		33.0
322	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Grant-Vista/Webb Peak	14.0
323	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	5.7
324	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	10.2
325	No Treatment	No Fuels Treatment	No Removal	No treatment areas		2.6
326	No Treatment	No Fuels Treatment	No Removal	No treatment areas		31.8
327	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Grant-Vista/Webb Peak	4.4
328	No Treatment	No Fuels Treatment	No Removal	No treatment areas		32.0
329	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Treasure Park	11.9
330	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	5.8
331	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	2.8
332	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; no live tree thinning	Masticate; hand cut, pile, and burn steep slopes; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	3.3

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
333	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; no live tree thinning	Masticate; hand cut, pile, and burn steep slopes; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	4.2
334	No Treatment	No Fuels Treatment	No Removal	No treatment areas		6.3
335	No Treatment	Underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	4.4
339	No Treatment	No Fuels Treatment	No Removal	No treatment areas		5.5
340	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate; hand cut, pile, and burn steep slopes; followup underburn	No Removal	Important Wildlife Area-General Rx	Mill Site	3.2
342	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.5
345	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate; hand cut, pile, and burn steep slopes; followup underburn	No Removal	Important Wildlife Area-General Rx	Mill Site	4.4
346	No Treatment	Masticate; hand cut, pile, and burn steep slopes; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Mill Site	10.0
348	No Treatment	No Fuels Treatment	No Removal	No treatment areas		5.0
349	No Treatment	Masticate; hand cut, pile, and burn steep slopes; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	17.3
350	No Treatment	No Fuels Treatment	No Removal	No treatment areas		15.8
354	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-Modified Treatment Area	Ash Creek	7.1
355	No Treatment	No Fuels Treatment	No Removal	No treatment areas		2.7
359	No Treatment	Masticate; hand cut, pile, and burn steep slopes; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Mill Site	19.7
360	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Grant-Vista/Webb Peak	17.9
361	No Treatment	No Fuels Treatment	No Removal	No treatment areas		12.3

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
362	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-Modified Treatment Area	Ash Creek	6.0
363	No Treatment	No Fuels Treatment	No Removal	No treatment areas		5.5
365	No Treatment	No Fuels Treatment	No Removal	No treatment areas		11.2
366	No Treatment	No Fuels Treatment	No Removal	No treatment areas		19.4
367	No Treatment	No Fuels Treatment	No Removal	No treatment areas		22.4
368	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Grant-Vista/Webb Peak	4.5
369	No Treatment	No Fuels Treatment	No Removal	No treatment areas		30.7
372	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.8
375	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Grant-Vista/Webb Peak	8.3
380	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Grant-Vista/Webb Peak	13.8
381	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.0
382	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	3.0
384	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.3
385	No Treatment	No Fuels Treatment	No Removal	No treatment areas		7.2
386	No Treatment	No Fuels Treatment	No Removal	No treatment areas		6.0
387	No Treatment	No Fuels Treatment	No Removal	No treatment areas		2.8
388	No Treatment	No Fuels Treatment	No Removal	No treatment areas		7.3
390	No Treatment	No Fuels Treatment	No Removal	No treatment areas		8.6
391	No Treatment	No Fuels Treatment	No Removal	No treatment areas		10.5
395	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Chesly Flat/Goudy Canyon	17.1
397	No Treatment	No Fuels Treatment	No Removal	No treatment areas		8.2
401	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Ash Creek	1.4

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
402	No Treatment	No Fuels Treatment	No Removal	No treatment areas		14.5
403	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Ash Creek	9.3
405	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-Modified Treatment Area	Ash Creek	23.8
407	No Treatment	No Fuels Treatment	No Removal	No treatment areas		9.3
408	No Treatment	No Fuels Treatment	No Removal	No treatment areas		14.5
411	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Mill Site	16.2
412	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by skyline	Important Wildlife Area-General Rx	Mill Site	7.3
413	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by skyline	Important Wildlife Area-General Rx	Mill Site	10.8
414	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by skyline	Important Wildlife Area-General Rx	Ash Creek	4.0
417	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.6
418	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Mill Site	18.7
419	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Mill Site	4.4
420	No Treatment	No Fuels Treatment	No Removal	No treatment areas		22.4
421	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Mill Site	7.0
422	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Mill Site	9.3
423	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Mill Site	5.2

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
425	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.5
426	No Treatment	No Fuels Treatment	No Removal	No treatment areas		28.6
427	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Ash Creek	1.9
428	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Ash Creek	16.1
430	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.5
431	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Ash Creek	16.5
432	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Chesly Flat/Goudy Canyon	40.7
433	No Treatment	No Fuels Treatment	No Removal	No treatment areas		20.2
434	No Treatment	No Fuels Treatment	No Removal	No treatment areas		6.4
436	No Treatment	No Fuels Treatment	No Removal	No treatment areas		8.1
437	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by cable	Important Wildlife Area-General Rx	Chesly Flat/Goudy Canyon	3.3
439	No Treatment	No Fuels Treatment	No Removal	No treatment areas		13.3
440	No Treatment	No Fuels Treatment	No Removal	No treatment areas		18.4
441	No Treatment	No Fuels Treatment	No Removal	No treatment areas		14.6
442	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Chesly Flat/Goudy Canyon	11.0
443	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Chesly Flat/Goudy Canyon	12.2
444	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.6
445	No Treatment	No Fuels Treatment	No Removal	No treatment areas		2.0
446	No Treatment	No Fuels Treatment	No Removal	No treatment areas		22.8
447	No Treatment	No Fuels Treatment	No Removal	No treatment areas		10.8
448	No Treatment	No Fuels Treatment	No Removal	No treatment areas		51.0

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
449	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Chesly Flat/Goudy Canyon	5.6
450	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Riggs Lake	7.1
451	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Riggs Lake	11.4
452	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.2
453	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Riggs Lake	6.8
454	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Riggs Lake	3.9
455	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.0
456	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by cable	Important Wildlife Area-General Rx	Chesly Flat/Goudy Canyon	8.2
457	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.6
458	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Riggs Lake	19.3
459	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Riggs Lake	5.5
460	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Riggs Lake	11.6
461	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Riggs Lake	1.7
462	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Riggs Lake	23.9
463	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.8
464	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Riggs Lake	33.3
465	No Treatment	No Fuels Treatment	No Removal	No treatment areas		61.0
467	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	12.4

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
468	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	4.0
469	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.0
470	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.7
471	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	11.8
472	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.2
473	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Grant-Vista/Webb Peak	5.5
475	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	7.2
476	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.5
477	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Grant-Vista/Webb Peak	16.5
479	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Grant-Vista/Webb Peak	2.0
480	No Treatment	No Fuels Treatment	No Removal	No treatment areas		8.3
481	No Treatment	No Fuels Treatment	No Removal	No treatment areas		2.7
482	No Treatment	No Fuels Treatment	No Removal	No treatment areas		6.1
483	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Grant-Vista/Webb Peak	4.2
484	No Treatment	No Fuels Treatment	No Removal	No treatment areas		13.8
485	No Treatment	No Fuels Treatment	No Removal	No treatment areas		10.1
486	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	9.8
487	No Treatment	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	3.4
488	No Treatment	No Fuels Treatment	No Removal	No treatment areas		13.3
489	No Treatment	No Fuels Treatment	No Removal	No treatment areas		14.0

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
490	No Treatment	No Fuels Treatment	No Removal	No treatment areas		28.2
491	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by cable	Important Wildlife Area-General Rx	Upper Cunningham	1.4
492	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.2
493	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Upper Cunningham	7.9
494	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Upper Cunningham	3.4
495	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Upper Cunningham	15.9
496	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter	No Removal	Important Wildlife Area-General Rx	Upper Cunningham	20.9
497	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.9
498	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter	No Removal	Important Wildlife Area-General Rx	Upper Cunningham	10.2
499	No Treatment	No Fuels Treatment	No Removal	No treatment areas		4.8
500	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter	No Removal	Important Wildlife Area-General Rx	Upper Cunningham	14.0
501	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Lower Cunningham	15.9
502	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Upper Cunningham	44.7
503	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Upper Cunningham	25.6
504	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Upper Cunningham	6.7
505	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Upper Cunningham	2.2
506	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Upper Cunningham	16.4
507	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Lower Cunningham	34.9
508	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Upper Cunningham	26.4

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
509	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Lower Cunningham	17.4
510	No Treatment	Underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Lower Cunningham	1.6
511	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-General Rx	Lower Cunningham	4.8
512	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Grant-Vista/Webb Peak	2.5
513	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn; followup underburn	Whole-tree yard; hand cut; remove by cable	Important Wildlife Area-General Rx	Grant-Vista/Webb Peak	3.2
516	No Treatment	No Fuels Treatment	No Removal	No treatment areas		5.2
517	No Treatment	No Fuels Treatment	No Removal	No treatment areas		15.0
518	No Treatment	No Fuels Treatment	No Removal	No treatment areas		3.3
519	No Treatment	No Fuels Treatment	No Removal	No treatment areas		2.6
520	No Treatment	No Fuels Treatment	No Removal	No treatment areas		8.1
521	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Chesly Flat/Goudy Canyon	16.0
522	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	No Removal	Important Wildlife Area-General Rx	Chesly Flat/Goudy Canyon	8.0
523	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Heliograph	37.0
524	No Treatment	Lop and scatter; underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Heliograph	21.5
525	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter	No Removal	Important Wildlife Area-General Rx	Lower Cunningham	17.5
526	No Treatment	No Fuels Treatment	No Removal	No treatment areas		5.9
527	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	24.3
528	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	10.2
529	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	6.8
530	No Treatment	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	4.0

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
531	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Masticate; hand cut, pile, and burn steep slopes; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-Modified Treatment Area	Chesly Flat/Goudy Canyon	5.3
532	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; Thin live <9 in. d.b.h.	Masticate; hand cut, pile, and burn steep slopes; followup underburn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-Modified Treatment Area	Chesly Flat/Goudy Canyon	8.6
533	No Treatment	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-Modified Treatment Area	Chesly Flat/Goudy Canyon	7.1
534	No Treatment	No Fuels Treatment	No Removal	No treatment areas		37.0
535	No Treatment	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-Modified Treatment Area	Riggs Lake	27.5
536	No Treatment	No Fuels Treatment	No Removal	No treatment areas		23.0
538	No Treatment	No Fuels Treatment	No Removal	No treatment areas		54.6
545	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Masticate	Whole-tree yard; machine or hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Grant Hill	29.7
548	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	Whole-tree yard; hand cut; remove by skyline	Important Wildlife Area-General Rx	Grant Hill	14.8
549	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; hand cut, pile, and burn	No Removal	Important Wildlife Area-General Rx	Grant Hill	17.7
550	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Lower Cunningham	4.2
551	No Treatment	No Fuels Treatment	No Removal	No treatment areas		6.7
552	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Lower Cunningham	3.8
553	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	8.9

Unit Number	Silviculture Treatment	Fuels Treatment	Removal Method	Treatment Area	Treatment Subdivision	Acres
554	Thin trees <9 in. d.b.h.; MSO Restricted (170 BA)	Lop and scatter; underburn	Whole-tree yard; hand cut; remove by ground-based equipment	Important Wildlife Area-General Rx	Lower Cunningham	3.4
555	Reduce mortality in snag pockets (0.25-1.25 ac group size) up to 12 in. d.b.h. to 6 snags/acre; no live tree thinning	Lop and scatter; hand cut, pile, and burn; followup underburn	No Removal	Important Wildlife Area-Modified Treatment Area	Grant-Vista/Webb Peak	2.8

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